Archaeologia Cambrensis 161 (2012), 51–163

Excavations at Carreg Coetan Arthur chambered tomb, Pembrokeshire

By Sian Rees

with contributions from Edward Besly, Richard Bevins, Paul Courtney, Randolph E. Donahue, Gill Evans, Alex Gibson, Maureen Girling, Catherine J. Griffiths, Elizabeth Healey, David Jenkins, Walter Keeler, Helen Keeley, Ben Stern, D. K. Whittaker and J. Leonard Wilkinson

Carreg Coetan Arthur on the Nyfer estuary, north Pembrokeshire, is the most coastal of the group of Nevern valley chambered tombs, often categorised as belonging to the Irish Sea portal dolmen tradition with links to tombs in south- and north-west Wales, west Cornwall and eastern Ireland. In 1979–80 excavations were undertaken over three seasons to ensure that the full extent of the site was protected from an adjacent housing development before being taken into State care. Excavations tested the extent of the preservation of the cairn and chamber interior. The site had been substantially disturbed by cultivation and human and rodent interference, but remnants of an old ground surface protected by a covering of redeposited subsoil survived outside the south and east side of the chamber, below which lay one complete quartz-tempered round-bottomed Developed Bowl inverted on a prepared 'paved' surface and associated with cremated bone and charcoal which gave a date of c. 3620–3020 cal. BC. Further sherds of similar fabric from other vessels lay scattered on the stone surface, which may tentatively be interpreted as a forecourt, or ritual area, holding the main area of burial rites. The ransacked interior of the chamber held sherds of quartz-tempered Developed Bowls, Impressed Ware and Beaker, as well as medieval and modern, pottery, charcoal and cremated bone. The southern half of the site was bounded by a ring of stones and boulders set into the subsoil; this had been cut through and destroyed by a field boundary adjacent to the megaliths and no definite traces of its continuation were found further north. Within the area defined by the ring were fragmentary traces of old ground surface, on which lay scattered and abraded sherds of Developed Bowl and burnished vesicular Carinated Bowl. Scattered deposits of cremated bone and charcoal-filled pits were encountered and an area of burning below the construction trench for the stone ring yielded a radiocarbon date of c. 3780–3380 cal. BC. These rites pre-dated the construction of the ring, the erection of the megalith and the subsequent 'forecourt' burial rites and covering. The stone ring was only indirectly associated with the re-deposited subsoil on the south-east, which may be best interpreted as a blocking or covering of the forecourt or ritual area rather than material associated with a covering cairn. Little evidence for any cairn material was found elsewhere and, accordingly, neither the association of the stone ring with, nor the nature of, any cairn can be proven. Had the stone ring acted, either in its original conception or subsequently, as a kerb or boundary to a cairn or platform surrounding the megalith, this would imply a small sub-circular construct, c. 10m in diameter, probably composed of stone and the sandy drift subsoil.

INTRODUCTION

Carreg Coetan Arthur (SN 0603 3934; Fig. 1), a Neolithic chambered tomb on the eastern outskirts of Newport, Pembrokeshire, has been variously referred to as Careg Goitan (Wilkinson 1871, 230), Penbont

(Daniel 1950, 199), Carreg Coitan Arthur (Grimes 1936, 139), Quoit Stone, Arthur's Stone (RCAHM 1925, 269–70), Coetan Arthur, Careg Coetan (Barnwell 1872, 149), and Hanging Stone (Fenton 1811, 552). In antiquarian literature it suffered somewhat in being regarded as a poor relation to its neighbour, the imposing Pentre Ifan, less idiosyncratic than nearby Cerrig y Gof, or just too local to a number of prominent antiquarians. George Owen of Henllys in the early seventeenth century refers to it as 'another beneathe the Towne but not comparable to this [Pentre Ifan], neyther in biggnes or in standinge soe highe' (Owen 1892, 254) while Wyndham's Tour (1775, 92–3) notes that it is 'still larger [than Cerrig y Gof] and quite perfect, of the same kind'. Fenton, who lived in Fishguard, refers to Pembrokeshire documents that describe land as being 'juxta Cromlech', the 'Cromlech beneath the town', but makes no further mention of it, while Colt Hoare in 1793[1] refers to it as 'another Druidical relict resembling in some degree the one at Pentreven but infinitely smaller in its proportions—the upper stone resembling an umbrella or large mushroom though there are several stones underneath, some fallen to the ground and others standing, it rests only on two. But as it is evident that some have given way it is impossible to say on how many it was originally supported'. Gardner Wilkinson gives it more attention with a reasonable description and measured plan and elevation (1871, 230, pl. XXXIm, fig. 5). Despite his claim that the megalith 'does not present so imposing an appearance', Barnwell (1872, 140) gives a more detailed description. Pitt Rivers,

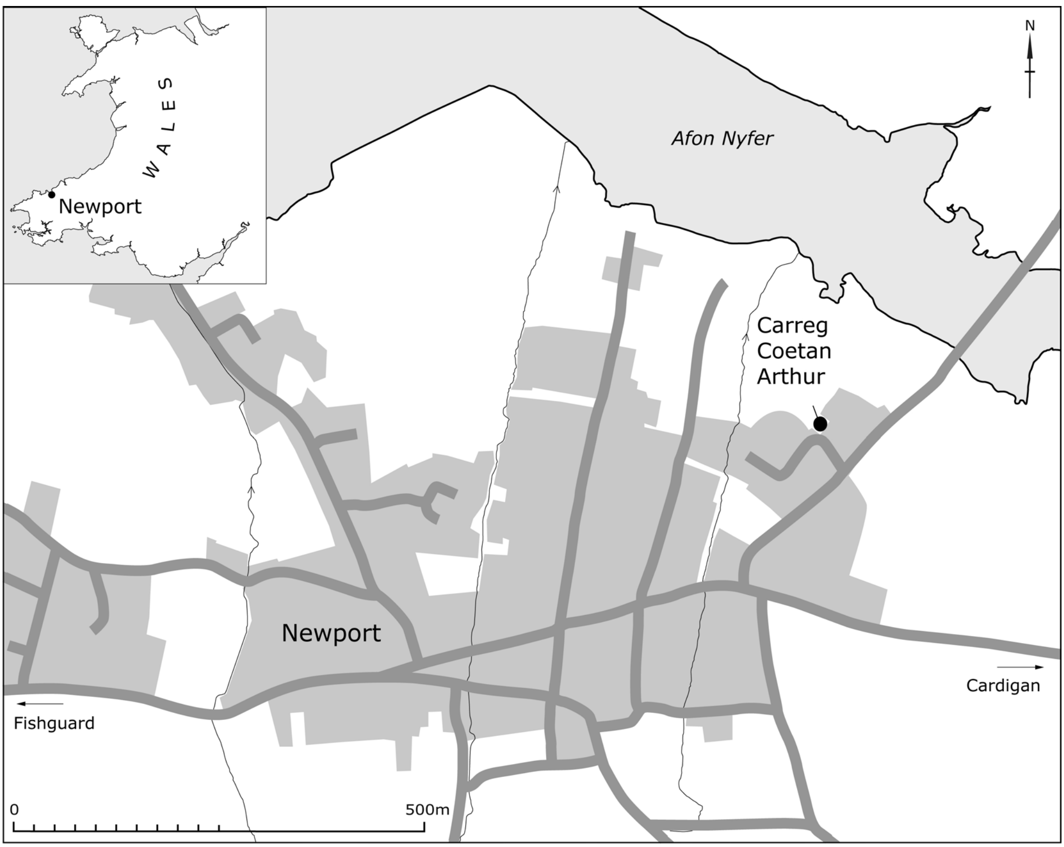


Fig. 1. Location of Carreg Coetan Arthur, Newport, Pembrokeshire.

as the first Inspector of Ancient Monuments, visited ‘Pen Bont Cromlech’ on 7 June 1884, an inspection that resulted in the production of a water colour view and plan.[2] Grimes’ (1936) and Daniel’s (1950) analyses then bring us into the modern archaeological age, with subsequent useful overviews by Lynch (1972), Barker (1992) and Nash (2006).

The megalith is situated on the Nyfer estuary on the north Pembrokeshire coast (Figs 2 and 3), the most coastal of a group of chambered tombs that run inland along the valley into the Preseli hills from the estuary and otherwise comprise Cerrig y Gof, Trellyffaint, Llech y Dribedd, Bedd yr Afanc, Mountain and, most famously, Pentre Ifan. Another site, Banc Llwydlos, strikingly similar to and 2.5 kilometres south-west of Bedd yr Afanc, was recorded by Drewett in 1984 and planned more recently by the Dyfed Archaeological Trust (Murphy and Wilson 2012, 209 and 11–13). Scarcely further from Carreg Coetan Arthur, but outside this defined Nevern Valley group, are several others such as the Goodwick chambers to the west (Fig. 3a, nos 70, 71, 77 and 72), Ffyst Samson to the south-west (no. 73) and Gwal-y-filiast and Carn Besi (nos 83 and 88) to the south and south-east.

The tombs of south-west Wales in general and in particular those of the Nevern Valley, given a discrete grouping by Lynch (1972), have always presented challenges of typological classification. The Nevern

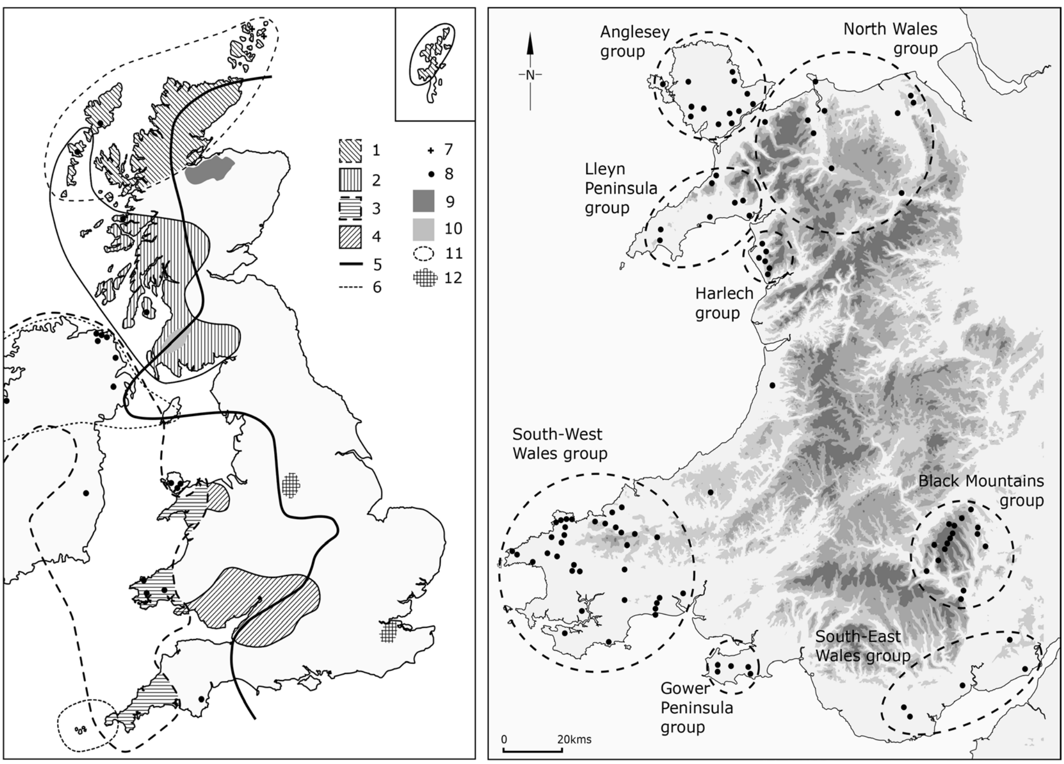


Fig. 2.
2a (*left*) Distribution of classes of megalithic chambered tombs in Britain and Ireland (after Lynch 1997, fig. 21). Portal dolmens are indicated by key no. 3 (United Kingdom) and dashed line (Ireland). 2b (*right*) Distribution of groups of megalithic chambered tombs in Wales (after Nash 2006, fig. 14).

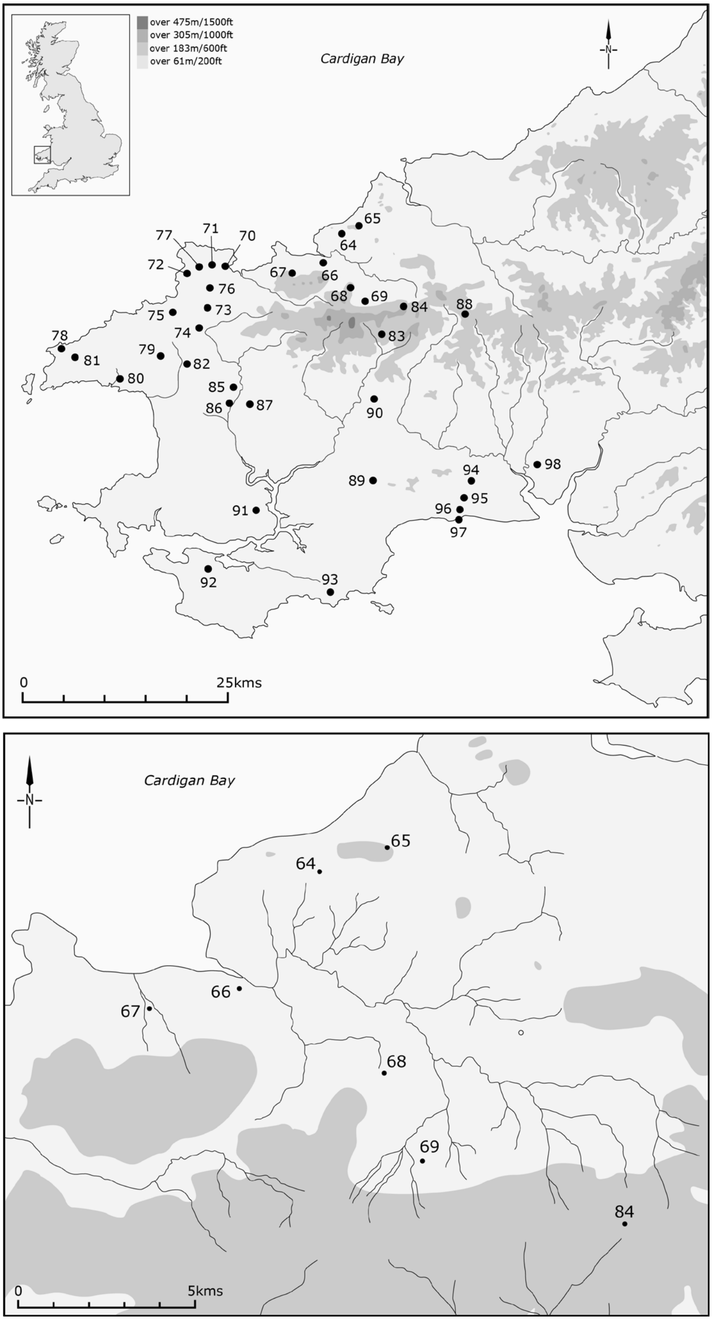


Fig. 3.
3a (*top*) Megalithic chambered tombs in south-west Wales (after Nash 2006, 170); 3b (*bottom*) Nevern Valley chambered tombs (after Lynch 1972, fig. 1). 64 – Llech y Dribedd; 65 – Trellyffaint; 66 – Carreg Coetan Arthur, 67 – Cerrig y Gof; 68 – Pentre Ifan; 69 – Bedd yr Afanc; 84 – Mountain.

tombs differ considerably from one another, with Cerrig y Gof and Bedd yr Afanc being quite eccentric and individualistic, Mountain so ruined as to defy classification. The magnificence of Pentre Ifan makes this site quite different again, dwarfing the remaining three, which are small box-like chambers with large but quite low-set orthostats and capstones. Grimes (1936, 132) used the term 'simple dolmen' to describe these sites and stated that he found himself 'unable to advance any typological classification of any real significance for these simple forms' though describing Carreg Coetan as a simple polygonal chamber. Lynch, however, suggests that Carreg Coetan and the rest of the group belong to the portal dolmen tradition, with links to Irish and Cornish chambers (Fig. 2; Lynch 1972, 70). Kytmannow (2008, 80) accepts Carreg Coetan Arthur, Trellyffaint, Pentre Ifan and Llech y Dribedd as belonging to the portal dolmen tradition, but allocating them a status as variations on a theme, with Carreg Coetan Arthur regarded as member of a Welsh group with single portals.

In 1979, planning permission was granted for a housing development in the field in which Carreg Coetan Arthur lay. It was accepted that the burial chamber, a scheduled ancient monument, would be protected from development and granted to the State in guardianship to ensure its future care. Excavations were held over three seasons on the site from 1979 to 1980 to investigate the extent of the site, to ensure that sufficient land was incorporated in the transfer.

Excavations in the summer of 1979 opened the area to the south of the chamber to investigate the extent and preservation of any surviving cairn. The features surrounding the megalith were found to have been very disturbed by agricultural and rodent activity, as well as unrecorded pit digging in the late eighteenth to early nineteenth century, and were difficult to interpret. Consequently the chamber itself was excavated during a season in Easter 1980 to explore preservation and the relationship with surrounding features; and in the summer of the same year the excavated area was extended to the north, with a section through the field bank and ditch, into the adjacent field, to investigate the extent of any surviving cairn on that side (Fig. 5).

Subsequent to the excavations, the site was bounded on the south and west by a new Pembrokeshire hedge and placed in the guardianship of the Secretary of State for Wales (now the Welsh Government). Thanks are due to the site owners, Mr and Mrs Barclay Edwards, for allowing the site excavation to be undertaken, and for giving the burial chamber into State care and the artefacts to the National Museum Wales, Cardiff. Copies of the archive have been deposited with Cadw–Welsh Government, the National Museum Wales and the Royal Commission on Ancient and Historical Monuments in Wales.

DESCRIPTION OF THE MONUMENT

Carreg Coetan Arthur burial chamber now stands in a small enclosure, 13m by 22m, in the northern corner of a piece of land largely developed for housing (Figs 4, 6). Prior to the development and the excavation this was a field used for permanent pasture for stock, a regime that had continued within living memory (pers. comm. Mrs Barclay Edwards, whose parents had farmed the field). The chamber lies 2m and 7.5m respectively from the north-western and north-eastern of the two old field boundaries. For convenience, and to simplify site plans, a site north was established so that in the following text, the north-west field boundary is referred to as the northern boundary of the site, the north-western orthostat the northern and so on. In addition, while Carreg Coetan Arthur has been adopted as the formal name of the site, it is sometimes abbreviated to Carreg Coetan in the text.

The monument comprises four orthostatic uprights and one capstone with three open gaps (G1–3) between the northern (S1) and south-western (S4); south-eastern (S3) and eastern (S2); and eastern and northern orthostats (Figs 5 and 7a–d). The capstone (S5) is supported by the eastern and south-western

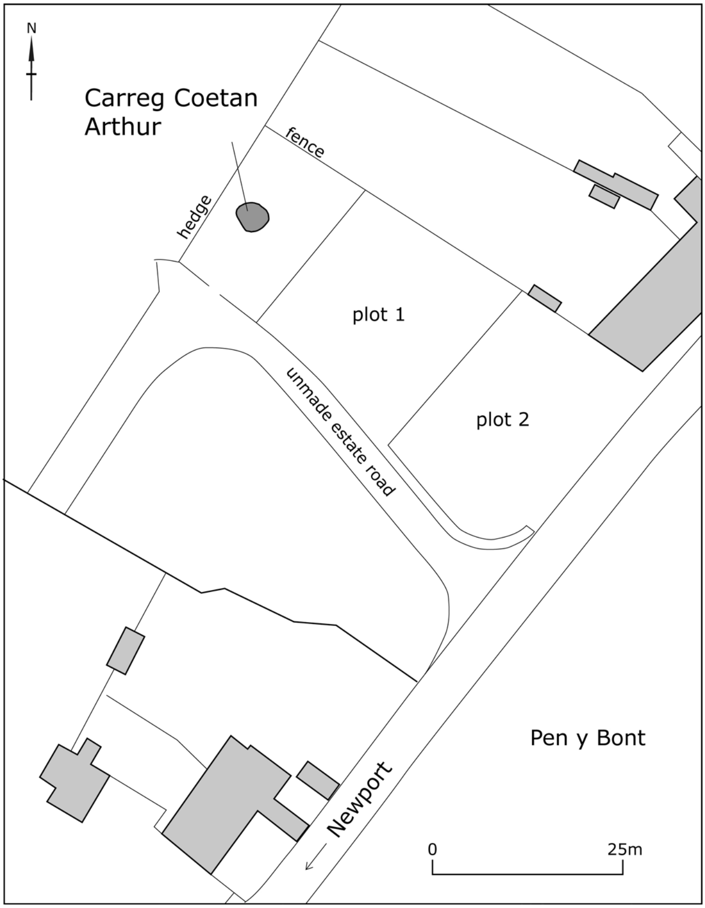


Fig 4. Location of Carreg Coetan Arthur in 1978, before excavation.

orthostats, but not the other two (Fig. 7b and c). The southern two orthostats are very close but do not quite touch. The northern and eastern are slighter stones (Fig. 7a and b) with pointed tops and slender cross sections, which (especially below ground level, revealed after excavation) taper in width and section at their bases, suggesting that they are shallower set. The southern two are more massive blocks (Fig. 7b), the vertical sides of which give the appearance of their being set more deeply into the earth.

All four orthostats and capstones are of local grey igneous siliceous stone (rhyolitic lavas or rhyolitic ash-flow tuffs from the Fishguard Volcanic Group, see Bevins, below) and, while none give any incontrovertible evidence of being dressed or fashioned and no definitive tool marks are evident, it appears that the flatter inner face of S1 at low level may be an artificial construct, while the lower inner faces of the southern two (Fig. 7d) may have been dressed to their current rounded appearance. The site was examined with strong directional light at nightfall which revealed some possible marks of dressing—light traces of pecking on the smoothed lower surface of the internal face of S4; and apparent grooves on the underside of the capstone on the western edge of a ridge between the upper surfaces of the southern stones S3 and

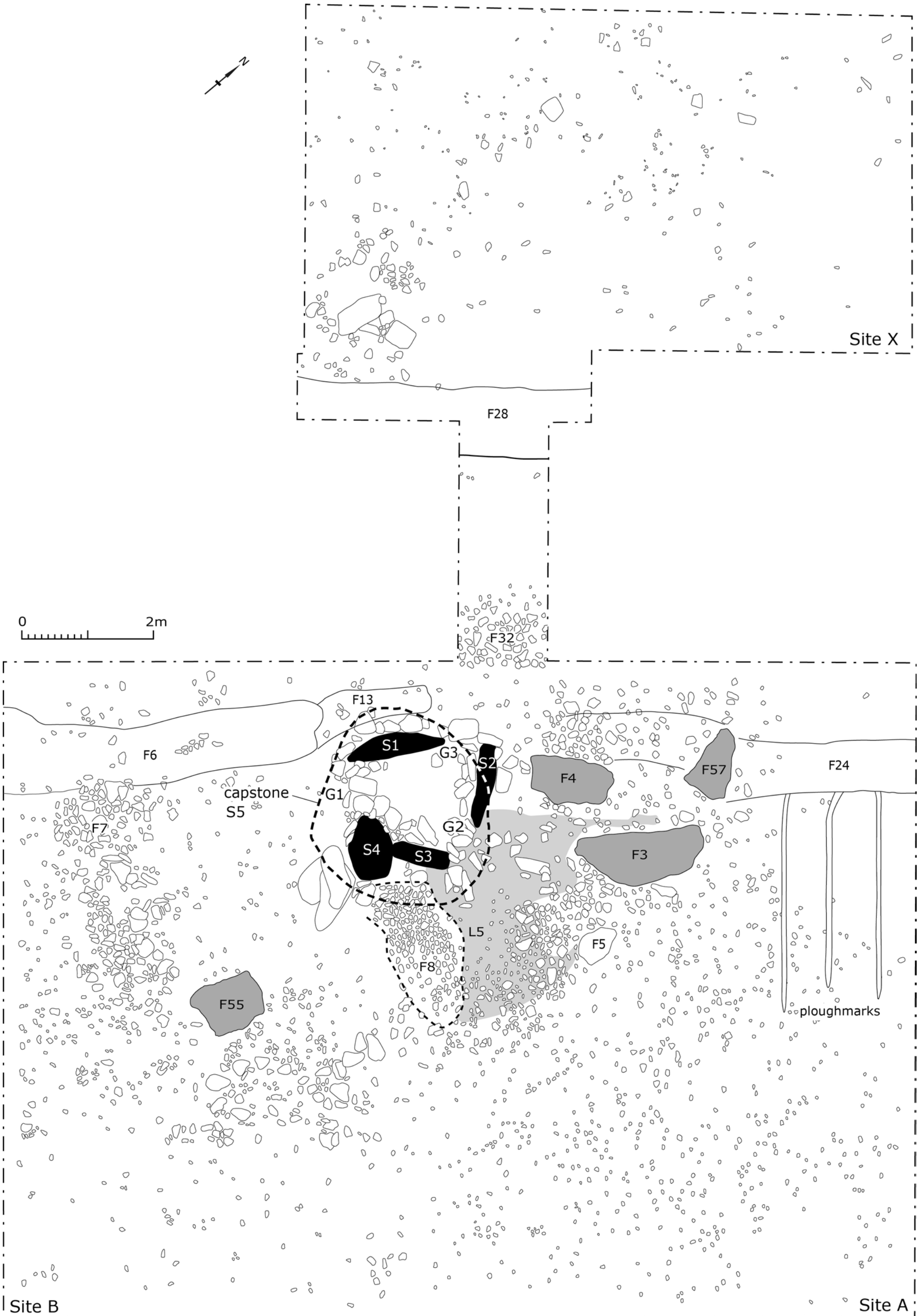


Fig 5. Excavated area, after removal of topsoil.

Fig. 6. Carreg Coetan Arthur from the south-west. © *Crown copyright: Cadw, Welsh Government.*

4, which may be the result of dressing of the stone to accommodate the two orthostats. The capstone (Fig. 7d) appears to show evidence of dressing on the sides where the irregular but smoothly weathered upper domed surface gives way to the flatter lower surface, though lichen growth obscures this area. However, all the orthostats, particularly the lower interior face of the south-eastern stone (S3; Fig. 7d), and the underside of the capstone show evidence of recent flaking and lamination, which makes examination of much of the original surfaces impossible. The conspicuous appearance of the site makes it inevitable that occasional damage will have been inflicted historically by visitors, while local farmers recall the rubbing of stock sheltering within the chamber in comparatively recent times.

The pointed tops of S1 and S2 give a feeling of lightness to the structure, while the solidity of the square-topped load-bearing S4 and the flat shape and cross-section of free standing S3 have suggested to some the impression of a doorway with one jamb and portal stone (Fig. 7b). S4 and S3 are only 0.08m apart at ground level and the gap between the eastern side of S3 and the eastern orthostat S2 adds to the feeling, in plan, at least, that there should be a second 'jamb' at this point. This impression of entrance is strengthened by the greater height on the south of the wedge-shaped capstone which gives the tomb an appearance of facing toward this side. This has been a contributory factor towards the classification of the chamber in the past as a portal dolmen. The tilted wedge-shaped capstone, small sub-rectangular chamber and the feeling of an entrance point from the door-like slab on the south and jamb-like upright

Fig. 7.
7a (*top left*) Carreg Coetan Arthur viewed from the south-west; 7b (*top right*) Viewed from the south; 7c (*bottom left*) Viewed from the east; 7d (*bottom right*) Viewed from the north. © *Crown copyright: Cadw, Welsh Government.*

to its side are characteristics shared by other western British tombs so classified (De Valera 1960, 64). The obvious weakness of the classification is the lack of the second, eastern 'jamb' stone. The south-east gap, between S3 and S2 (G2), the position where symmetry would demand a second jamb were this chamber to be securely classified as a conventional portal dolmen, is in fact not the largest of the three gaps between orthostats, though still, along with the gap on the open west side, large enough theoretically to have housed further uprights. However, G2 is largely oriented north–south; its east–west dimensions are merely 0.30m. Were there to have been an orthostat of the same dimensions as S4 at this point, its eastern side would have projected well beyond (*c*. 0.40m) the capstone, which would have appeared uncomfortable from the front view (Fig. 7b), all other orthostats, save the northern basal part of S2, being positioned under its shelter—S4 is 0.43m within the capstone edge and S3 only 0.30m within. Contemporary concepts of symmetry, it seems, could never have been fully satisfied at Carreg Coetan.

The northernmost upright of the chamber, S1 (Fig. 7d), stood 1.2m high above pre-excavation ground level, 1.54 by 0.45m at pre-excavation ground level. Triangular in appearance, it is the smallest and apparently shallowest founded of the four, widest 0.15m above pre-excavation ground level, tapering to a point at the top but, excavation revealed, also tapering quickly both in width and section just below ground level, suggesting that it is not deeply founded. A flat oval in cross section, it does not touch (and thus does not support) the capstone. Its surfaces are mostly worn and irregular but its inner face is flat (Fig. 7a) and this and its rounded west corner at the base may suggest dressing. Only 6mm separates the pointed top from the capstone surface which appears to have laminated at that point; it is, therefore, entirely possible that the orthostat originally supported the capstone, or was designed to do so.

The eastern stone S2 (Fig. 7c and 7d) stood 1.25m high externally, 1.3m high internally, above pre-excavation ground surface and measures 1.30 by 0.35m wide/thick. It has an irregular cross-section, tapering from the thickest northern end to the almost pointed southern edge, and to its pointed top which supports the capstone. It is similar in shape to S1 in its tapering sides and roughly triangular shape. There is some lamination and damage on the mid and lower interior face, the midpoint on the northern edge and on the southern edge at the base. It tilts some 0.12m out of vertical towards the chamber interior, though whether this is an original or intentional feature is unknown. Had this been due to subsequent settlement, the original angle of the capstone could have been slightly different. Its outer surface is undamaged and exhibits one small depression that, though irregular, could be a cupmark—though deeper it conforms in dimensions to those at Trellyffaint, which most authorities accept as genuine.

The southern orthostat S3 (Fig. 7b) stood 1.15m high above pre-excavation ground level (now 1.37m above restored ground levels), and measured 0.95 by 0.25m at ground level, 0.95 by 0.26m nearing the top. It is a sturdy rectangular slab in appearance, though tapering at the very top to a point on its western side. A flat rectangle in cross section, it does not touch the capstone. However, it is only 45mm from the capstone, and may originally have been intended to support it. Significant lamination and damage has occurred on the lower third of the inner face and on the upper part of the east edge. The apparent dressing of the north-west corner of the stone all the way down the interior face is probably the result of subsequent damage. There is also some lamination on the exterior upper surface at its closest point to the capstone, which again suggests that originally it may have touched the capstone.

The south-western orthostat S4 (Fig. 7a and b) stood 1.30m high above pre-excavation ground levels, and measured 0.73 by 0.53m at the top, 0.68 by 0.85m at the pre-excavation ground level. It is a massive square-topped stone, sub-oval in cross section with a far greater girth than the others. It supports the capstone along with S2. Its southern face protrudes 0.30m beyond the face of S3, emphasising its jamb-like appearance. Its irregular upper surface touches the capstone at three points and it seems possible that the capstone may have been dressed to receive it. The apparent rounding, with slight traces of pecking, on the interior face at low levels is suggestive of dressing but may be geological.

The capstone, S5 (Figs 6 and 7), is a massive wedge-shaped slab measuring 3.10m north–south by 2.68m east–west (maximum measurements length and width) and 1.13m (maximum thickness at the southern side). The maximum dimensions are at the southern end (Fig. 7a and b) where the stone is tilted higher to rest on orthostat S4. It reduces in height and in thickness to the northern end to form an acute angle in section, and rests on S2. The southern wedge-shaped end is more irregular. The reduction in thickness from south to north is on quite a gentle curve, while on the lateral east–west cross-section the capstone appears as having a domed upper surface from the north (Fig. 7d), triangular from the south (Fig. 7b). The irregularity of its shape make estimation of weight difficult, but it is probably between 16 and 17 tons. An eye of faith can detect dressing at the edges where the smoother irregular domed upper surface meets the flat lower surface forming the chamber ceiling (Fig. 7d), but the appearance of longitudinal striations on the east and north is probably merely the result of lichen growth. It has suffered significant damage from lamination on the edges and parts of the lower surface and at one part of the upper domed surface, but it seems probable that the ridge on the underside between the southern orthostats S3 and S4 and the apparent striations on that ridge are indeed the results of dressing to accommodate the orthostats.

The interior of the chamber (S6) is a small, compact sub-rectangle, 1.60m north–south, 2m east–west (to the exterior edge of S1 in G1) maximum measurements,,1.34m north–south and 1.7m east–west (to the midpoint of S4) the minimum. The internal height is 1.5m (south) and 1m (north) above pre-excavation ground surfaces, 1.8m above excavated surface (mid point).

Three gaps between orthostats S1 and 4 (G1), S2 and 3 (G2) and S1 and 2 (G3) now give the chamber an open feeling on the west, less so on the east (Figs 5, 7a and c).

G1, the open area on the west, running north–south, is 0.85m wide at pre-excavation ground levels. The widest gap, it was considered to be a possible site of a now missing side stone or possibly a drystone walling fill. Its framing by the square, upright orthostats S1 and S4 give it a rectilinear appearance.

G2, on the south-east, is 0.5m wide north-north-east/south-south-west at pre-excavation ground levels and has been conceived as the possible site of a now missing removed upright (possibly even the prostrate stone F3), which theoretically could have formed a second 'jamb' to the 'portal' entrance; alternatively it could have been filled by drystone walling. It appears considerably larger in elevation than in plan due to the severely tapering side of S2.

G3, on the north-east, is 0.47m wide at pre-excavation ground levels and, as the smallest gap, was considered more likely to have been blocked by drystone walling; its limited size made it improbable as the position of an orthostat. It too seems wider in elevation that it actually is in plan due to the tapering east side of S1.

EXCAVATIONS 1979–1980

First season (7–24 July 1979)

An area 14m east–west by 10m north–south was opened to the east, south and west of the chamber, leaving unexcavated a 4.5 (north–south) by 3m (east–west) area of the chamber for later separate excavation. Safety considerations dictated that the chamber would be excavated separately, as the orthostats and capstone would require propping. Running section lines east–west (A–B) and north–south (C–D) through the site and chamber were established, with Site A to the east, Site B to the west (Figs 5 and 8).

The area had remained uncultivated since at least the 1930s (pers. comm. Mrs Barclay Edwards), and in the two years prior to the excavations the housing development had commenced. The site was covered with a weedy patchy turf and, in one discrete area on the south, a layer of builders' debris (Level 1) was found to overlie a layer of decayed turf horizon (Level 4) which was removed. Deep tyre ruts in the topsoil from the west to this point indicated the route of builders' vehicles.

Immediately below turf levels, a mass of small and medium sized stones and boulders was found around the large supine stone (F3) to the east of the chamber (Fig. 5), the result of field clearance stone dumping in the corner of the field. Modern glass and pottery within a topsoil matrix attested to its recent derivation. Far fewer stones were found on the more open west side, though there was a similar, smaller concentration against the field bank on the north of Site B. The rise in ground levels towards the field banks on the north and east were found to constitute low stony banks full of decayed bracken roots which represented the uncultivable strip adjacent to the field boundaries.

Topsoil (Level 2) was found to be a 0.6–0.8m thick ploughsoil built up through cultivation and found throughout the area except for the immediate, uncultivable surroundings of the chamber. Considerable quantities of post-medieval North Devon and Buckley coarse wares (seventeenth/eighteenth-century- to nineteenth-century) were uncovered in upper horizons, and medieval (thirteenth- to sixteenth-century) local west Welsh siltstone-tempered wares (Dyfed Gravel-Tempered fabric; O'Mahoney 1985; Papazian and Campbell 1992) in lower horizons (see Courtney, below). The quantity of the latter, and paucity of display wares, suggests a nearby medieval peasant farmstead or settlement, the pottery either being dumped on waste ground, or the product of manuring. Interestingly, only a couple of small sherds (Medieval Fabric

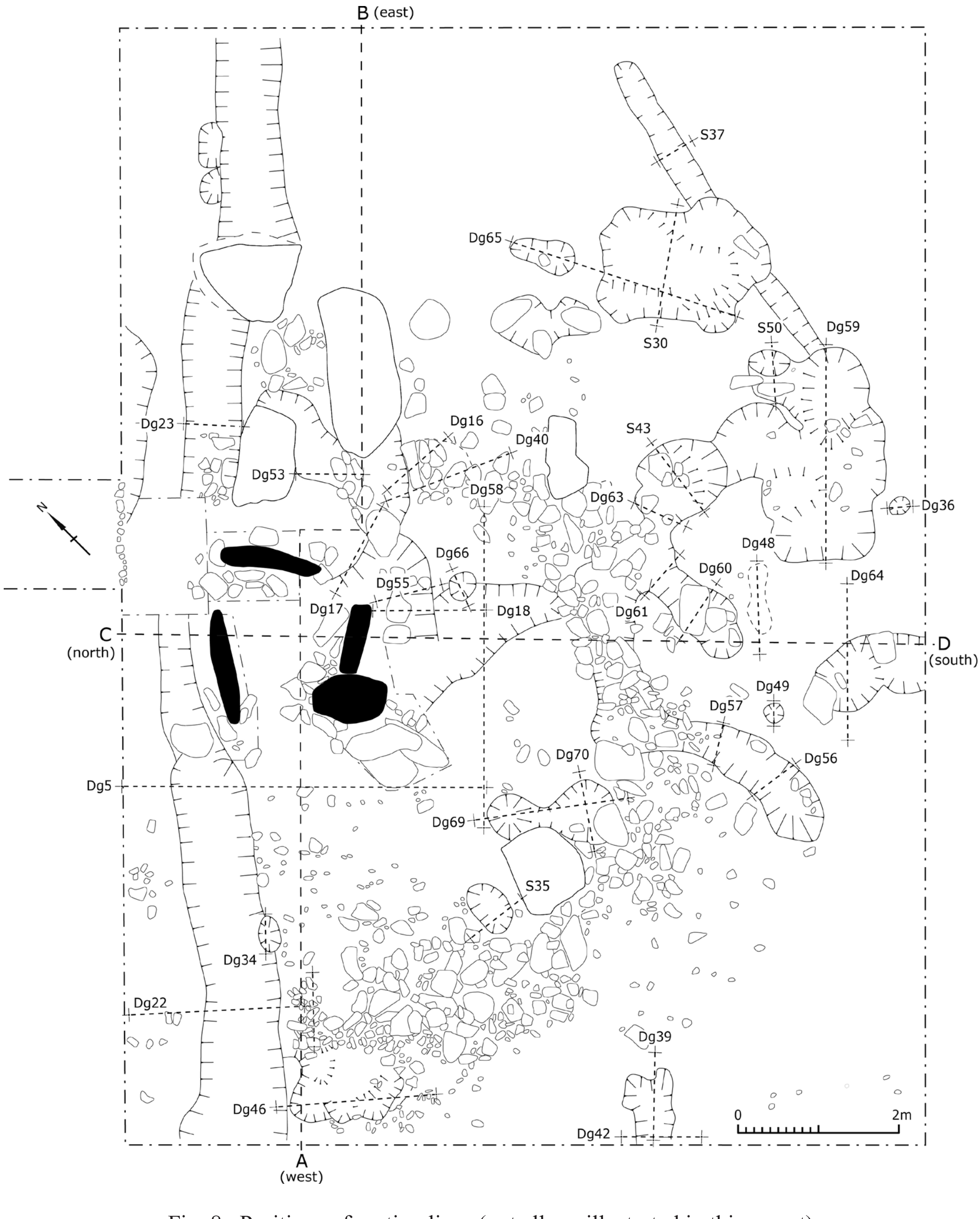
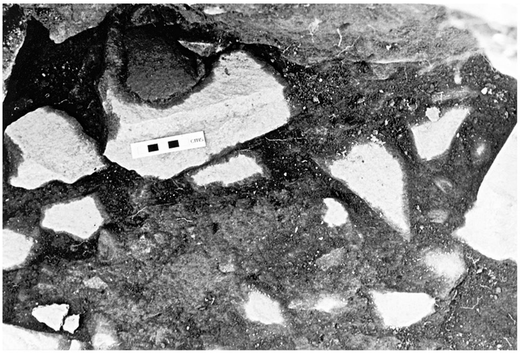
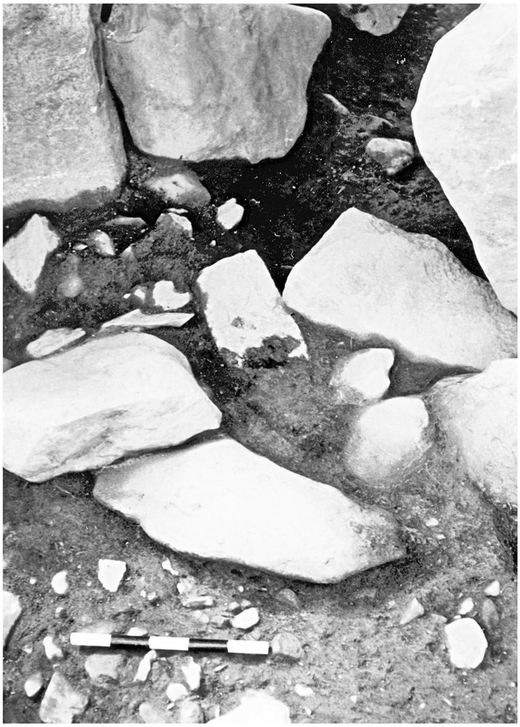


Fig. 8. Positions of section lines (not all are illustrated in this report).

D) seemed contenders as products of the medieval kiln excavated nearby (Talbot 1968) and the assemblage is generally of poorer quality and variety than that excavated by Brennan and Murphy (1993–94; Brennan 1994) on three medieval burgage plots in the town of Newport immediately to the west.

The removal of the topsoil (Figs 5, 9c and d) revealed a greater extent of the two large stones discernible at ground level lying to the east of the chamber, parallel to and south of the field boundary. One of these, a flat topped boulder (F4), 1.3m long, 0.55m wide, 0.7m from S2, was found to be lying on and within topsoil and had evidently been dumped into this position in the relatively recent past. The other, a pointed, extremely large, lower set stone (F3), to the south and east of F4, was positioned 1.5m east of S2; it was 2.15m long, 0.8m maximum width, pointed at one end and slightly curving, with no discernible dressing. It had been suggested by a number of observers (e.g. Daniel 1950, 199) that these boulders might have been part of the chamber that had subsequently fallen or been removed. One of the objectives of the excavation was to try to determine if the apparent gap between the south and east orthostats of the chamber (S3 and S2) had originally housed this (or another) stone. Another boulder (F57), 3.5m to the





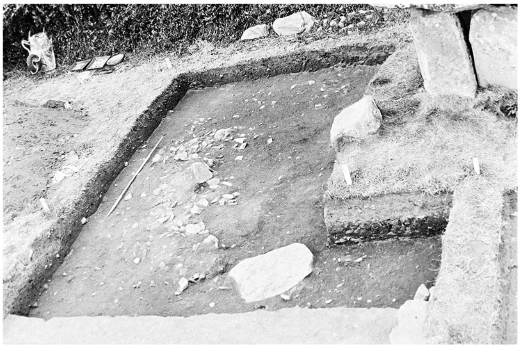


Fig. 9.
9a (*top left*) Detail of old ground surface and pottery spread; 9b (*top right*) G2 and pinning stones for S2; 9c (*bottom left*) spread of stones immediately below ploughsoil, east half of site; 9d (*bottom right*) spread of stones immediately below ploughsoil, west half of site. Scales: 9a, divisions 10mm; 9b, 0.25m; 9c, 2m. © *Crown copyright: Cadw, Welsh Government.*

east of S2, in the brown soil that later proved to be the fill of the field boundary ditch, was subsequently found to be earth-fast and to pre-date the digging of the ditch. Both this and a smaller stone (F5) in topsoil 2.8m to the south-east, had ploughmarks on their upper surface, showing how close to the monument cultivation had occurred. Subsequent excavation revealed three north–south running ploughmarks cut into the subsoil east of the chamber suggesting periodic deep ploughing in this area. Given their proximity to the current field banks, this ploughing probably pre-dated the enclosure of the field.

Removal of the topsoil revealed the field ditches running along the southern side of the northern hedge bank (Fig. 5, F6 on west, F24 on east). The V-shaped ditches were cut into the subsoil to a depth of 0.25m; the western line ran up to the chamber veering slightly northwards towards S1 and was found to have been recut on at least two occasions presumably for cleaning out silts; one recut (F13) extended the ditch eastward, passing only 0.3m away from S1 and petering out just north of G3. The lower fill of the eastern ditch (F24) contained medieval sherds with later pottery types confined to upper fill horizons suggesting that the field shape was long established. It was slighter, changing direction to accommodate F57. The history of cultivation resulted in a greater depth of ploughsoil on the west of the site, unencumbered by the boundaries on the field corner. It had been hoped that the uncultivated headland on the north and the uncultivable corner of the field on the east might have assisted survival of deposits immediately outside the chamber, but this proved only partially to be the case.

A superficial deposit of stony yellow/orange redeposited subsoil (Level 3) was found at a high level in a strip on the north of the chamber. Interpreted as relatively recent deposited upcast from the field ditch or periodic de-silting exercises, it formed the matrix to some of the most superficial stones on the east of the site, below which lay a shallow horizon of stony topsoil. The undisturbed subsoil below lay at a higher level than elsewhere, presumably due to the lack of agricultural activity. This contrasted with the level on the open west side of the site, where cultivation would presumably have been possible closer to the chamber.

On removal of the ploughsoil in Site B south of the field ditch, an arc of small/medium stones (F7) about 1.5m wide was revealed in the lower horizons of the ploughsoil and embedded into the subsoil running from the field ditch on the north to encircle the chamber at a distance of *c*. 3.2m (Fig. 5). It comprised large numbers of differing sizes of stones and boulders, the majority around 10–20mm in diameter, with lesser numbers up to 0.40m. Within the inner edge of the ring, 2.4m from the south-west orthostat, was one large boulder (F55) which was deeply embedded in the subsoil. Amongst the stones at the lowest horizons of ploughsoil were encountered small sherds of Neolithic pottery, brown/black burnished vesicular Carinated Bowls, characterised by large voids caused by the leaching out of calcareous inclusions, and quartz- and grit-tempered Developed Bowls (see Gibson and Jenkins below, and Fig. 27). Abraded and individual sherds were concentrated in an area on the south-western part of the ring, 2.8m from the south-west orthostat S4 and just to the east of the earth-fast boulder F55, but isolated sherds were found all around the west and south-west. The large majority of sherds lay within the area bounded by the ring of stones. On the north, the ring of stones had been cut by the field ditch F6, beyond which the area had been very disturbed by the creation of the field boundaries and the bracken roots from the uncultivated headland; a few small stones within the subsoil (Fig. 5) may represent a continuation of the ring northwards, but no artefacts or any traces of old ground surface survived to substantiate this.

The variety of stone types present on the stone arc on the west comprised considerable quantities of small quartz pebbles, pieces of flat siltstone, water-worn pebbles, loose stones of a variety of sizes and stones apparently set on edge. The dislocation of some of the smaller stones within the ring was demonstrated by the spread of stones over the southern lip of the field ditch presumably due to plough action; this again suggests the early silting of the field ditch and the continuation of ploughing close to the chamber and northern field edge.

Immediately south of the chamber, 0.7m from the southern orthostats, the stony fill of a large modern pit (Fig. 5, F8) dug into the subsoil was found. The pit clearly represented a significant disturbance close to the chamber, but, as it extended into the central chamber area, it was left unexcavated at this point.

Second Season (24 March–13 April 1980)
The excavation of the chamber was undertaken in a three-week period as a discrete episode, as the required stabilising measures to support the chamber stones during excavation would inevitably have obstructed excavation of areas immediately outside the structure. A 1m wide strip outside the chamber was, however, re-excavated to give the link between subsoil levels previously uncovered. The established section lines were continued through the chamber (Fig. 8).

The area excavated comprised an area of 3.5 by 4.5m, the chamber interior and immediate exterior on all four sides. The space available for excavation to the north of the orthostats was under 1m in width, due to the presence of the field hedge. The western half of the chamber was excavated first.

Immediately below the turf within the chamber was a disturbed layer full of stones derived, perhaps, from field clearance or children playing dens, with medieval to modern pottery sherds and glass (Fig. 12a). Outside the chamber on the north, set against S1 were six boulders, one deeper set (F14, Fig. 10d), lying in a brown soil. While space for excavation was limited here, the fact that S1 does not support the

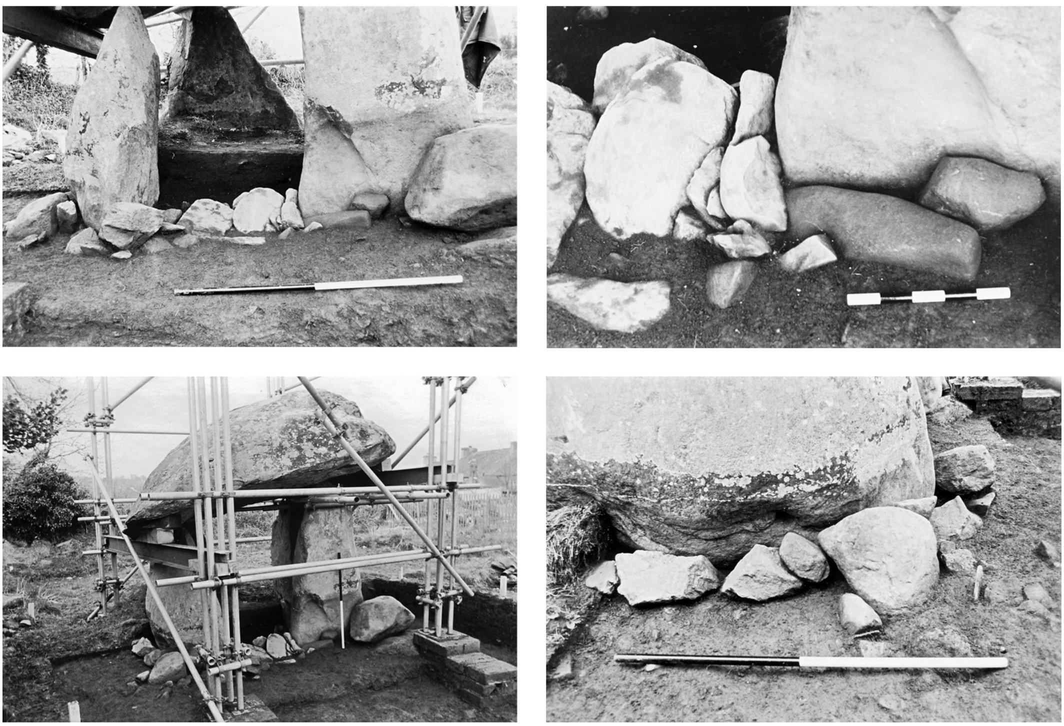


Fig. 10.
10a (*top left*) G1 from west, lower horizon of ploughsoil; 10b (*top right*) Pinning stones for S4; 10c (*bottom left*) G1 and stones outside S1; 10d (*bottom right*) Stones outside S1. Scales: 10a, 10c–d, 1m; 10b, 0.25m. © *Crown copyright: Cadw, Welsh Government.*

capstone gave a greater licence for excavation without fear of destabilising the structure. The ground level was lower on this side than elsewhere perhaps due to the presence of the field ditch or the fact that this strip constituted a walkway or shelter for stock. The boulders were piled against the orthostat but set within topsoil levels and were clearly of recent derivation.

Outside the south-west stone (S4) a similar, larger boulder 0.9m long, and two further lower ones were found tight against the orthostat (Figs 5, 11a). It was initially thought possible that these boulders might have been supports for the orthostats, though it was also possible that they were nothing more than the results of field clearance. The boulders, in any case, were considered to have some stabilising function now at least, and it was thought to be unwise to remove. Consequently this external corner of the chamber received no further excavation.

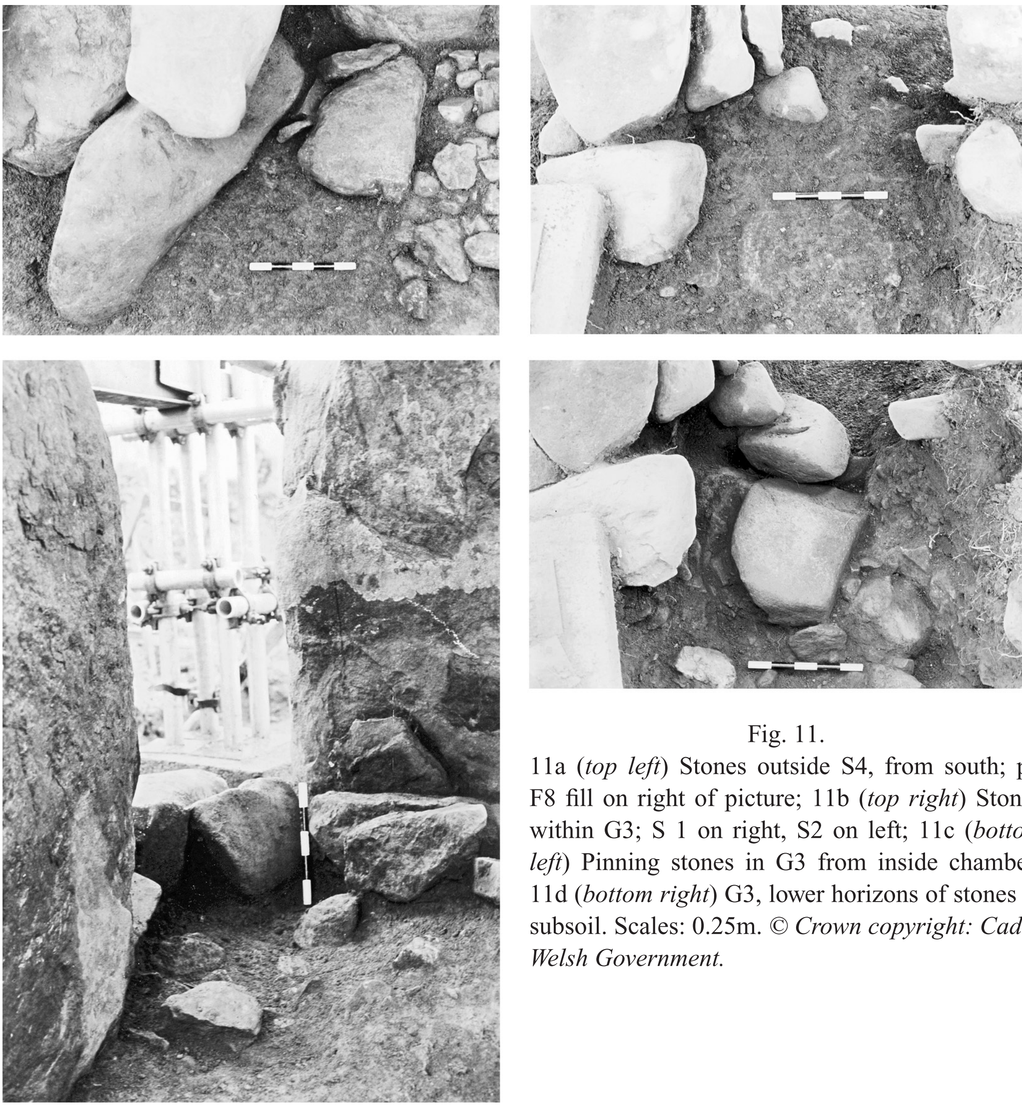


Fig. 11.
11a (*top left*) Stones outside S4, from south; pit F8 fill on right of picture; 11b (*top right*) Stones within G3; S 1 on right, S2 on left; 11c (*bottom left*) Pinning stones in G3 from inside chamber; 11d (*bottom right*) G3, lower horizons of stones in subsoil. Scales: 0.25m. © *Crown copyright: Cadw, Welsh Government.*

On the west side of the chamber, topsoil was carefully removed from the gap between the northern and south-west uprights (G1), where features associated with a missing upright might well have been expected. Within topsoil layers was a series of three large, ten smaller, boulders similar in character to those outside S1 (Fig. 10a, Fig. 12a, F9). They did appear to be slumped outward towards the exterior of the chamber and their function as possible packers for a now missing side-stone was considered, though it was difficult to see how such a side-stone could have been removed without removing the boulders at the same time. Three were piled at an angle against the base of S4 (Fig. 10b), but all were sitting in ploughsoil and were intrinsically unlikely to be prehistoric. This was repeated in the gaps between the north and east stones (G3) and the east and south stones (Figs 12a, 11b and 13a, G2). In each case piles of stones, four in G3, F10, and nine in G2, F11 (Fig. 12a) within the topsoil filled the gaps, but were loose in topsoil layers; they presumably represented recent activity—children's dens, or possibly blocking of the chamber against stock access.

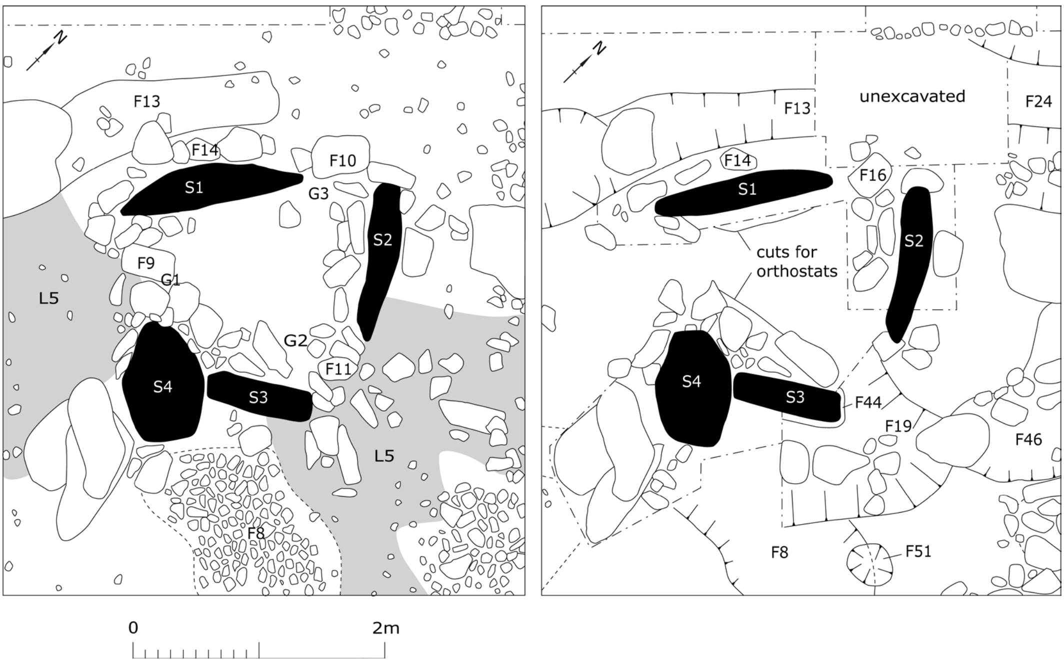


Fig. 12.
12a (*left*) Chamber after removal of topsoil; 12b (*right*) Chamber, lower horizons.

At the same level within the chamber, the modern disturbed brown soil (Chamber Layer I) gave way to a brown soil with orange subsoil patches, containing charcoal and medieval sherds (Chamber Layer II). Continuous phosphate analysis was undertaken within and around the chamber, at topsoil, intermediate and lower levels. The readings were all very high suggesting the use of the chamber by stock or shelter and were regarded as irrelevant to any understanding of the archaeology of the site (Fig. 14a). The phosphate analysis was also extended to test the old ground surfaces and features generally throughout the site (Schwartz 1967) during all but the initial season of excavation (see Keeley and Girling, below).

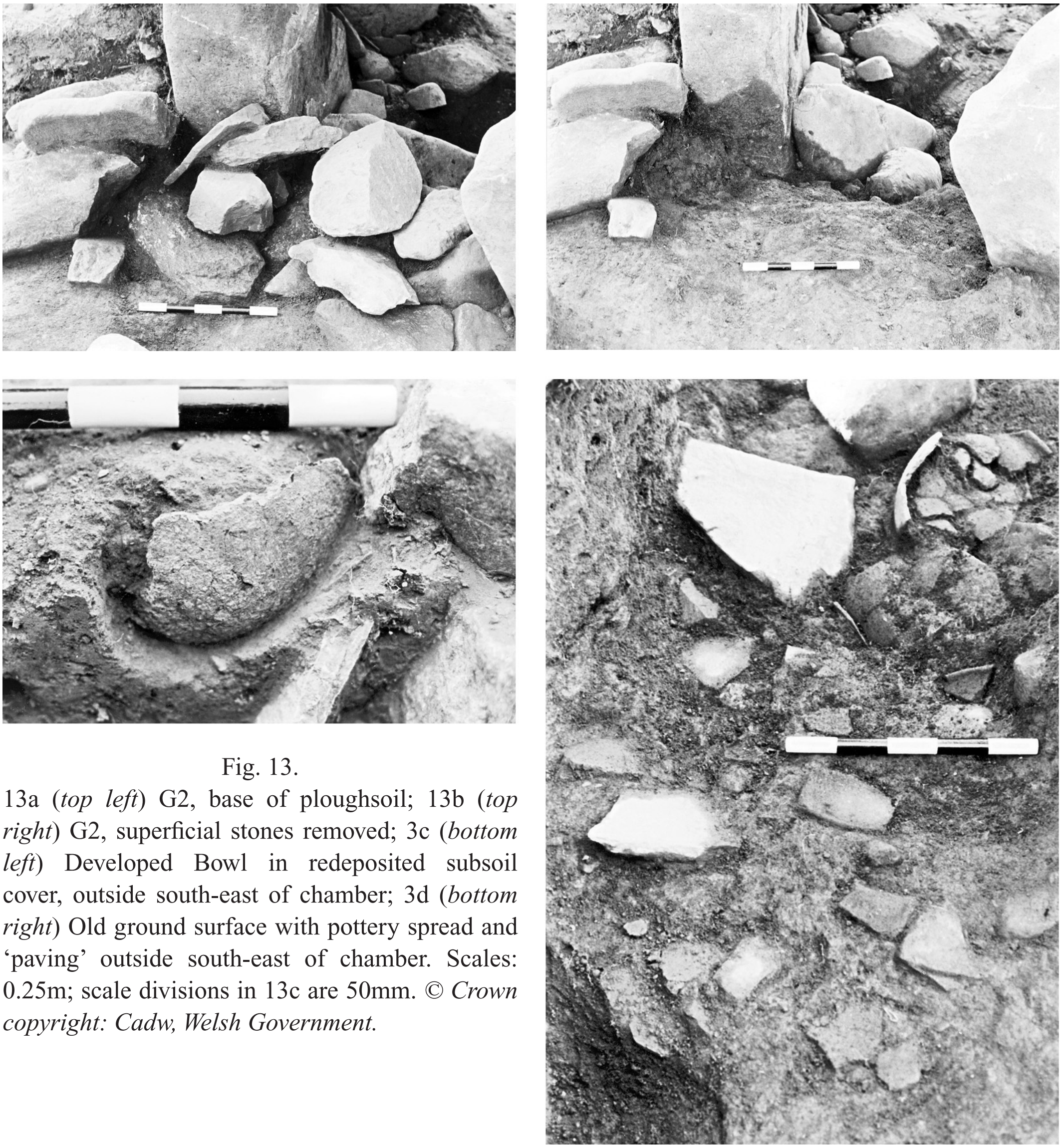


Fig. 13.
13a (*top left*) G2, base of ploughsoil; 13b (*top right*) G2, superficial stones removed; 3c (*bottom left*) Developed Bowl in redeposited subsoil cover, outside south-east of chamber; 3d (*bottom right*) Old ground surface with pottery spread and 'paving' outside south-east of chamber. Scales: 0.25m; scale divisions in 13c are 50mm. © *Crown copyright: Cadw, Welsh Government.*

Topsoil was removed from the area immediately outside the east side of the chamber to reveal a brown soil full of small stones, glass and modern pottery derived from the use of this uncultivable area as a dump and field clearance area and clearly the same as that found further east in the first season. Below this was a complex area of soils on the north including redeposited subsoil probably deriving from the excavation of the field ditch. Around all the supine stones, especially the large F3, considered as a possible contender as an original orthostat, but also around the more recently deposited flat topped stone, were solution hollows, where dark soil had worked its way around the stone edges into the yellow/orange clay (Fig. 15, F25, F43 and F58). Because of the limited area available for excavation around the four stones, the nature of the subsoil—whether natural or redeposited—was at this point uncertain.

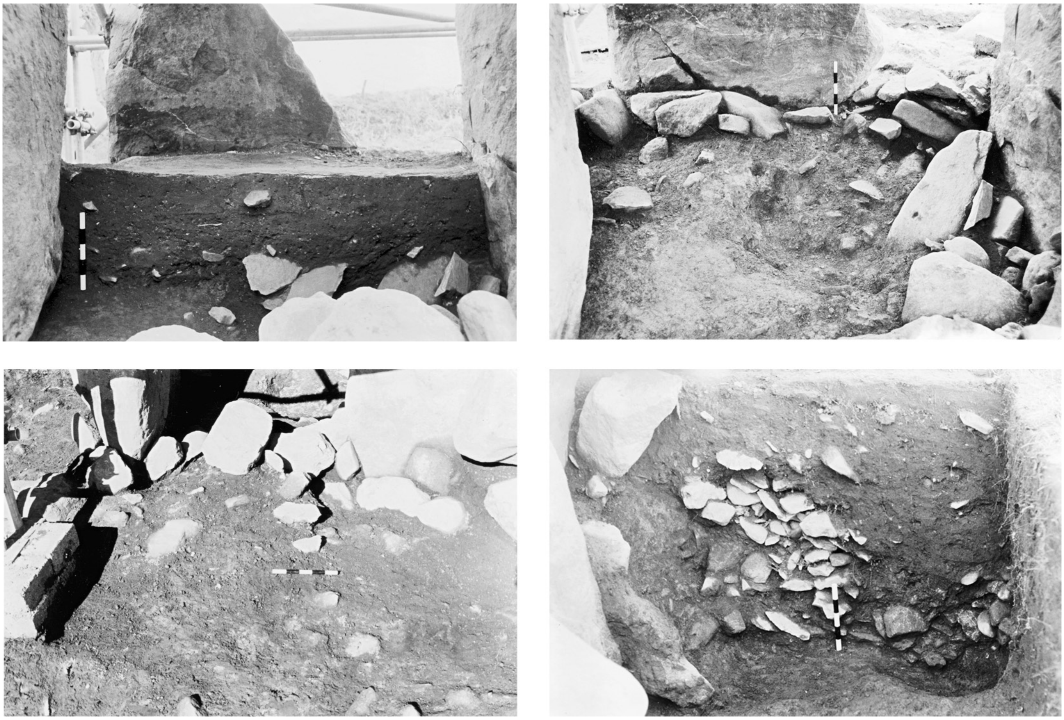


Fig. 14.
14a (*top left*) Excavation of Chamber interior – west-facing section through fill, facing west; 14b (*top right*) Interior of chamber – fill removed, showing pinning stones for S2, 3 and 4, cut for S1 stone-hole; 14c (*bottom left*) G1 – stones within gap and traces of redeposited subsoil outside chamber; 14d (*bottom right*) Section through north side of pit F8, facing west. Scales: 0.25m. © *Crown copyright: Cadw, Welsh Government.*

The fill of the northern part of the large modern pit (F8) on the south of the chamber, noted in the first season, was now excavated (Fig. 14d). The pit was some 1.4m wide, dug immediately outside the two southern orthostats S3 and S4, and extended beyond this central area of excavation. Evidently dug in the late eighteen or early nineteenth century, its fill contained a large quantity of small stones, post-medieval glazed pottery and, apparently deliberately positioned at the bottom, a worn George III halfpenny (see Besly, below), but also Neolithic pottery and flint, presumably deriving from a destroyed Neolithic horizon, or old ground surface. It had been dug through the whole southern exterior of the chamber but did provide an interesting section (Fig. 16) showing that it had been cut through a layer of redeposited subsoil (5) overlying a dark charcoal-rich layer, interpreted as an old ground surface (6). This gave the first indication that there might survive small sections of covering or cairn material protecting an old ground surface to the east and south-east of the chamber.

On the north of the chamber, the extension (F13) of the field ditch (F6) was excavated (Fig. 12). Cut through the subsoil, it gave a useful section through undisturbed subsoil as a reference point. The boulders outside the northern orthostat S1 (Fig. 10c and d) were planned and removed but found to have brown soil and modern pottery beneath confirming their recent deposition. This orthostat, though

Fig. 15. Ring of stones, old ground surface (L6 and L9) and covering layer of redeposited subsoil (L5).

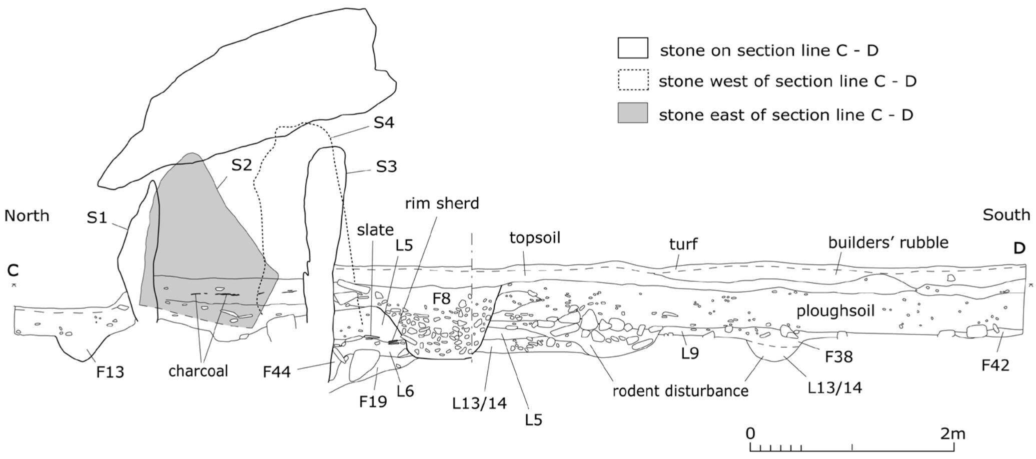


Fig. 16. Main north–south section across site.

non-weight-bearing, nonetheless tapered downward significantly from both sections and appeared to be shallow set. The excavation therefore ceased at this level, with the strip of disturbed subsoil adjacent to the field bank and the larger earth-set boulder (F14) remaining in position (Fig. 12).

Within the chamber interior, the brown mottled soil (Level II) was excavated (Figs 16, 18). The excavation of the western half (Fig. 14a) revealed that the layer was some 0.20m deep towards the three gaps and the orthostats, and 0.30m deep towards the centre of the chamber. It was very mixed and displayed evidence of intermittent disturbance. Within lower horizons within the brown soil were lenses of a darker, uniform more charcoal-rich soil some 50mm thick (Layer III). From these discontinuous lenses derived some Neolithic sherds of Developed Bowl (Sherd Groups 9, 15 and 18) and flint. At this point the north–south section was drawn and the eastern side excavated. This revealed the same stratigraphy through Levels I, II and III, and excavation over the whole chamber interior revealed the undulating surface left after disturbance apparently dug from Level II/III (Fig. 14b). The Level II fills of the depressions in the surface were found to contain medieval pottery, suggesting that all levels within the chamber were disturbed, but it was impossible in the confined space to detect separate episodes of disturbance.

Beneath Level II/III was a layer of subsoil. This may have been undisturbed natural subsoil into which, at the sides of the chamber, the orthostats and their pinning stones had been excavated. The apparent cuts for the stone-holes for S1, 3 and 4 were seen in plan (Figs 11c, 12b, 14b and 17). The upper edges of stones interpreted as packing stones, set against the inside faces of both southern orthostats were evident, with four large and four smaller wedged-shaped stones tilted towards the northern sides of S4, and two large stones set against the inner side of S3 (Fig. 14b). The chamber side of the stone-hole for S4 was detected in plan cut into the subsoil on the outer edge of the packers (Figs 12b and 17). The horizon continued right up to the cut for the stone-hole for S1 which was discernible on plan internally (but not outside the chamber, due to lack of space for excavation). The orthostat had no pinning stones discernible at this level, though, given the apparent shallow base to the stone, an unexcavated section around it was left on all sides, and, therefore, the apparent lack of packing stones could not be verified. No cut for S2 was detected, though the six stones that lay at the interior face of the orthostat may have been packers; two were tightly set at angles against the side (Fig. 14b), and the outer side of the stone appears to have been

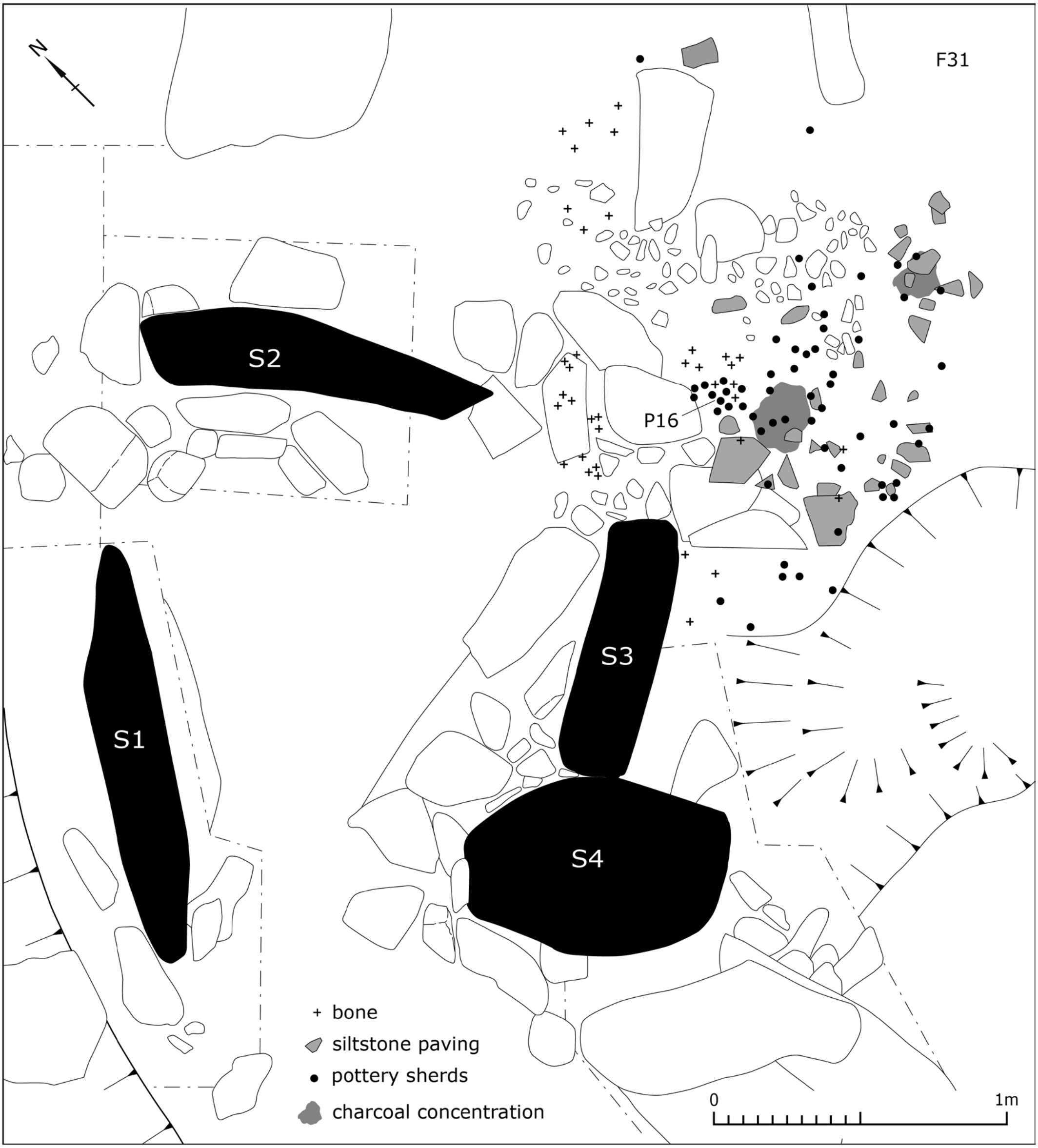


Fig. 17. Detail of old ground surface outside chamber.

supported by three packers (see below) on the southern edge of this stone within G2. The horizon ran up and into the three gaps (Figs. 11c and 14b) but the unexcavated areas left for safety against the apparently shallow set S1 and S2 and the packers against S3 and 4 made any further excavation in the chamber impossible due to lack of space and support. No attempt was made to excavate the original holes for the stones from the interior and it was decided to leave the chamber unexcavated below the disturbed Levels II/III rather than to section the bottom of the chamber to test the nature of the (undisturbed as opposed to redeposited?) subsoil. It remains a strong possibility that further excavation of the chamber interior could reveal more information about the construction of the megalithic structure.

The eastern gap (G3) between the northern (S1) and eastern (S2) orthostats was excavated further. The series of stones (Fig. 12a, F10) in brown soil immediately below turf layers were recorded and removed and found to be superficial. Removal of all topsoil revealed subsoil, on which was a large stone F16 (Figs 12b and 11b), which appeared to be a deliberately positioned slab set between S1 and the pinning stones for S2 (Fig. 11c and d). It seemed unlikely, therefore, that any further orthostat stood on this side, unsurprising given the narrowness of the available space, though F16 could have been the remnant of drystone walling or, possibly, could have supported a shallow orthostat (the latter seems improbable as it would have been intrinsically unstable). However, given the apparent shallow settings of S1 and S2, it was decided not to excavate further to verify the nature of the subsoil nor the stone-holes for either orthostat.

The western gap (G1) was similarly excavated further to explore the nature of the series of boulders and stones (Fig. 10a and c; Fig. 12a, F9) that had previously been found to lie piled together in a brown soil between the northern and south-western orthostats. They were found to comprise several layers of stone. The topmost three stones were clearly superficial, set in brown soil with no evidence to suggest that they had any connection with the structure; similar to their equivalents in G2 and G3, they probably derived from relatively recent den building or possible blocking of the structure from stock. Separated from this layer of stones by a few centimetres of brown topsoil were three flat stones set into the subsoil at an angle to the south that appeared to be packing stones for S4 (Figs 12b and 14c). Adjacent to and north of these stones, below the topsoil, was a very thin layer of a redeposited subsoil (Fig. 15, L5) overlying the undisturbed subsoil. Scarcely continuous, it was best discernible where it overlay small patches of brown soil with patches of purple staining and charcoal similar in nature to the old ground surface on the east. It was better preserved where it was closest to the megalith, but, at its greatest, was only 50mm thick, at points where it had accumulated in depressions in the subsoil, close to the packing stones for S4 (Fig. 18). Unfortunately, no artefacts were contained within the layer. It was interpreted as the remnants of a covering material over traces of an old ground surface immediately outside the western side of the chamber. The presence of the packing stones for S4 on the south side of G1 and the remnants of the redeposited subsoil on the north makes it unlikely that any orthostat originally stood in this space, though it may have been filled with walling of which no trace now remains.

The south-eastern gap (G2) was, at this partially-excavated ground level, some 0.90m wide between the southern (portal) stone S3 and the eastern orthostat S2, but at pre-excavation levels the width was only 0.65m, due to the tapering side of S2. Nonetheless the interpretation of Carreg Coetan as a portal dolmen suggested that originally there may have been an upright in this corner of the chamber to act as the other 'jamb' to frame the portal stone S3, the equivalent to the south-western stone S4. A potential contender for this upright was the supine stone F3, which appeared to be roughly the right size and shape, with a pointed end. The excavation of this gap revealed the usual series of boulders (Fig. 12a, F11; Fig. 13a) which, as in G1 and G3, on excavation were found to be superficial, set in brown soil and probably derived from relatively recent interference. Beneath these, however, lay a quantity of redeposited subsoil (Fig. 12a, L5; Fig. 13b), lying at a higher level than the disturbed interior of the chamber. This yellow/brown redeposited subsoil (Layer 5) had a high charcoal content. The charcoal was subsequently sampled and gave a radiocarbon date of *c*. 3360–2920 cal. BC (CAR-393).[3] Layer 5 extended beyond the gap outside the chamber to the east, north and south and had been dug through on the south by modern pit F8/12 (Fig. 12a). It was clear that when this had been deposited, there had been no orthostat or walling closing this gap, which appeared to have led directly to the exterior of the chamber.

The redeposited subsoil (Layer 5) on the south and east of the chamber was then excavated. At this stage tentatively interpreted as remnants of cairn material or forecourt blocking surviving in undisturbed

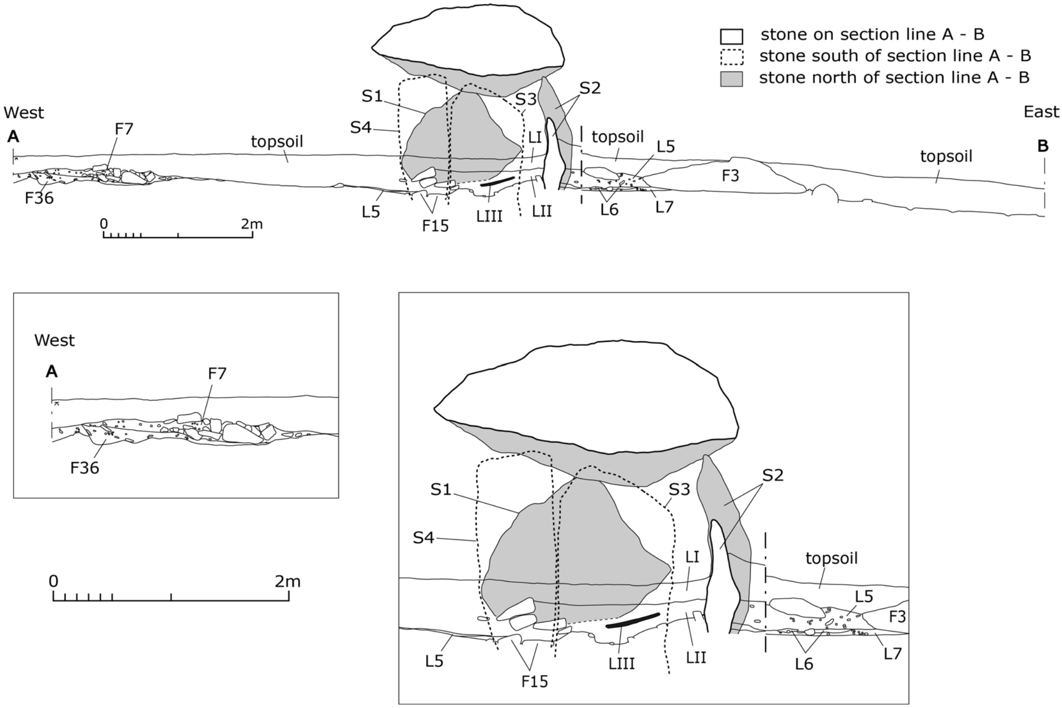


Fig. 18. Main east–west section across site.

areas, it was nonetheless considered possible that it comprised the results of subsequent emptying of the chamber on one or more occasions, with Neolithic horizons and subsoil from the chamber being thrown out either in relatively modern times or even as part of later Neolithic or immediately post-Neolithic activity. Within the body of the redeposited subsoil was found one half of a small round-bottomed quartz-tempered Developed Bowl (Fig. 13c) in two pieces (P5 and 129, Sherd Group 7), immediately adjacent to the pit F31 (see Fig. 15 and below). This was unusual in that it was the only Neolithic pottery found within the redeposited subsoil or cairn material as opposed to the old ground surface. A joining rim sherd of the same pot (Fig. 29, P131) was discovered 0.40m to the north, again within the redeposited subsoil, 0.30m to the west of the supine stone F3. This poses the question as to the origin of the vessel prior to its deposition within the 'cairn material'. It is possible that it was deliberately deposited where found, though this seems less likely than it being derived from an old ground surface used prior to the covering of the area—possibly the area of old ground surface immediately adjacent to and disturbed by F31. This poses further questions as to the nature of burial activity at the structure. If there were repetitive burials or deposits at the monument, which seems likely after so considerable a construction (just taking Carreg Coetan at face value without reference to comparative rituals documented from other excavations), had each burial been covered, presumably the cairn or blocking/covering material, at least in the area of activity, would be re-excavated periodically. This presumably would disturb remains from earlier activities or interments.

Beneath the redeposited subsoil was a brown soil layer (6) littered with Neolithic sherds that appeared to represent a Neolithic old ground surface (Figs 17 and 13d). Immediately outside the chamber a round-bottomed quartz-tempered bowl (Fig. 17, P16, Developed Bowl, Sherd Group 6) was found, inverted on a rough flat paving of pieces of stone, with burning and cremated bone pieces (C6, see Wilkinson, below) associated with it (Fig. 19a). The pottery was very soft and the large quartz inclusions made it friable. It was lifted and transported immediately to the archaeological conservation laboratory at Cardiff University for treatment prior to washing and processing. Adjacent to this pot (Figs 17 and 19b–d), a thin layer of old ground surface was exposed revealing a large quantity of sherds of Developed Bowl, identical in fabric but clearly belonging to different vessels (Sherd Groups 7, 8, 9, 10, 11, 12). Some lay in close association with one another, others were more scattered. Around and beneath them were pieces of stone, burning and charcoal and cremated bone. The area of old ground surface below P16 was stained with burning which continued through the depth of this layer. This area evidently continued beyond the immediate external area of the chamber into sections of the site that would await excavation in the third season.




Fig. 19.
19a (*top left*) Detail of pot 16, inverted and crushed, on old ground surface outside south-east of chamber; 19b (*top right*) Detail of old ground surface extending into G2; 19c (*bottom left*) and 19d (*bottom right*) Details of old ground surface and pottery spread outside G2. Scales: 0.25m. © *Crown copyright: Cadw, Welsh Government.*

The interpretation of the redeposited subsoil as remnants of a covering or blocking protecting an old ground surface with laid pottery on a rough stone floor seemed the most plausible. The 'flooring' was not especially even and the stone pieces appeared randomly distributed. But the stratigraphy implied a ground surface prepared in some way with stones that had been selected for rough paving for their ability to provide flat, strong surfaces (see Bevins, below), on which had been deposited pottery vessels, one of which was inverted, presumably originally containing the cremated bone and charcoal that was found scattered around and within the heap of sherds. Whether the vessels had all originally been deposited as complete vessels and subsequently broken with the subsequent covering, or whether they had been scattered as sherds around the main inverted pot P16, cannot be proven. The alternative hypothesis that the material had been shovelled out of the chamber robbed in post-Neolithic times was really untenable given the unmixed nature of the stratigraphy and purely Neolithic artefacts. The stratigraphy also made implausible the hypothesis that it may have resulted from a Neolithic clearance prior to subsequent burial within the chamber. It remained a possibility that the old ground surface in its final condition could have been the result of different phases of burial and ritual with P16 as the final burial and the other sherds representing a breaking or scattering of previous burials.

Within the area of exposed old ground surface, all pottery and cremated bone was lifted and samples of charcoal taken for radiocarbon dating and charcoal identification (Figs 27, 9a and 19d). The scatter of stone chips appeared to form a rough floor (Fig. 17) and comprised some 26 flat rough slabs, varying in size from 120mm to 25mm in length laid over a fairly discrete area 1.3m north-west/south-east, 1.0m north-east/south-west, extending from a point 0.20m from the western corner of orthostat S3. The distribution of the overlying pottery sherds was wider than the distribution of the slabs. The old ground surface had been destroyed on the south-west by the digging of F8 (Figs 15 and 17), though the incidence of pottery, bone and charcoal had largely petered out before the disruption caused by the pit F31 on the south-east. The slabs and chips were rough with no apparent attempt at dressing the edges, but all were flat on upper and lower surfaces. Their distribution did not suggest that they had been carefully laid to touch, though subsequent disturbance would undoubtedly have altered their position; they gave the impression of having been laid to a roughly horizontal surface, though some were now tilting into the ground. In some cases, the pot sherds rested directly on the upper surface of the stone chips; in others, soil, charcoal and cremated bone separated pottery from the stone. The largest pieces of stone, those on the north-west, closest to S3, lay adjacent to sherds rather than under them. The stone was examined carefully to see if they had been marked in any way but no dressing or patterning was evident. One appeared to have been drilled or notched, but was broken through this hole and it was difficult to be positive that this was deliberate fashioning. This piece was the only one which could be matched with another joining piece found nearby but not immediately adjacent. There was no evidence, therefore, that they had ever constituted a structure (cist or container, for example) and their varied geology supports this. Some appeared to have been struck, showing evidence of percussive blows, presumably during collection or subsequent fashioning. Their geological identification as siltstones and fine sandstones (see Bevins below) confirms that they were not derived from the same source as the chamber orthostats (probably rhyolitic tuffs) but had perhaps been selected as being durable but easily split, making them suitable for a surface. The source of the stones could have been relatively local, the lithologies being located in the Preseli hills. Amongst the laid slabs were many other small pebbles and stones, especially on the north and east (Fig. 17) which appeared to be a continuation of this surface but may merely have been constituents of the underlying subsoil. These were planned along with the slabs, though it was impossible to know if they constituted a deliberate inclusion within the prepared surface.

Beneath the stone pavement were two concentrations of burning, 0.20m and 0.16m in diameter, as well as more random scatters of charcoal below and around the flooring. To the south of S3 and to the west of the stone flooring was a rather diffuse area of a blue clay-like deposit (later interpreted as decayed stone, which may originally have formed a component of the surface) with another further south. Other than these, the old ground surface comprised a thin layer of dark brown soil overlying the stained upper surface of the subsoil (Layer 7) and either undisturbed subsoil (Layer 8) or the fill of the stone-hole for S3 (Fig. 12b, F19).

The old ground surface outside the chamber appeared to run as a continuous layer into Gap 2 where its appearance was identical to that outside, with charcoal and scatters of cremated bone deposits, though no pottery sherds lay within this area (Fig. 17). Beneath this old ground surface was a surface of disturbed yellow/brown subsoil, within the northern half of which were six large stones (Fig. 9b). Three were set at an angle against the south-east corner of the eastern orthostat S2 and at least one seemed to have served as a packing stone; they protruded 0.42m into the gap G2 and cremated bone scatters were found overlying one of them. The area immediately adjacent to the two packing stones was not excavated further. Three larger stones lay to their south-east, lying partially embedded within a sandy soil subsequently found to have been the fill within stone-hole F19 for S3, perhaps acting as packers or placed to add extra support for the packers. Cremated bone and stone chips lay on the old ground surface around these lower stones also, continuing in an unbroken layer from outside the chamber where the main pottery vessels had lain.

In the southern half of G2, outside the packers for S2, the stony sandy redeposited subsoil subsequently (see below) proved to be the fill of the stone-hole for S3. Accordingly there can have been no original orthostat within this gap, which must have remained an open point within the tomb, or closed, after or between depositions, by stone walling. It may have functioned as an access point to the chamber along with the western G1, given that the portal in the front would have been immoveable.

Immediately to the south-west of supine stone F3 and 1.1m south-east of the point of deposition of P16 was a feature which had first appeared as a spread of small stones at redeposited subsoil level. On excavation, this stony spread proved to be the upper horizon of the fill of a small pit (Fig. 15, F31; Fig. 20a and Fig. 21). The clearance of the upper superficial stones in the fill revealed two courses of slabs forming the north-western edge of this feature, a shallow pit or hollow with a fill of brown soil and stones, 0.70m wide and 0.10m deep, which appeared to have been excavated into the redeposited subsoil covering over the old ground surface. A north-west/south-east section across the feature (Fig. 24a) shows a 0.25m deep layer of redeposited subsoil (A) lying over the undisturbed old ground surface (C), rich in sherds and cremated bone, immediately to the west (chamber side) of the slabs while, beyond and to the south-east, the lens of redeposited subsoil (D) was only 50mm deep, with no sherds or cremated bone. This suggested that the pit had been excavated into the side of the covering or cairn material. It was initially considered that the courses of slabs on the side of F31 could have related to the stone ring rather than this later pit—possibly comprising a small remnant of kerb stones surviving on the south-east of the chamber, constructed to contain the cairn material and the area of burial activity. However, excavation showed that the slabs were clearly a component lining to the pit F31 which had been dug into the covering material.

The function and date of F31 is unknown. It may have demarcated the edge of a forecourt or area of burial practice and may even have held some sort of upright or marker. However, this could only have been slight with a foundation depth of only 0.10m into the cairn material. The fill of F31 (B) comprised a brown soil reminiscent of Layer 9 (found amongst the ring of stones on the west, Site B) with several large stones within, which could conceivably have acted as packers for an upright. Equally possibly, it could have held a subsequent burial, in theory, though its fill was devoid of artefacts, burning, charcoal or cremated bone. Being dug through cairn material and old ground surface, it was clearly a deliberately excavated feature, but its date and function is unknown. Phosphate analysis of samples from the centre and the base of the pit gave a strong positive reading from the former, and a positive from the latter (see Keeley and Girling,

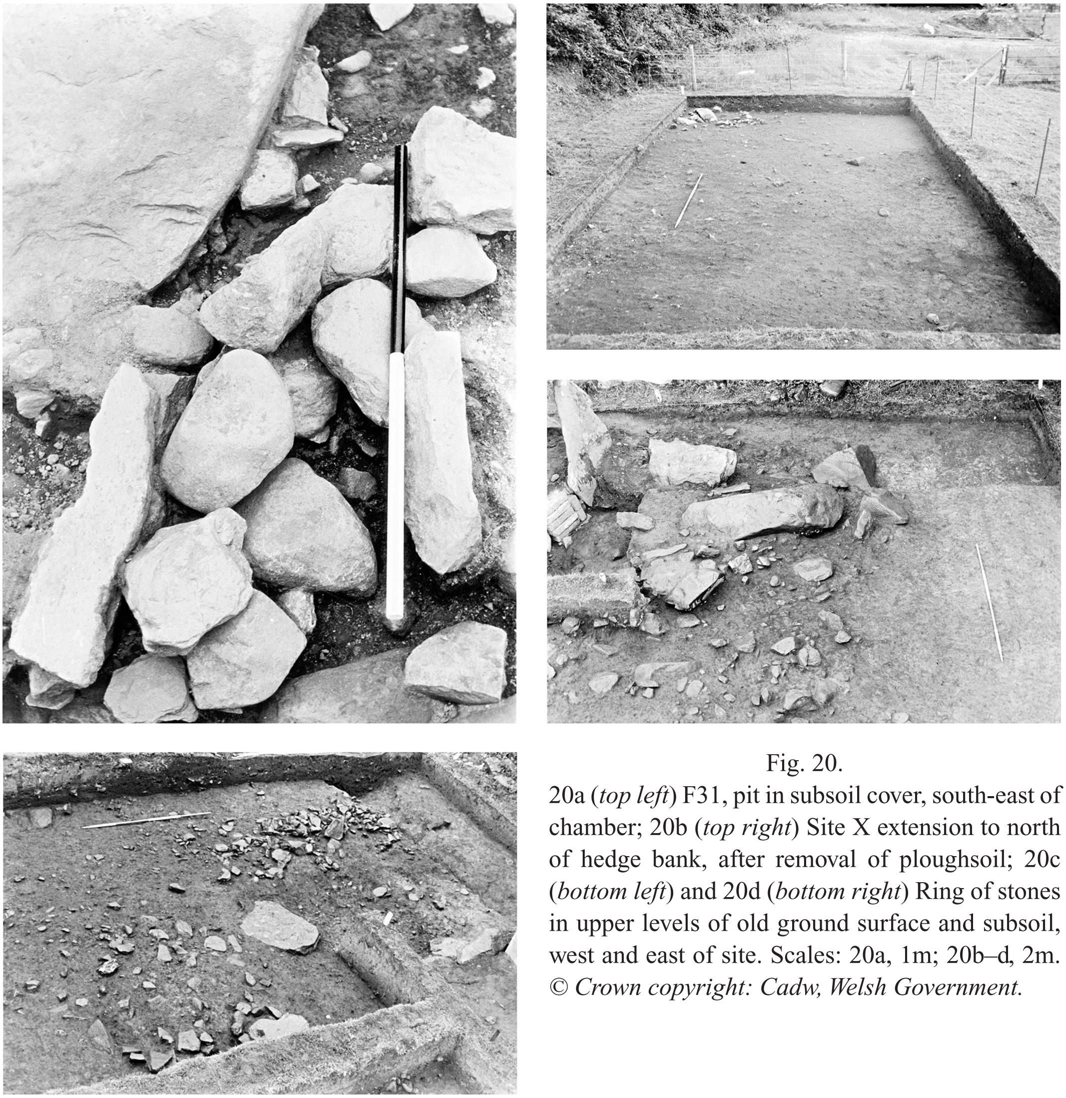


Fig. 20.
20a (*top left*) F31, pit in subsoil cover, south-east of chamber; 20b (*top right*) Site X extension to north of hedge bank, after removal of ploughsoil; 20c (*bottom left*) and 20d (*bottom right*) Ring of stones in upper levels of old ground surface and subsoil, west and east of site. Scales: 20a, 1m; 20b–d, 2m. *© Crown copyright: Cadw, Welsh Government.*

below) suggesting some anthropogenic material and the heavy mottling with manganese suggested that water may have moved through the feature at some time.

The area was then backfilled over a membrane and the chamber fill was retained by a temporary wall of concrete blocks (visible on Fig. 20d, and Fig. 22a and b) to avoid contamination during backfilling and subsequent excavation in the summer.

Third season (5 July to 2 August 1980)
The excavation of the main area of the site was now continued, with the ring of stones to the west, south and east of the chamber uncovered. The area immediately outside the chamber was reopened but with ramps of backfilled material against the external faces of the south-western orthostat S4 and the northern

and eastern S1 and S2. The interior of the chamber was left with backfill revetted by blocks through each of the three gaps between orthostats.

A new area 9.5 by 5.5m (Fig. 5, Site X) in the field to the north was opened, joined to the main site by a 1.5m section through the field bank immediately to the north of the chamber (Fig. 20b). This was designed to test the hypothesis that the ring of stones, had it formed the boundary of either a circular, rectilinear or trapezoidal cairn, would continue to the north and traces might survive. Unfortunately, after removal of topsoil down to subsoil, there were no traces of any structure within the area other than a few stones within the subsoil on the south-west corner of the site; elsewhere, the nature of the top of the subsoil was unvaried throughout the opened area and no anomalies within stone distribution either in topsoil or subsoil were discernible. The field had evidently been long used for cultivation with a considerable build-up of cultivation horizons, with masses of medieval and post-medieval sherds. No Neolithic artefacts or pottery, burning or cremated bone were discovered. Nevertheless, the nature of the stones within the corner was essentially similar to those in the arc of stones in the main site. They lay some 6.2m from the northern orthostat, and might possibly represent the continuation of a sub-circular ring north of the chamber, removed by cultivation elsewhere. If so, the ring would have been sub-circular indeed, as the best surviving section of the arc of stones, on the west, lay only 4.5m from the western orthostat of the chamber. Were these stones to be accepted as part of an original cairn, its maximum measurement would have been some 12m from north-west to south-east, with the chamber set towards the southern side (Fig. 15).

The section through the field bank demonstrated that the existing bank had been preceded by a stone wall (F32), the foundations of which had been dug into subsoil; no traces of prehistoric ground surfaces survived beneath either boundary. The wall and bank which formed the southern boundary of the northern field had, like that on the south, had a field boundary ditch (F28) on its north (field) side, which had presumably contributed toward the disturbance of any continuation of the ring of stones or cairn material. The excavation of the ditch revealed medieval and post-medieval sherds and iron nails within its fill, like the ditches on the south. The bank/wall and the two ditches together constitute a strip of disturbance some 6m wide immediately to the north of the chamber, which is regrettable; it remains a possibility, though probably remote, that elsewhere the bank may have preserved features of the cairn or old ground surface, but this was certainly not the case in the 1.5m section excavated.

The field ditch south of the boundary bank (F24) was partially excavated. The large stone (F57), previously noted to be earth-fast within it, appeared to have been left in situ, with the ditch dug around it. A solution hollow (F25) had developed around it through the ditch fills (Fig. 15). One of the two large supine stones (F4) lay on the southern side edge and, as its removal was unnecessary, the ditch was not completely excavated; however, the eastern half, away from the chamber, was bottomed and found to contain sherds of medieval pottery in its lower fill.

The large modern pit (F8) found in the second season to have been dug immediately outside the south of the chamber was now fully excavated, yielding the same late eighteenth- and early nineteenth-century pottery as previously noted. The pit had been cut within 0.15m of the south-western and 0.30m of S3 and had thus been very destructive of prehistoric levels (Figs 12a and 16). However, sufficient stratigraphy remained unaffected immediately outside the chamber at lower levels, and beyond the pit to the south, for the main north–south stratigraphy to be discernible (Fig. 16). Immediately outside the chamber orthostats was a surviving wedge of redeposited subsoil (Layer 5) covering an 0.85m length of extant old ground surface with slate and pottery, below which were found the upper levels of the fill of the stone-hole (F44 and F19, see below) cut for the southern orthostat S3. Unfortunately, excavation beyond the upper horizons of this cut had to be curtailed for safety reasons, before the base of the stone was revealed. The modern pit itself had been cut into the subsoil, destroying the old ground surface, though not as deep as the bottom of the southern orthostat. To the south, the pit narrowed (Fig. 15: its undulating base and irregular sides initially gave rise to the idea, subsequently rejected, that it had been recut, thus this southern part was labelled F12) with the result that a small sliver of redeposited subsoil covering survived on the west side; this showed that both old ground surface and the redeposited subsoil cover had originally continued at least to this point around and to the south of the chamber.

The extent of the disturbances to the site from the field boundaries, the eighteenth- to nineteeth-century pit and cultivation was clear; now, the continuation of the excavation of the ring of stones, especially on the south of the chamber, revealed further disturbances afforded by another agent of destruction, that of rabbits. A series of hollows and burrows (F27, 33, 40, 41, 37, 42, 47, 38, 48 and 52) had disturbed the ring of stones in some areas, especially the south and south-east, to a significant degree (Figs 15 and 21), while other areas, especially to the west, remained largely unaffected.

The ring of stones was cleaned to remove any smaller superficial stones potentially dislodged by the plough, after which the form of the ring was more reliably discernible with many larger stones within the ring firmly set into the subsoil (Fig. 20c and d). Adjacent to the western part of the stone ring were areas of a thin dark chocolate-coloured soil (Fig. 15, L9) apparently protected from the plough in pockets and undulations in the subsoil or amidst the stone ring. This soil appeared to be the equivalent of the sealed old ground surface (Layer 6) found beneath the redeposited subsoil covering (Layer 5) on the south-east of the chamber, and which had itself extended beyond the covering to the south and east in Site A. It contained significant quantities of Neolithic sherds, both a hard voided black/brown burnished vesicular ware with simple rims (Carinated Bowl), and a grit-tempered or fine quartz-tempered ware with red/buff outer and inner surfaces (Developed Bowl, see Fig. 27 and Gibson, below). On the west, Layer 9 was only discernible adjacent to the stone ring, and was not generally detected further in towards the chamber save for a few discrete pockets underlying the poorly preserved remnants of the redeposited subsoil, Layer 5, immediately outside the western side of the chamber and Gap 1. The extensive system of animal burrows on the south and south-east made the pockets of surviving old ground surface (Layer 9, Site B and Layer 6, Site A) extremely difficult to follow. On the south and south-east ephemeral traces of the layer survived inside and outside the apparent line of the stone ring and extended to the supine stone F3 on the north-east; the narrow strip between F3 and the field ditch was so disturbed that little trace of this layer survived save in a small strip to the north of F3, underlying the redeposited subsoil. No traces were found further north beyond the ditch on either side of the chamber.

On the south and west, the layer formed the matrix of the slight depression cut into the subsoil in which lay the stones of the ring. On the west, concentrations of charcoal (F36 and F29) lay adjacent to the stones of the arc (Fig. 15). F36 comprised an irregular hollow, with an undulating bottom on which a considerable charcoal deposit had been laid directly onto the subsoil, a deposition which evidently pre-dated the excavation of the hollow for the kerb stones (Fig. 18). Upper horizons of F36 then appeared to have been cut in preparation for the laying of the stone ring immediately to the east.

The sequence would appear, then, to be the initial use of the site for the deposition of burnt material in pits or depressions cut into the subsoil, followed, probably quite soon afterwards, by the construction of the stone ring. The surviving stratigraphy was slight but this sequence appeared reasonably reliable.

Below Layer 9 were patches of a dark brown soil (Layer 7/13, originally labelled separately in Sites A and B but later merged) that probably represented remnants of the soil horizons below the old ground surface (Fig. 21). It, like Layer 9, was by no means continuous and would appear to have been removed or disturbed in areas. In places on the south of the chamber it could be seen to be cut by the scoop or depression for the stone ring. Below L13 and L6 was the stained upper surface of the subsoil (Layer 14) and underlying this, the undisturbed natural sandy drift subsoil (Layer 8). Layers 6/9, 7/13 and 14 were roughly equivalent to the area of the ring of stones, protruding a little way beyond it in places and not

Fig. 21. Detail of ring of stones (lower level), L7 (lower horizons of buried soils) and excavated features.

appearing in several areas within the arc. They presumably relate to a roughly cleared surface from which traces of the old ground surface survived, which was subsequently used as a working/burial area. On the south-east this was covered by redeposited subsoil, which was only found within the line of the stone ring. The slight traces of this covering found on the west suggested that here too there may originally have been a covering of redeposited subsoil of which now scant traces survived.

The removal of the north–south section baulk between Sites A and B then allowed a proper appreciation of the total architecture of the site (Figs 15, 21, and 22a). On the west the ring of stones formed a reasonably regular arc but it became less coherent as it approached the large flat boulder F55 that lay somewhat off line; it was set firmly in the subsoil and was apparently naturally positioned. To the south of the chamber, the arc became less regular and was found to have suffered considerable disturbance from the rabbit warren. Initial excavation in upper horizons suggested that there might have been an in-turn on this south side (Figs 15 and 22a). As forecourts are familiar features at chambered tombs, and have been found at portal dolmens, such as at Dyffryn Ardydwy I (Merioneth) and Twlc y Filiast (Carmarthenshire), this feature was almost expected at the point. As excavation continued to define the area, however, the inturn seemed less convincing, given the considerable disturbance in this area. The series of higher set larger blocks of stones apparently forming a line within the arc were only one course high and the 'inturn' was not reflected in the stones below; these, actually set into the subsoil and less subject to rodent disturbance, showed a plan of an irregular arc with a step or change in line directly to the south of the chamber (Figs 21 and 22b). Rodent disturbance was evident even at subsoil level and it is, therefore, far from certain that even this apparent step was an original feature. On the south-east of the chamber and outside the area of the rodent disturbance, the arc of stones regained regularity, incorporating another earth-fast boulder F56, some 2.7m south-east of the chamber (Fig. 21). One metre north of F56, the arc was cut by the slabbed pit, F31, and then lost coherence and petered out as it approached the area now covered by the large supine stones on the north-east. On this south-east side, however, the arc of stones and the outer edge of the redeposited subsoil covering the sherds and cremated bone achieved a coincidence over a short distance (Figs 15 and 18), with the redeposited subsoil lapping over and mixing with the inner stones of the ring.

Outside the main ring of stones on the south and south-east were amorphous hollows in the subsoil with a fill of large stones and a matrix of mixed grey-brown soil (Figs 15, and 22). The two major hollows, F27 (Fig. 22d) and F41/40, connected by a long straight animal burrow F33, presumably represented nesting areas of an extensive series of burrows (Figs 15 and 21). Immediately to the north of F27 lay smaller, but similar, hollows (F48 and F52). The stones had apparently slumped into the fill of this extensive series of burrows and on excavation they were devoid of any artefacts or old ground surface remnants. It is possible that the stones had formed some component of a cairn, but their complete lack of context and association with other features makes their interpretation problematic. Traces of the darker soil, probably derived from the old ground surface (Fig. 15, L6/9), were found mixed intermittently within the loam fill of these stony hollows. It was considered possible that, before being colonised by rodents, they might originally have been created by prehistoric excavation to remove and utilise supine boulders for creation of the chamber; however, this could not be proved nor disproved. That the natural subsoil does hold large boulders deposited presumably by glacial action was graphically illustrated by a section through the subsoil cut for the widening of the B road which was, coincidentally, being undertaken by the former Dyfed County Council to the south of the site, where a large natural boulder was exposed in the section of the cutting for the road (but see Bevins, below, for discussion of this). Alternative hypotheses were that they might originally have held trees, either part of the original forest cover of the site or subsequently.

Hollow F41 to the south of the chamber was 2.6m long, an appropriate length for a candidate orthostat (Fig. 23, a) However, had the hollow been created for the removal of such a potential orthostat, it might have been expected that marks of excavation, a ramped side, or at least remnants of Neolithic ground

Fig. 22.
22a (*top left*) Stone ring upper levels, from south-east; 22b (*top right*) Stone ring, lower levels, from south-east with pits and burrows excavated. 22c (*bottom left*) Stone-filled burrows on south-east; 22d (*bottom right*) Detail of F27. Scales: 22a and 22c, 2m; 22b and 22d, 1m.

surface would have been uncovered, and no such evidence was found. Instead the hollows were filled with smaller stones and had been riddled with rabbit burrows. On balance, it seems most likely that the hollows were merely the result of prolonged rabbit activity with boulders from the subsoil, naturally occurring or dislodged by burrowing and periodic cultivation, gradually settling within them.

Beyond the main burrows F27 and F41 were two smaller features cut into the subsoil, F34 on the south-south-east and F37 on the south of the chamber. Unconnected with the warrens, they were not associated with any stratigraphy or other features and had no artefacts within them. F34 was a circular pit, 0.24m across and 0.10m deep, evidently dug into the subsoil though, with no association with any other feature and, containing no charcoal or artefacts, impossible to date (Fig. 24, c). F37 was a longer irregular hollow, 0.90m long and 0.10m deep that probably merely represented a trial burrow.

To the south of the chamber, immediately outside the arc of stones, and connected to the warren described above, were a number of similar stone-filled hollows (Fig. 15). F38 (Fig. 23, c–e) was a large amorphous area of warren with two nesting areas, one on the south-east, connected to and continuous with F41, and one on the south-west which was connected to F47, a sinuous underground warren extending to the south-west, away from the ring of stones. South of and between F38 and F47 was a similar warren hollow F42, some 1.4m long (Figs 15 and 23f) which ran southwards beyond the limit of the excavation.

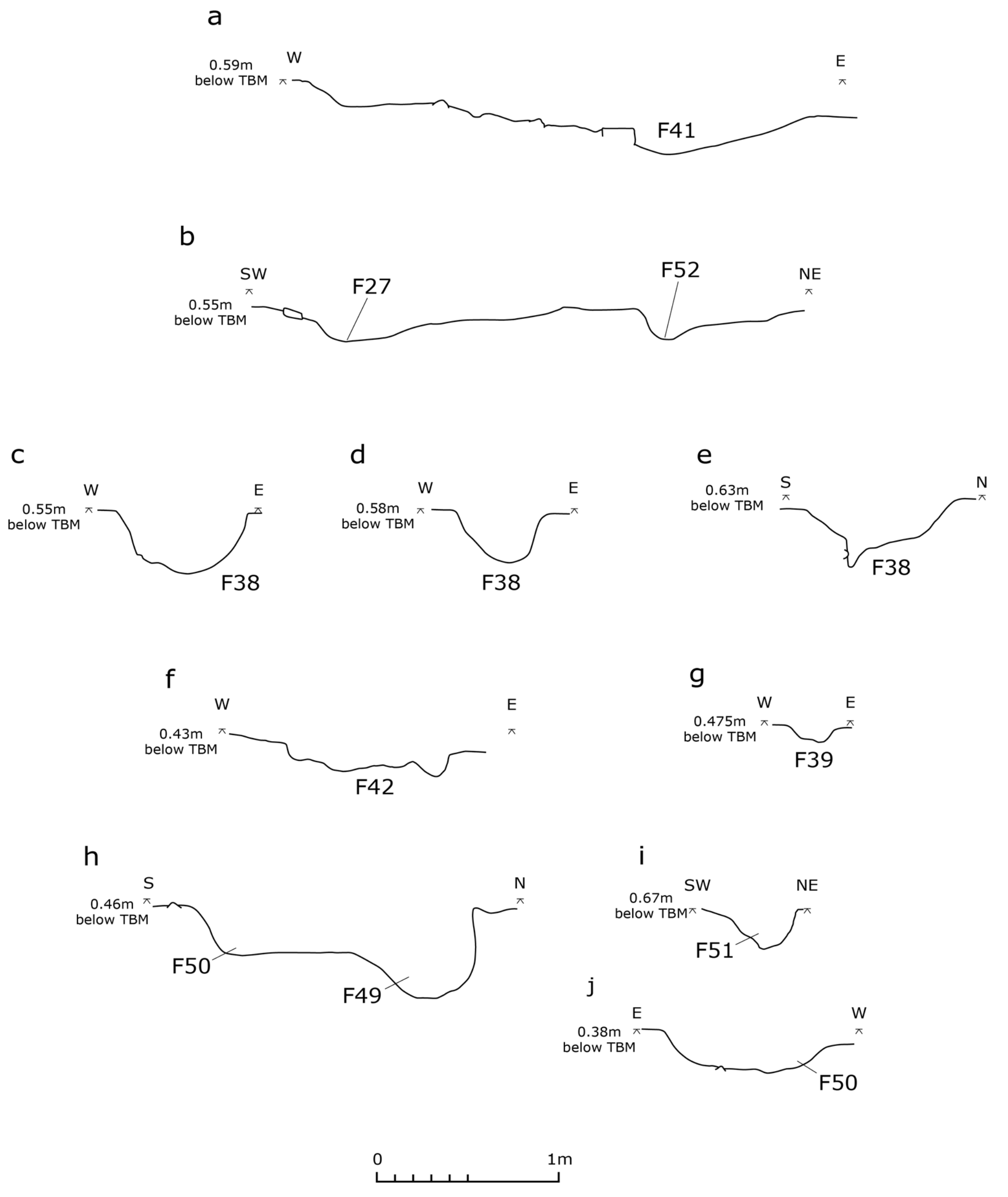


Fig. 23. Profiles. See Fig. 8: a–Dg59; b–Dg65; c–Dg60; d–Dg61; e–Dg63; f–Dg64; g–Dg49; h–Dg 69; i–Dg66; j–Dg70.

While the southern extent of the warrens was easily detectable, the northern edges petered out when they reached the line of the arc of stones. There seems little doubt, however, that the ring of stones on this southern part will have been impacted upon by the warren and its eccentric line here may be the result of

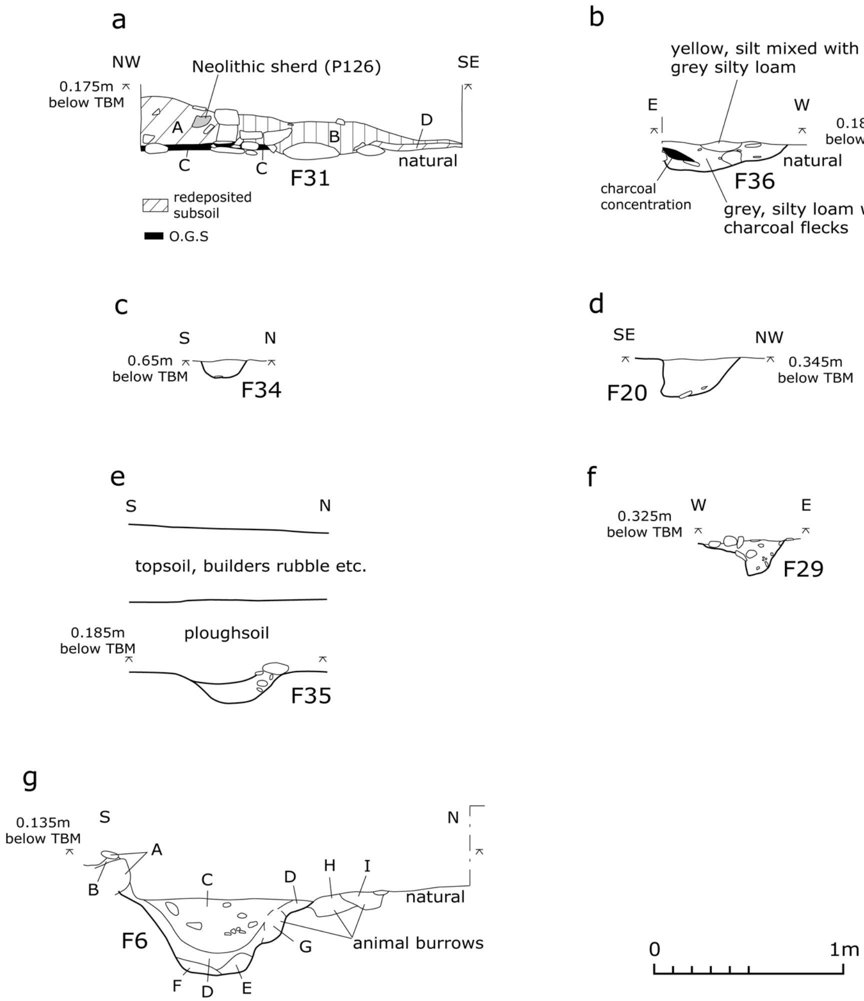


Fig. 24. Sections. See Fig. 8: a–Dg16; b–0.15m N of main section line; c–Dg36; d–S35; e–Dg42; f–Dg34; g–Dg22.

displacement. The warrens produced no Neolithic sherds but the one broken and burnt piece of polished axe unfortunately came from the very disturbed context within F38 (Fig. 25).

Nevertheless, north of, and amidst the warren were some undisturbed areas. Most notably south of the chamber, the area of redeposited subsoil and old ground surface defined by the inner edge of the ring of stones was found to survive to the south of S3 where the warren and eighteenth-century pit had stopped short of the chamber. This small section of old ground surface was a continuation of the main area and like this held pottery sherds. Immediately outside the chamber, 1m south of orthostat S3, was a small circular pit F51 (Fig. 21; Fig. 22b; Fig. 23, i) cut into the subsoil, 0.34m in diameter, round bottomed and 0.22m deep. Only the lowest part of this pit survived, cut into the subsoil below where the modern F8 had removed all upper section. It had no associated artefacts. Between warren areas F42 and F47, a small

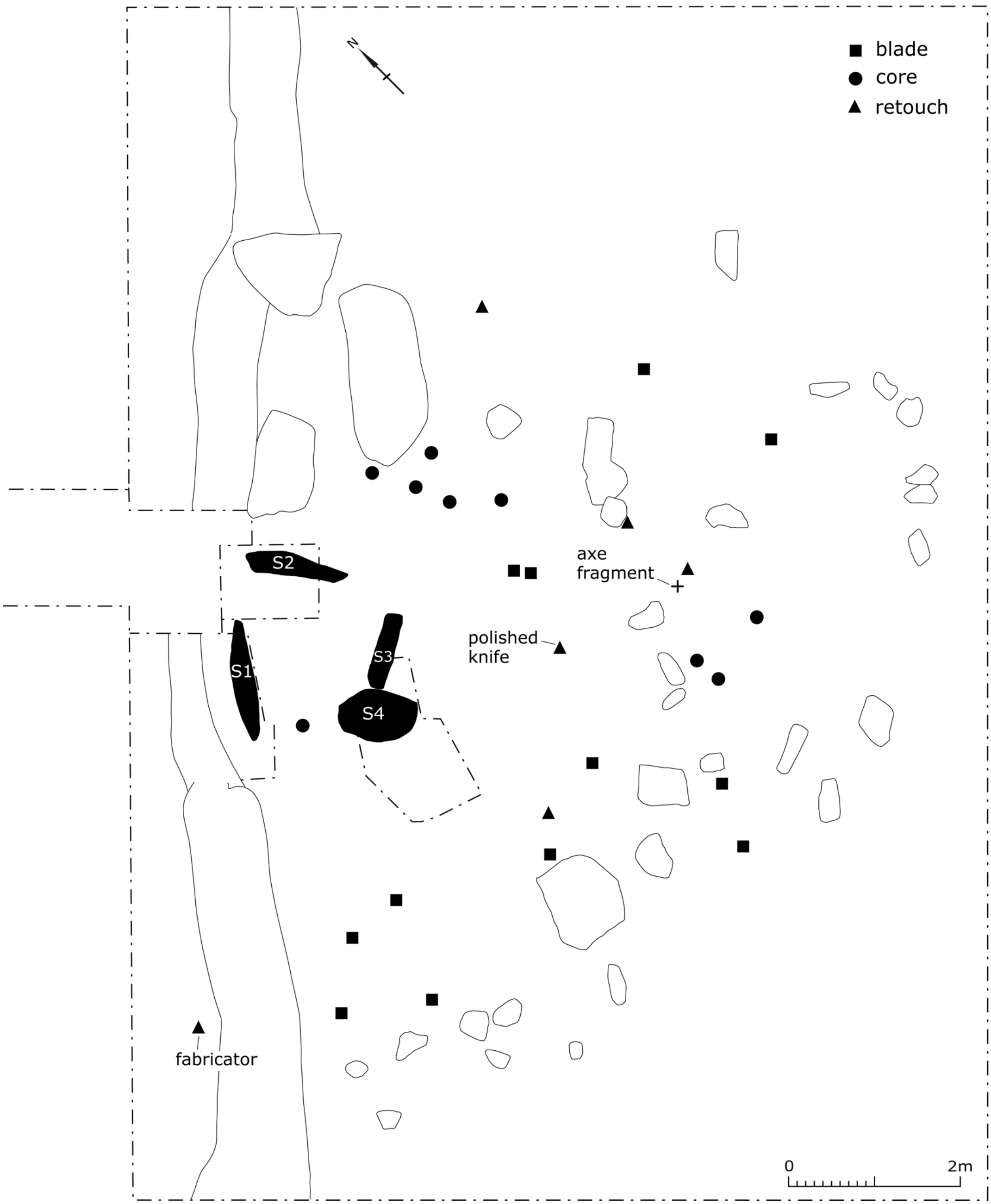


Fig. 25. Distribution of lithic cores and blades (secure contexts) and retouched pieces (all contexts).

pit F39, 0.25m in diameter and 0.10m deep, was probably Neolithic, with a fill of Layer 9, though it was devoid of finds or charcoal (Figs 21, 23g and 22b).

On the extreme south-west of the excavated area were found two arcs of stakeholes (Fig. 21, F26) cut into the subsoil with a fill of brown soil. They were 50–80mm in diameter and 80–100mm deep. Too regular to be root holes, they were without association or artefacts and were undatable.

On the west side of the chamber the rabbit warren had not extended north or west of boulder F55. The ring of stones was, accordingly, better preserved, as were a number of amorphous small hollows and pits. One, F20, had been dug immediately to the north of F55, 2.4m south-west of the south-west orthostat (Fig. 26a). It lay within the inner stones of the stone ring, 0.8m from the outer, and measured 0.40m across, 0.20m deep, an irregular D-shape in section, with its south-eastern straight edge toward F55, confirming that the boulder was at least *in situ* by the time of the digging of the pit. It had a fill of dark earth, burnt bone, Neolithic pottery sherds (Modified Carinated Bowl, P228–9, SG23) charcoal and flint. Its D-shaped section was curious, and looked as though it had been dug with a spade in a single cut. It appeared to have been dug through Layer 9 but whether it pre- or post-dated the kerb (Fig. 24, d) was uncertain. Phosphate analysis gave a strong reading in the centre of the pit and positive from elsewhere, suggesting that it contained some anthropogenic material (see Keeley and Girling below).

Fig. 26.

26a (*top left*) Stone ring, detail of lower stones on south-west, near F55, with Neolithic pits; 26b (*top right*) Stone ring from south-east, Neolithic pits south of chamber and near F55; 26c (*bottom left*) Completed excavation of stone ring, from south-east; 26d (*bottom right*) Raising of natural boulder F55. Scales: 1m.

Hollow F50, found immediately to the south-east of the earth-fast boulder, was a pit containing Neolithic pottery (Carinated Bowl P215, SG4) but its original form was uncertain, having been disturbed by the warren F47. Immediately to its north-east was a round-bottomed pit F49, 0.60m across and 0.55m deep, which had escaped disturbance from the adjacent warren, and produced quantities of Neolithic sherds apparently carefully deposited around the sides of the pit (Figs 23h, 26b, 27). No complete vessels were represented, but the single sherds were of different fabrics (Sherd Groups 2, 4, 15, 19, 21 and 24) of Developed Bowl, Carinated Bowl and Modified Carinated Bowl. The best-preserved pieces of cremated bone also derived from this pit, including a section of jaw and tooth. Its matrix was a grey silty soil and like F36, it probably pre-dated or was contemporaneous with the raising of the kerb (Fig. 23h).

A number of other small hollows or depressions were found dug into subsoil, some underlying Layer 9, others apparently dug through it or not associated with it at all. F36, west of the chamber and outside the ring of stones has already been described (see above). Its charcoal component was sampled for radiocarbon dating and gave the earliest date for the series, *c*. 3780–3380 cal. BC (CAR-392) thereby giving an indication of date of the raising of the stone ring (Fig. 24, b); F35 was similar to F36 in appearance, being a spread of brown soil in a scoop in the subsoil, analogous to the old ground surface but without any artefacts or cremated bone associated; it did have a charcoal component (see Griffiths, below). It was 0.92m long (east–west, but incomplete as it ran westward into the section and beyond the area available for excavation), 0.50m wide, and 0.18m deep (Fig. 24, e). A small pit, F29 (Fig. 24f), 0.40m diameter and 0.19m deep, had been cut into the subsoil, 1.6m to the east of F36; it had a similar charcoal fill and had similarly been cut by and partially destroyed by the field ditch, though lower horizons of the destroyed north side were visible in the sloping ditch side.

The excavation continued with the removal of the area of redeposited subsoil (Fig. 15, L5) to the south-east of the chamber. The western part of this had been revealed in the second season and shown to be overlying the old ground surface and quartz-tempered pottery deposits. The redeposited subsoil continued further from the chamber in a 2.4m wide segment from the supine stone F3 on the north and south to the eighteenth- or nineteenth-century pit F8, which had cut through it. The old ground surface (Layer 6) invariably survived beneath it and considerable numbers of sherds of the quartz-tempered Developed Bowl were found, in some cases associated with cremated bone and charcoal on and amidst the same laid surface of siltstone pieces encountered previously (Fig. 17). No further complete vessels were found but the considerable number of sherds encountered were all of the same type of Developed Bowl, with the quartz tempering of Fabric 2 (Sherd Groups 6–16, see Gibson, below, and Fig. 27).

The complex and constrained area around supine stone F3 was then tested, though, as neither of the supine stones were moveable, excavation was restricted. The topsoil around the stones had contained large numbers of superficial stones deriving from field clearance. Beneath this lay the redeposited orange-yellow subsoil (Fig. 15, L5) continued from the deposit encountered the previous season, of the same presumably Neolithic derivation. Beneath the 0.25m deep lens of redeposited subsoil was a layer of charcoal-mottled soil which appeared to be the continuation of the old ground surface found further toward the chamber, but thinner and devoid of any pottery deposits. The removal of this thin layer revealed the apparently undisturbed subsoil; found within this was a large shallow amorphous hollow F46 that continued under the western edge of the supine stone F3 (Figs 21, 26c). Completely devoid of charcoal or cremated bone within its sandy fill, this was subsequently tentatively interpreted as a natural undulation or an indentation in the subsoil possibly created by, or after, the deposition of, F3, but its excavation was inevitably incomplete where it passed under the stone. There was no evidence to suggest that F46 was a man-made hollow or that stone F3 was anything other than a naturally positioned boulder, though its final excavated form, the pointed ends being proud of the ground levels, inevitably give it the appearance of resting in a non-natural position. There were no such doubts about F4, the supine stone lying by the field

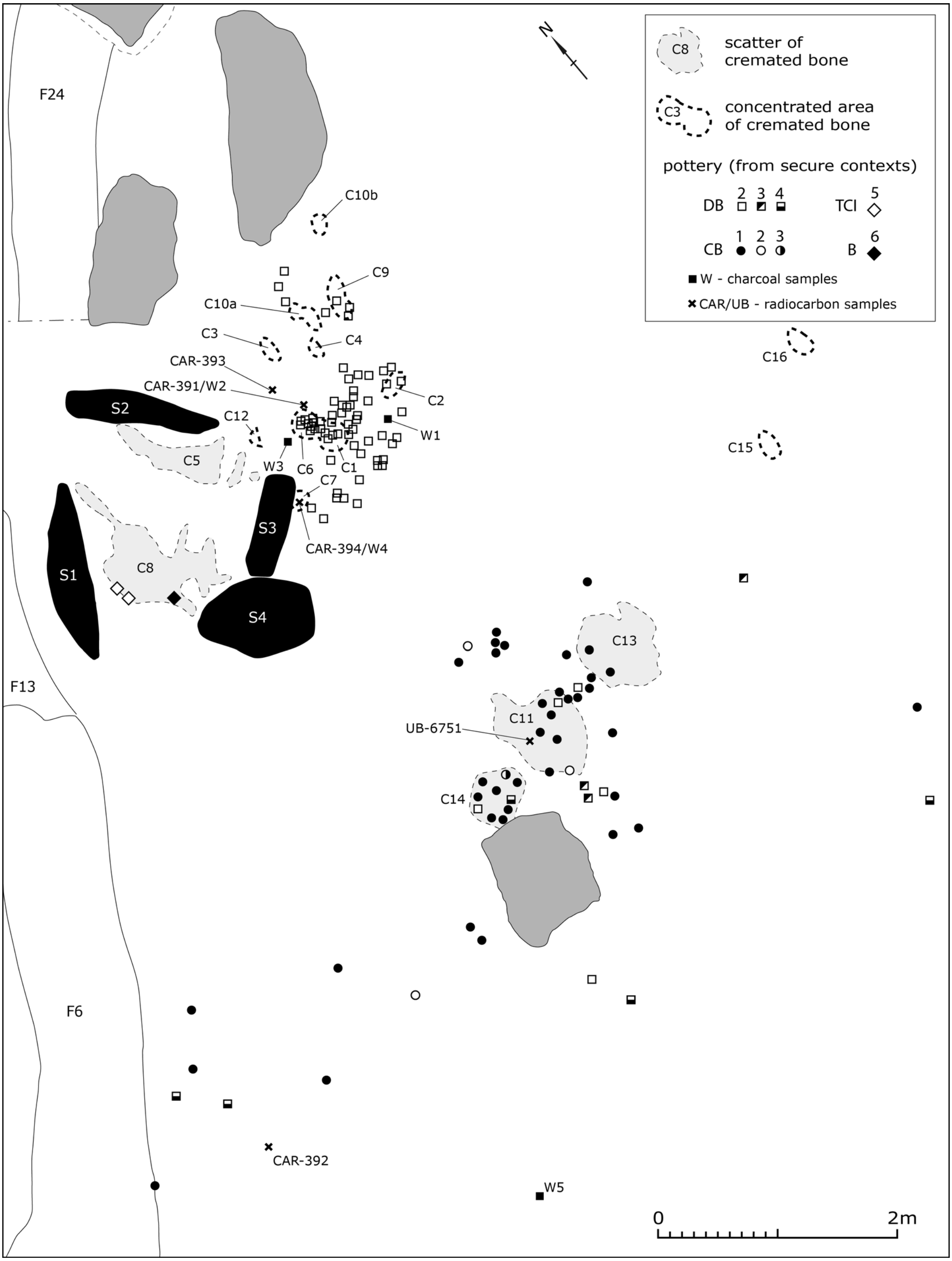


Fig. 27. Distribution of Neolithic pottery types (secure contexts and chamber; DB=Developed Bowls; CB=Carinated Bowls, TCI=Twisted Cord Impressed Ware; B=Beaker; 1–6=Fabric Types), cremated bone deposits, and positions of charcoal and radiocarbon samples.

edge to the north-west of F3; ploughsoil and small stones appeared to underlie it, though the solution hollow F43 had severed any direct connection; the stone could not be moved, so a section against the stone was left unexcavated. It had evidently been dumped in comparatively recent times, probably for field clearance. Traces of redeposited subsoil and old ground surface may survive beneath F4, though the stone lies immediately on the field ditch edge and doubtless deposits beneath will have been disturbed.

The excavation of redeposited subsoil and old ground surface allowed an appreciation of the form of the ring of stones which was coincident with the outer edge of the redeposited subsoil for a short 2m stretch on the south-east of the chamber between the modern pit and rabbit warrens on the south and F31 and supine stone F3 on the east (Fig. 15). The discontinuous nature of the survival of this redeposited subsoil found only in the segment on the south and east of the chamber, with slighter traces on the western, beyond gap G1, means that its original function remains uncertain. The initial hypothesis that it represented the component material from a cairn that would originally have covered the entire site could not be verified as, at the best preserved section of the stone ring on the west, no redeposited subsoil deposits were coincident with the stone arc. On the south and east of the chamber, where the redeposited subsoil survived well, the line of the stone ring was more difficult to ascertain. Alternative hypotheses were considered, that this material could be better interpreted as a covering or blocking over the burial deposits within a forecourt to one side of a cairn; or (given the lack of evidence for a cairn) some sort of platform or defined working area; or that it might originally have continued around the chamber on all sides, surviving best in the discrete area on the south-east either merely accidentally or because, perhaps, it was laid more thickly at this point to cover deposits or burials.

The nature of such a forecourt or separately defined ritual area was virtually impossible to determine given the disturbed nature of the archaeology. The components of the stone ring that were set into the subsoil on the east could, with the eye of faith, be seen to turn slightly in towards Chamber G2 (Figs 21 and 26c), which could suggest some sort of forecourt where the most reliable survival of old ground surface lay with the deposited stone, pottery including the inverted pot 16, and the cremated bone. North of this point virtually no stones survived save for some earth-fast stones within the field ditch, the slabs bounding F31 and the large supine stone F3. No stones appeared to pass beneath the supine stone, and the few that were found on the north of the field ditch were superficial. The nature of the stone ring and certainly the form and shape of any hypothetical forecourt on the east, therefore, remains unclear.

The interior of the chamber received no further excavation in the final season, but the excavation of the redeposited subsoil and old ground surface on the exterior of the chamber on the south and south-east permitted a test section to explore the stone-holes for the erection of the four orthostats of the chamber; it was hoped that this might yield some dating evidence and evidence for the construction of the megalith. As the interior was so small an area, reduced further by the internal pinning stones, and as safety considerations forbade the further excavation of the shallow-seated northern orthostat S1 and eastern orthostat S2, there was no possibility of testing the stone-holes from within. From the exterior of the chamber, the same safety considerations made excavation around S1 and S2 ill advised. The large boulders lying on the external face of the south-western S4 had resulted in our leaving this external side of the chamber unexcavated; this was partly due to the difficulty of removing these large boulders and partly for stability/safety reasons, as this was a load-bearing orthostat. The full excavation of the eighteenth- or nineteenth-century pit on the south of the chamber had already exposed a significant depth of the southern exterior face of orthostat S3 and had revealed the upper levels of the cut for the stone-hole (Fig. 16). This orthostat was evidently deep seated but was not load-bearing, and thus it was chosen as the best candidate for exploration of a stone-hole. Accordingly, a section against its south-eastern corner was excavated (Fig. 12b). The edge of what was first interpreted as the stone-hole was discovered only 0.20m from the side of the orthostat (Fig. 16, F44); it was excavated to a depth of 0.20m at which point its curving profile resulted in the edge being only 50mm from the side of the stone, making it impossible to excavate to any greater depth. The side of the stone at 0.20m below the top of the subsoil was straight, not tapering, and gave no indication of the depth of the orthostat. The fill of the stone-hole had contained a small deposit of cremated bone (C7) and a reasonable quantity of charcoal, though distributed throughout the hole rather than being in one piece. Nonetheless it was clearly an important date to try to ascertain so was submitted for radiocarbon dating. Its date of *c*. 3650–3190 cal. BC (CAR-394) can be assumed to at least give an indication of the date of erection of the megalith.

During the excavation of what was assumed to be the stone-hole, the material through which it had been excavated, initially thought to be undisturbed subsoil but with less assuredness as the excavation continued, was tested by sectioning. The nature of the glacially derived subsoil was very variable in character but on excavation it became clear that there was an area of fill within a pit excavated from 0.70m outside and south of the base of S3. This loose area of fill, (Fig. 12b, F19), was excavated 0.70m further south-west to the unexcavated area outside S4, and 0.80m to the north, where it was found to curve around to section the south-eastern G2 and into the chamber. Excavation ceased at this point and it was not continued into the chamber interior; this ’pit’ was not visible in plan either inside or outside the chamber; its excavation outside the chamber was perforce done by ‘feel’ rather than visually. It was 0.20m deep at the edge, but became rapidly deeper as it approached the orthostat S3 and had two large and two smaller boulders within its fill, two of which were tilted towards the orthostat (Fig. 16). The boulders were not removed; consequently the depth of the feature could not be discovered nor its function fully understood given the constraints of space for excavation and safety considerations. It was initially considered that F19 could have represented the sides of a large pit dug, perhaps, to extract a candidate orthostat or raw material for a cairn or platform prior to erection of the megaliths, but its sloping sides towards S3 and pinning stones made it more likely that it was a stone-hole, large though it was. It is possible that S3 and 4, being so close together, would have been erected in one large hole excavated to accommodate the entire ‘portal’ (I am most grateful to Frances Lynch for this suggestion). Certainly the stone cut visible for S3 and 4 seen inside the chamber floor did not seem to have any break between the two stones. Its fill was devoid of artefacts other than a few small pieces of charcoal. The two boulders that tilted towards S3 appeared to be pinning stones and it seemed most likely that the feature does indeed represent the original cut for the orthostat or orthostats. It may have been subsequently recut, or there may have been further disturbance while the stone was manoeuvred into position, resulting in F44. The possibility that F44 could be a solution hollow around the stone was dismissed during excavation, as it appeared to be a more deliberate feature.

The removal of the redeposited subsoil (Layer 5) and old ground surface (Layer 6) around F3 showed how the edges and both pointed ends of supine stone F3 lay largely above subsoil, but with the lower surface lying in the probably natural indentation F46. Unfortunately it remained unresolved as to whether its deposition was natural or man-made, though its appearance after excavation, with its two pointed ends lying largely proud of the subsoil, gave a strong indication that it had been deposited by man (Fig. 26c). Several other boulders—F57 (the boulder in the ditch), F56 (to the south-east), and F55 (on the south-west)—lay more deeply embedded in the subsoil and appeared to be naturally set, contrasting with the more exposed appearance of F3. The stratigraphy around F3 was unhelpful as the redeposited subsoil (Layer 5) found adjacent to the western pointed end of the stone and in a narrow lens extending some way along its northern edge, had been removed immediately against the stone by solution hollow F58 that had been created between the cairn material and the stone, thereby destroying any direct contact between the two. However, the fact that small amounts of redeposited material did survive along the northern edge and to a lesser degree in pockets along the southern as well as all along its western end suggests that the stone lay on or within the ‘cairn’ material and its eastern end probably extended beyond it. The stained upper horizon of the subsoil (Layer 7) which represented the interface between the old ground surface and undisturbed subsoil was detected around the entire stone so presumably, if it had been deposited, this must have occurred before much cultivation had taken place as, outside this line, L7 was not apparent, presumably removed by the plough. So, while it could conceivably have been a natural boulder cleared around during the creation of the megalith and cairn and incorporated within it as the eastern edge of the cairn material was piled up around it, it seems more likely that it was brought to the site either during the megalithic building phase or early in the subsequent history of the site and dumped on the edge of the cairn. It still remains a possibility that it originally formed part of the structure, as an orthostat outlier standing to the east, for instance, with its original hole now buried by its fall, but the stratigraphy and excavated evidence makes it impossible that it formed part of the chamber itself as an orthostat in any of the existing gaps.

If F4 and probably F3 are eliminated as being natural boulders, it seemed that the ring of stones had still incorporated at least two other boulders, F55, F56 and perhaps F57. Subsequent to the main excavation season, it was decided to test this hypothesis and lifting gear was employed to lift F55, chosen as being accessible and yet clearly an important component, given that the three pits, F49, F50 and F20, had been excavated adjacent to it. The stone was massive and set fast within subsoil, with clean subsoil around and beneath it (Fig. 26d). There was nothing to suggest that it was anything other than a natural boulder within the subsoil. The Neolithic pits F49, 50 and 20 excavated against it suggest that it may have had some significance during the creation of the ring of stones, with the deposition of the sherds of different vessels and the cremated bone within F49 assuming a particular significance at an early period within the history of the site.

DISCUSSION OF THE RESULTS OF EXCAVATION

Dating evidence

The lack of dating evidence from chambered tombs in south-west Wales has bedevilled studies of these sites. The radiocarbon dates from Carreg Coetan Arthur, four from charcoal and one from cremated bone (Fig. 27 and see Dresser, below), constitute the most comprehensive series of dates from any of the tombs from the area and any of the portal dolmens in Wales and Cornwall. Together they assist in understanding the date range for the construction of the chamber as well as pre-megalithic activity but also provide further evidence for dating for contemporary pottery and flint artefacts (see below). The earliest derived from F36, a deposit of charcoal beneath the stone ring west of the chamber at *c*. 3780–3380 cal. BC (CAR-392). The sample from the fill from the stone-hole F44 for chamber orthostat S3 was *c*. 3650–3190 BC (CAR-394); the sample from the old ground surface beneath the cairn material east of the chamber and associated with the quartz-tempered Developed Bowls was *c*. 3620–3020 cal. BC (CAR-391) and the sample from the redeposited subsoil south-east of the site, interpreted as covering or blocking over the area of ritual activity, *c*. 3360–2920 cal. BC (CAR-393). The dates have been subjected to Bayesian chronological modelling which has been published elsewhere in relation to other radiocarbon dates for Neolithic sites in the Marches and Wales (Whittle *et al*. 2011, 534–5). The most secure dates were the samples from F36 and the old ground surface, as they comprised rich deposits of well-preserved pieces of charcoal. Kytmannow's dating of the cremated bone gave the youngest date, *c*. 3090–2900 cal. BC (UB-6751), younger than expected and later than the apparent closing of the tomb ritual area, but it should be noted that it derived from a different material and was undertaken by a different laboratory several years after the batch of dates for the charcoal.

These dates would suggest that pre-cairn activity pre-dated the construction of the stone ring and then the megalith, after which ritual or burial rites were performed at least outside the chamber; finally these deposits were covered with blocking material. Further cremations may have followed the establishment of the megalith and the final closure of the structure. This interpretation has a logical progression though it may be over dependent upon the reliability of the dating. The charcoal from the old ground surface (Layer 6), directly associated with the quartz-tempered Developed Bowls, stone 'paving' and cremated bone around which it was found, does at least give a date for the later deposits at the site, while the charcoal found from within the covering material above (Layer 5) may derive from the final closure but may have originated within the surrounding old ground surface. The dates associated with the stone ring help date the initial site demarcation, pre-megalithic constructions and rites, but the sherds of Carinated Bowl found near the spreads of cremated bone were generally abraded and scattered, which makes this association with the date of the pottery manufacture less reliable.

Kytmannow's analysis of the dating of portal dolmens in Wales, Ireland and Cornwall (2008, 103–4; also Whittle *et al*. 2011, 755) suggests that the first depositions and activity at Carreg Coetan Arthur, within the late Early Neolithic or Early Middle Neolithic and continuing through the Middle Neolithic, correspond in date quite closely with the sparse numbers of Irish Sea area portal dolmens with carbon dates, such as Sperris Quoit and Zennor Quoit, Cornwall (see below). While none of the Carreg Coetan series conclusively dates the construction of the chamber itself (as opposed to pre-chamber activity) the date from the orthostat stone-hole F44 (*c*. 3650–3190 cal. BC), is probably not too far from the construction date though, again, the charcoal may have derived from adjacent ground surfaces; this pushes the date of construction well into the Middle Neolithic. Kytmannow's second phase of activity observed at various Irish Sea portal tombs (see below) is evidenced at Carreg Coetan by the Impressed Ware and Beaker sherds in the chamber (see Gibson, below). The samples of charcoal taken for radiocarbon dating were not specifically identified but were selected from larger samples taken from the same contexts which were subsequently identified. It can be confidently asserted that all would have been from tree pollen (alder, oak and hazel) and this should be taken into account when assessing their reliability.

Artefact distribution, function and dating

Quartz-tempered Developed Bowls (SGs 6, 8–19, see Gibson, below), cremated bone and charcoal were all found together on the old ground surface surviving on the south-east of the chamber (Figs 17 and 27), an ill-defined area of burial/ritual activity, which subsequently received a covering over the deposits. This covering material itself held three pieces of a quartz-tempered round-bottomed bowl of the same Developed Bowl type as on the old ground surface (SG7). The association of this Developed Bowl in Fabric 2, characterised by its large quartz inclusions and out-turned rims with incised line decoration, with the deposits of cremated bone in this context is clear, despite their probable origin as cooking vessels (see Keeler and Stern, below). The association of this fabric with the charcoal yielding the date *c*. 3620–3020 cal. BC (CAR-391) from the burial area is secure, and with the charcoal from the covering material *c*. 3360–2920 cal. BC (CAR-393) slightly less so (Figs 17 and 27). This fabric and form conforms reasonably to Decorated Bowls found elsewhere, dated to between 3700 and 3300 cal. BC (see Gibson, below). The thin-section analysis of the fabric of the Developed Bowl (sherd P64, Fabric 2) with its large quartz clasts, suggests a manufacture close to the site (see Jenkins and Williams, below). Residue analysis undertaken from one sherd from P16 (Sherd Group 6, Developed Bowls in Fabric 2), the complete vessel from outside the chamber, revealed an abundance of saturated fatty acids indicating the presence of a degraded oil or fat (see Stern, below, Fig. 32) suggesting the use of the pot for storing or, more probably, cooking animal products such as milk or cheese. The residue analysis will, apparently, only give such strong results after prolonged use involving heating with fats, so probably cooking rather than storage (Stern in Gibson 1999, 118); it is also unlikely that fat derived from human cremation would give such readings. The majority of the flint cores found from secure contexts (5 out of 8) came from the old ground surface in this area (Fig.

25). Neither Carinated Bowls nor retouched tools and only two blades came from this context.

All the sherds of Carinated Bowl (Fabric 1), Modified Carinated Bowl (Fabrics 1, 2 and 3), and the fewer sherds of Developed Bowl (Fabrics 2, 3 and 4) were found to the south and west of chamber, all adjacent to the stone ring, within Layer 9 (Fig. 27). The main sherd concentration, mostly of Carinated Bowl in Fabric 1 (vesicular), was found amongst scatters of cremated bone but in a less reliable context than on the south-east. The thin section analysis of the Fabric 1 sherds (P117 and 173, see Jenkins, below) showed that its distinctive voids were caused by the dissolution of calcite cleavage fragments; its calcareous nature and possible presence of chert grains implies an origin within a limestone/chalk area for the materials used in the majority of the Carinated and Modified Carinated Bowls, and thus a non-local manufacture. Interestingly, however, the sherd of Fabric 3 (P539), identified as Modified Carinated Bowl, was interpreted as being of local manufacture. Of the few sherds of Developed Bowls found in this area, only four are Fabric 2 (quartz-tempered) and do not contain the same large quartz tempering as those found within the burial area on the south-east. Sherd Group 19, Developed Bowls in Fabric 4, seemed most likely to have had a local manufacture. Thus all pottery interpreted as Developed Bowls appear to have been manufactured locally, albeit incorporating materials deriving from different local areas; the Carinated Bowls appear to have been manufactured non-locally, while Modified Carinated Bowls were made of two distinct fabrics, of local and non-local manufacture respectively. The dating of charcoal found adjacent *c*. 3780–3380 cal. BC (CAR-392) adds to the growing body of dating evidence for Carinated Bowl vesicular ware, such as at Llandegai, north-west Wales, where it was dated to around 4000–3700 cal. BC (see Gibson, below). One sherd of Carinated Bowl (Sherd Group 4, Fabric 1) was subjected to residue analysis and interestingly gave the same result as the residue from the Developed Bowl sherd, described above, having an abundance of fatty acids suggesting a use connected with storing or cooking milk or cheese (Fig. 32). However, analysis of sherds from Sherd Groups 14 and 15 (Developed Bowls, Fabric 2) and 1 (Carinated Bowls, Fabric 1) gave no significant positive result, suggesting that not all pots deposited on site had previously been used in the same way or for not sufficiently long to give a positive reading. The majority of the flint blades from secure contexts (10 out of 12) came from positions near the ring of stones (Fig. 25).

The few features that pre-dated the stone ring were generally devoid of artefacts; the charcoal rich F36, which certainly pre-dated the ring, and F29 and F35 which may do so, held charcoal but no artefacts. A potential early feature, F49, a pit dug against the large boulder F55, which may be contemporary with or possibly pre-date the stone ring, contained, interestingly, single sherds of two Developed Bowls, Fabrics 2 and 4, and three from Carinated Bowls and Modified Carinated Bowls in Fabrics 1 and 3, laid out, apparently deliberately, around the interior rim of the pit. F20, another similar small pit dug adjacent to F55, contained two sherds of Carinated Bowl, Fabric 1, while F50, also dug against F55 but disturbed by rabbit activity, contained a single sherd of Carinated Bowl, Fabric 1. Thus it would appear that, despite the earlier date generally given to Carinated Bowls, Developed Bowls in Fabrics 2 and 4 and Carinated and Modified Carinated Bowls in Fabrics 1 and 3 were all in use at the same time (see Whittle *et al*. 2011, 863).

A number of Carinated Bowl sherds of Fabric 1 from different sherd groups, together with a few Developed Bowl sherds, were found amidst Cremated Bone Deposit 1, east of F55 (Fig. 27). This context was on the surface of Layer 9, under the base of the ploughsoil and thus potentially had been subject to some disturbance. The dating of the cremated bone, undertaken in an attempt to secure a date for this type of pottery, which is generally considered early, was in fact the latest in the series of dates from the site: *c*. 3090–2900 cal. BC (UB-6751). However, the strict connection between pottery and bone was not secure, though the cremated bone itself seemed a reasonably undisturbed discrete deposit.

The interior of the chamber itself had been thoroughly ransacked and Neolithic, Bronze Age and medieval pottery sherds were randomly mixed with cremated bone and charcoal. However, it was within this disturbed context that the Impressed Ware sherds and the single Beaker sherd were found. Sherds from disturbed contexts are not generally shown on Figure 27, but an exception was made for these latter two types, given their rarity and importance as evidence for the continuing interest in the chamber in the Bronze Age.

Flint is generally poor quality material derived from beach pebbles (see Figs 35–38 and Healey, below) as at Carreg Samson and elsewhere, (Lynch 1975, 24; Wainwright 1963). The discovery of Mesolithic microliths from the foreshore at Newport is discussed below (David 2007, 127; Thomas 1923) and it seems likely that the blades found at Carreg Coetan Arthur, apparently of a different technology from the other flints, derive from Mesolithic activity (see Healey, below) as well as the two microliths which certainly do. However, finer artefacts, such as the polished knife and fabricator (Fig. 38) are almost certainly imported, higher quality, flint and, along with the cores and flakes, are compatible in date with the main period of use of the chamber. The distribution of blades, cores and retouched flints from secure contexts is shown on Figure 25 but it is unfortunate that the few tools that were recovered were all from disturbed areas, as was the fragment of burnt polished axe (Fig. 39); their position is also shown on Figure 25. However, the microwear analysis (see Donahue, below) confirms that the knife and fabricator were not new tools made specifically to accompany burial or ritual deposition, but tools that had already seen a fair degree of use probably for leather or hide working. One of the Mesolithic microliths, interestingly, also appears to have seen service in the cutting of soft tissue, probably flesh.

Stone objects were as disparate and enigmatic as usual at chambered tombs and were invariably from disturbed contexts (Fig. 39). The waisted stones, perforated disc and quartzite pebble are all paralleled by similar artefacts from other sites (see below) but are generally poorly dated. The whetstones were from topsoil and could be any date. The fragment of polished and fire-cracked stone axe was from a very disturbed context but similar fragments are commonly found at chambered tombs and may have been associated with ritual deposition.

Ritual and burial—deposits of cremated bone

The understanding of ritual practices undertaken in a culture totally different from our own experience is impossible, but Carreg Coetan Arthur did produce evidence which adds to our appreciation, if not understanding, of the activities connected with belief systems. A component of this evidence comprises the deposition of cremated bone invariably with charcoal and sometimes with pottery, in small pits, on old ground surfaces or on prepared surfaces relating to the megalithic chamber. The creation of these pits and surfaces and of the architectural components of the site—the ring of stones, the megalith itself and the covering of the deposits—will be described later.

Cremated bone deposits were in four main areas (Fig. 27). The best preserved and most dense deposit was that on the old ground surface outside the chamber on the south-east; protected by the redeposited subsoil cover, it was uncontaminated save for the likelihood that earlier deposits had been scattered and disturbed as subsequent deposits were made (Specimens C2, 4 and 9, Wilkinson, below). The deposit beneath the inverted pot P16 had a discrete character suggesting that it originally had been held within or was accompanied by the vessel, perhaps the final deposition on the site, and was associated with heaps of charcoal that gave a radiocarbon date of *c*. 3620–3020 cal. BC (CAR-391).

On ground surfaces (Layer 9) to the south-west of chamber adjacent to boulder F55 and amidst sherds of largely Carinated Bowl in Fabric 1 was a more disparate scatter of cremated bone which could have been subject to some disturbance from plough action or animal burrowing (Specimen C11, Wilkinson, below). The cremated bone gave a radiocarbon date of *c*. 3090–2900 cal. BC (UB-6751), considerably later than expected. The nature of this deposit and its relationship to the chamber is not easy to ascertain. It could be a deposit of bone laid down as a separate activity either before or after the erection of the megalith; its position and association largely with Carinated Bowl sherds suggests the former while its comparatively late radiocarbon date tends to suggest the latter. Its apparent association with Carinated Bowl, rather than the Developed Bowl Fabric 2 sherds found on the south-east, differentiates the two, but, as noted above, the deposit could have been disturbed.

Another substantial and interesting deposit (Specimen C14, Wilkinson, below) was from F49, a pit dug against the boulder F55, and probably pre-dating the kerb. This contained the fragment of jaw and tooth and was described (see Wilkinson, below) as having different characteristics from the other deposits. Due to its particular interest and relative good preservation, it was not selected for destructive dating, though it would be valuable to test the date of this early fragment. It seems to be a discrete and early, almost certainly pre-megalith, deposit of bone within a pit; it was apparently accompanied by single sherds from several different pots laid within the pit alongside the boulder that was subsequently selected to be a component of the stone ring surrounding the chamber.

The final major concentration was from the chamber interior (Specimens C5 and 8, Wilkinson, below). While it was significant in quantity, its context was so disturbed that, while the fragments were assumed to be associated with the chamber, nothing could be said about their date or position within the chamber.

Two other small concentrations were found on the south of the site (Fig. 27), slightly outside the stone ring, as far as this could be understood in this disturbed area (Specimens C15 and 16, Wilkinson below). They were on a piece of old ground surface (Layer 9) that had survived between two rodent burrows. They lay on the surface of Layer 9 and, similar to deposit 2 above, could have been subject to disturbance. Nonetheless, they were discrete concentrations rather than thin scatters.

Small fragments were also recovered from other secure contexts—the redeposited subsoil south-east of chamber (Specimens C3 and 10a and b, Wilkinson, below), from around pot P17 on the old ground surface south-east of the chamber (Specimen C1, Wilkinson, below); and from F44, the stone-hole for orthostat S3, from which came Specimen C7 (see Wilkinson, below) and which just could be remains of inhumation, though this seems unlikely given the soil conditions. A small deposit (Specimen C12) derived from the old ground surface near G2 to the east of the chamber and a small, scattered deposit was found on the old ground surface but under ploughsoil (Specimen C13) to the south-west of the chamber.

Sufficient cremated bone from different contexts was found for it at least to demonstrate that cremation was practised by the people who used the megalith, and cremated bone was deposited during activities presumably associated with burial and/or ritual at Carreg Coetan Arthur. Whether or not inhumation may have been similarly, or even primarily, practised cannot be known, due to the acidity of the soils which militates against survival. Whether the amount of bone discovered allows us to interpret the site as primarily a tomb is uncertain. It seems unlikely that the amount of bone within any of these deposits was the remains of a complete individual. We can only surmise whether these were token deposits to honour an individual—that is, the celebration of an individual was the prime motive; whether they represent as much of the ash as was recoverable after cremation on an open pyre—that is, burial was the prime motivation; or whether they were, conversely, deposits of human remains put down to honour the chamber as the house of a deity, for example. Were the chamber to be regarded as a house of ancestors, of course, we can nicely combine the two, the deposits signifying the addition of the deceased individual to the ancestral home. It does seem clear that deposition of cremated remains was a constant throughout the history of the site from before the stone ring was constructed through to what was probably the final Neolithic activity outside the megalithic chamber.

The deposits were very different from one another in terms of the body parts represented, as far, of course, as we can ascertain these, given the limits of identification possible with cremated remains. The earliest, from pit F49, contained fragments of mandible, metatarsal and humerus; those associated with the ring of stones contained small long bones and a piece of skull; from the stone-hole for S3, rib bone; from the old ground surface outside the chamber, long bones, thumb bones, forearm long bone, part of an adult male femur and skull; and from the chamber interior, parts of long bones, one of which was probably from a forearm. Ageing the individuals is even more difficult but two pieces were sufficiently diagnostic to make an attempt: it is suggested that the mandible from F49 belonged to a fairly young adult, a piece of forearm bone from Layer 5, redeposited subsoil, south-east of the chamber, an adult male (see Wilkinson, below).

Environmental surroundings of Carreg Coetan Arthur

The excavations provided only limited evidence for the surrounding environment contemporary with activity at and construction of the megalithic chamber. Soils were incompatible with preservation of pollen or bone other than cremated bone; the latter was all human in origin. The voids within the pottery fabrics were shown on thin sections to have been cause by the leaching out of calcite inclusions rather than deriving from seeds or vegetable material (see Jenkins below). However, examination of the charcoal deposits from the old ground surfaces, while not identifying any macroscopic seeds or other vegetable matter, did allow some identification of species of wood (see Griffiths, below).

Samples from the area of burial activity (Table 5, nos W1 and 2) contained a preponderance of *Alnus* (alder) with smaller amounts of *Corylus* (hazel) and a single piece of *Quercus* (oak). Alder is a damp loving species and its good representation within the charcoal is not surprising, given the low-lying coastal position of the site. However, within the probably earlier samples (nos W3 and 5)—those from below the stone paving beneath the burials, and that from the pit F35 which may pre-date the stone ring—hazel was the most frequent, with alder in smaller quantities and small amounts of oak. The sample from the socket for orthostat S3 (no. W4) interestingly contained no alder, but similar quantities of hazel and oak. These results at least indicate that all three species were present in woodland reasonably close to the site, with probably alder most prevalent on the river banks and estuary and the hazel and oak in the drier areas inland.

The evidence from the charcoal equates well with that from pollen deposits studied in the past. Seymour's work (1985) identifies, within the diagram from Dinas Head, to the west, alder present in reasonable amounts at *c*. 4500 BP, of a similar date to Carreg Coetan, though on the decline from a high some 600 years earlier. Scott (2002) analyzed pollen from two boreholes on the estuary shoreline only 400m from Carreg Coetan. The basal layer of his borehole 23 appears to be contemporary with activity at Carreg Coetan (the radiocarbon date of 4560±50 BP (Beta-163489) derives from a horizon below the base of pollen in borehole 22, which appears equivalent to the base layer of borehole 23) and shows a predominance of alder with lesser amounts of hazel and oak and some grasses. The original vegetation comprised alder carr woodland with willow and reed, sedges and aquatic taxa and with oak and hazel around the drier margins. A marked expansion in alder woodland at the point contemporary with Carreg Coetan coincides with a decline in sedge and aquatic taxa and in oak and hazel woodland, with a small increase in Poaceae (grasses) and herb taxa particularly *Plantago* (plantain). This could indicate some interference with the woodland, small-scale clearance perhaps through human agencies, resulting in greater amounts of herb taxa (Caseldine, pers. comm.). Though the boreholes were from a wetter position than Carreg Coetan, the proximity of the samples to the chamber at least gives a useful indication of a surrounding open oak/hazel woodland environment with alder particularly predominant at the water's edge.

Whether the two latest charcoal deposits most closely associated with the burial activity (samples W1 and 2), which contained the most alder, imply some specific selection of alder as being particularly appropriate for cremation or some other aspect of the ritual activity, is of course unknown. The charcoal from the other samples, with their greater quantities of hazel, but with oak and alder present, perhaps represent better the components of the surrounding mixed woodland. The total absence of alder from the sample W4 from the orthostat socket, dating between samples W1/2 and W3/5, is interesting; it is tempting to detect selection here, perhaps, of stronger oak and hazel for rollers or levers for erecting the chamber's orthostats; this is almost certainly pushing the evidence too far; conversely, it is certainly not the case that it implies the elimination or reduction of alder in the surrounding woodland within the history of the site. Alder remains an important component throughout the pollen diagrams. Though the pollen diagrams from Dinas suggest that alder was in decline from a higher predominance some 600 years before activity at Carreg Coetan, they and those from the estuary show alder remaining important to the end of the sample periods. Consequently the earlier Carreg Coetan samples being hazel rich and the later being alder rich cannot be taken as reflecting the general development within the surrounding woodland.

The absence of any evidence from Carreg Coetan for arable agriculture is interesting. The pottery residue analysis (see Stern, below) suggests some bowls at least had been used for milk or cheese storage or, more probably, cooking and the microwear analysis of flint tools (see Donahue, below) suggests use in hide preparation or meat cutting but with certainly no evidence of silica gloss deriving from grain processing. The absence of macro remains of grain or vegetable matter within the charcoal cannot of course be used as evidence of an exclusively pastoral farming regime at Carreg Coetan. Larger charcoal samples might have produced different results. It is noteworthy that at Upper Ninepence (Radnorshire), the large majority of flint microwear and residue analysis on pottery showed evidence for animal husbandry, but just one flint showed silica gloss, complementing the results of the analysis of the charred plant assemblage that contained cereal remains (Gibson 1999, 101, 118, 143). Nonetheless it remains the case that there is at Carreg Coetan no evidence for arable farming; the evidence for animal husbandry, on the other hand, is reasonably robust.

Position, construction, morphology and function

Carreg Coetan Arthur stands on low-lying ground on the Nyfer estuary, 13.7m above sea level, 100m from a small stream to the west and 160m south of the south-west bank of the river estuary where it narrows to an easy crossing point. By the early Neolithic it seems that sea level rise had slowed to a point where shorelines stabilised, and, accordingly, it may not be too simplistic to assume that the topography was not dissimilar to the contemporary situation (Taylor 1980, 117; Seymour 1985, 378). Even were sea levels slightly lower than today the position of the river between two areas of higher ground is unlikely to have been any greater distance from the chamber, which stands on an area of sandy drift, on land that rises very slightly towards the south and affords views to the Preseli hills. The shores of the estuary now have a light wooded cover and the evidence from the charcoal deposits from the site and pollen analysis from samples nearby suggests that the alder, oak and hazel that abound there today were present around the time of the chamber's construction, though at what proximity to the site is impossible to say. The pollen diagrams suggest that woodland was the dominant environment, with alder probably concentrated on the wetland edge and with hazel and oak on higher slopes; even at the time of the burial chamber, clearances were small scale with no evidence for arable agriculture. The area is now good stock rearing land and historically the chamber had stood in the corner of a field used for cattle and previously for cultivation with field boundaries to the north and east.

The presence of Mesolithic microliths and probably other flintwork (see Healey, below) from the disturbed interior of the chamber is neither unusual nor unexpected. Mesolithic flints have been found on the foreshore at Newport (David 2007, 127; and Murphy pers. comm.) where the estuary, with its combination of marine, coastal and terrestrial environments, would be seen as a classic area for Mesolithic presence. They were also found further west, at Carreg Samson itself and adjacent area (Lynch 1975) and are frequently found at Neolithic chambers such as, in much greater quantity, beneath the inland cairn at Gwernvale, to the east, in Brecknock (Britnell and Savory 1984, 50). This presence at three known chambered tombs from south Wales does, however, have to be noted and explained—it is illogical to discuss at length the meaning of the presence of Beaker sherds attesting to later use of chambers, while not asking questions as to the meaning of Mesolithic artefacts at the sites. That the position of these sites would have been known by Mesolithic peoples prior to the megalith building seems certain. Whether they exerted some special significance, however, cannot be known and no dates at Carreg Coetan attest to actual activity here prior to the early fourth millennium. Whether or not features such as the stakeholes just to the south-west of the chamber, undatable and without any specific form, could be earlier than the chamber is entirely surmise, though similar features have been noted elsewhere. Both microliths at Carreg Coetan unfortunately came from disturbed contexts within basal layers of ploughsoil, though the blades, thought to date from the Mesolithic (see Healey, below), interestingly, all come from the old ground surface around the ring of stones, and not from old ground surfaces associated with burial deposition in the Neolithic.

The nature of the site prior to the construction of the megalith could not be established with any precision due to the cultivation of the field to the west and south; the apparent slight rise in level of subsoil immediately around the tomb giving the appearance of it sitting on a small eminence is probably an illusion. All that can be said is that the pre-cairn site was not a hollow or depression and may have been slightly raised. It is possible that boulders were present showing above the ground surface, which may have attracted the tomb builders (but see Bevins, below); the general glacial movement suggests that this would not be the case, though local variations may well explain this (John 2013). It would appear that the sandy drift that comprises the subsoil holds natural boulders of considerable size (see above, but also Bevins, below), which may have commended the site for construction in some way, or at least facilitated the construction of the chamber and may to an extent have dictated its form. A short walk along the foreshore brings numerous examples of large boulders incorporated into bridges and walls, and, as mentioned above, road widening near the site undertaken coincidentally at the time of the excavation uncovered an enormous boulder, as well as the housing development itself uncovering several. The amorphous hollows to the south of the site could possibly have originally been created by excavation of orthostats or capstone, by clearance of the site of unwanted protrusions, or erection of structures associated with the construction of the megalithic chamber, but there is no firm evidence for this. Excavation certainly established that smaller boulders lying on the surface of the subsoil, presumably fortuitously in a roughly circular form, were incorporated within the monument at an early stage.

If the radiocarbon dates from Carreg Coetan Arthur are to be taken perhaps more literally than is strictly permissible, a sequence of events at the site may now be described. Around 3780–3380 cal. BC (CAR-392) the site was first used for some sort of ritual activity with the deposition of charcoal within pits or depressions in the ground or the lighting of a fire on what is now the west of the chamber. There followed, perhaps immediately, the building of an arc of stones set into a shallow trench about 0.20m deep. This ring of stones appears to follow the line of at least three boulders set deep in the subsoil but perhaps partially visible above ground levels. Whether or not the large supine F3 was present at this stage is unproven. The extent, shape and function of this stone setting must remain uncertain due to the destruction of its presumed continuation northwards by the field ditch. What survives now is a rough semicircle, more regular on the west, then apparently changing alignment slightly immediately south of the chamber. Significantly disturbed by rodent activity, this change in alignment might be an illusion. As the ring of stones continues further east, it becomes more difficult to trace but appears to change direction, approaching the gap G2 between eastern orthostats S2 and S3. This change of direction aligns with the area of the burial pottery deposits, so might denote the formation of an area to be used for ritual or a forecourt against this open side. North of this point the disturbance caused by the eastern field ditch has resulted in the destruction of any continuation of the stone ring. Immediately adjacent to the recently dumped supine stone F4 were some boulders apparently deeply set in the subsoil which might represent the sides of a forecourt or continuation of the ring, but the limited space for excavation here made this impossible to prove.

Presumably at a similar stage as, or just prior to, the formation of this stone ring, two pits, F49, F50 and perhaps F20, were excavated on either side of the large boulder F55. F49 was particularly interesting and held a series of pottery sherds of different vessels and fabric types (P213, 208, 212, 214, 207–14; SGs 2, 4, 21, 24, 19, Carinated Bowl, Modified Carinated Bowl and Developed Bowl), along with the largest deposit of cremated bone, including a piece of jaw bone with a fragment of impacted tooth. F50 and F20 also contained sherds of Neolithic pottery (Carinated Bowl P215 and Modified Carinated Bowl P228–9 respectively). Within the area enclosed by the stone ring there survived ephemeral patches of a brown soil which produced scatters of flint, cremated bone and pottery (mostly burnished vesicular Carinated Bowl but with a few sherds of Developed Bowl). Some of these derived from apparently *in situ* positions amidst the stones of the ring where pockets of a rich chocolate-coloured brown soil, interpreted as disturbed old ground surface, survived. While the plough may have disturbed upper levels of the stone ring, the position of the majority of the sherds seemed secure, within the shallow trench within which the stone ring was set, or in undulations in the subsoil enclosed by the ring. Other spreads of sherds were directly beneath the base of ploughsoil on Layer 6, or in areas disturbed by animal burrows, where reliability of context was less assured. Lower strata of ploughsoil produced flint and pottery especially above the stone ring. Also within the area enclosed by the stone ring were a few small pits surviving between areas disturbed by the modern pit and the rabbit warrens. So disturbed was this area that the original number and distribution of these pits, their date or function—none had any artefacts or charcoal—cannot be known.

The ring of stones appears to have had an existence or function prior to the construction of the megalith if we are correct in detecting no great elapse of time between the depositions at F36 and the creation of the stone ring; but it may, of course, have been planned from the start as the boundary of a cairn or mound which would eventually cover, or a working platform to surround, the chamber. Only in a small stretch on the east side was there any coincidence between the redeposited subsoil and the ring of stones and it cannot be certain that this material, perhaps comprising a cairn or platform or forecourt blocking, was bounded by, incorporated or indeed had anything to do with the stones of the ring. Nonetheless, in the absence of any other evidence as to the shape or extent of a cairn or platform, it might be hypothesised that the stone ring was an indication of the area in which rites would be undertaken and over which a cairn or covering was planned. Within the area bounded by the ring were patches of a thin brown/grey horizon (Level 7/13) which lay over the subsoil and which was interpreted as remnants of the soil horizons below the old ground surface, perhaps the surviving traces of soils after clearance of the site before construction. When examining stratigraphy in this area it is important to remember that, during the megalithic construction phase, this was a building site with the clearance, disturbance, passage of feet and general mess we may associate with moving and lifting these huge blocks of stone and hauling or levering them into large dug stone-holes. It is inevitable that ground surfaces previous to the construction phase will have been greatly disturbed.

Next in the sequence of radiocarbon dates is the *c.* 3650–3200 cal. BC (CAR-394) from the stone-hole for orthostat S3. This is some 200 years later than the previous date, but, while the first date was from a rich and reliable deposit of charcoal, the sample taken from the stone-hole was less cohesive. As explained above, the carbon date for the stone-hole for S3 may not indicate the date of the original excavation for the stone's erection, as it came from the fill of F44, immediately around the base of the orthostat. This might represent the fill of the hollow created by the manoeuvring of the stone into position, which could have filtered in subsequent to the stone's erection. Nonetheless it does at least give some indication of the date of creation of the megalith and logic concurs with the sequence of the dates which suggests that the megalith was erected after the establishment of a site boundary. Whether or not boulders were excavated on site for the orthostats we cannot know, though it seems likely that candidate stones may have been readily available. It is possible that the amorphous hollows around the site, later used by rabbits, may be the results of such extractive episodes, but the excavation of the hollows, roughly compatible with the size and shape of several of the orthostats, did not yield any evidence in the form of stepped sides, cut marks or ramps, nor were any artefacts found within, though, they were, of course, considerably disturbed by the warren. As far as can be established, the present condition of the chamber with four orthostats and one capstone is what was intended and was built with no further elaboration or megalithic components. Drystone walling may have been inserted in the gap G3 between the northern S1 and eastern S2 or even as a temporary closure in one or both of the other two gaps. The orthostats would presumably have been positioned first by levering them to rest in prepared stone-holes, packing them with pinning stones and backfilling. Subsequently the capstone would have been raised to rest on them.

The methodology of construction of the megalithic chamber can never be fully understood, though there is something inherently improbable about the flimsy wooden ramps shown in some archaeological reconstruction drawings. Engineering advice (Martyn Western, pers. comm.) suggests that a solid platform would be required to make the soft sandy drift sufficiently resistant to prevent the capstone boulder, in the case of Carreg Coetan perhaps some 16–17 tons in weight, sinking into the subsoil during transportation. Firstly, after topsoil removal, a solid stone base along an access track might be laid down within the subsoil, after which wooden piles would be raised on the sides to retain a ramp during construction. These could either be individual posts on centres with horizontals providing lateral support, or a continuous line of contiguous timber piles. Within this framework, the stone and subsoil ramp could be raised to the level of the top of the orthostats; the chamber interior and openings between orthostats would probably need to be filled and blocked to prevent orthostat collapse. The increasing vulnerability of the ramp as its height and lateral thrust increased could be counteracted with further stone and subsoil piled against the wooden framework. It seems likely that the ramp would have approached the chamber on the highest, southern, side. Unfortunately, Carreg Coetan was very disturbed on this side, but it is just possible that postholes F34, F39 and F51, which had no apparent purpose in terms of deposition or burial rites, might have had some connection with the piling within such an, admittedly completely speculative, construction methodology; similarly, the considerable quantity of stone found slumped within the warrens could represent remnants of a ramp. Whether this hypothetical ramp would have been a temporary structure, dismantled after the capstone was in place, or whether it was left, in part at least, and actually enhanced by the construction of a surrounding cairn is yet another avenue for debate.

If a cairn did exist at this stage, it was of unknown form and extent; if the ring of stones formed its outside edge, it would have had a 10m diameter with a circular form at least on the south, perhaps made of a mixture of subsoil and stones as there was no evidence for any other material on the site. The only evidence for any such covering, be it cairn or platform, is the wedge of redeposited subsoil that extended beyond the point interpreted as the main ritual area, outside the southern orthostats; and also a few small sections of redeposited subsoil found in G1, on the west of the site. The former could be better interpreted as a covering over the burial area, or forecourt. The evidence for such a forecourt with a stone revetment enclosing an area on the south and south-east of the chamber outside G2 is reasonable, but given the level of destruction on the south of the chamber, its form is unclear. Certainly this area must have been open periodically for burial rites and logic would suggest that its position would have been made evident above ground level by some sort of marker set within the cairn structure.

The height of any putative cairn is inevitably unknown. The conventional view is that small cairns thought to have surrounded these structures could not have covered the tombs totally but that the capstone might well have remained exposed to view. Recent hypotheses suggest that the existence of any such cairns is but dubiously evidenced. If the ring of stones is accepted as the likely outside edge of an 8 to 10m diameter circular cairn, to cover the capstone completely it would have had to rise some 2.5m above subsoil level. A profile of this acute shape, of more than 1 in 2, is unlikely to have been stable. A covering to the lower edge of the capstone—requiring a height of 1.5m (1 in 4)—seems still improbable given the nature of the subsoil (Martyn Western, pers. comm.), and the survival of more material might have been expected. There is no evidence against there having originally been a low circular platform merely covering ground surfaces, with the area of burial activity marked in some way but covered to the same level as elsewhere. Indeed, the chamber itself may have remained open for access, or gaps between orthostats may have been blocked with drystone walling thereby only temporarily restricting access to a structure that remained visible.

The robust geological make-up of the five main components of the tomb render dressing an onerous task; little in the way of incontrovertible tool marks are present on the stone faces, though, as discussed in the site description, smoothing and marks on the lower parts of the southern two and the northern orthostats and an apparent hollowing on the lower surface of the capstone could be man-made.

The chamber has apparently retained the same form since the earliest descriptions of the site. Colt Hoare[5] was the first to have noted that the capstone only rests on two orthostats and the nineteenth-century descriptions, plan and sketches given by Gardner Wilkinson (1871, 230 and pl. xxxi, 5) and Barnwell (1872, 140) show that the form has not changed for over a hundred years; the Royal Commission Pembrokeshire Inventory concurs (1925, 269–70), giving little additional information. More modern specialists offer more detailed descriptions (Grimes 1936, fig. 25; Lynch 1972, 69–70), though Daniel (1950, 99) only mentions three orthostats, but 'four large stones which were probably once part of the chamber' and describes 'slight traces of a barrow' as did Barnwell before him.

A pre-excavation contour survey undertaken in 1978 showed a rise in ground levels towards the chamber in all directions, save from the boundary on the north, but excavation soon showed that this 'barrow' was the result of field clearance, stones being piled around the chamber to remove them from the cultivable land. Other than the elimination of the 'barrow', excavation suggested that the chamber was well preserved in its essential construction. The contemporary view of a small, sub-rectilinear chamber, defined by four megalithic orthostats, two of which support the massive wedge-shaped capstone, may well represent the original construction, in that none of the gaps between orthostats seem likely to have held further uprights. While the orthostats and probably the capstone have suffered some flaking and interference through the millennia (there are numerous stories of local young men demonstrating their prowess by setting about the capstone with crowbars), there is no reason to suppose that undue subsidence, human interference or structural collapse has altered the essential construction. Nonetheless, it can never be proved whether the relative position of capstone and supporting orthostats corresponds with the original intention of the builders. However much respect we give to the original architects and engineers responsible for the construction of the chamber, it could never have been an exact science. It would only have required a minor settling of the now tilting eastern orthostat either during the construction or immediately afterwards to have resulted in an alteration of the angle of the capstone. Experiments with a clay model of the chamber, undertaken admittedly by archaeologists with no knowledge of engineering, suggested that the 'straightening' of S2 to eliminate the 0.12m list out of vertical, raised the whole northern side of the capstone thereby separating it further from the top of S1. Nonetheless, the flaking visible on the underside of the capstone, separated by only 6mm from S1, could have created that separation accidentally. Similarly the upper point of S3 is also laminated; it is possible that this too originally touched the capstone, though it is normal for the 'portal stones' at portal dolmens to be standing free of the capstone.

Commentators on portal dolmens, and indeed all other types of megalithic structures, seek to find some relevance in the orientation of the tombs and various hypotheses are advanced as to the rationale behind sites' axes. Kytmannow (2008) has tabulated the orientation of portal tombs and concludes that 45 per cent have the portal stones oriented to the east. The portal stones at Carreg Coetan, assuming we are correct in seeing them as such, face south-east, though it is interesting that it is Gap 2, outside which the main area of ritual activity lay, that faces east. Sunrise on the summer solstice would be directed towards the pointed eastern S2, sunset on the pointed S1 but certainly not through the 'portal'. Kytmannow suggests that portal dolmens, often sited parallel to streams and watercourses, tend to face away from the sea, but inland to the source of the water, while other specialists emphasise their tendency to face uphill to significant landscape features. Tilley in particular (1994, 105) describes the Nevern tombs as being 'deliberately sited so as to command vistas of the landscape feature that completely dominates the visual field in the area, the high crag of Carn Ingli'. At Carreg Coetan, the 'portal' to the chamber does indeed face inland to higher ground towards the source of the stream at the side of which it stands, but does not face the highest point in the landscape, Carn Ingli, to the south-south-west, but to lower land to its east. Its low-lying position means that it does not enjoy extensive views, as the higher lying Pentre Ifan or even Trellyffaint and Llech y Dribedd do, though, like all these, Carreg Coetan seems to have no major orientation toward the sea. The surrounding landscape now is certainly dominated by Carn Ingli and, to a lesser extent, the river and estuary; however, given the contemporary environment surrounding the site apparently being predominantly woodland with only small clearings, it is far from certain how much of the present view could have been enjoyed by the tomb builders or of the tomb from the surrounding countryside. It might easily have been situated within a clearing in the wood.

The third of the radiocarbon dates, *c*. 3620–3020 cal. BC (CAR-391), comes from charcoal taken from the area of ritual activity. This section of preserved old ground surface immediately outside the south-east gap (G2) seemed intact, with a rough pavement of small slabs of stone, apparently selected for strength and cleavage. On this surface were found sherds of quartz-tempered round-bottomed Developed Bowls with, most notably, one intact inverted bowl (P16) found immediately outside the chamber and associated with cremated bone and charcoal; it was from this reliable deposit that the date derived. The old ground surface extended around to the south side of the chamber where it was destroyed by the pit and to the north-east as far as the prostrate stone F3. It is likely that P16, containing cremated bone and charcoal, was the final burial deposit on this surface and that both cremation and pottery type are securely dated by the radiocarbon sample. Whether the area was used repeatedly over many years for burial and ritual is unknown, though it seems unlikely that such an expenditure of effort would have only been for a single burial or deposition. The many sherds of similar quartz-tempered fabric but from different vessels found scattered on this surface may represent the deposits from earlier burials; alternatively they may represent a scattering of subsidiary vessels as part of the same burial rite. The stone paving was rough and uneven and some sherds were tilted between and even below some of the slabs. This suggested that the sherds were the product of earlier interments with, perhaps, some rough re-establishment of the paving before the final deposition.

The chamber interior was unfortunately very disturbed. The upper strata were found to have been disturbed by bonfires, deposition of rubbish and general digging, while boulders piled within the gaps and against the bases of the orthostats were found to be of recent derivation. Within the disturbed strata, however, flint (including the two microliths), flecks of cremated bone and Neolithic pottery (with one Beaker and two Impressed Ware sherds) were randomly distributed with modern and medieval sherds. This may suggest that burial deposition of the Neolithic and perhaps token deposition from the early Bronze Age did occur within the chamber, but the nature of such activity remains unknown. Similarly the chamber gave little evidence of construction techniques. Packing stones for the orthostats were found but excavation was very limited due to safety reasons. However the excavation of G2 revealed the continuation of the old ground surface from outside into the gap, beyond which it had been dug away in the chamber interior. Below the traces of old ground surface in the gap were found, in the northern half, the upper parts of packing stones for S2 and, in the southern half, the edge of the stone-hole for S3. This at least proved that no orthostat had originally stood in that position.

Over the old ground surface in the ritual area or putative forecourt was a layer of redeposited subsoil some 0.25m thick. Within this deposit was found most of another quartz-tempered Developed Bowl and sufficient charcoal to yield a date of *c*. 3360–2920 cal. BC (CAR-393). It is difficult to interpret this subsoil layer as anything other than the final covering over the last burial despite the date being 120 years after the date of the charcoal around the final burial; but given the standard plus/minus of 80 years of both, it is probably acceptable statistically as a similar date. The redeposited subsoil covering was found in a wedge now bounded by the supine F3 on the north, the Pit F12/8 on the south-west and the chamber interior and orthostats on the west. It petered out towards the east on a roughly circular arc *c*. 2m from the chamber. The exact derivation of the subsoil used for this blocking is unknown and hence the original purpose and origin of the broken Developed Bowl vessel within remains uncertain also. It incorporated small amounts of cremated bone and there was a charcoal element within the material; it could therefore have come from an area further outside the monument which had seen earlier rites and the situation of the vessel suggests that it was accidentally incorporated in the material.

The final radiocarbon date from the site was *c*. 3090–2900 cal. BC (UB-6751), from a deposit of cremated bone found within the ring of stone south-west of the chamber. The presence of Impressed Ware and Beaker sherds within the chamber, albeit in a very disturbed context, shows that the chamber went on attracting burial or deposit after its main period as a funerary monument. The cremated bone came from an unsealed context scattered on ephemeral traces of old ground surface, though close to sherds of Carinated Bowls. If by *c*. 3090–2900 cal. BC there was a covering over the ground surfaces surrounding the chamber, which seems likely, it is possible that this was a later deposit buried within a pit dug into this covering, now totally destroyed and only coincidentally positioned near the Carinated Bowl sherds; alternatively, the date, taken from a very small sample of cremated bone, may not be reliable. A more reliably evidenced late element at the site was the digging of a small pit F31 within the redeposited subsoil/forecourt blocking on the south-east on the site, close to supine stone F3. It was a shallow pit defined by slabs, two courses of which survived on the north-east side. It had a stony fill, with a strong phosphate reading, and was devoid of artefacts or charcoal. Its date and function is unknown. It is noteworthy that a cist was discovered dug into forecourt blocking at Penywyrlod Cotswold-Severn tomb near Talgarth, Brecknock. While this could not be dated reliably, it had been used for a deposit of human bone and was interpreted by Savory as a final act of closure of the tomb (Britnell and Savory 1984, 35).

Subsequent to these late events (final closure, perhaps the subsequent burial of a cremation in the side of the cairn on the south-west in *c*. 3090–2900 cal. BC, the deposition of Impressed Ware and Beaker sherds in the early Bronze Age, and the excavation of the slabbed pit on the south-east within the forecourt blocking), the area was incorporated into cultivated land and then enclosed in a field. The earliest sherds within the ploughsoil derive from the medieval period and the uncultivable area immediately around the chamber was used for stone dumping. The final detectable anthropogenic activity was the excavation of the pit F8/12 immediately outside orthostats S3 and 4. The George III halfpenny apparently positioned on the very bottom of the pit does suggest that this may have been an undocumented excavation contemporary with Fenton's opening of Cerrig y Gof nearby.

It was disappointing that the present position of F3 was never satisfactorily explained but it may have fallen or been dumped in this position during cultivation. It remains a possibility that it was moved to the present position during the planning of the megalith and was either rejected or incorporated with other undoubtedly natural boulders within the stone ring; another hypothesis, equally impossible to prove, is that it formed a component of an earlier monument associated with the stone ring prior to the erection of the megalith, and was felled either accidentally or deliberately during the formation of the megalith. This has some support from the radiocarbon dates which show a 200-year gap between the ceremonies associated with the stone ring and the erection of the megalith, but has little other evidence to support it. Further excavation on the site with lifting equipment so that the ground beneath F3 could be examined for stone-holes might prove these hypotheses one way or another.

GENERAL DISCUSSION

The typological classification of megalithic chambered tombs has exercised specialists for many years, and understandably, as, until the absolute dating offered by radiocarbon and the increasing number of excavated tombs, there was little else to help our understanding of these impressive sites. Morphological classification systems are more productive in some areas than others—the category of Cotswold-Severn tombs and their grouping in south-east Wales and the Cotswold area of England, for example, is clearly coherent and helpful, though what these morphological differences actually meant to their creators, and how one explains apparent outliers (e.g. Capel Garmon in Denbighshire) is unknown. When it comes to the tombs of south-west Wales, however, authorities have grappled with the classification of these megalithic structures that appear to have little to connect them save their small size and their individuality. It may be more relevant, therefore, first to describe the features that Carreg Coetan Arthur displays comparing them with others.

The only other excavated tombs in south-west Wales are Pentre Ifan and Bedd yr Afanc, excavated by Grimes in 1936–37 to 1958–59 and 1938 respectively (Grimes 1939b; 1949), and Carreg Samson (Lynch 1975) though both Fenton's opening of Cerrig y Gof in 1810 and disturbances to Ffynnondruidion in 1830 (Fenton 1811, 24 and 554–5) produced artefacts and scant descriptions of the events. Cummings' excavations at the perhaps unfinished tomb at Garne Turne may now be added while, slightly further east in Carmarthenshire, the small tomb at Twlc y Filiast was excavated by Savory in 1953. Many of the Cotswold-Severn tombs in Brecknock and Glamorgan, with the outlier at Capel Garmon in Denbighshire, have been excavated (Grimes 1939a; Britnell and Savory 1984) as have several of the northern Wales, tombs including Din Lligwy, Pant-y-Saer, Trefignath, Din Dryfol, Bryn yr Hen Bobl and the magnificent late passage graves of Barclodiad y Gawres and Bryn Celli Ddu (for an overview see Lynch 1969). There is, therefore, an increasing body of information about burial practice and rites associated with Welsh megalithic tombs of different morphological types, the dates of their construction and use and the artefacts found associated with them. Outside Wales, but within the same Irish Sea region as Carreg Coetan, two groups of megalithic chambered tombs survive in Cornwall, of which the westerly group, clustered in the far western tip of the county, include Sperris Quoit, excavated by Thomas and Wailes (1967) who in the same publication reassess early work at Zennor. Irish portal dolmens are found in the east and north (Fig. 2a), the excavations at Ballyrenan (Davies 1937) and Drumanone (Topp 1962) being relevant to our study.

Dating

The absence of any radiocarbon dates from south-west Wales tombs for comparison with those from Carreg Coetan Arthur is compensated to some extent by dating derived from more distant but recently excavated megaliths at Gwernvale, Penyrwyrlod and Trefignath while two recent dating programmes (Whittle *et al*. 2011; and Kytmannow 2008) have provided further evidence from older excavations such as Parc le Breos Cwm, Ty Isaf and Pipton long cairns from the Brecknock group and Twlc y Filiast, south Wales; Sperris Quoit and Zennor Quoit in Cornwall; and Ballykeel, Ballyrenan, Drumanone, Poulnabrone and Ballynacloghy in Ireland. The series of dates from charcoal and human bone compare reasonably well with the date range from Carreg Coetan. Dates from two pits outside but probably contemporary with the life of the cairn at Gwernvale (Britnell and Savory 1984, 152) of 3340–2890 cal. BC[6] and 3630–3090 cal. BC[7] are roughly contemporary with the Carreg Coetan 'forecourt' covering and old ground surface below, while dates from Parc le Breos Cwm (Whittle *et al*. 2011, 536–7) cover over 1000 years from the same start date to 400 years later than the Carreg Coetan series. Dates from Penywyrlod of 3950–3640 cal. BC[8] (Britnell and Savory 1984, 29) and Trefignath of 3980–3690 cal. BC[9] (Smith and Lynch 1987, 45) are both slightly earlier. While these four Welsh tombs belong to different morphological groups (Cotswold-Severn and a multi-period long cairn), more analagous portal tombs from Cornwall and eastern Ireland have also been tested (Kytmannow 2008). Cremated bone from a pit beneath the doorstone at Sperris Quoit gave a date of 3630–3370 cal. BC[10] and a small piece of cremated bone from Zennor Quoit of 3340–3020 cal. BC.[11] Of the five Irish tombs yielding dates, only Poulnabrone, with ten dates from human inhumations which range from 4050–3700 cal. BC to the Bronze Age,[12] and Ballynacloghy, 3760–3380 cal. BC,[13] gave Neolithic dates, as deposits from Ballykeel, Drumanone, Ballyrenan and, similarly, Twlc y Filiast in Wales all date to the Middle Bronze Age.

Though none of these tombs are geographically close to Carreg Coetan Arthur and they are morphologically very diverse, they provide a useful comparison to the Carreg Coetan Arthur date range of some 860–460 years between *c*. 3780–3380 cal. BC and *c*. 3360–2920 cal. BC. The position of the first depositions and activity at Carreg Coetan Arthur within the late Early Neolithic or Early Middle Neolithic and continuation of activity through the Middle Neolithic corresponds reasonably well with Sperris and Zennor Quoits, Cornwall, and Ballynachloghy and Poulnabrone in Ireland. The dates from the Cotswold-Severn group are comparable but apparently begin slightly earlier, though their evidently long period of use suggests that part of their history, at least, is contemporaneous with that of Carreg Coetan. The series of dates from the Bronze Age at Twlc y Filiast, Ballykeel, Drumanone, Ballyrenan and Poulnabrone (Kytmannow 2008, fig. 7.10) is interesting in view of the later pottery found within the chamber at Carreg Coetan.

Kytmannow's (2008, 110) Bayesian modelling for the Irish Sea portal tombs dates brings her to the conclusion that portal dolmens were constructed not later than 3600 cal. BC, and used from the Early to the beginning of the Late Neolithic in 2900 cal. BC. After this, some 400 years elapsed before the next phase of activity at the end of the Later Neolithic/Early Bronze Age, when such later deposits were dated as being made at tombs at Ballyrenan, Co. Tyrone, Drumanone, Co. Roscommon (Topp 1962), and at Twlc y Filiast, Carmarthenshire (Savory 1956). While none of the Carreg Coetan series conclusively date the construction of the chamber itself (as opposed to pre-chamber activity) the date from the orthostat stone-hole probably gives a reasonable approximation of the construction date. This date of *c*. 3650–3190 cal. BC (CAR-394) pushes her date for portal dolmen construction well into the Middle Neolithic. Carreg Coetan produced no dates from the later period of activity at these tombs, but the presence of Impressed Ware and Beaker in the chamber demonstrates that this later deposition phase was present at this site also.

Burial rites

It might be considered that the choice of cremation or inhumation as a burial practice would hold a strong significance for the tomb builders. However, as will be seen, the choice of practice does not seem to have a particular relevance that we can detect today. It must be appreciated, of course, that the survival of bone in the acid soils of west Wales is notoriously poor, which naturally favours evidence for cremation.

However, the amount of cremated bone found at Carreg Coetan in numerous contexts (with the pottery vessels on the flooring outside the tomb which must indicate the final burials; in small quantities in the chamber albeit in very disturbed contexts; contained in what appeared to be early pits contemporary with or pre-dating the stone ring; and in spreads to the south-west of the chamber which could have been a late deposition within the cairn associated with the radiocarbon date on bone of *c*. 3090–2900 cal. BC, UB-6751) certainly indicates that cremation of the dead was at least practised if not exclusively throughout the history of the tomb (see Wilkinson, below). A small piece of cremated bone was found on the chamber floor at Carreg Samson, and 'burnt bone' was discovered at Twlc y Filiast; the absence of any bone at Pentre Ifan may or may not suggest that inhumation was the rite practised there. It is unfortunate that the 'particles of bone' discovered at Cerrig y Gof were not described further by Fenton. Cremated bone was also found at the north-west Wales tombs of Bryn yr Hen Bobl, Barclodiad y Gawres, Bryn Celli Ddu, and the east chamber of Dyffryn Ardudwy. However, Bryn yr Hen Bobl and Bryn Celli Ddu contained both cremation and inhumation, and at Capel Garmon, Lligwy (an early excavation where inhumed bones appear associated with Grooved Ware), Pant-y-Saer (bone of uncertain date but possibly Bronze Age) and Tyddyn Bleiddyn (from early excavations) only inhumation is recorded. At the Cotswold-Severn tombs of the south-east inhumation appears to have been the preferred rite, with inhumed remains found at Gwernvale, Penywyrlod (Talgarth), Ffostyll South, Pipton, Tinkinswood and Ty Isaf among others. However, both rites were evidently practised at the two late Anglesey passage graves and inhumation alone at several north Wales monuments—though most of this evidence derives from early excavations where an association with later pottery indicates a later date. Cornish and Irish soils share the same problem over survival of inhumation, but cremated bone was found at Sperris Quoit and Zennor Quoit (Thomas and Wailes 1967) and Ballyrenan while Ballynocloghy and Drumanone appear to have had both cremation and inhumation and at Poulnabrone only inhumation has been uncovered. Poulnabrone and Ballynocloghy lie on the west of Ireland in limestone country well suited to the survival of inhumed bone; it is interesting that only these of the Irish tombs tested by Kytmannow give dates of Early/Middle Neolithic. Is it possible, she wonders, that inhumation was the earliest rite, cremation coming into fashion later in the Neolithic? Though the apparent bias towards the rite of cremation within chambered tombs of the Atlantic sea front could be entirely spurious as inhumed remains would have disappeared in western areas, the presence of cremated remains at the Cornish, Irish and Welsh tombs is interesting, and Carreg Samson, Twlc y Filiast and Carreg Coetan and, further afield, Dyffryn Ardudwy (the later, eastern chamber) are linked at least by the burial rite practised.

Artefacts

The types of artefacts encountered at the tombs show many similarities. At Carreg Coetan the excavation demonstrated that the main ritual or burial practice was associated with quartz-tempered round-bottomed Developed Bowls found with cremated bone and charcoal in front of the tomb. This ware was dated to *c*. 3620–3020 cal. BC (CAR 391), and there can be little doubt that these, probably locally manufactured, pottery vessels saw their final use as cinerary urns. However, the residue analysis (Stern, below) suggests that they had contained milk or cheese probably over a sustained period. The opinion of a modern potter (see Keeler, below) is that they would have been originally constructed as cooking pots, perfectly compatible with cooking over an open fire and most unlikely to have been constructed purely for burial rites.

Similar quartz-tempered round-bottomed Developed Bowls have been found not infrequently at Welsh chambered tombs, particularly in Cotswold-Severn tombs as well as at the Neolithic settlement at Clegyr Boia, near St David's (see Gibson, below). Similar sherds with impressed decoration on rims were found at Clegyr Boia, while Gwernvale and Ty Isaf chambered tombs produced analogous ware.

Burnished vesicular Carinated Bowls, very similar to the Carreg Coetan Arthur sherds, have been found at the tombs of Dyffryn Ardudwy, Ty Isaf and Gwernvale, and particularly at the Neolithic settlements at Clegyr Boia at St David's (see Gibson, below). The lack of comparable thin section analysis for pottery from these analogous sites makes it impossible to prove any link in place of manufacture, but the pottery from Carreg Coetan appears to derive from a limestone/chalk area, far from its final place of deposition. Residue analysis suggests that this pottery, like the Developed Bowls, was used for the storage or, more probably, cooking of animal products such as milk or cheese. The association of this well-made burnished ware with early Neolithic sites in the Irish Sea area is interesting, and it is unfortunate that at Carreg Coetan Arthur this pottery type derives from less securely dated contexts in scatters on an old ground surface with no firm associations with the spreads of cremated bone found adjacent to, but not amidst, the sherds. Nonetheless, the fact that sherds of Carinated Bowls in Fabrics 1 and 3 were found in the same pit as those of Developed Bowls in Fabrics 2 and 4 shows that the two pottery types were in use contemporaneously at Carreg Coetan.

The instances of Impressed Ware and Beaker sherds found at excavated megalithic tombs of all classifications are legion, showing how these tombs continued at least to exert a sense of power into the early Bronze Age. Small amounts of Impressed Ware were found in late contexts at Gwernvale (see Gibson below) and at Bryn yr Hen Bobl, for example. Differing types of Beaker pottery, inserted secondary deposits as single sherds, as at Carreg Coetan Arthur, or as whole pots, have been found at Dyffryn Ardudwy west and east chambers, Tinkinswood and Capel Garmon, but at others actual Beaker or Bronze Age interments have been found (as at Pant-y-Saer, Anglesey). Whether the insertion of pottery, burials or the addition of cup mark decoration, as at Trellyffaint (and just possibly at Carreg Coetan Arthur) and thought to be Bronze Age, denotes a continuation of respect for, or a desire to adopt or to diminish, their religious connotations can never be proved (Cummings and Whittle 2004; Nash 2006, 176), but should at least be noted.

The types of Mesolithic and Neolithic flint artefacts from Carreg Coetan are paralleled by those from several chambered tombs in Wales (see Healey, below); even the rarer polished-edged knife is paralleled by one from Gop cave, north Wales.

The presence of polished axes, either complete or fragmentary, at Welsh chambered tombs and other sites where a ceremonial function is suspected, is also not uncommon. The chip of fire-cracked polished axe from Carreg Coetan Arthur was unfortunately from a very disturbed context in one of the rabbit warrens. Nonetheless we know that axes were found in the chambers at Ffynnondruidion (Pembrokeshire), Gwernvale, Ty Isaf (Brecknock), and Din Dryfol as well as from the henge at Llandegai in north-west Wales (Lynch and Musson 2001, 69–71) (see Healey, below).

Morphology

Carreg Coetan Arthur shares with numerous tombs from different classes the concept of ritual area or forecourt, burial rite and closure of that area after, probably, multiple burials or depositions. But first, we should examine the parallels for pre-cairn activity. At Carreg Coetan this comprised the excavation of small pits on the site, some of which could be proved to be early stratigraphically as they underlay the ring of stones, some of which held charcoal which provided radiocarbon dates. The earliest date from the site was from one such pit (F36) below the ring of stones on the west of the site. However, unfortunately, several other pits were undatable and might or might not denote pre-cairn activity (F34, F40, F5) while others appeared to be contemporaneous with the chamber itself. Neolithic pits holding cremation or burning have been found not only in burial chambers but also at apparently open settlement sites such as Milbarrow, Wiltshire (Whittle 1994, 16–19), Upper Ninepence, Radnorshire (Gibson 1999, 160) and Coygan, Carmarthenshire (Wainwright 1967, 14–16) where a pit containing charcoal, pottery and animal bone with, nearby, two polished stone axes with flakes from two others was described as a rubbish pit. When found at burial chambers they are generally assumed to be components of burial ritual; they are frequently found on excavated tombs of all classifications and areas (Gwernvale, Penywyrlod, Trefignath, Twlc y Filiast) sometimes with cremated remains. Sometimes these pre-date the burial chamber, as did the small cremation pit at Sperris Quoit, dug near the outer face of an orthostat; sometimes appear to be contemporaneous with its active life, as at Dyffryn Ardudwy west cairn; and pits dug into cairn or forecourt material either for ritual purposes, as proposed at Pentre Ifan, or for subsequent burial, as at Penywyrlod, are also encountered. The pit at Dyffryn is especially comparable to Carreg Coetan, as a pit dug just in front of the portal held sherds from five pottery vessels, all incomplete, in a manner analgous to pit F49.

Site boundaries

The definition of the site by laying a boundary, such as the ring of stones at Carreg Coetan, perhaps for defining or enclosing the site or ritual area, or perhaps for the confining of a cairn or platform around the megalith, is a less commonly encountered feature at the Irish Sea tombs. The architecturally much more impressive drystone retaining walls around the cairns of Cotswold-Severn tombs are quite different from the irregular and poorly preserved Irish Sea tombs. Barclodiad y Gawres, the fine passage grave in north-west Wales, arguably, has such a boundary, though this too is of a very different type and considerably more coherent. Most of the cairns around excavated sites in the Irish Sea area are difficult to define, or, at least, the early excavations concentrated on the chamber, taking less interest in the surroundings. The long cairn around the composite Ballyrenan comprised an ‘orange floor’ the edge of which was largely surmised (Davies 1937, figure facing p. 89) while the stony spread surrounding the chamber at Drumanone was interpreted as probably representing the much reduced remains of a covering cairn, but appeared to have no formal edge or boundary (Topp 1962, fig. 1). The cairn at Sperris Quoit was described from field evidence as a low mound 40ft in diameter, 1–2ft high, but with no evidence of a boundary, though excavation was small-scale (Thomas and Wailes 1967). At Pentre Ifan the cairn was defined, but only by an irregular line of stones set into shallow stone-holes and virtually nothing remained of the cairn itself (Grimes 1949). Twlc y Filiast’s oval stone cairn was difficult to define, though Savory (1956) interpreted two upright slabs and a stretch of rough walling as constituting the edge of the structure, interestingly noting that adjacent and perhaps incorporated within it were several glacial blocks still in their original positions but mixed with mound material. The cairn of the small tomb of Carreg Samson was not defined (Lynch 1975), its stony composition just petering out away from the chamber. Probably the best parallel for Carreg Coetan is the primary, western, tomb at Dyffryn Ardudwy with its small, 9m-diameter round cairn bounded by a kerb of rounded stones and small boulders, and much better preserved V-shaped forecourt (Powell 1973, 21).

Cairns and platforms

The shape and size of the cairns of the Irish Sea groups of tombs are surprisingly difficult to ascertain due to lack of excavation and the slightness of field remains. The assumption that Carreg Coetan was surrounded by a circular cairn around 8–10m in diameter presupposes that the southern arc originally continued north of the field ditch which had destroyed it; that the ring constituted an outer edge rather than an internal feature; and that there was originally cairn material, stone and subsoil perhaps, now vanished, between the stone ring and the chamber. It was, in any case, built but roughly and was irregular in shape. Dyffryn Ardudwy I is again analogous, with its remnants of a similar oval-shaped and 9m diameter cairn. Pentre Ifan, in the study by Lynch (1972, 70–7, originally had a small, irregular square cairn, later elongated to a long rectangular structure. The eccentric Cerrig y Gof was certainly circular, while the cairn at

Twlc y Filiast seems to have been roughly oval, about 18m by 9m in extent amidst a rocky stream edge. The cairn at Sperris Quoit appears to be circular, but guesses at cairn shape from unexcavated field evidence alone is a very hazardous method, due to stone clearance, agriculture, incorporation into banks and so on. Based on ground observation alone, it seems that Irish portal dolmens had both long and round cairns (De Valera 1961, 64) though the excavated (though composite) Ballyrenan had a long rectangular cairn. With all this variety and irregularity, it seems an inescapable conclusion that the visual architectural distinction of the cairn was not an important consideration in the Irish Sea tombs. Indeed Whittle suggests that they may have been more platforms than raised mounds, sometimes defined, sometimes not and sometimes, as at Carreg Coetan and Twlc y Filiast, incorporating natural features (Whittle 2004, 85). Certainly they are quite unlike the organized, architecturally superb, stone-slabbed long cairns with integral revetments designed to counteract lateral thrust that are such an important feature of the Cotswold-Severn tombs.

Antechambers, forecourts and paved surfaces

A common feature in the Irish Sea group of cairns is a forecourt or antechamber, prepared for ritual activity by the establishment of, for example, a paved surface or a pit for the deposition of offerings or burial. Twlc y Filiast had an apparent roughly constructed forecourt in the cairn, leading to a stone-slabbed antechamber in which a pit with cremated bone was found. Dyffryn Ardudwy I had a similar forecourt facing east, holding evidence of ritual within, though in a pit full of pottery, rather than on a prepared paved surface. The later eastern tomb also had a vestigial forecourt with a blocking on which pottery had been deposited. The impressive curving forecourt at Pentre Ifan is well known, and also had a pit on the right of the entrance as at Dyffryn Ardudwy, but devoid of contents. Forecourt blocking, interpreted as closure of the cairn either as a final or temporary act (would this distinction necessarily have been known by those who undertook this?) is very common and encountered at Gwernvale, Tinkinsood, Din Dryfol and Parc le Breos Cwm and at Bryn yr Hen Bobl where Neolithic pottery was found, as at Carreg Coetan, within this blocking material. The subsequent burial or deposit of bone within the forecourt blocking, a possible interpretation of F31 at Carreg Coetan, is paralleled at Penywyrlod (Britnell and Savory 1984, fig. 8, 22–3).

Orthostats and availability of materials

The use of massive local boulders at all tombs in south-west Wales and Cornwall suggests that availability of appropriate materials must have been an important factor. The size of components of the chambers, especially the capstones, is noteworthy even in relatively inconspicuous or poorly understood sites such as Carn Besi, Cerrig y Gof and the Llanwnda and Goodwick chambers. We cannot tell if availability of appropriate boulders locally was a primary factor in the shape and size of chambers which might otherwise be similar in date, function and cultural association. Given the lack of excavation of these lesser known sites, their connection with better known, more impressive neighbours cannot be understood. However, the actual size of the interior of the chambers in all sorts of sites, is not so varied. Constrained greatly by the size of available capstones, nonetheless there is a similarity of size between the usually roughly rectilinear box-like chambers at Carreg Coetan (2m by 1.7m), Dyffryn Ardudwy (2.5m by 1m), Llech y Dribedd (1.6m by 1.9m), Trellyffaint (1.2m by 1.4m), Pentre Ifan (2.2m by 1.5m) and even the multiple cists at Cerrig y Gof (*c*. 1.2m by 1.8m). The polygonal chamber at Carreg Samson is bigger (2m by 2.8m).

Architecture

Turning finally to the morphology of the construction of Carreg Coetan, its identification as a portal dolmen would have been strengthened by the discovery of a stone-hole for the missing ‘jamb’ on the south-east corner. As excavation has shown that this could not have held an orthostat, one of the characteristics of these tombs is missing. However it still has features that have been recognised as belonging to this classification of tomb (De Valera 1960)—a wedge-shaped, tilted capstone, pointed orthostats, a roughly rectilinear chamber and a low-lying position. These features, along with a strong feeling of an entrance on the south side, are undeniable. Kytmannow's definition of the tombs of the South West as being variants within the general portal dolmen tradition seems reasonable and at least suggests a connection that develops Grimes' despairing nihilism. But the tombs in the Nevern Valley and in south-west Wales in general are undoubtedly particularly disparate and the point of trying to squeeze these monuments into a particular classification system is of uncertain benefit, particularly given the lack of excavation and poor state of preservation of the lesser and most uncertainly classified. Indeed, Tilley (1994, 90) describes their very individuality as one of the characteristic features of the group; a deliberate construct so that each monument should make a 'contrasting visual impact'.

Burial rites, and pottery styles are shared with Pentre Ifan and with Carreg Samson only a few miles away to the west, which also has pointed orthostats and a massive capstone despite its classification as a passage grave and indeed Whittle *et al.* (2011, 852) prefer to regard the site as belonging 'within the repertoire of portal tombs'; massive, tilting capstones and small rectilinear chambers are features of several of the adjacent sites, such as the Goodwick tombs. Similarities of material culture, date, location and architectural form link sites more convincingly than architectural differences divide them and it seems highly unlikely that the builders of these megalithic structures were unaware of one another even if they were not exactly contemporary. In conclusion it seems reasonable to state that Carreg Coetan Arthur, along with most other Nevern valley and south-west Wales tombs, share a feeling of belonging to or being influenced by a long-lived (rather than especially early or late) portal dolmen tradition in its widest sense that characterises many of the Irish Sea groups of tombs; but that to identify them as belonging rigidly to that class is to belittle their regional distinctiveness. Whittle *et al*. (2011, 863) speak of a scenario whereby existing regional identities from pre-Neolithic societies were retained and transferred into the new medium of pottery; it may not be fanciful to see this regional individuality continuing within the architecture of megalithic construction, especially given the enforced variation imposed by the availability of raw material.

Tilley challenges us to consider the function of the chambered tombs (1994, 206–8). The votive nature of bone deposits suggest that burial is not the prime motive, nor is it as a repository for deposited goods or offerings. The lack of evidence for agricultural activity found generally in these Early/Middle Neolithic sites contrasts with the evidence for animal husbandry, a claim that is certainly supported by the evidence from Carreg Coetan. Husbandry, he continues, requires seasonal movement through the landscape and hence a new attitude towards ownership and inheritance as animals, especially cattle, began to assume a symbolism of wealth. The building of monumental chambers, he suggests, were as cultural markers, legitimising patterns of social control and making reference to 'already established ancestral connections with, and pathways through, the landscape'. The tombs could indeed be linked within routeways utilized by a mobile society as permanent and important markers. Certainly the extraordinary architectural statements that these tombs make in their surroundings continue to inspire us today.

PREHISTORIC POTTERY

By Alex Gibson

Introduction

The prehistoric pottery from Carreg Coetan Arthur comprised 2.8kg of pottery, some of which had been conserved and reconstructed. It was examined macroscopically in good daylight using a ×10 hand lens where necessary and the fabric descriptions here, therefore, are based on macroscopic analysis alone.

The ceramics were arranged into fabric groups. Two main fabric groups were identified; Fabric 1 was very voided and 'corky' in texture while Fabric 2 was much harder and contained abundant crushed quartz opening agents. Fabrics 3–6 occurred in much smaller quantities. Fabrics 1 to 4 represent Neolithic ceramics, 5 and 6 Late Neolithic and Bronze Age.

The fabric groups were then subdivided into sherd groups (SGs). These probably equate to individual vessels and can be compared to estimates of minimum number of vessels. The writer prefers the term 'sherd group' rather than 'vessel' as, in the absence of conjoining sherds and given the similarity of fabric, it is recognised that each sherd group may represent a number of different but similar vessels. Equally, given the variability of fabric coarseness and thickness commonly found in hand-mixed clays and hand-built pots, it remains a possibility that a number of sherd groups do in fact represent a single pot. Some conjoining sherds were noted within each sherd group.

Fabrics

Fabric 1. This comprises a vesicular but hard and well-fired fabric with smooth, often burnished, surfaces. The fabric is characterised by voids resulting from leached out calcareous inclusions. Colour varies from light grey-brown to dark reddish brown surfaces and black cores.

Fabric 2. This hard and well-fired fabric has abundant quartz inclusions. The surfaces vary from light brown to grey and black and from smooth textured to rough and gritty. The inner surface in particular is frequently broken by protruding quartz fragments. The fabric is invariably hard and well-fired.

Fabric 3. A hard, well-fired fabric with sand inclusions. The surfaces are smooth and have a slightly pink tinge. The core is black.

Fabric 4. Sherds with sand inclusions and with pink-light brown surfaces. The sand inclusions give the sherds a gritty texture.

Fabric 5. Soft soapy-textured fabric, black throughout. The fabric has an open matrix and contains grog.

Fabric 6. Beaker fabric with pink-brown surfaces and a black core. The fabric contains fine sand and finely crushed grog.

Carinated Bowls

Sherd Group 1 (Fig. 28). Sherds in a light grey-brown to brown fabric with dark core. The sherds are all small. Two rim sherds (P22, P29) are from simple, rounded and everted rims. The sherds are too small to allow an estimation of diameter. 19 sherds (P22, P27, P29, P33, P34, P54, P116, P121, P122, P153, P592/3); weight 35g; Fabric 1. Contexts: P22 – B, base of ploughsoil; P27, 29, 33, 34, 54, 116, 121, 122, 153 – B, L9/13, SW of chamber; 592/3 – B topsoil.

Sherd Group 2 (Fig. 28). Well-fired sherds similar to Sherd Group 1. The surfaces are a little more pitted. The rim sherd (P94) is, like Sherd Group 1, rounded and everted with a slight external lip. The surfaces are smooth and well-finished. 9 sherds (P39, P41, P94, P96, P171, P213, P290, P292, P295); weight 26g; Fabric 1. Contexts: P39, 41, 94, 96, 171 – B, L9, SW of chamber, P213 – F49; P290–5 – L6.

Sherd Group 3. Well-fired sherds similar to Sherd Group 1. The surfaces are a little more pitted and the sherds are dark grey. 5 sherds (P190, P191, P279, P281); weight 7g; Fabric 1. Contexts: B, L9 and 13, SW of chamber.

Sherd Group 4. Well-fired sherds similar to Sherd Group 1. The surfaces are a little more highly polished and the fabric slightly harder and more brittle. Coil breaks are visible on some sherds. A slightly rounded shoulder sherd has traces of a concave neck surviving. The sherd is too small to estimate diameter. 23 sherds (P21, P28, P30, P35, P36, P38, P42, P47, P49, P115, P117, P121, P172, P208, P215, P585, P586, P590, P594); weight 81g; Fabric 1. Contexts: P21, 28, 30, 35, 36, 38, 42, 49, 115, 117, 121, 172 – B, L9 and 13, SW of chamber. P208 – F49; P215 – F50; P585, 586, 590, 594 – B, topsoil.

Modified Carinated Bowls

Sherd Group 5 (Fig. 28). Rim sherd from a large vessel some 240mm in internal diameter. The fabric is extremely hard and well-fired, light brown throughout, and the surfaces are extremely smooth. The rim is strongly everted and the top of the rim carries radial burnishing. Two body sherds are in a similar fabric and colour and may be from the same vessel. 5 sherds (P23, P43, P198, P534, P595); weight 46g; Fabric 2. Contexts: P23, 43, 198 – B, L9, SW of chamber; P534, 595 – B topsoil.

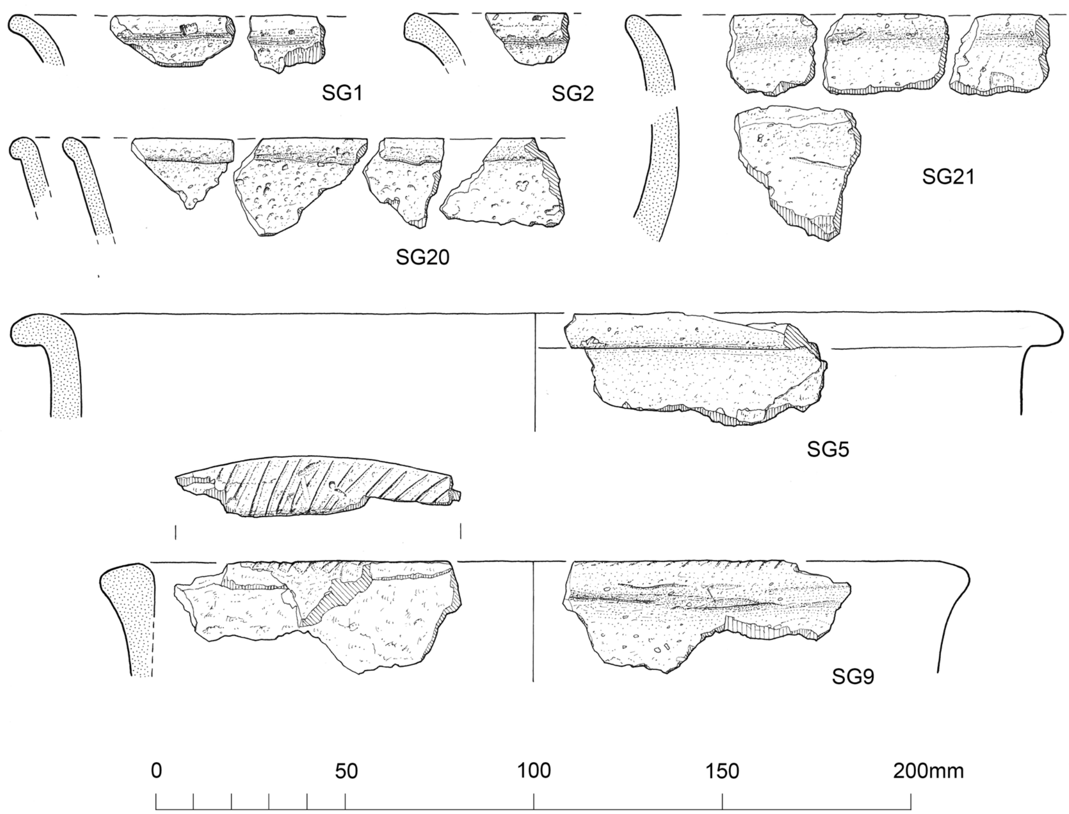


Fig. 28. Neolithic Pottery: Carinated Bowls, Sherd Groups 1, 2 (Fabric 1); Modified Carinated Bowls, Sherd Group 20 (Fabric 1), Sherd Group 21 (Fabric 3), Sherd Group 5 (Fabric 2); Developed Bowl, Sherd Group 9, (Fabric 2).

Sherd Group 20 (Fig. 28). Six rim sherds and body sherds from a small bowl. The fabric is thin (*c.* 5mm) and the rim sherds too small to estimate diameter. The rim is rounded, everted and has a slight external beading. 32 sherds (P173); weight 47g; Fabric 1. Contexts: A/B, L13, south of chamber.

Sherd Group 21 (Fig. 28). Three rim sherds, two neck sherds and a shoulder sherd from a Carinated Bowl. The rim is simple and rounded but too small to estimate diameter. The shoulder sherd is abraded and may possibly be from a separate vessel. 6 sherds (P212, P530, P531, P532, P537, P539); weight 52g; Fabric 3. Contexts: all B, ploughsoil, except P212 – F49.

Sherd Group 22. Four body sherds. 4 sherds (P199, P306, P307, P308); weight 23g; Fabric 1. Contexts: P199, B, L9 S of chamber; P306–8 F8 modern pit.

Sherd Group 23. Two small neck sherds. Dark grey-brown throughout. 2 sherds (P228, P229); weight 3g; Fabric 1. Contexts: B, F20 SW of chamber.

Sherd Group 24. Four body sherds. Dark grey fabric. Some burnishing. 4 sherds (P165, P214); weight 14g; Fabric 1. Contexts: P214 – B, F49; P165 – A/B L9.

Developed Bowls

Sherd Group 6 (Fig. 29). Largely reconstructed round based bowl, 200mm internal diameter at the rim, in a hard well-fired fabric varying in colour from grey-brown to black. Quartz inclusions up to 5mm across break both surfaces, particularly the inner. The rim is thickened with an external lip. It has been formed by applying a strip of clay to the inside (join void clearly visible). The rim is decorated on the top by a series of close-set radial incised lines. The outer lip is also decorated with short vertical incisions. Both surfaces have visible wipe marks resulting from the finishing of the vessel, especially below the rim. The inner surface has traces of carbonaceous residues and one large body sherd has a possible seed impression on the outer surface. 30 sherds plus small crumbs (P16); weight 912g; Fabric 2. Contexts: A, L6, old ground surface SE of chamber, immediately outside G2.

Sherd Group 7 (Fig. 29). Hemispherical bowl in a hard and well-fired fabric with abundant quartz inclusions erupting through both surfaces, especially internally. The rim is flat-topped, 110mm diameter, with slight internal and external lips. 3 sherds (P5, P129, P131); weight 263g; Fabric 2. Contexts: A, redeposited subsoil L5, SE of chamber.

Sherd Group 8 (Fig. 30). Round-based bowl with out-turned rim some 220mm in internal diameter. The fabric is hard and well-fired, black to grey-brown and light brown in colour, and with abundant quartz inclusions visible on both surfaces but lying flush with the surfaces. The outer surface is burnished with horizontal burnishing facets clearly visible. The rim is decorated with close-set diagonal incisions. In the outer rim angle, there are impressions from the potter's fingernail, resulting from the forming of the out-turned rim. One sherd is perforated by a drilled hole, possibly a repair hole, drilled through post-firing. 40 sherds plus small crumbs (P10, P180); weight 325g; Fabric 2. Contexts: A, L6, old ground surface, SE of chamber.

Sherd Group 9 (Fig. 28). Rim and body sherds in a hard well-fired, light brown fabric with a grey core. The rim is thickened and out-turned with an estimated internal diameter of *c.* 200mm. Horizontal smoothing marks can be seen on the outside of the rim. The top of the rim is flattened and decorated with fine,

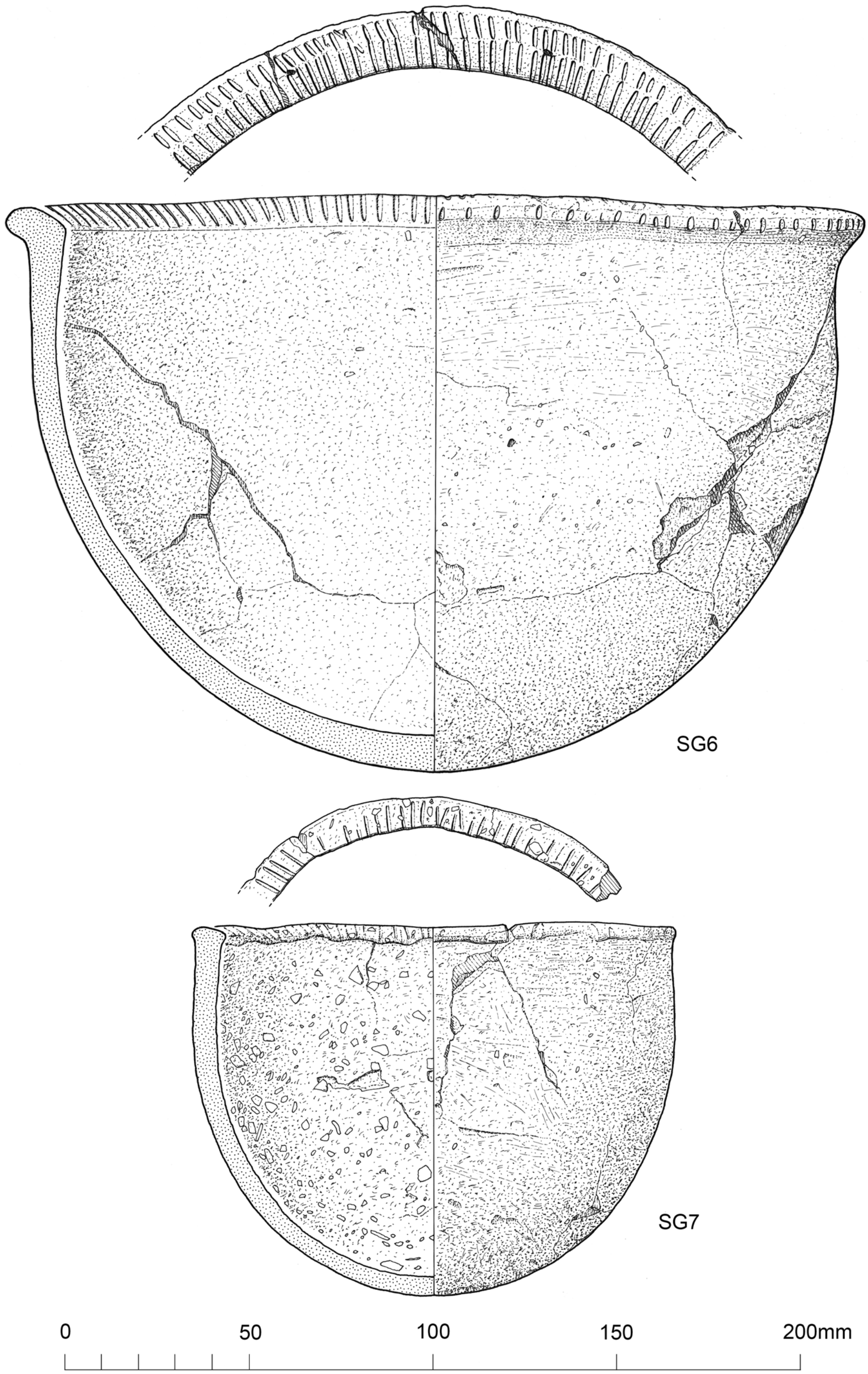


Fig. 29. Neolithic Pottery: Developed Bowl (P16), Sherd Group 6 (Fabric 2), Developed Bowl (P5, 129, 131), Sherd Group 7 (Fabric 2).

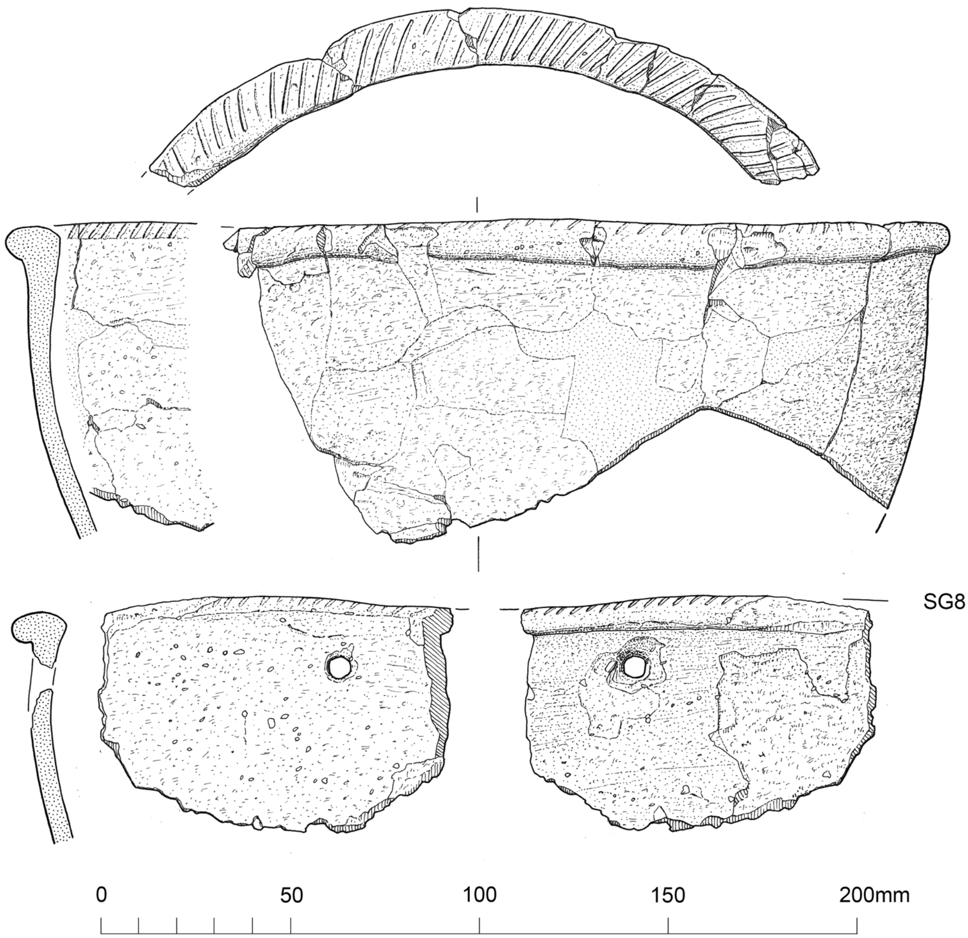


Fig. 30 Neolithic Pottery: Developed Bowl (P10, P180), Sherd Group 8 (Fabric 2).

close-set and oblique incisions. The rim is similar to Sherd Group 8 but the surface colouration, lack of burnishing and slightly different rim form all suggest a separate vessel. Some of the body sherds also have horizontal smoothing marks. 14 sherds plus small crumbs (P6, P10, P12, P58, P60); weight 62g; Fabric 2. Contexts: A, L6, old ground surface SE of chamber; P58 – chamber interior LII.

Sherd Group 10 (Fig. 31). Rim and body sherds in a hard well-fired fabric. The surface colour ranges from light brown to light grey-brown and the fabric is dark grey with some join voids between coils visible. Quartz inclusions erupt through both surfaces. The rim is rounded, thickened and slightly everted. 9 sherds (P5, P17, P20, P62); weight 63g; Fabric 2. Contexts: A, L6, old ground surface, SE of chamber.

Sherd Group 11 (Fig. 31). Rim and body sherds in a hard, well-fired black-brown fabric. Abundant quartz inclusions erupt through the inner surface which also tends to be lighter in colour. The rim has an estimated internal diameter of *c.* 150mm. The rim is rounded, undecorated and thickened externally. 25 sherds plus small crumbs (P6, P8, P76); weight 196g; Fabric 2. Contexts: A, L6, old ground surface, SE of chamber.

Sherd Group 12 (Fig. 31). Rim and body sherds in a hard, well-fired fabric with crushed quartz inclusions, a light brown outer surface, grey-brown inner surface and a grey core. The inclusions break through the inner surface. The rim is similar to those in Sherd Group 11 but the lightness of the fabric may suggest a different but similar vessel. The rim has an internal diameter of *c.* 140mm, is rounded, undecorated and thickened externally. 27 sherds (P9, P53, P76); weight 90g; Fabric 2. Contexts: A, L6, old ground surface, SE of chamber.

Sherd Group 13. Undecorated body sherds ranging in colour from grey to light brown. Uniting these sherds is their thinness (4–6mm) the hardness of the fabric, the sparseness of inclusions breaking the outer surface in contrast to the abundance of inclusions that break through the inner surface. These sherds may possibly belong to some of the sherd groups described above. 15 sherds (P18, P19, P91, P99, P178, P535, P536); weight 60g; Fabric 2. Contexts: A. P18, 19 – L6 old ground surface SE of chamber; P91 and 99 – A, L5, among ring of stones east of chamber; P178 – among ring of stones, S of chamber; P535–6 – topsoil to west of chamber.

Sherd Group 14. Undecorated body sherds very similar to Sherd Group 13 but, in this case, the quartz inclusions are as sparse on the inner surface as they are on the outer. 16 sherds (P6, P11, P17, P59, P130, P291, P293, P294); weight 73g; Fabric 2. Contexts: P6, 11, 17 – old ground surface SE of chamber; P59, 130 – A, L5 and L6, SE of chamber; P291–4, chamber interior LII.

Sherd Group 15. Undecorated body sherds similar to SG 14 but the sherds are thicker (8mm) and heavier. Many sherds have carbonaceous residues on the inner surface. 17 sherds plus small crumbs (P14, P15, P17, P40, P57, P61, P64, P65, P208, P296–P303); weight 160g; Fabric 2. Contexts: all, A, old ground L6, SE of chamber; except P40, B, L9; P 296–303 – Chamber interior LII; P208 – F49.

Sherd Group 16. Undecorated wall sherds similar to Sherd Group 5. 2 sherds (P46, P305); weight 16g; Fabric 2. Contexts: P46 – B, L9; P306 – F8, modern pit.

Sherd Group 17. Undecorated wall sherds. 8 sherds (P118, P156, P119, P589); weight 46g; Fabric 3. Contexts: P118 and 119, B, L13 S of chamber inside ring of stones; P156, BL9 inside ring of stones, SW of chamber; P589, ploughsoil SW of chamber.

Sherd Group 18. Undecorated wall sherds. Pink-light brown smooth surfaces. 5 sherds (P31, P292, P591, P601, P614); weight 20g; Fabric 2. Contexts: P31, 614 – B, L9; P292, chamber interior; P591, 601 – B, ploughsoil.

Sherd Group 19. Undecorated body sherds. 52 sherds plus small crumbs (P24, P51, P112, P192, P207, P214, P611, P533, P538, P540, P541, P542, P543, P544–P548, P549, P550, P554, P564, P551–P560, P573, P571–P580, P574, P599); weight 159g; Fabric 4. Contexts: P31, 614, 112 – B, L9; P51 – B, L10; P192 – amidst ring of stones on SW of chamber; P 24, 611, 533, 538, 540, 541, 112, 544–8, 549, 550, 554, 564, 551–60, 573, 571–80, 574, 599 – B, ploughsoil; P207, 214 – F49.

Late Neolithic

Sherd Group 25 (Fig. 31). Two sherds, one lacking the outer surface. The more complete is a rim sherd with an estimated internal diameter of 160mm, though the rim itself is rather flattish and this may be an overestimate. The sherd is decorated externally with 3 horizontal lines of twisted cord impressions. The rim is flat-topped and is decorated with a single encircling line of the same technique. 2 sherds (P251, P271); weight 16g; Fabric 5. Context: Chamber interior, LII.

BEAKER

Sherd Group 26 (Fig. 31). Small sherd with traces of five lines of toothed comb impressions. 1 sherd (P265); weight 1g; Fabric 6. Context: Chamber interior, LII.

Bronze Age?

Sherd Group 27. Body sherd with a light brown outer surface and black inner surface with traces of carbon residue. Undecorated. The sherd may be from an Urn or may possibly be Late Neolithic. 1 sherd (P271); weight 12g; Fabric 5. Context: Chamber interior, LII.

Undiagnostic crumbs

P86, P148, P127, P224, P603.

Discussion of the prehistoric pottery

As many as eight sherd groups appear to be represented in Fabric 1 (Sherd Groups 1–4, 20 and 22–24) and probably all represent Carinated Bowls (Fig. 28). Carinated Bowls in a similar vesicular fabric are well known in Wales, in particular from Clegyr Boia, Pembrokeshire (Williams 1953) where, like the present assemblage, the vessels' surfaces are smooth and well-finished. The voids at Clegyr Boia are formed from leached out sea-shell but it has now been established that the voids in that from Carreg Coetan Arthur were derived from burnt-out calcite (see Jenkins, below). Vesicular fabrics have also been noted in the assemblages from Ty Isaf and Gwernvale, Brecknock (Grimes 1939a: Darvill in Britnell and Savory 1984) but despite microscopy at the latter site the exact opening agent was not identified though it has subsequently been identified as plant material by Peterson (2003). At Dyffryn Ardudwy, Gwynedd, it was suggested that charcoal had been used as the opening agent (Lynch 1969) and again the pottery is fine and well made with good smooth surfaces, brown in colour and with the characteristic 'corky' appearance. The similarly pitted pottery from Llandegai, Gwynedd, as at Carreg Coetan, was considered to owe its voided nature to the leaching out of calcitic inclusions (Williams and Jenkins, in Lynch and Musson 2001). It is from Clegyr Boia, unsurprisingly, the nearest of the comparative sites, that the Fabric 1 sherds have their closest parallels. Though fragmentary, the rim forms of Sherd Groups 1, 2, and 20 can all be paralleled in the Clegyr Boia assemblage. They are essentially simple rims though Sherd Group 20 has a slight lip or beading characteristic of Modified Carinated Bowls.

Radiocarbon dates for corky Carinated Bowls from Llandegai and Gwernvale suggest it is primary or near primary to the Welsh Neolithic spanning *c.* 4000–3700 cal. BC. However, it has been pointed out that some of these dates may suffer from the old wood effect. Nevertheless, Carinated Bowls appear in western Britain at the advent of the Neolithic in the first two centuries of the fourth millennium (Whittle *et al.* 2011). The burnished rim of Sherd Group 20 would be seen as a Modified Carinated Bowl by Alison Sheridan (2007) and therefore would not be regarded as primary, at least in Scotland. Nevertheless, the radiocarbon dates suggest that the development of this modified material was rapid and the degree of

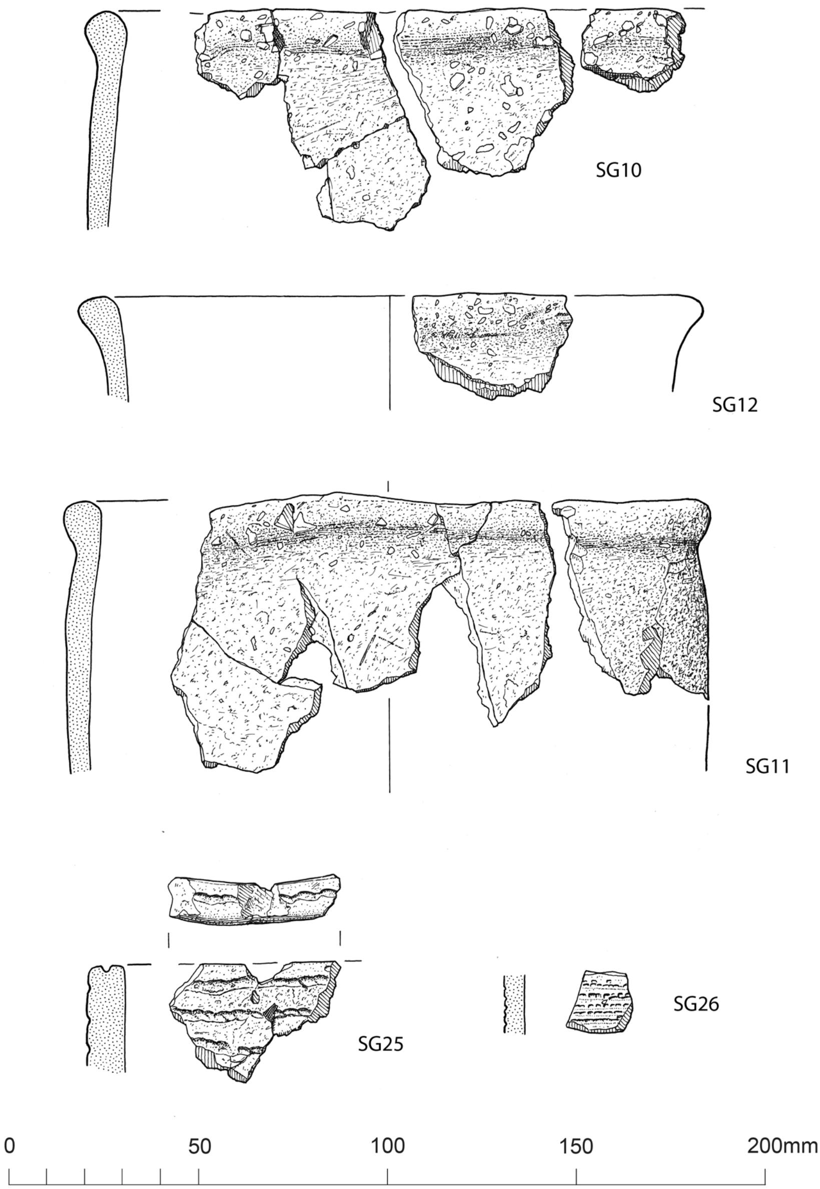


Fig. 31. Neolithic Pottery: Developed Bowl, Sherd Groups 10, 11, 12 (Fabric 2); Late Neolithic and Beaker Pottery: Twisted Cord Impressed Ware, Sherd Group 25, (Fabric 5); Beaker, Sherd Group 26 (Fabric 6).

overlap between Carinated Bowls and Modified Carinated Bowls is considerable. Despite the potential relative chronological difference, the actual absolute chronological difference may be minimal and the two were undoubtedly in contemporary use at Carreg Coetan Arthur.

Vessels in Fabric 2 are altogether more coarse and certainly belong to Developed Bowls (Sheridan's Modified Carinated Bowls). These large vessels in a comparatively coarse yet hard, well-fired and well finished fabric (at least externally) may also be broadly contemporary with those in Fabric 1 though recent analysis of the radiocarbon dates suggests a range of *c.* 3800–3400 cal. BC (Whittle *et al.* 2011). The simple decoration on the rims of Sherd Groups 6, 8 and 9 (Figs 28–30) suggests the advent of the decorated bowl tradition which was current from *c.* 3700–3300 cal. BC (Whittle *et al.* 2011) in southern Britain. The hemispherical forms of Sherd Groups 6–8 (Figs 29–30) and the modified or thickened rims of Sherd Groups 5–12 are in keeping with this identification. The identification of quartz as the main opening agent might suggest the deliberate selection of this material and therefore marks a fundamental change in ceramic technology from shell to white stone as the inclusion of choice. The similarity of finish of Sherd Groups 6 and 8 (Figs 29–30), namely the wiping and burnishing as well as the close-set incisions on the rim may suggest the work of the same potter though this is difficult to prove in largely undecorated vessels clearly made in the same tradition.

Once again there are abundant local parallels for these Fabric 2 vessels. A hemispherical bowl with thickened rim comes from the floor of the chamber at Carreg Samson and this too is stone-tempered (Lynch 1975). Clegyr Boia again provides parallels, largely as a result of the size of the assemblage. Here there are not just thickened rims but also everted rims with radial incisions (Williams 1953). The phase 2 pottery from Gwernvale and the plain bowls from Ty Isaf match Sherd Groups 7, 10–12 (Britnell and Savory 1984; Grimes 1939a); the radial burnishing on the top of the rim of Sherd Group 5 is also found at Ty Isaf though the lugged forms at Ty Isaf are not present at Carreg Coetan Arthur. Sherd Group 6 finds close parallel at Mount Pleasant, Glamorgan, though the latter has a corky fabric and appears slightly larger than Sherd Group 6 (Savory 1955).

Sherd Group 8 has a perforation which has been drilled from the outside of the vessel after it has been fired (Fig. 30). Similar drilled holes have been noted elsewhere in Wales, principally at Dyffryn Ardudwy (Powell 1973), Clegyr Boia (Williams 1953), Trefignath (Smith and Lynch 1987), and Ty Isaf (Grimes 1939a), all of them in the upper part of the vessel. Drilling a hole in an already fired and brittle medium such as ceramic must have been an afterthought as it would have been far easier to have perforated the vessel whilst still plastic had the perforation been part of the original design. Consequently they have been interpreted as repair holes (Cleal 1988). It is envisaged that originally there would have been a pair of holes one either side of a crack in the vessel wall and that they would have been used to thread through a binding material to hold the crack together. It is assumed that the drilled hole in Sherd Group 8 is a similar device but that its partner has been lost (but see Keeler, below, for a view as to the perceived value of these pots).

Sherd Group 25 (Fig. 31) is identified as late Neolithic Impressed Ware, possibly in the Mortlake or Fengate substyle. There is little to suggest a collar *sensu stricto* except for a slightly accentuated curvature to the angle of the internal surface so the identification is tentative. Nevertheless, the softness of the fabric and the grog inclusions support the hypothesis, probably tending towards the Fengate style given the Mortlake preference for quartz inclusions (Gibson 1995). Though also found on Early Bronze Age pottery, such as Collared Urns and Food Vessels, twisted cord decoration is also an Impressed Ware trait. Impressed Ware is rare in west Wales but moulded rims and encircling lines of both twisted and whipped cord impressions come from the assemblage at Ogmore, Glamorgan (Gibson 2001) where the twisted cord line on the rim itself can also be paralleled. Impressed Ware has also been recovered from other chambered tombs in Wales. At Gwernvale, a small amount of Impressed Ware was associated with the closing of the monument (Britnell and Savory 1984). At Bryn yr Hen Bobl (Anglesey), a similarly small amount of Impressed Ware came from the terrace to the south of the main cairn (Lynch 1969). A larger assemblage from eastern Wales at Upper Ninepence (Radnorshire), includes a rim that may well be the best parallel for the present vessel (Gibson 1999, fig. 51, P1). The fabric of both vessels would also appear to be similar and a suite of associated radiocarbon dates for the Impressed Ware phase at Upper Ninepence suggests a currency of *c.* 3500–2900 BC.

No doubt surrounds the identification of P26 as Beaker (Fig. 31). This fine-walled vessel is in a typically fine fabric and decorated with lines of fine toothed comb impressions. Insufficient survives to allow the vessel to be attributed to a particular sub-style. Once again, a Beaker presence in secondary contexts at chambered tombs is well known in Wales. A beaker bowl from Tinkinswood, Glamorgan has been interpreted as early by Savory (1980, 76) while later (necked) vessels come from the chambered tombs of Capel Garmon (Denbighshire), Ty Isaf (Brecknock), and Pant-y-Saer (Anglesey) (ibid. 77). This sherd from Carreg Coetan Arthur yet again demonstrates the Chalcolithic fascination with older monuments and perhaps their continued importance and ceremonial focus.

Further study

It was considered that thin section analysis of the two main fabric types might refine the macroscopic descriptions given above. Samples of the main fabrics of Neolithic ware were sent for preparation and examination of tangential thin sections in the hope that this might identify the cause of the voids in Fabric 1 and analyse the naturally occurring inclusions in both Fabrics 1 and 2 to suggest the origin of the clay (see Jenkins below). Five pottery sherds from different sherd groups and fabrics with apparent residue adhering to surfaces were sent for absorbed residue analysis to identify any traces of contents and thus provide an extra comparison between the two fabric types (see Stern, below).

ANALYSIS OF ORGANIC RESIDUES ON THE NEOLITHIC POTTERY

By Ben Stern

Organic residues on five sherds of Neolithic pottery (Carinated Bowl P35, SG 4; Developed Bowl P16, SG6; Developed Bowl P11, SG14; Developed Bowl P14, SG15; and Carinated Bowl P122, SG1) from Carreg Coetan Arthur were analysed by gas chromatography-mass spectrometry (GC-MS).

SAMPLE PREPARATION

Visible residues were removed from the interior surface of each sherd by scraping with a metal spatula. The resultant samples were extracted with three aliquots of ~2ml DCM:MeOH (dichloromethane:methanol 2:1, v/v), with ultrasonication for 5 minutes followed by centrifugation (5 min. 2000 rpm). Excess BSTFA (*N,O*-bis(trimethylsilyl)trifluoroacetamide) with 1% TMCS (trimethylchlorosilane) was added to derivatise the sample which was warmed at 70°C for one hour. Excess derivatising agent was removed under a stream of nitrogen. The samples were diluted in DCM for analysis by GC-MS. A method blank was prepared and analysed alongside the four samples.

Instrumental (GC-MS)

Analysis was carried out by combined gas chromatography-mass spectrometry (GC-MS) using an Agilent 7890A Series GC connected to an 5975C Inert XL mass selective detector. The splitless injector and interface were maintained at 300°C and 340°C respectively. Helium was the carrier gas at constant flow. The temperature of the oven was programmed from 50°C (2 min.) to 350°C (10 min) at 10°C/min. The GC was fitted with a 15mm × 0.25mm, 0.25μm film thickness HP-5MS 5% Phenyl Methyl Siloxane phase

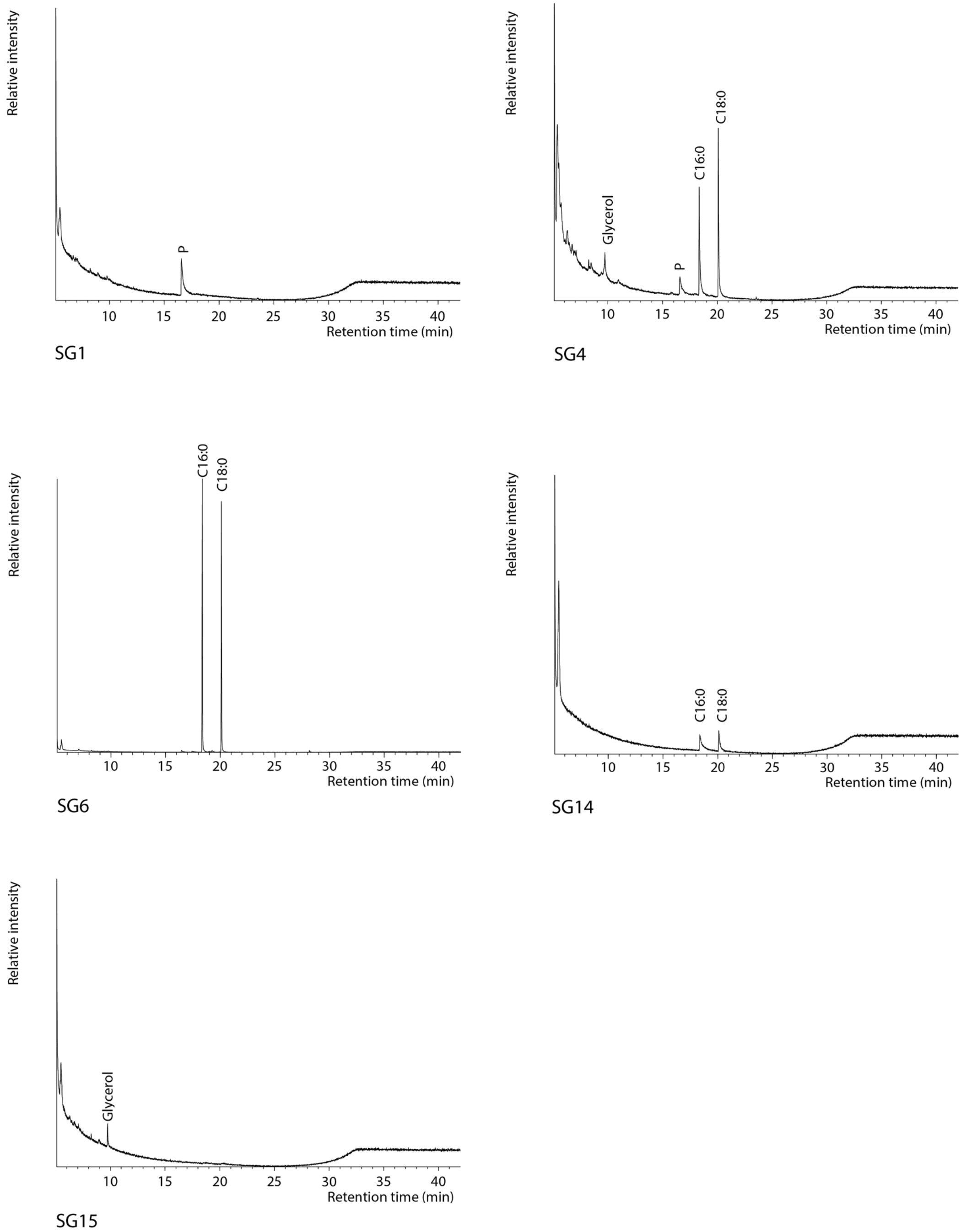


Fig. 32. Chromatograms of the BSTFA derivatized solvent extracts from selected Neolithic sherds.

fused silica column (Agilent J&W). The column was directly inserted into the ion source where electron impact (EI) spectra were obtained at 70 eV with full scan from m/z 50 to 800.

Results

The results are presented as chromatograms of the BSTFA derivatized solvent extracts (Fig. 32). These show each separated component of the solvent extract as discrete peaks, the area under each peak being representative of the abundance.

Fatty acids with 16 and 18 carbons were recovered from samples of Sherd Groups (SG) 4 (P35), 6 (P16) and 14 (P11). Samples SG4 and SG15 (P14) contained glycerol, which is a likely degradation product of triacylglycerides. However, no triacylglycerides were recovered. The low concentrations of glycerol and that of the fatty acids from sample SG14 mean that it is difficult to exclude contamination as their origin (e.g. from the adhering soil, handling etc.).

The abundances of the saturated fatty acids $C_{16:0}$ and $C_{18:0}$ in samples SG4 (P35, Carinated Bowl, Fabric 1) and SG6 (P16, Developed Bowl, Fabric 2) are significant and this indicates the presence of a degraded oil or fat. No sterols were recovered, so it is not possible to determine if these fatty acids originate from a plant or animal source; however, animal products (such as milk, cheese etc) have a higher fatty acid content and leave a higher lipid concentration than plant oils—although there is no molecular evidence here to distinguish between these sources.

The remaining samples yielded only a phthalate plasticiser (a synthetic molecule, probably originating from the sample packaging). The raised baseline from 30–42 minutes is termed 'column bleed' a normal occurrence as part of analysis, this is only revealed here as the vertical scale has been enlarged for these samples. Therefore these remaining samples contain no indigenous lipid.

PETROGRAPHIC ANALYSIS OF THE NEOLITHIC POTTERY

By David Jenkins

Several fabrics within the Neolithic pottery assemblage were seen to have voids within their matrix; pot 16 (Developed Bowls, Fabric 2) was examined by Phil Parkes (University of Cardiff, Archaeology Laboratory) to assess suitability for casts and by Astrid Caseldine (University of Wales, Trinity Saint David) to examine microscopically to see if it could be established if the considerable number of voids within this pot could have originated as vegetable matter or seeds, burnt out during firing. The fabric was too friable to allow casts to be made and too irregular and coarse to allow microscopic analysis.

Five sherds of different fabrics were then submitted for thin-section petrographic analysis. These included representative sherds of the four main fabrics of Developed Bowls, Carinated Bowls and Modified Carinated Bowls. The Impressed Ware and Beaker fabrics (see Gibson above, Fabrics 5 and 6) were not sent for analysis as their representation (three of the former, one of the latter) in the assemblage was too small to permit this.

Summary

Petrographic analysis has been carried out on five selected Neolithic sherds from excavations at Carreg Coetan Arthur. Thin-sections have been prepared and examined under the microscope to characterise sherd fabric and establish the mineralogy/petrology of components and so provide information on provenance and classification.

The fabrics of the five sherds show a diversity of matrix texture, porosity, temper and clast petrology. In particular, two sherds exhibit 'clast voids' interpreted as due to the loss of calcite cleavage fragments

under acid conditions: grog, by contrast, is rare or absent in the samples selected. On this basis two of the sherds can be classified as Fabric Group 1, and three as Fabric Group 3b/e according to the scheme proposed by Williams and Jenkins (2004)

The provenance of the material used in producing two of the sherds could be linked to nearby outcrops of various igneous rock types, although clasts in the on-site soil do not appear to have been used as a source of filler. Another sherd contains distinctive (but not diagnostic) white quartz as filler. The other two sherds with a 'corky' fabric have only rare clasts; however, they differ in having a calcareous history, and one contains possible chert, suggesting an origin in a more distant limestone area.

Introduction

Five Neolithic sherd samples were received for petrographic analysis from Carreg Coetan Arthur to supplement the report by Alex Gibson on a macroscopic examination of pottery from the site in which six fabric groups were proposed within the 27 sherd groups identified. The five sherds received for petrographic analysis from amongst the total sample are summarized in the following table.

Table 1. Details of sherds received for petrographic analysis

Sherd no.	Sherd Group	Gibson Fabric	Vessel type
P117	4	1	Carinated Bowl
P173	20	1	Modified Carinated Bowl
P64	15	2	Developed Bowl
P539	21	3	Modified Carinated Bowl
P543	19	4	Developed Bowl
no samples	–	5	Late Neolithic/Bronze Age
selected	–	6	Beaker

Methodology

Where possible, two portions from each sherd were selected (*c*. 25 × 10mm), one of which was refired at 500ºC overnight to clarify darker fabrics by the oxidation of organic pigments. The two portions were then impregnated with a polystyrene resin system and, when cured, standard thin-sections were prepared by John Fletcher at the British Geological Survey, Keyworth (Notts.). Slides were examined for fabric and mineralogy/petrology using a polarising microscope and quantitative analyses were made for standard components (voids/matrix/grains/grog/clasts) using a Swift Point Counter, employing a total of >200 counts to give a sensitivity limit of >0.5% or better. However, there are obvious limitations to how representative of a pot such a section can be (see discussion in Williams and Jenkins 2004).

For reference purposes, a slide was also prepared of the sediment that would have been available locally as a 'filler' if chosen by the prehistoric potters. This took the form of the 2.0–0.6mm fraction of a buried soil from the site that was washed, impregnated with resin and a thin-section prepared as above.

Results

Thin-section descriptions are presented below and analytical data are summarised in Table 2. Reference thin-section images were also prepared directly for larger scale fabric features using a Nikon Coolscan IV, and are presented, together with images of the sherds prior to impregnation, in Figure 33.

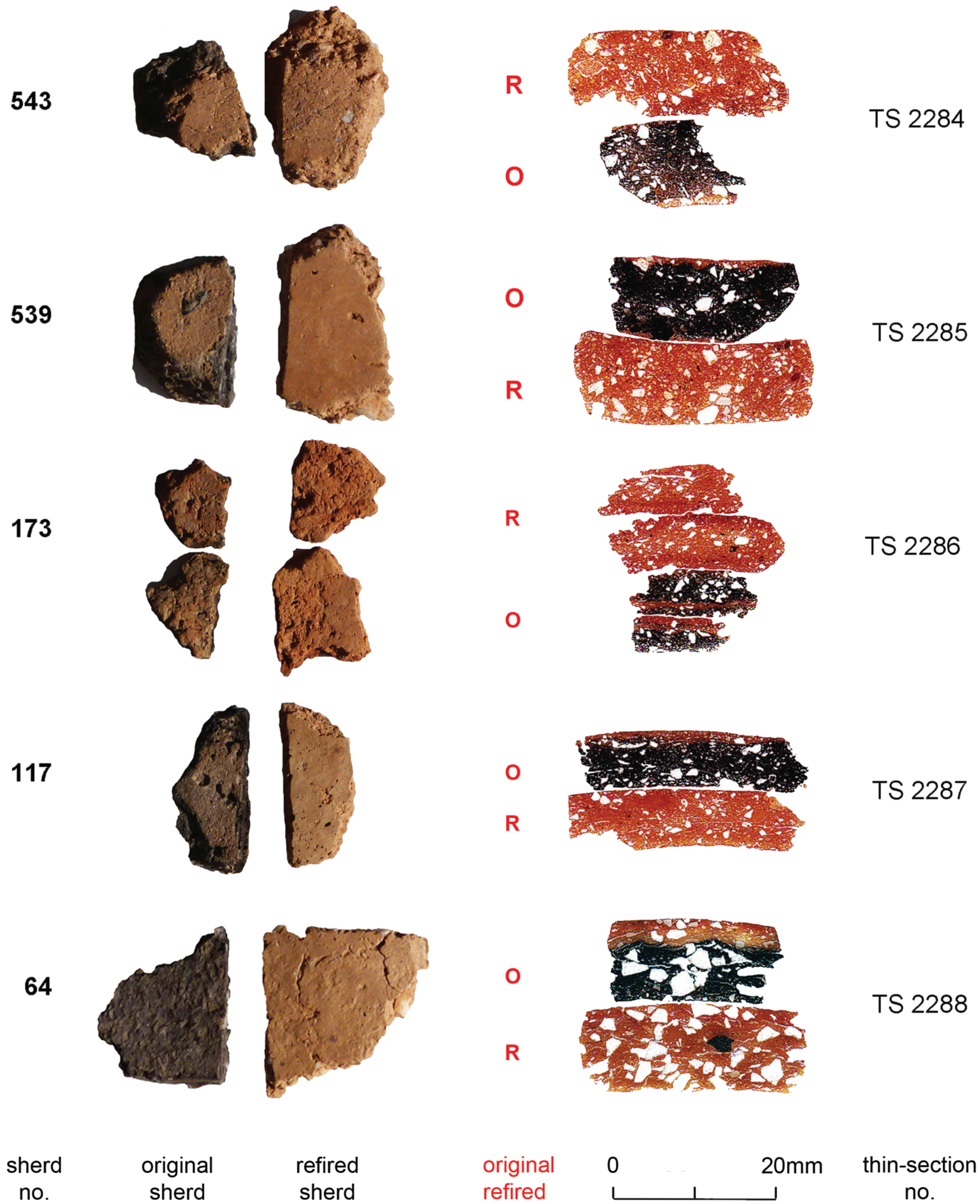


Fig. 33. Carreg Coetan Arthur sherd thin-sections. Note that in thin-section all voids show as white, as do quartz clasts, especially in 64; clasts in 543 and 549 are not distinguishable from the matrix at this scale – black organic pigments are present in the original but not refired sherds.

Table 2. Petrographic analysis of the Neolithic Pottery: summary of analytical data

Sample	P64	P117	P173	P539	P543	Local soil 2.0–0.6mm fraction
Laboratory TS No.	2284	2285	2286	2287	2288	2289
Colour						
Original – surface	Light brown	Brown	Strong brown	Light brown	Reddish yellow	
Munsell	7.5YR6/4	10YR5/3	7.5YR4/6	7.5YR6/4	7.5YR6/5	
Original – core	Dark grey	Very dark grey	Dark grey	Very dark grey	Reddish yellow	
Munsell	7.5YR4/6	7.5YR5/3	7.5YR4/0	7.5YR4/0	7.5YR6/5	
Refired	Reddish yellow	Reddish yellow	Reddish yellow	Reddish yellow	Dark grey brown	
Munsell	7.5YR6/5	7.5YR6/5	7.5YR6/5	7.5YR6/6	7.5YR4/1	
Sherd thickness (mm)	9–11	6	4-6	8–10	10	
Point count total	278	202	255	299	265	96
			Volume.%			
Voids – structural	11.5	<13.3	<18.8	9.6	8.6	
clast voids (calcitic)	<	>7.4	>6.2	<	<	
Matrix (< *c.* 63µm)	56.4	71.2	70.5	58.5	62.5	
Texture	silty clay	sandy clay	sandy clay	silt	sandy clay	
Orientation (agg. birefr.)	moderate	moderate	weak	weak	weak	
Grains (*c.* 63–630µm)	2.8	5.4	4.3	10.0	8.6	
Grog	<	0.9	<	P*	<	
Clasts (>*c.* 630µm)	28.9	1.4	<	21.5	20.2	(100%)
v. altered silicic ign. (coarse)	<	<	<	<	11.3	2
v. altered silicic ign. (fine)	<	<	<	7.6	<	21
large quartz (vein/ign)	25.1	<	<	13.0	7.9	13
rounded quartz (aeolian?)	p	<	<	<	<	8
fine quartz sandstone	<	p	<	0.6	0.3	4
shale/siltstone	1.4	1.4	<	<	<	35
chert?	<	p	<	<	<	–
slate/phyllite	<	<	<	<	<	–
quartz schist	p	<	<	<	<	p
iron concretions	1.7	<	<	0.3	0.7	13
Fabric Group (Williams and Jenkins 2004)	3e	1	1	3e/b	3b/e	

< = below the lower sensitivity limit of this method (0.5%); *p = present, but not recorded in the point count, (i.e. < 0.5%)

Discussion

The analytical data obtained from the thin-sections may be interpreted in terms of the general fabric of the sherds in relation to Neolithic pottery from elsewhere in Wales, the differences and similarities between individual fabrics, and of the provenance of the geological materials used in the production of the pots.

In their general characteristics the five sherds examined are diverse in nature. This is evident in their degree of tempering and porosity where three are moderately (P64, P539 and P543: 20–29% by volume) tempered with coarse filler (up to 3mm), and of medium porosity (10–12% voids >20µm) whilst two (P117 and P173) are sparsely tempered and 'corky' in nature with high porosity (20–25% voids).

This porosity is manifested as geometrically distinctive rhomboid shaped ‘clast-voids’, resulting from dissolved calcite cleavage fragments and comprising at least 24–35% of the total porosity. However, no distinctive concavo-convex, ribbed fragments are recognisable which would be indicative of intact shell fragments as reported from Clegyr Boia, Pembrokeshire (Williams 1953) or from Din Dryfol, Anglesey (Jenkins 1987).These are characteristics shown by other Neolithic pots analysed from northern Wales (Fig. 34a–b; Williams and Jenkins 2004).

Most filler takes the form of rock clasts which, from their dominantly angular shape, were obtained by the crushing of rock material—either from outcrop or coarse sediments (e.g. cobbles in glacial sediments). Grog, a characteristic filler of some of the pottery in Neolithic and other prehistoric periods, was observed only rarely in P117 and P539, but grog-rich (Gibson’s Fabrics 5 and 6, see above) were not included in the sample analysed. As discussed below, the rock clasts are dominated by angular quartz fragments (up to 3mm in size) in P64, together with strongly weathered igneous material in P539 and P543. The matrices are of sandy-clay to silty-clay texture, showing correspondingly moderate/strong orientation, except in P543 which has a sandier texture, and in P173 which is calcareous and has a nearly isotropic matrix.

Although all five sherds show significant differences in fabric and composition, P64, P539 and P543 all fall within Group 3b/e as proposed by Williams and Jenkins (2004) whilst P117 and P173 with ‘corky’ fabrics fall within Group 1.

Differences are shown in fabric and composition between the five sherds. Although the colours of four (reddish-yellow) are similar after re-ignition suggesting similar total iron contents in the ‘clay’ used, P543 is dark grey-brown suggesting use of a different ‘clay’ material. Porosity is evident in the common occurrence of thin, discontinuous, irregular voids roughly parallel to the sherd sides, accompanied by occasional larger linear voids and occasional rounded vughs. In P539 and P543, however, the fine voids are rarer as reflected in their lower void content (*c.* 9%). As mentioned above, the porosity is increased in P64 (*c.* 12%) and in P117 and P173 it is further enhanced (to *c.* 20–25%) by the presence of the distinctive rhombic voids attributed to the dissolution of calcite cleavage fragments in Neolithic pottery in north Wales (Williams and Jenkins 2004): even these will tend to be underestimates as only those with well-defined shapes have been put into this category of ‘clast-voids’.

Differences are also obvious in the clast lithologies of the five sherds. Large angular quartz fragments are common in P64 and P539, but less so in P543, and are accompanied by clasts of silicic igneous material in P539 which is dominant in P543. The nature of the silicic igneous material is mostly difficult to identify due to strong alteration and/or weathering but tends to involve finer extrusive lava/tuffs in P539 and coarser intrusive material in P543. Similarly, the quartz clasts appear to be mainly of vein quartz in P64 but may be of igneous origin in P539 and P543. There were rare possible instances of more mafic material containing oxidised chlorite and epidote/clinozoisite, again highly weathered, in P539.

These results are compared visually in Figure 34 to similar analyses of Neolithic sherds from north Wales (Williams and Jenkins 2004). Triangular diagrams are informative in plotting three selected groups of properties, such as percentage matrix, filler and voids for sherd fabric (Fig. 34a) and percentage clasts, grog and voids for nature of filler (Fig. 34b). This is useful to reveal grouping and for comparison of sherds. For both fabric and filler it shows that the five Carreg Coetan Arthur samples fall within the general group boundaries evident from over 70 corresponding sherds analysed from north Wales. However, it also shows that P173 is at the edge of its group in both respects and it again illustrates the general sparsity of grog as a filler (<1%) in Gibson’s Fabrics 1–4 samples when compared to other Neolithic pottery in north Wales where it can be a major component of the filler (up to 80%, Fig. 34b). A third level of grouping according to clast detailed petrology has not been illustrated but is referred to in the conclusions.

As to provenance, the clasts provide information relating to possible geological source or sources of material used by the Neolithic potters. These include outcrops of rocks within the area and glacial deposits

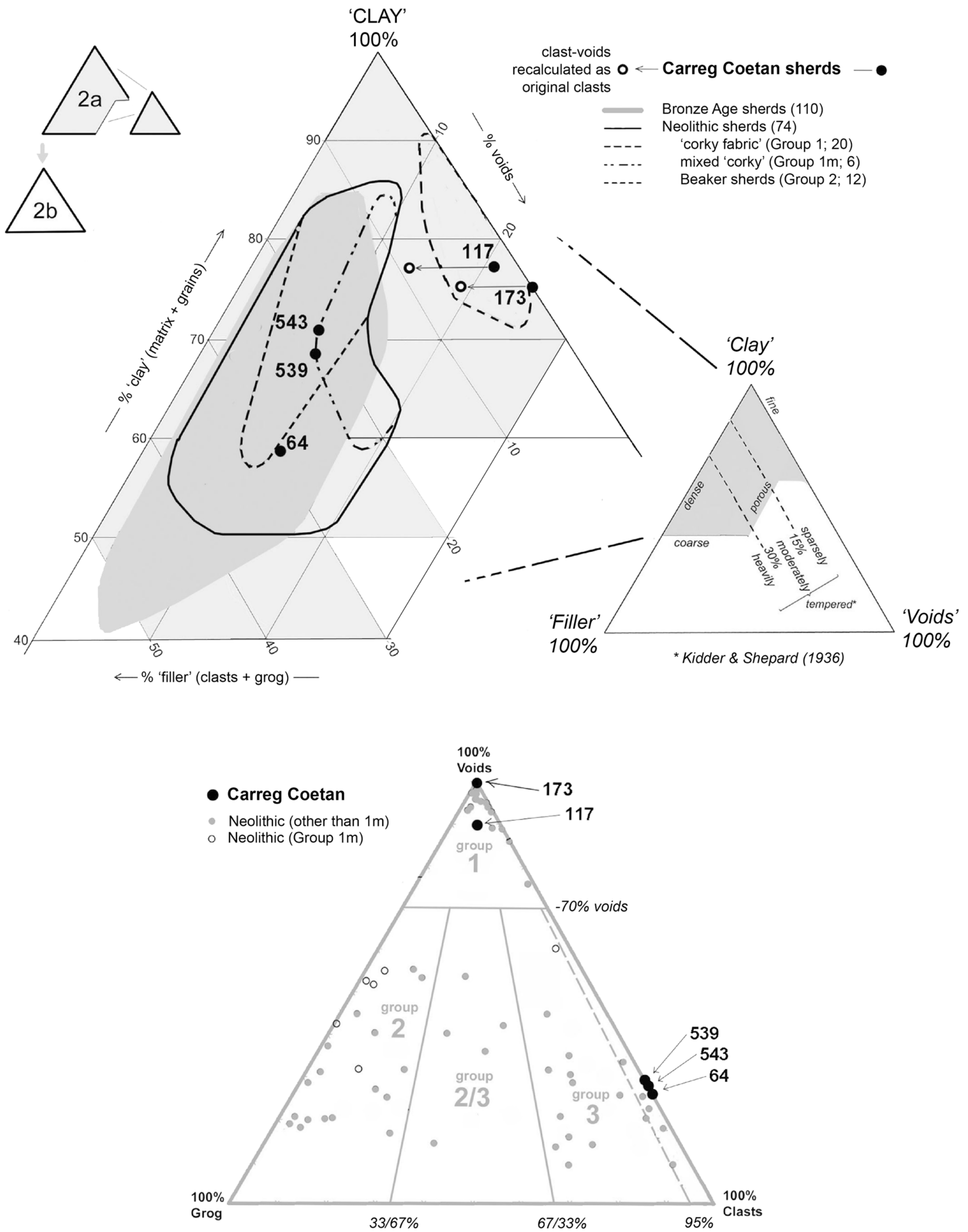


Fig. 34. Carreg Coetan Arthur sherds in relation to 74 Neolithic sherds from Wales. a (*above*) in terms of their fabric (percentage 'clay' filler and voids), b (*below*) in terms of filler types and porosity (percentage clasts, voids and grog).

from a more extensive area which have been mapped and studied in some detail (Howells 2007; Kokelaar *et al.* 1984, fig. 3). The dominating rock types to the east are various sedimentary shales and sandstones of Ordovician age, but just to the south and a few kilometres to the west there are exposures of igneous rocks of the Llanrian Volcanic Formation of the Aran Volcanic Group which includes rhyolites, thick rhyolite tuffs and volcanoclastic rocks together with basalts (Howells 2007, 46 and 52), whilst further afield (e.g. Mynydd Preseli) are complexes of gabbro, dolerite and diorite intrusions with minor microgranites, etc. The nearby igneous rocks are a probable source of the different silicic clasts in P539 and P543

Carreg Coetan Arthur lies on the southern limit of glacial deposits left by Irish Sea ice and this could add to the diversity of material available to Neolithic potters, especially in the form of cobbles of favoured rock types such as quartz. It might also account for the rare grains of schistose quartz seen in P64 and to a lesser extent in P539 and P543. The dominance of quartz clasts in P64 and to a lesser extent in P539 and P543, suggests such a selection but this material could be from either veins or from the igneous rocks. The clasts in P64, P539 and P543 are therefore considered likely to have been derived from different places near to the site.

In detail, the petrology of the local soil material available as a potential source of filler (sediment column in Table 2) differs from that of the filler seen in the pots where shale clasts, for example, are relatively uncommon (1.4% in P64 and P117 only). The soil material also contains occasional, but very distinctive, clasts of what appears to be weathered devitrified silicic material that was not detected in any of the sherds. It is therefore concluded that material actually on site was not used in the production of any of the five sherds analysed.

The unusual dearth of clasts in P117 (1.4%) and P173 (<0.4%) is distinctive and makes provenancing of these two sherds difficult. However, the calcareous nature and possible presence of chert grains in P117 implies a more distant (limestone/chalk) source**,** as does the presence of clast-voids in both. More generally, the absence of recognisable bioliths such as phytoliths, diatoms, spicules etc. in the sherds implies that source material was sterile, for example glacial till, rather than derived from contemporaneous Neolithic soils, lacustrine or marine deposits. The possible bone fragments noted in P117 together with isotropic pink-brown void infillings, also in P173, raise the possibility of use of these pots as cinerary urns with subsequent redeposition of Fe/Al-phosphates (Jenkins and Owen 2003).

Conclusion

The fabrics and clast compositions of the five sherds analysed, although differing from each other in detail, are generally comparable to similar varieties of analysed Neolithic pottery from elsewhere in Wales. The five sherds selected excluded grog-rich fabrics such as Gibson's Fabrics 5 and 6 and no bioliths indicative of soil/fresh-water or marine sources of clay were found. Three sherds are moderately tempered with rock clasts (i.e. Williams and Jenkins Fabric Group 3) with dominant silicic igneous rock (3b) or quartz (3e). The two others are characterised by a 'corky' fabric resulting from the dissolution of distinctive calcite cleavage rhombs (but not of intact shell material) and lack evidence of provenance other than that from a non-local calcareous area (i.e. limestone/chalk). Individually the following points can be made from the five thin-sections analysed:

P117 Rhombic calcite clast-voids present (>7%), v. low rock clast content (1.4%) of shale and rare grog (1%) non-diagnostic of provenance (Williams and Jenkins Fabric Group 1).

P173 Similar to P117 with calcite clast-voids (>6.2%) but more extreme with no detectable clasts, grog or diagnostic grains (Williams and Jenkins Fabric Group 1).

P64 Clast-tempered sherd dominated by angular clear quartz (25%) with minor rounded shale clasts (1.4%) and iron-concreted material (1.4%) and an angular quartz grain fraction with occasional larger well rounded quartz – non-diagnostic of provenance, other than very rare clasts of quartz schist? (non-local – IrishSea till?) origin (Williams and Jenkins Fabric Group 3e).

P539 Moderately clast-tempered with large angular quartz (13%<2mm), highly altered fine-grained silicic igneous clasts – rhyolite/tuff? (7%), and also fine quartz sandstone (0.6%); provenance most likely from local area (Williams and Jenkins Fabric Group 3e/b).

P543 Moderately clast-tempered with altered medium grain-size silicic igneous quartz/felspar (11%) and angular quartz (8%), also fine quartz sandstone (0.3%); provenance most likely from local area though different from that of P539 (Williams and Jenkins Fabric Group 3b/e).

In terms of the fabric types proposed by Gibson, it can be seen that his Fabrics 2 (P64), 3 (P539) and 4 (P543) all fall within Williams and Jenkins Fabric Group 3, but within different petrographic subdivisions: P64 – 3e (quartz clasts); P539 – 3e/b (silicic igneous > quartz); P543 – 3b/e (quartz > silicic igneous). Moreover, the types of silicic igneous clasts differ in P539 (highly altered fine grain) and P543 (less altered coarser grain). Although they probably both derive from the same local rocks (Llanrian Volcanic Formation), they would represent different subdivisions within it.

Sherds P117 and P173 are both designated as Gibson's Fabric 1 and similarly fall within Williams and Jenkins Fabric Group 1 ('corky ware' in which clast voids dominate the filler), but they differ in detail with rare grog and shale clasts being present in P117 but absent in P173. However, this difference may or may not be significant in terms of a production site.

Thin-section descriptions

P64 (Lab. TS No. 2284)

Voids (11.5%, medium porosity) Small irregular linear voids mostly parallel to sherd edges but some larger voids are perpendicular. Common oval voids (100–500µm). *Matrix* (56.4%) Silty clay showing moderate/high aggregate birefringence. Pale brown (2.5YR5/2) in thin-section. Some void margins stained brown by ferric oxides. *Grains* (2.8%) mostly small (0.05–0.1mm) angular quartz but with occasional larger (0.4mm) well-rounded (wind blown) grains. *Bioliths* (not seen, <0.4%). *Grog* (not seen, <0.4%). *Clasts* (28.9%. 'moderately/heavily tempered'): 1. (25.1%) large (up to 8mm) angular clasts of a coarse (1mm) quartz – vein and/or plutonic rock derived; 2. (1.7%) large sub-rounded clasts of dark red-brown iron-concreted; 3. (1.4%) sub-rounded ovoid flakes of fine-grained micaceous shale; 4. (0.7%) large sub-angular clasts of quartz mosaics ± oxidised chlorite/biotite, i.e. quartz schist; 5. (present, <0.4%) rare clasts of occasional quartz in fine grained dusky quartz matrix, i.e. weathered silicic extrusive/tuff?

P117 (Lab. TS No. 2285)

Voids (13.3%, medium porosity) very fine short parallel linear voids and occasional larger vughs, some with pale pink/brown isotropic infillings. (7.4%) common rhombic clast-voids 0.5–1mm in size, ± isotropic infilling. *Matrix* (71.2%) yellow-brown silty clay showing weak 'granular' aggregate birefringence with patchy local layering showing stronger birefringence.Yellowish-red in thin-section (6YR5/6) with localised darker iron staining. *Grains* (5.4%) common angular/sub-angular small (15–50µm) clear quartz often with fine calcite inclusions. Occasional muscovite flakes and rounded micrite, rare green tourmaline prims. *Bioliths* (p; <0.5%) possible rare rounded buff grains of near isotropic bone? *Grog* (0.9%) occasional large (1mm) sub-rounded clasts with same fabric as the matrix but disorientated and paler. *Clasts* (1.4%, 'sparsely tempered'). Rare sub-rounded 0.7mm clasts of dusky microcrystalline quartz with round clear features – fossils? i.e. chert?

P173 (Lab. TS No. 2286)

Voids (18.8%, high porosity) short, (<2mm) narrow (0.1mm) linear concordant voids common, some en echelon, with irregular transverse voids and vughs. (6.2%) small to large (40–500µm) rhombic clast-voids with pale buff shrunken isotropic infillings. *Matrix* (70.5%) silty clay showing very weak aggregate birefringence – almost isotropic. Some weak layering around voids. Fine-grained calcareous matrix. Reddish brown in colour. *Grains* (4.3%) very angular quartz with undulose extinction up to 0.5mm, and rare larger (0.3mm) rounded aggregate quartz grains. Rare muscovite flakes and rare sub-angular fine quartz sandstone and dusky sericitic quartz grains. *Bioliths*(not observed <0.4%). *Grog* (not observed <0.4%). *Clasts* (<0.4%, i.e. effectively temper absent).

P539 (Lab. TS No. 2287)
Voids (9.6%, medium porosity) short, (<2mm) narrow (0.1mm) linear concordant voids common, and larger irregular lenticular voids common. *Matrix* (58.5%) silty clay, buff, stained brown locally with Fe deposition. Weak aggregate birefringence and orientation. *Grains* (10.0%) common angular irregular and sub-rounded quartz grains and occasional muscovite flakes. *Bioliths* (not observed, <0.3%). *Grog* (present, <0.3%). *Clasts* (21.5%, 'moderately tempered'): 1. (13.0%) large (up to 1.5mm) angular vein quartz, some with inclusion trails and 'streaky' extinction, some dusky with sericite inclusions and Fe stained. Also clear quartz aggregates and altered, dusky with inclusions including inclusion trains and muscovite and zircon; 2. (7.6%) angular/sub-angular dusky altered stained feldspar (plag); 3. (0.6%) subangular/rounded grains with angular quartz in a finer grained Fe-stained matrix; some grains have euhedral overgrowths, i.e. fine quartz sandstone?; 4. (0.3%) heavily Fe-stained near opaque with areas of plagioclase altered chlorite and residual skeletal clinozoisite/epidote, i.e. very altered mafic igneous?

P543 (Lab. TS No. 2288)
Voids (8.6%) some large irregular ovoid vughs and large sinuous conformable linear voids. *Matrix* (62.5%) sandy loam brown in colour with numerous areas of Fe deposition. Fairly dense showing weak and 'granular' showing only 'speckled' weak aggregate birefringence.*Grains* (8.6%) very angular small quartz and, and angular/sub-rounded grains of altered feldspars and clear plagioclase and rare zircon and clinozoisite. *Bioliths* (not observed, <0.4%). *Grog* (present, <0.4%) rare rounded 0.5mm clasts with paler disorientated fabric cf. host. *Clasts* (20.2%, 'moderately tempered'): 1. (11.3%) large (2mm) sub-angular/angular clasts with small patches of clear quartz and buff dusky altered feldspar with sericite and Fe-stained, i.e. very altered igneous rock; 2. (7.9%) large (1mm) angular clear quartz with inclusion trains and sweeping/strained extinction, and rare distinctive jagged (saw-tooth) quartz grains ± muscovite; 3. (0.7%) large rounded Fe-cemented red-brown clasts; 4. (0.3%) fine quartz sandstone with attached vein quartz?

Old ground surface, 2–0.6mm fraction (Lab. TS 2289)
Rock clasts observed: shale/phyllite, common ovoid (flaky) clasts, often iron-stained; iron-concreted material – occasional rounded clasts, often opaque red-brown; quartz – occasional large rounded clear grains; quartz – occasional angular clear quartz with inclsion trains and streaky birefringence; medium grained silicic igneous – occasional clasts with quartz/feldspar with biotite/oxidised chlorite, titanite and clinozoisite, rare myrmikite and hornblend; fine grained silicic igneous – occasional clasts of fine quartz mosaic with coarser patches, and some sericite/muscovite/chlorite; rare silicic igneous? – distinctive porous, devitrified (?) altered material – micropegmatitic material, quartz + clinozoisite, apatite + altered feldspar, coarse quartz mosaic, some stellate; rare schistose(?) quartz mosaic + biotite/sericite; rare fine quartzose (+ some feldspar) sandstone.

NOTES ON POT 16 FROM A POTTER'S PERSPECTIVE
By Walter Keeler

Pot 16, the Developed Bowl, SG 6, Fabric 2, found inverted on the stone surface outside the south-east side of the chamber (Fig. 29), was brought to the studio of Walter Keeler, a craft potter from Monmouth, on 17 February 2013 for an informal discussion on its method of manufacture and potential use. The following notes are derived from the conversation:

This is a round-bottomed pot, 240mm in diameter and 160mm deep, with large quartz inclusions, with internal and external surfaces which display considerable variation from a pink/buff to a blackened colour. The pot was hand formed, probably from coils, but possibly from building up; the rim was in any case probably added from a coil. The pot may have been fashioned in a pit, excavated as a sort of mould. The decoration on the rim was probably formed from incising with a twig, and the break on the upper part of the rim between inner and outer parts of each incised mark suggests that, after forming, the vessel was stored on its rim for drying. Watching potters making similar pots in various parts of Africa suggests that they could be made quite easily and quickly, in about 20 minutes and then would be left to dry for a day before firing, possibly in a bonfire, to 800 degrees centigrade. This would leave the rather uneven coloration on the fabric surfaces.

The shape and type of the pot suggests that it is a cooking pot. The fabric would have been quite compatible with the storage of liquids or solids and cooking them on an open fire. Such pots may not have been highly valued, as they could be quickly manufactured. It could be that pots were disposed of for hygiene reasons after the death of the owner.

LITHIC ARTEFACTS

By Elizabeth Healey

The lithic artefacts recovered from the excavation of Carreg Coetan Arthur come from a number of different contexts as summarised in Table 3. While a lot of the artefacts do come from lower levels of the plough soil or from disturbed contexts, a substantial number are from the old ground surface and indeed most of the material may originally have derived from this context. In particular one should note that

Table 3. Summary of lithic artefacts from Carreg Coetan Arthur

Context	cores	split pebbles	flakes	blades	retouched pieced	struck pieces	total	notes
Old ground surface	5	2	38	13	1 fabricator 1 retouched flake	6	66	
Old ground surface in stone ring	–	1	3	–	1 polished edge knife 3 flakes with edge retouch 1 frag. ?hammerstone	–	9	
Neolithic pit	–	–	2	–	–	1	3	
Ring of stones	–	–	–	1	–	–	1	
Cairn material	2	–	4	–	–	1	7	
Disturbed chamber layer	1	–	11	–	–	2	14	
Hole for orthostat	–	–	1	–	–	–	1	
Base of ploughsoil	3	2	10	–	1 microlith; 2 burins	2	20	
Ploughsoil	8	4	43	2	1 serrated 2 edge-retouched flakes	7	67	3 flakes with Neolithic pot
Other, disturbed contexts	1	1	8	–	1 ?microlith frag 1 scraper; 2 retouched flake 1 worn edge	–	15	plus axe frag.
Total	20	10	120	16	18	19	203	

almost all the blades were from the old ground surface and from amidst the stones ring (Fig. 25) along with the polished-edge knife and the fabricator. Lithic artefacts are illustrated in Figures 35–39.

Raw material

Virtually all the raw material used is pebble flint which is plentiful locally in the drift or from the beach (Walker 2003, 10); in marked contrast to this flint are three retouched pieces which are of good quality lustrous, dark grey flint (Fig. 38, P500, P604, P68) which are likely to have been acquired as finished objects, two of which were from the old ground surface and may have been associated with burial deposits. There are also two flakes that are probably not pebble flint (Fig. 37, P100, P285).

The pebbles for the most part are quite small (under 40mm in length) but occasional larger flakes or pebbles measuring as much as 77mm in maximum dimension indicate that bigger pebbles were present. The quality of the pebbles varies; some are slightly lustrous, others matt and opaque. They are mostly light grey or yellow beige in colour, though a few are mid-grey. They have a smooth water-worn cortex suggesting that they were collected from the beach or drift. Some of the pebbles with a single scar may indicate that they were tried for quality and discarded if not suitable.

Apart from the flint there is a small fragment from a stone axe (unsourced) which has been heavily calcined (Fig. 39, P186).

Reduction technology

Cores and split pebbles account for about 16.5% of the assemblage. This is a seemingly high proportion compared with sites where flint is more plentiful and larger in size and is almost certainly the result of the low productivity of each pebble. To a large extent the size and shape of the pebbles dictated how the pebbles were reduced. There are 20 regular cores amongst which are 16 pebbles which have been broken open to create a striking platform (Fig. 35, P187, P154 and P136) which may be set obliquely to the flaking surface (as P309) and four pebbles from which flakes have been struck directly from the cortex without preparation as, for example, P490 (a not uncommon practice judging by the number of flakes which have cortical striking platforms). The cores mainly produced flakes but there are two bladelet cores (P187 and P136). In addition to the cores there are ten split pebbles (P351) and nineteen other pebbles with random scars from all contexts, some of which may be fortuitous.

Usually flakes or bladelets are extracted only from the front of pebble which has a flattish flaking surface, but occasionally this extends further, as P187, where about three quarters of the circumference has been exploited. All the cores have cortex on the back and often on the sides. The cores are quite small, P309 being the largest at *c*. 42mm in length. Most are uni-directionally flaked, but there is one small opposed platform bladelet core P136, and five show evidence of having been flaked from other platforms (i.e. changed orientation cores) for example P154; this is corroborated by the dorsal scarring pattern on some of the flakes. Trimming of the edge of the platform is evident on at least six of the cores suggesting that it was being prepared in order to remove more flakes. Several cores appear to have been abandoned because of deep step fractures on the flaking face.

The split pebbles (*pièces esquillées*) (e.g. Fig. 35, P351) are pebbles which have splintered ends and scars in both directions resulting from knapping on an anvil. The technique is associated with small pebbles which are difficult to hold (see Le Brun-Ricalens 2006; Vergès and Ollé 2011 for full description of technique). A third of the pebbles from Carreg Coetan Arthur have been reduced in this way. It is commonly practised in Wales and elsewhere when small raw material is involved (Jacobi 1980, 177).

The majority of the products from the cores are flakes, a total of 132 or 87%, 13 of which are retouched, and 20 blades and blade-like flakes of which 4 are retouched accounting for 13% of the removals. Flakes were produced on site using percussion as is evidenced both by the cores and by two flakes from the old ground surface which refit (Fig. 35, P128b and P168).

Most of the flakes (over 80%) have cortex on all or part of their dorsal surfaces, reflecting the small size of the pebbles from which they were struck. In terms of their dimensions they are a heterogenous group. The complete flakes tend to be squat; they vary in length from 70mm to less than 20mm; the majority are small: 44% are under 30mm in maximum length and a further 32% under 40mm. Widths range between 10mm and over 30mm; 34% are between 16mm and 20mm wide, 22% between 21mm and 25mm and 17% between 25mm and 30mm. Over half are between 5 and 10mm thick and a further 28% over 10mm. Striking platforms are mostly (54%) plain scars of varying width—about a third of which are narrow, a further 29% are cortical but only 7% are splintered. Flakes tend to be used for scrapers (Fig. 38, P500) or to have edge-retouch (Fig. 37, P100, P285 and P410). Two, however, may have burin facets (Fig. 37, P342) though these could be fortuitous.

The blades, however, are different. None have cortex, they are much slenderer than the flakes (see examples illustrated on Fig. 36). They range in length from 35mm to 54mm, most being between 35 and 42mm. In width they are between 10 and 25mm although all but one is under 20mm. In thickness they range between 3mm and 6.5mm. They tend to be struck from unidirectional cores, but one is from a bidirectional core and one from a changed orientation core. Many of the blades have chipping around their edges but in view of the depositional circumstances (see Donahue, below) it is difficult to say whether this is accidental damage or occasioned in use. The only formal tool made on a blade is the microlith P373 (Fig. 38). The polished-edge knife P604, is made on a substantial blade of flint which is not of local origin and fabricator P68, on a thick blade-like flake.

Retouch and other modification

There are seventeen retouched pieces which have definite secondary modification; they include a microlith and another possible fragment (P373 and P501), polished-edge knife P604, fabricator P68, and scraper P500 (Fig. 38). In addition to the more formal tools there are two blade-like pieces of dark lustrous grey flint which have edge-retouch and a largish flake of gravel flint which has a serrated edge which is inversely retouched and concave in shape. Additionally there are two flakes (Fig. 37, P342) which have scars struck down the length in the manner of burin, though this could be fortuitous.

The microlith (P373) is an elongated trapeze type with abrupt retouch and of early Mesolithic date. Use-wear analysis indicated that it was probably used to cut soft material (see Donahue, below). The other

Key for Figures 35–38

Symbols

- cortex
- ● bulb present
- ○ bulb truncated
- extent of striking platform
- ↓ possible burin blow (P342)
- serrations (P410)
- striations from grinding (P604)
- polish (P604)

Microwear (see report by Donahue for details)

DHS – dry hide scraping
HC – hide cutting
HMI – hard material impact
HS – hide scraping
HT – hafting traces?
HWT – hafting wear traces
ID – impact damage
MC – meat cutting

Pigment

R – red ochre/haematite (P604)

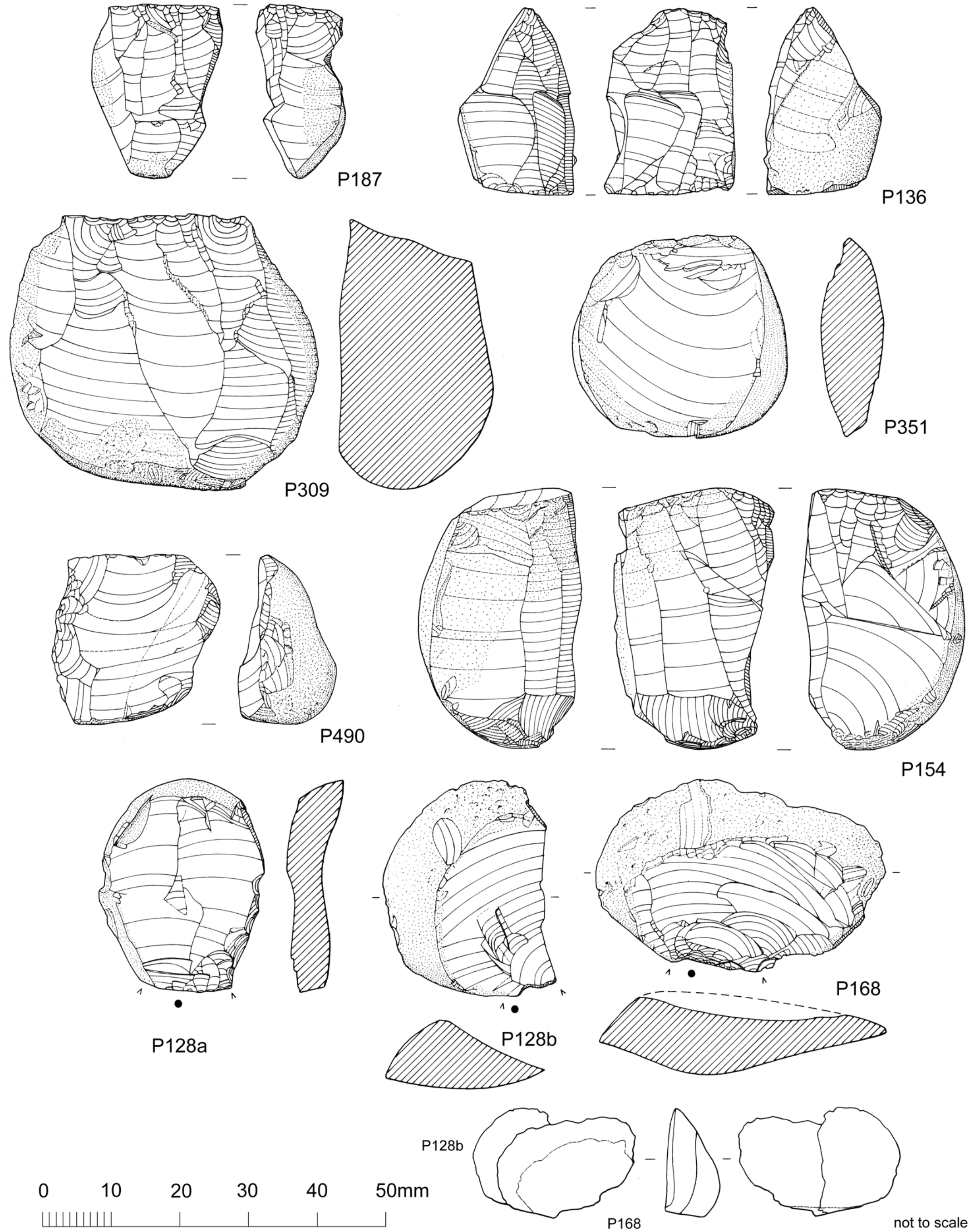


Fig. 35. Neolithic flint cores and flakes: P187 – single platform bladelet core; P136 – opposed platform core; P309 – single platform core; P351 – split pebble; P490 – core with damage on edge; P154 – core struck from three directions; P128a, 128b and P168 – typical flakes, shown refitted (bottom right).

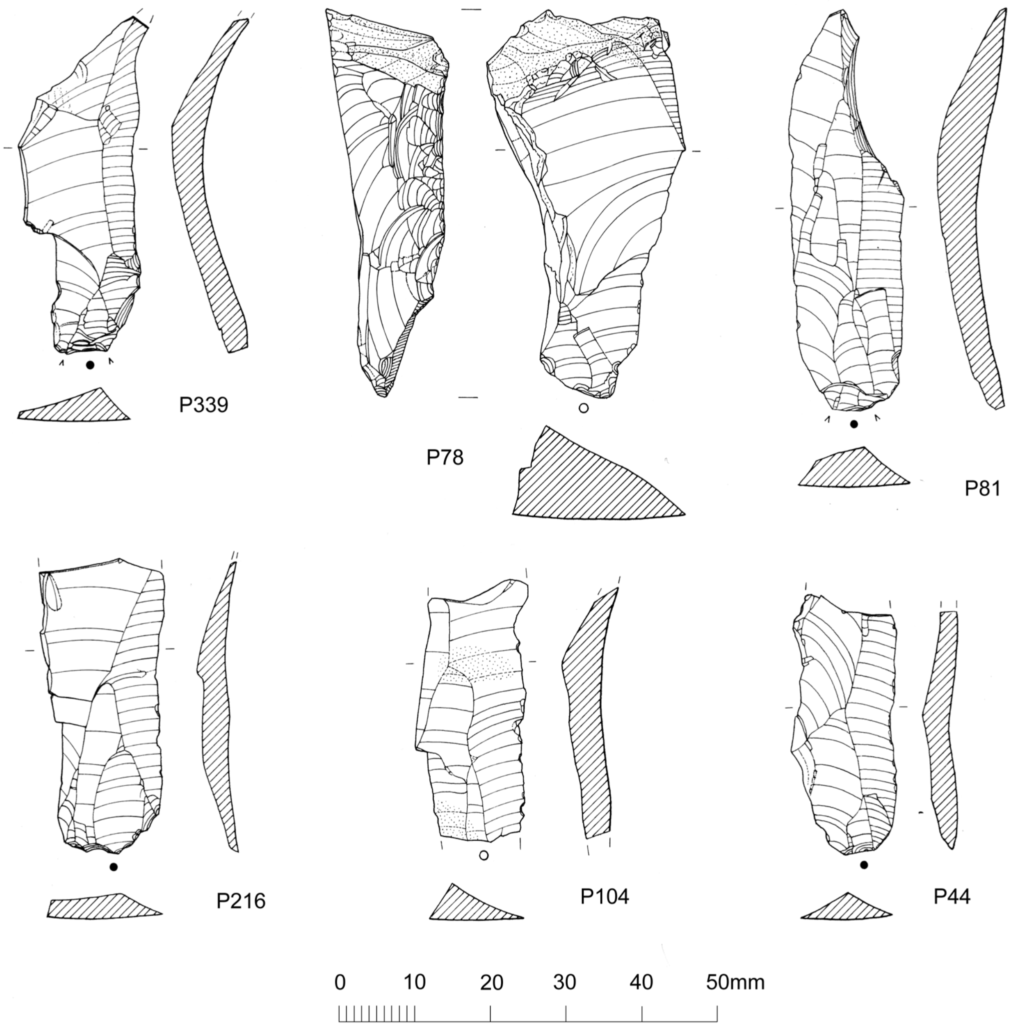


Fig 36. Blades: P339 – blade; P78 – edge trimming piece of blade-like proportions; P81 – blade; P216 – blade, distal end damaged; P104 – blade segment; P44 – proximal end of blade. See Key for drawing conventions and details of microwear.

fragment, P501, with a short length of abrupt retouch may be part of a microlith but is too fragmentary to classify and the fact that is comes from a disturbed context suggests that the retouch may have been caused by damage. Both are made on pebble flint.

The possible burins (Fig. 37, P342) have a facet struck from the distal end down the thickness of the blank forming a facet on the edge; while they technically fall into the category of burin, the spall could have been removed fortuitously.

The polished-edge knife (Fig. 38, P604) was found south of the chamber in the interface between ploughsoil and cairn material, but just on the edge of modern pit F8. It is a highly elaborated artefact. It

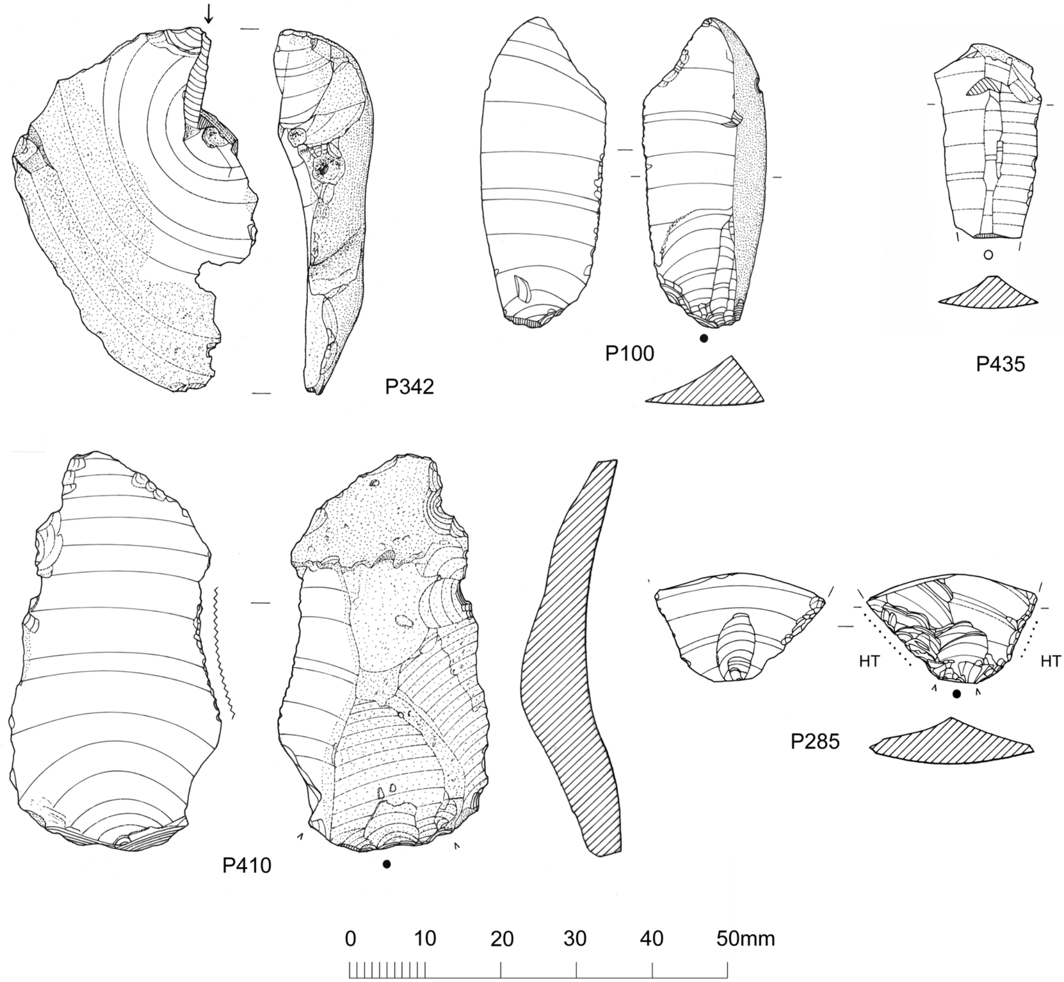


Fig. 37. Examples of edge-retouched pieces: P342 – flake with possible burin facet; P100– blade-like flake with edge chipping, probably caused by post depositional damage; P435 – blade with edge chipping probably caused by post depositional damage; P410 – flake with edge-retouch and possibly serrated in concave area; P285 – proximal fragment of flake with bifacial flaking on lateral edges and possibly hafting damage. See Key for drawing conventions and details of microwear.

is a blade of mid grey-brown semi-lustrous flint and belongs to Manby's class of polished flake knives (Manby 1974, 86–7 and figs 36–7). It was bifacially flaked with pressure retouch on the convex right edge which extends over most of the dorsal surface on both faces, much like a plano-convex knife (Clark 1932). The ventral surface has some horizontal striations on the ventral surface which partly obliterate some of the flake scars and may be from the grinding to shape the left edge to form a sharp bevel. The ends have also been retouched. They are both rounded with wear and have small deposits of red pigment, possibly red ochre. The type of wear and the presence of ochre is consistent with leather working (see Donahue, below).

The fabricator (Fig. 38, P68) was found on the line of the stone ring but north of the field ditch to the west of the chamber, where the survival of the old ground surface was very fragmentary. It is made on a thickish piece of flint and is of mid-grey flint and relatively large compared to the flint in the rest of the assemblage and was probably acquired as a finished object. Both ends and the upper part of the left edge and proximal part of the right edge have macroscopically visible wear. The rounding encroaches on to the dorsal surface of the distal end. The ends and sides are worn from alternate faces as if switched

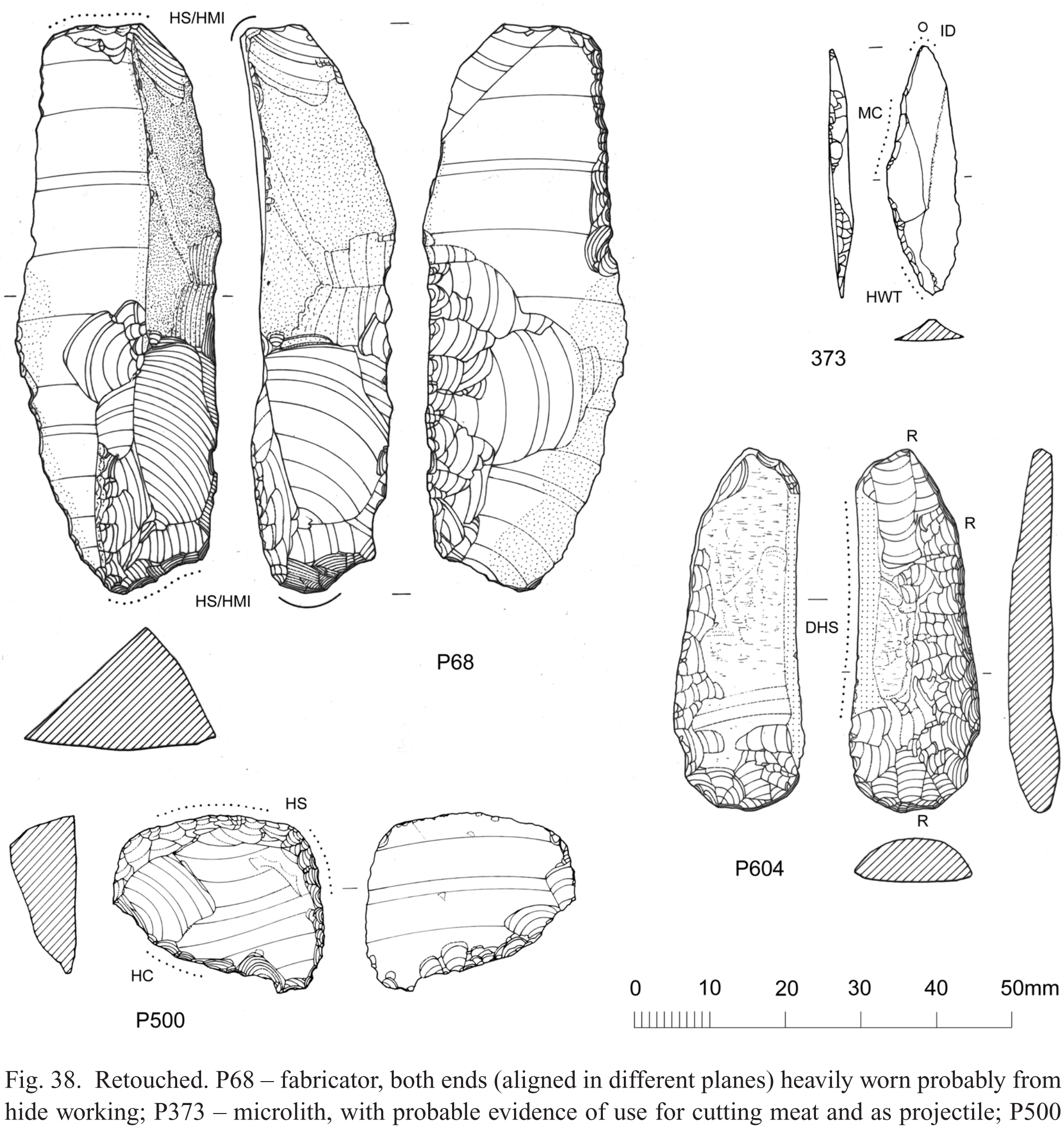


Fig. 38. Retouched. P68 – fabricator, both ends (aligned in different planes) heavily worn probably from hide working; P373 – microlith, with probable evidence of use for cutting meat and as projectile; P500 – scraper, with evidence of use of fresh hide scraping and bone or antler working; P604 – polished-edge knife with signs of intense use from dry hide working and traces of red ochre (R). See Key for drawing conventions and details of microwear.

around in use. It also has direct edge-retouch on the proximal part of the left edge and inverse, somewhat invasive, flat retouch on the ventral. Again it was probably used for hide working and possibly also on a hard material (see Donahue, below).

The scraper, P500, (Fig. 38) is atypical in shape and made of non-local flint. It was recovered from a disturbed rubble layer, possibly deriving from upcast from building works adjacent. However, it shows several phases of retouch and was used for scraping fresh hide, cutting bone (see Donahue, below).

Other pieces with chipped edges include a blade, P435 (Fig. 37), which has macroscopic rounding on one edge (probably due to post-depositional damage: see Donahue, below) and a flake with a serrated edge, P410 (Fig. 37), unfortunately both from unhelpful contexts (ploughsoil, field ditch respectively). The proximal end of a flake of dark grey lustrous flint, P285 (Fig. 37) has bifacial edge-retouch probably occasioned from a haft (see Donahue, below).

In addition there are four flakes with edge-retouch/chipping from the old ground surface and three retouched pieces from the plough soil or disturbed layers. They were not subject to use-wear analysis so it is not known if this is use or post-depositional damage.

Discussion of the lithic artefacts

The flint assemblage from Carreg Coetan Arthur suggests at least two phases of activity. The presence of early Mesolithic activity is unequivocally signalled by the microlith P373 and is not surprising given the amount of Mesolithic activity recorded in the area (Walker 2003, 10–14 and 21–2; David 2007). Unfortunately, because of the disturbed nature of the site, it is not possible to separate all the Mesolithic artefacts. However, the blades, almost entirely from the old ground surface in the outer ring of stones (see Fig. 25) and of a different technology from the flakes, probably derive from Mesolithic activity as may the two bladelet cores (Fig. 35, P187). It is interesting to note that one of the blades (Fig. 37, P435) is made of similar flint to the microlith. Mesolithic activity is frequently associated with megalithic tombs such as Gwernvale (Healey and Green 1984, 129f), and possibly Penywyrlod (Britnell and Savory 1984, 26) and elsewhere, for example Hazeleton North (Saville 1990), which may well suggest that such places were significant throughout prehistory (Barton *et al.* 1995). It is probable that most of the knapping debris (cores and flakes) is contemporary with activity associated with the portal dolmen as suggested by the concentration of the cores in the forecourt area, some on the old ground surface (see Fig. 25).

Particularly interesting in terms of the tomb are the polished-edge knife which has clearly had a long life history (P604) and a fabricator (P68) both from the old ground surface, the knife from within the stone ring. They are made of non-local flint of which there are only two other pieces; a flake with edge-retouch (P100) from a similar context. The other artefact, scraper P500 of similar flint was found amongst modern rubble.

The absence of manufacturing debris associated with these artefacts suggests that they were imported as finished tools, probably especially for burial or deposition, although both have seen heavy use prior to deposition. The use of artefacts of non-local flint is not infrequently found at other sites. For example, although not directly related to the burial, large ogival arrowheads of non-local flint were found at Gwernvale (Healey and Green 1984, 130–2) and a plano-convex knife at Ty Isaf (Grimes 1939a, fig. 4).

Polished-edge knives like P604, are very rare in Wales, only two others being known; one, a chance find at Ogmore by Sea (Hamilton and Aldhouse Green 1988), the other from the chamber at Gop Cave (Boyd Dawkins 1901). They otherwise occur mostly in northern England (Manby 1974) and are indirectly associated with late Peterborough Wares and other specialised items (Pollard 1994a and b). Plano-convex type knives are associated with pre-tomb activity at Gwernvale and one, of 'better quality flint than the usual beach pebbles' was found in chamber II at Ty Isaf (Grimes 1939a, fig. 4, no. 60) and at Trefignath where a large knife was found in the portal to the eastern chamber (Healey 1987, 55–6, fig. 29, no. 48).

The small fragment from a stone axe (Fig. 39, P186) is from a disturbed context but the fact that it is heavily calcined may indicate that it was part of the cremation; the burning beyond recognition and the fragmentation of artefacts is a characteristic of some late Neolithic pit deposits (Jackson and Ray 2012). It is not unusual for axes to have special meaning (Darvill 2011) or to be associated with chamber tombs, as, for example, at Ffynnondruidion (Pembrokeshire), Gwernvale, Ty Isaf (both Brecknock), Din Dryfol and three tombs in Anglesey, so it may well have also been part of a significant deposition.

The presence of elaborated artefacts in a tomb context is not unexpected and seems to be part of wider trend towards the elaboration of artefacts in the Later Neolithic; this is demonstrated in various tool forms as well as the use of exotic flint, including polished discoidal knives and mace heads and a large blade with a serrated edge from Capel Eithin and an unfinished example from the Penmachno hoard (Walker 2003, 89–91).

MICROWEAR STUDY OF LITHICS FROM CARREG COETAN ARTHUR
By Randolph E. Donahue

Seven flint artefacts were submitted for lithic microwear analysis. These include a polished knife, a fabricator, a scraper, a microlith and 3 edge-retouched flakes and blades (Table 4).

Lithic microwear analysis is the microscopic examination of surface wear and fracture scars that form along the edges of artefacts of fine-grained siliceous stone such as flint and chert. Experimental studies demonstrate that microscopic wear and fracture scar characteristics resulting from tool use vary systematically according to the worked material (e.g. hide, wood, meat, bone) and according to the applied forces and motions such as cutting, scraping, and wedging (Donahue 1994). The improved understanding of these principles and relationships permits microwear analysts to infer past uses of lithic artefacts with a greater degree of precision and accuracy than achieved through reliance on either macroscopic attribute analysis or ethnographic analogues of tool form. Following deposition, natural processes also produce systematic wear features that may make inferences about tool use more difficult (Levi-Sala 1986a; 1986b), but can also improve understanding of site formation processes (Donahue 1994; Donahue and Burroni 2004; Burroni *et al*. 2002).

Methods

All artefacts were photographed and then gently washed in water with a soft nylon brush to remove adhering sediment. This was followed by bathing the artefacts in 10% HCl for 10 minutes, followed by a rinsing in tap water, then bathing in water for a further 10 minutes. They were then patted dry with a clean, lint-free towel. During microscopic observation ethanol was used to degrease artefacts as necessary. The cleaning process tends to remove minerals and sediment deposited on the surface while it was in the buried environment. It does not remove strongly adhering residues or all of thick mineral deposits. As a result residues resulting from tool use may be located, although without chemical analyses of the residues, it is unlikely that these can be identified.

All artefacts were viewed principally at 200× magnification with an Olympus KL-BH2-UMA metallurgical microscope with incident-light and long working-distance objectives. Microscopic characteristics of edge fracture scars, striations, pitting, surface polishing, ridge rounding, plastic deformation and thermal alteration (micro-cracking, potlidding and crazing) were recorded and interpreted (following Donahue 1994; Burroni *et al*. 2002). These data provide information about tool use, tool resharpening, tool recycling and hafting, and site formation processes.

Results

Polished-edge knife P604 (Fig. 38)

It is finely retouched and the concave edge has been polished further. Wear resulting from tool use is evident on the edge and up the adjoining faces. *Details*. The polished surface shows intense wear near the edge and lessens up the face. The polishing consists of intense grinding perpendicular to the edge. The earliest stage of polishing appears to be the production of striations (furrows) measuring about 1.0 units (at 200×) and appears followed by production of striations measuring 0.1 to 0.2 units in width. Use-wear at the edge has tended to obliterate these striations. There are fine striations that go both perpendicular and parallel with the edge; some, even most, of these may be post-depositional. The edge is well rounded with occasional fracture scars with rounded arises (the ridges produced by the retouch). Along the edge there occur large hemispherical pits and short, deep, and wide furrows typical of dry hide scraping. Red colour residue is observed in one location along the edge and is typical of haematite (red ochre). The wear has very much the characteristics of dry hide working, but with quite a bit of added brightness. This could relate to the edge polishing. The rounding and wear characteristics extend, even intensifying, to within 5mm of the proximal end. There is then a limited amount of a very bright polish on the proximal few mm of the lateral edge. It is bright and smooth and too extensive to be bone. It is likely to be antler or wood. The proximal end shows much red/orangey residue (again likely to be red ochre). This end has been modified: the bulb has been excised with flakes from the proximal and lateral edges; retouch of the proximal end, appearing unassociated with platform preparation, has produced a convex working edge, albeit not a particularly good scraper edge. Given that the working edge is the concave edge, it is likely that the hide was worked by swinging it over a horizontal pole. In conclusion, the wear is characteristic of dry hide scraping.

Fabricator P68 (Fig. 38)

The 76mm long, 26mm wide, 18mm thick tool has unifacial retouch at both ends although they are not aligned on the same plane. Both ends show wear, but the visibility is not good on the distal end. At the distal end there is some metal residue, but this is likely recent. The proximal end shows intense rounding with a matt texture and typical of hide working, but there are no striations to indicate direction. On top of this wear are areas of surface deformation, probably the result of striking a hard material. The wear produced by the hard material is thought to be from use, but post-depositional modification cannot be ruled out. In conclusion, both transverse edges show two kinds of wear: there is extensive wear that has a matt texture and lying on this surface is bright wear, not atypical of plastic deformation that is likely the result of striking a hard material. This wear may be post-depositional and not related to tool use. There is also some metal residue possibly produced during excavation.

Scraper P500 (Fig. 38)

Virtually all edges show moderate to heavy rounding. The surface wear is typical of that from hide, primarily fresh hide as there are few hemispherical pits and the surface is mostly rough with a sheen rather than matt. Striations are always perpendicular to the edge, thus indicating a scraping motion. The (right) lateral edge (the direction it was struck is uncertain) shows the most wear although the thickest edge (distal) shows much wear as well. Given multiple episodes of retouch, there is little meaning as to which edge was used the most. The thin left edge also shows wear. It is similar in character with the other edges except that the striations are in multiple directions indicating cutting as well as scraping was occurring. Inside the concave section of this edge, there are large patches of a smooth, highly polishing wear, although it is not dissimilar to plastic deformation. The burin-like edge at the opposite end of this edge has little distinctive wear, but there appears to be bright, rough wear along the bit edge and the ventral burin scar edge. This may result from either bone or antler, but it is likely bone. In conclusion, both the right and distal edges have been used quite intensively for scraping hide, probably fresh. The left acute edge appears to have been cutting and possibly scraping hide, while the burin-like edge at the end of this edge appears to have wear from bone or antler graving.

Microlith P373 (Fig. 38)
The material is similar to that of artefact P435 and visibility of wear is poor. The right and distal edges both display wear. There are many small fracture scars and nibbling along the edge. There are also occasional larger and deeper fracture scars unlikely to be associated with use. These fracture scars are mostly at around the distal 5mm portion of the cutting edge and are thus near the tip of the backed point. The tip itself is missing. There are two flake scars initiated at the distal end on the ventral surface, side by side and parallel with the axis of the tool. While it is possible that this was a cutting tool, it is also possible that this is a projectile point. There are wear characteristics to support both hypotheses. If the tool was used as a knife, then the material cut would have been soft, most likely meat. In conclusion, the tool shows damage typical of a projectile point, but there is also wear along the sharp lateral edge that seems to relate to meat cutting. Thus, the tool may have been used for multiple purposes, or successfully struck an animal and developed further wear from contact with the flesh.

Edge-retouched blade P100 (Fig. 37)
Details. The distal third of the edge is not visible as a result of a fossil inclusion that causes the material to be grainier (coarser) and light grey in colour. The remaining part of the edge shows little edge rounding and many fracture scars, mostly large (0.5–1.0mm wide). They have point initiations and hinge or feather terminations. Wear could result from meat cutting, but the fracture scarring is atypical of tool use unless the person was very heavy handed. It is most likely that the wear and scars result from post-depositional modification. *Conclusions.* It was not possible to determine tool use of this specimen because of post-depositional modification.

Edge-retouched flake P285 (Fig. 37)
Details. This is the proximal fragment of a flake. The lateral edges show much damage; both fracturing and wear, but they are very irregular and atypical of any use. The snapped edge is very sharp and the surfaces here show no wear whatsoever indicating that the wear on the lateral edges result from before the flake was snapped. It is likely that the lateral edges reflect damage from hafting and this end was discarded following the breakage of the tool. If the lateral edge wear is post-depositional, then the snap must have occurred very late, e.g. during excavation, while in the buried environment. *Conclusions*. There is very little useable edge; however, the edges show much irregular wear and scarring, possibly resulting from hafting or from post-depositional processes. It is unlikely that this wear results from tool use.

Edge-retouched blade P435 (Fig. 37)
The quality of the material is not very suitable for microwear analysis because it is light coloured and relatively coarse. Fracture scars are small to medium in size with bending initiations and mostly feather terminations. The wear is fairly well developed and somewhat matt in character, but it is not typical of hide. Fracture scars and wear are not consistent and it is likely that the wear results from post-depositional modification. The distal end shows some rounding, but besides being somewhat matt on the projection, there is also plastic deformation indicative of post-depositional modification. The distal end was probably truncated to remove the plunging termination of the blade. The right edge has the same pattern as the left edge. In conclusion, the wear that is visible on the left and right lateral edges appears to be the result of post-depositional processes

Conclusions

The sample of artefacts provides some useful information about the site (Table 4).

Table 4. List of the studied tools and their uses

Artefact number	Tool type	Tool uses
P604	polished-edge knife	hide scraping
P68	fabricator	striking hard object; hide scraping
P500	scraper	hide scraping
P373	microlith	armature and/or meat cutting
P100	edge-retouched blade	undetermined
P285	edge-retouched flake	hafting damage?
P435	edge-retouched blade	undetermined

Assuming that the artefacts are reasonably representative and no particular category is excluded then it is interesting to observe the prevalence of hide working in the assemblage and the complete lack of herbaceous plant wear ('sickle gloss'). This result is not unique. At the site of Upper Ninepence (Radnorshire) microwear analysis of lithic artefacts found in pits associated with Peterborough Ware showed a broad-base economy that included much herbaceous plant cutting. Lithic artefacts found in pits in association with Grooved Ware pottery at the same site, however, showed much meat cutting and hide working (Donahue 1999). Analyses of residues of pottery in these pits showed lipids associated with sheep on the Peterborough Ware and residues of lipids from pigs associated with the Grooved ware (Dudd *et al.* 1999).

STONE ARTEFACTS
By Sian Rees

Waisted stones (Fig. 39, P612, P613)

Two water-worn, dolerite, waisted stones (102mm × 75mm and 95mm × 60mm), one with a seam of quartz forming the wider end. Both have rounded ends, one wider than the other, and have pecked grooves forming a waist on each side. One has subsequently been broken. One exhibits slight pitting, from use, perhaps as a hammerstone. From disturbed contexts within G3, between chamber orthostats S1 and S2.

The date of these tools is unknown, but a similar artefact, though smaller, labelled a net sinker apparently came from a late Neolithic occupation layer beneath a Bronze Age cairn at Sant-y-Nyll, Glamorgan (Savory 1962; Burrow 2003, fig. 42, no. 8). They may be weights, but the apparent selection of hard quartz to form the wider end of one, and the slight pitting on the wider end of both suggests that they may have had a function more allied to hammerstones.

Perforated stone disc (Fig. 39, P478)

Small sandstone disc (35mm × 35mm) with smoothed edges and a drilled hourglass perforation toward one side from which a suspension groove runs to the outer edge. A similar shaped but rather finer example without the suspension groove comes from Ty Isaf burial chamber (Grimes 1939a, 131–2, fig. 4; Burrow 2003, fig. 42, no. 9) which Grimes describes as a pendant, from the entrance passage to Chamber II.

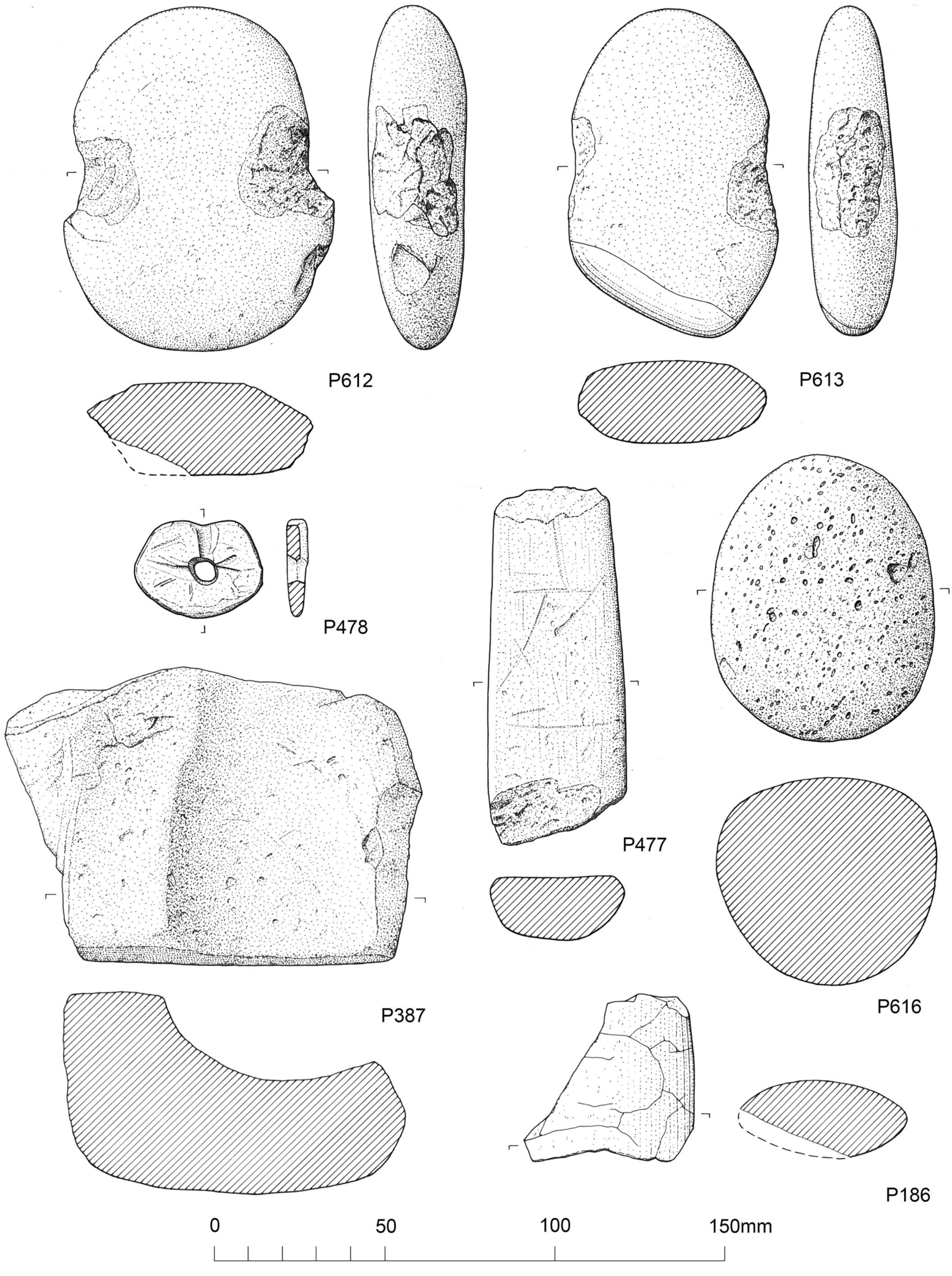


Fig 39. Stone Artefacts: P612, P613 – waisted stones; P478 – perforated ‘amulet’; P477 – whetstone; P616 – quartzite pebble; P387 – socket stone; P186 – fragment of fire-cracked polished stone axe.

Another undated example called a ‘net sinker of hard stone’ with what appears to be the start of a suspension groove on one side comes from the foreshore at Rhyl, with an implied Neolithic date (Glenn 1926, 201, c). However, a similar but apparently Mesolithic ‘bead’ from Waun Fignen Felen (Barton *et al.* 1995, fig. 6) casts further doubt on the secure dating of these artefacts. Undated, from topsoil.

Quartzite pebble (Fig. 39, P616)
Oval quartzite pebble (85mm × 60mm), possibly fashioned, with pitted exterior, especially at rounded ends. Undated, though there are parallels of Neolithic date; see Pant-y-Saer chambered tomb (Anglesey) where a quartzite pebble was found, apparently used for grinding, found in a deposit outside the north wall of the chamber (Scott 1933, 217–8, figs 19a and b). From disturbed Layer III, Chamber.

Whetstones (Fig. 39, P477)
P477 is a fragmentary sandstone whetstone (100mm × 40mm max.) smoothed on two sides. Undated, from topsoil. P387 (not illustrated) is a chip of stone used as whetstone (85mm × 48mm), smoothed on one side. Undated, from topsoil.

Perforated stone tool (P686)
Broken triangular piece of stone (75mm × 50mm) with smoothed central wide perforation, unknown function and date. From topsoil.

Socket stone or mortar fragment (Fig. 39, P387)
Curved, fashioned piece of sandstone (115mm × 85mm), broken in half, with smoothed hemispherical interior, apparently worn. From topsoil, undated.

GEOLOGICAL ANALYSIS OF CAPSTONE, ORTHOSTATS AND STONES FORMING NEOLITHIC SURFACE

By Richard Bevins

Capstone and orthostats

Capstone. Grey-green siliceous rock with a poorly-developed cleavage. It is most probably rhyolitic and contains small feldspar crystals (generally <2mm in size) and possible lithic fragments (see Figs 40a–b). The colouration suggests that the rock has been altered by low-grade metamorphism. It is probably a rhyolitic tuff.

Orthostat S1. Dark grey to greenish-grey siliceous rock. It contains a strong fluidal texture which may be original flow banding in a rhyolitic lava or a flattening texture in a welded ash-flow tuff (Fig. 40c). The colouration suggests that it has been altered by low-grade metamorphism. It is probably either a rhyolitic lava or a rhyolitic ash-flow tuff.

Orthostat S2. Grey to greenish-grey poorly cleaved, siliceous rock. It contains small feldspar crystals (generally <2mm in size). The colouration suggests that the rock is altered by low-grade metamorphism. It is probably a rhyolitic tuff.

Orthostat S3. Dark grey to greenish-grey siliceous rock. It contains small feldspar crystals (generally <2mm in size) and possible lithic fragments. The colouration suggests it is altered by low-grade metamorphism. It is probably a rhyolitic tuff. A chip of stone (no. 1925) found during excavation in

Fig. 40. a (*top*) Photograph of the Carreg Coetan rhyolitic capstone showing small (<2mm) feldspar crystals; b (*middle*) Photograph of the Carreg Coetan rhyolitic capstone showing a poorly-developed cleavage and a probable rhyolitic lithic fragment; c (*bottom*) Photograph of Carreg Coetan rhyolitic orthostat S1 showing a well-developed fluidal texture. *Photographs: Richard Bevins*.

disturbed layers within chamber, but probably deriving from orthostat S3, was examined separately. It is also probably a rhyolitic tuff.

Orthostat S4. Orthostat S4 is a dark grey to greenish-grey siliceous rock with a poorly developed cleavage. It contains small feldspar crystals (generally <2mm in size). The colouration suggests it is altered by low-grade metamorphism. It is probably a rhyolitic tuff.

Source of the capstone and orthostats
All of the five principal Carreg Coetan Arthur stones (capstone and the four orthostats) are of igneous origin, they are all siliceous (rhyolitic), are typically poorly cleaved and have all been altered by low-grade metamorphism. They are all either rhyolitic lavas or rhyolitic ash-flow tuffs. The stones all bear marked similarities in terms of the composition, lithological make-up, alteration state and style of deformation, to rhyolitic lavas and tuffs of the Fishguard Volcanic Group which outcrop in a belt across north Pembrokeshire stretching from Porth Maen Melyn, on Pencaer, in the west, to the Crymych area in the east. Rocks of the Fishguard Volcanic Group crop out in the area immediately south of Newport and hence a local origin is probable.

Stone surface outside the south-east side of the burial chamber
Numbered samples of stone from the surface were examined macroscopically.

Descriptions of numbered samples
1263a A light grey, cleaved, spotted siltstone. The 'spots' are poorly formed, metamorphic minerals (probably chlorite after cordierite or andalusite) which grew as a result of contact metamorphism by an intrusive igneous body. *1263b* Siltstone—?fine sandstone. *1263c* Siltstone—fine sandstone. *1264* A light coloured, poorly cleaved, crystal tuff. Both feldspar and quartz crystals occur in a finer, banded matrix, the continuents of which are not discernible without a microscopic investigation. *1265* Olive coloured siltstone. *1266* Siltstone—fine sandstone. *1267* Olive-coloured, poorly cleaved siltstone. *1268* Friable mudstone. *1269* Light grey, strongly cleaved mudstone. Its fine grained nature negates a fuller description. The well developed cleavage permits the use of the term 'slate' for this sample. In two pieces found adjacent. *1270* – Siltstone—?fine sandstone. *1271* Poorly cleaved, spotted siltstone. The origin of the spots is the same as 1264. *1272* Fine sandstone. *132, 133, 134, 144* Chips of stone from beneath Pot 129: all fine sandstone.

Source of the stones from the stone surface
The presence of a cleavage in all of the specimens and their low metamorphic grade suggests that they are of a Lower Palaeozoic age. All of the lithologies identified may be located in the Preseli hills, although it must be mentioned that, similarly, they may be located in other areas of Wales where rocks of Lower Palaeozoic age crop out. All stones are easily split and are relatively durable making them suitable for a working surface. The more friable slate has in general not been selected.

SOILS

By Helen Keeley and Maureen Girling[14]

The site was visited by HK during the first excavation season and by MG in the second. Advice on the nature of the soils and soil development, the nature of the old ground surface and soil content of specific features was given during visits and samples of soils were taken for further laboratory analysis.

The megalith was constructed in an area of sandy drift. An old ground surface on the south-east of the chamber was examined and was found to be sealed by up to 0.45m of sand (cairn material) upon which was developed a structureless yellow/orangey plough-soil (0.74m) leached to grey where exposed, with small-medium pebbles.

The old ground surface was recognised as a brown, fine silty layer containing pot sherds, bone, charcoal and stones. There was, however, no marked soil development from the old ground surface in those sections examined, although the former land surface was a well-marked feature visible over the site. Samples were collected for possible soil-pollen analysis though the pollen preservation status of the site could not be predicted.

Within pockets in the stone ring were protected areas of old ground surface; their distinctive chocolate brown colouration is probably due to the presence of decayed organic material in addition to fine charcoal and ash. The texture of this deposit is slightly finer than the overlying soil.

Samples from the old ground surface were taken; one had a pH of 6.4 (in distilled water) and therefore good pollen preservation in the soil was deemed to be unlikely (the soil was not particularly organic and had not been waterlogged).

Qualitative phosphate testing (Schwarz 1967) was carried out on soil samples from Neolithic Pit F20. Tests proved ‘strong’ in the centre of the pit, ‘positive’ from elsewhere in the fill, while external controls were ‘trace’ and ‘weak’. This suggests that the pit contained some anthropogenic material.

Soil samples from the centre and the base of F31, the slab-lined pit on the east of the chamber, were tested. The sample from the centre was dark brown friable coarse sandy loam, slightly more humic and silty than the sample from the base and gave a strong blue coloration in the phosphate test. The sample from the base was yellowish brown coarse sandy loam, slightly friable and with a strong medium subangular blocky structure, very heavily (about 80%) mottled with manganese (and probably some iron) oxides and gave a positive result in the phosphate test. The sample from the centre did not appear to have been burnt. The manganese staining in the basal sample suggested water may have moved through this deposit at some time.

CREMATED BONE

By J. Leonard Wilkinson, with additional comments by D. K. Whittaker[15]

Specimen C1 (weight 3g). Several small fragments of bone, maximum size 6.5mm × 6 mm and 0.1mm thick and represent the cortex of a small long bone. Some fragments are blackened; there is charcoal present, and one piece of charcoal has some bone adherent to it. Found amongst Pot 17, SSE of chamber on stone surface (Fig. 27).

Specimen C2 (weight 12g). Several small pieces of bone, white in colour, not charred. There are a number of small pieces of charcoal present. There are several small long bone fragments up to 10mm length and 2.5mm in thickness. One piece of skull vault 24mm × 26mm and 3.5m thick, with diploe present, no sutures. One flat bone fragment 25mm × 22mm with cortex either side—possibly basi-sphenoid from skull base. From on old ground surface SSE of chamber.

Specimen C3 (weight 3.7g). Bone, some charred and pieces of charcoal are adherent to one bone flake. Most of the fragments are small, but one is 30mm × 10mm and 2mm thick, probably the cortext of a long bone from the forearm. From cairn material, SSE of chamber.

Specimen C4 (weight 0.5g). Two fragments of long bone cortex. The larger fragment is 20mm × 5mm and 2mm thick; this is bowed on its long axis, as is often seen as an effect of cremation and is probably from a small long bone of the hand or foot. From old ground surface south-east of chamber.

Specimen C5 (weight 3.35g). Bone, mostly very small pieces and powder, with a few larger pieces. One piece of bone is charred. The largest fragment, 17mm × 7mm and 5mm thick, is from a major long bone. A few pieces of charcoal are present. From disturbed lower layers within chamber.

Specimen C6 (weight 7.7g). One bone flake is adherent to charcoal and several small traces of charcoal are present. Mostly cortical fragments of small long bones. The fragment, 17mm × 9mm × 7mm, is almost certainly the articular base of the terminal phalanx of the thumb. From amongst inverted pot P16 on old ground surface SSE of chamber, with charcoal and may represent the final burial deposit.

Specimen C7 (weight 2.4g). Two bony fragments, which are not charred. The larger, 24mm × 10mm, is of a piece of human rib. From F44, the stone-hole for orthostat S3.
Specimen C8 (weight 3.3g). Bone, much of it powder with several very small pieces. Three long bone fragments, none of which is charred; the largest is 26mm × 9mm and 4mm in thickness and is probably from a forearm bone. From disturbed lower layers within chamber.

Specimen C9 (weight 17.3g). Only one-third of the specimen is bone, the rest soil with numerous charcoal fragments. Specimen washed and sieved. It consists mostly of small flakes of cortex of the small long bone type, one fragment, 10mm × 8mm and 2mm thick, is probably of a forearm long bone. From old ground surface SSE of chamber, beneath cairn material.

Specimen C10a (weight 2.6g). Single fragment of long bone cortex 21mm × 7mm and 2mm thick. Not charred. From Site A, Layer 5.

Specimen C10b (weight 10.5g). Six bone fragments and some fine flakes: most of these show obvious charring. The largest fragment, 42mm × 15mm, is of major weight bearing long bone with strong cortex 9mm thick. This is most likely from the upper medial part of the shaft of an adult femur, probably male. The smaller fragments have a cortical thickness up to 4mm. From Base of Layer 5, adjacent to Stone F3.

Specimen C11 (weight 9g). The majority of the specimen consists of small fragments of human long bone up to 20mm in length and 7mm thick. There are also four small fragments of the petrous temporal bone of the skull, with imprints of the semicircular canals of the inner ear. No charring, but some bone showed fissuring as typical following cremation. Two small fragments are of animal origin, not charred, orange coloured, appear to have splintered. Found in scatter, adjacent to sherds of Carinated Bowls, Site B, Layer 9, SW of chamber. Sample taken for radiocarbon dating (UB-6751).

Specimen C12 (weight 2.6g). Single rib fragment, 37mm in length, not charred. From Site A, Layer 6.

Specimen C13 (weight 2.5g). Six small fragments, less than 5mm in size, very brittle, white, chalky consistency with traces of original bone structure: demineralised bone. From Site B, Layer 14.

Specimen C14 (weight 19.1g). This is the largest specimen, containing more intact and representative remains. Washed and sieved. Consists of twenty-one bone fragments from an adult. These include two of skull vault up to 20mm in length and 4mm thick. From F49, Neolithic pit on south-west side of Site B, close to boulder F55, within ring of stones.

There is a fragment of mandible, which includes the empty sockets of 1st molar and 2nd premolar roots. An X-ray of this revealed that there was a retained root of a deciduous 1st molar. This observation is of interest because it is not nowadays seen as a result of natural exfoliation of the deciduous teeth but most commonly as a result of inexpert extraction at a particular stage of development. Deciduous teeth are sometimes more firmly embedded than usual and their roots are bound to the bone in what is known as 'ankylosis'. If we suppose that in such a condition there is, superimposed, an occasion of a grossly traumatic bite—such as biting on a stone or a bone—the tooth (possibly with already damaged crown) could shatter, leaving the root behind, perhaps permanently, fused at its tip with underlying bone, and becoming subsequently submerged by bone growth. Ultimately resorption might well take place, given time, so this argues for a young rather than old adult. It would seem most probable, therefore, that the diagnosis should be 'ankylosis of deciduous molar, shattered by a traumatic bite on a hard object such as bone or stone, and subsequently retained, probably in a fairly young subject'. Dr D. K. Whittaker provided the following additional comment: 'The specimen is of the cortical plate of an alveolar process and contains the partial or complete sockets of four tooth roots. The alveolar margin is intact on one socket (anterior) and slightly damaged on the others. The teeth were lost post-mortem. The shape and direction of inter-radicular trabeculae lead me to believe that this is from the mandible. The contour of the buccal surface (cortical plate) and the general shape of the tooth sockets indicate that it is probably from 65/ region. The lower border is not original and has therefore been rounded off and probably packed with bone ash during cremation. A radiograph indicates the presence of a retained deciduous root from either the distal root of D/ or mesial of E/. There is no evidence of resorption or attempted exfoliation and this might indicate a) surgical or traumatic removal of this tooth and b) a relatively young person.'

Long Bones: 27mm fragment of proximal end of a metatarsal; 42mm shaft fragment of major long bone, probably humerus with cortex 28mm thick; 11mm fragment of the lower outer edge of the shaft of humerus with cortical thickness of 4mm. No charring or fissuring.

This specimen is rather different from the others, not only in being larger and more regionally representative, but not so brittle or demineralised. It is possible that it was in a different micro-environment, or had been treated differently and perhaps the burial was less disturbed.

Specimen C15 (weight 4.3g). Fragments of small long bones, the largest being 13mm × 7mm. Chalky appearance, no charring. Amidst ring of stones.

Specimen C16 (weight 4.4g). The largest piece is 20mm × 10mm and is probably from the zygomatic arch of the skull. The other fragments are from small long bones. No charring. From Layer 9, below ring of stones, south of chamber.

Conclusions

Apart from two small splinters of bone, all this skeletal material appears to be of human origin. There are no bones that can be identified as having come from children; probably only mature or adult remains are represented. Many of the fragments are very small and, in general, assessment of age and sex has not been attempted.

In a little over half the specimens there is direct evidence of cremation, either charring, fissuring, heat produced deformation or the presence of charcoal, sometimes still adherent to bone. The average size and general appearance of most of the fragments is that commonly found in cremation remains. Two specimens consisted of human rib fragments which were intact in cross section and these may have come from an inhumation. One (Specimen C7) was from the socket stone for a chamber orthostat.

Specimen C14 differs from the others in several aspects, probably from being in a discrete and more sheltered burial deposit. It is evidently the remains of a young adult who seems to have suffered a traumatic accident with the shattering of a tooth in the past.

CHARCOAL IDENTIFICATIONS
By Catherine J. Griffiths

Five samples were received for charcoal identification from a variety of contexts associated with Carreg Coetan Arthur chambered tomb (Fig. 27, sample numbers W1–5). The aim of the analysis was to gain information about the woodland in the area around the time the tomb was constructed and in use. The tomb is the most coastal of the group of Nevern Valley chambered tombs and lies close to the Nyfer estuary on the north Pembrokeshire coast and therefore charcoal from the tomb was likely to provide further evidence for the nature of Neolithic lowland woodland in Wales. The provenance of the samples was as follows: *Sample W1* From the old ground surface outside and to the south-east of the chamber. *Sample W2* Found with a sherd of pottery from the old ground surface adjacent to pot P16. The sherd may have been associated with the main inverted pot or associated with an earlier burial. *Sample W3* From below the silt stone paving on which deposition of cremated bone were found. The sample may relate to the final or earlier burials. *Sample W4* From F19, the stone-hole for orthostat S3. *Sample W5* From F35, a Neolithic pit outside the ring of stones surrounding the chamber to the south-west.

Method
The samples were dry sieved through a 2mm mesh to separate the larger identifiable fragments of charcoal. Subsamples of randomly selected charcoal, representing around 50% of the identifiable material, were examined from each sample. The charcoal was identified using a Leica DMR microscope with an incident light source and a magnification of up to ×200. The charcoal was identified on the basis of standard anatomical characteristics (e.g. Schweingruber 1978; Schoch *et al.* 2004). Nomenclature follows Stace (1991).

Results
The results are summarized in Table 5. The whole assemblage comprised alder (*Alnus glutinosa*), hazel (*Corylus avellana*) and oak (*Quercus* spp.), predominantly alder and hazel, with some variation between samples. Charcoal from sample W1, from the old ground surface outside and to the south-east of the chamber and from sample W2, from the old ground surface below pot P17, was mainly alder with a small quantity of hazel and, in each case, one fragment of oak. Hazel was more frequent in the remaining three samples. In sample W3, from below the siltstone paving, and sample W5, from F35, a Neolithic pit outside the ring of stones surrounding the chamber, hazel along with alder were the predominant species and oak was present, whereas in sample W4, from the stone-hole F19 for orthostat S3, hazel and oak were present in broadly similar amounts and alder was absent.

Discussion of the charcoal remains
The charcoal evidence provides some information about the woodland available for exploitation contemporary with activity at Carreg Coetan Arthur and hints at changes in the woodland during this period. However, the use of charcoal to reconstruct past woodland environments is difficult as the charcoal

Table 5. Carreg Coetan Arthur charcoal identifications

Sample	W1	W2	W3	W4	W5	Total
Quercus spp. (oak)	1	1	4	11	1	18
Alnus glutinosa (L) Gaertner (alder)	19	20	9	–	9	57
Corylus avellana L. (hazel)	5	4	12	14	15	49
Total	25	25	25	25	25	125

may have originated from a few burnt branches which have subsequently broken into numerous charcoal fragments, perhaps suggesting a particular species was more significant than it was in the woodland. Equally species may have been deliberately selected and others avoided.

However, from the species present at Carreg Coetan Arthur alder, hazel and oak woodland appears to have been present in the local area with alder an important element of the woodland around the time of funerary activity. A date of 3620–3020 cal. BC (CAR-391) was obtained from charcoal (sample W1) from the old ground surface around the final deposition of cremated bone and pottery. Alder generally grows in damp conditions, for example damp wood, by lakes and rivers (Stace 1991). The source of the alder may have been either the river Nyfer or the Nyfer estuary which is a few hundred metres north of the monument. A pollen diagram (Scott 2002) from the Nyfer estuary probably covering the period when Carreg Coetan Arthur was built and in use shows an increase of alder pollen with a decrease in oak pollen and a slight increase in hazel pollen, after an initial decline. The oak and hazel would have been growing on drier ground, either as part of primary woodland or as regeneration after clearance, especially hazel.

Almost equal quantities of hazel and alder and a small quantity of oak were present in the samples from below the siltstone paving and a Neolithic pit near to the chamber. The similarity of the assemblages may suggest that the samples from beneath the paved area and the pit were contemporary, although the sample from the paved area may be broadly contemporary with use of the chamber, whereas the Neolithic pit F35 is thought to pre-date the chamber on the basis of a radiocarbon date of *c*. 3780–3380 cal. BC (CAR-392) from a similar feature (F36). However, the material from the paved area was not dated.

Sample W4 from the stone-hole for orthostat S3 contained almost equal amounts of oak and hazel charcoal, with no alder present. The context for this sample is dated to 3650–3190 cal. BC (CAR-394) and may either relate to activity associated with the building of the tomb or activity associated with an earlier ground surface. The lack of alder in the sample may indicate the presence of oak and hazel in the immediate vicinity.

When the charcoal assemblage from Carreg Coetan Arthur is compared with other Neolithic sites in Wales the predominance of alder in the later contexts is of note. In general the other assemblages contain charcoal from oak, hazel, birch, sloe, rosaceous species, ash, poplar/willow and yew, especially oak and hazel and the presence of alder is limited (Caseldine 1990; Caseldine pers. comm.). Alder has been recorded from Late Neolithic pits at Llandegai (Lynch and Musson 2001) and from the middle fills, again dated to the Late Neolithic, of the enclosure ditch at Banc Du in the Preseli hills (Darvill *et al*. 2006). Finally in contrast with the assemblage from Carreg Coetan Arthur, charcoal from Pentre Ifan burial chamber was identified by Hyde (1949) as being gorse (*Ulex europaeus*), but is undated. Hyde inferred that gorse was burnt due to lack of woodland in the area, which appears not to be the case at Carreg Coetan Arthur.

MEDIEVAL AND LATER POTTERY

By Paul Courtney[16]

The medieval and later pottery/ridge tile from the site comprised 1411 sherds (14.9 kg) virtually all from ploughsoil contexts which is reflected in the small size and highly worn nature of most sherds, especially the soft medieval wares. The following sherds came from features: F8/F12 (probable 19th-century pit) Medieval Fabric A, 3 sherds, Medieval Fabric B, 7 sherds (2 internally glazed); F22 (Site A field ditch) Medieval Fabric A, 1 sherd; F24 (Site B field ditch) Medieval Fabric A, 1 sherd; F28 (Site X, 19th- or early 20th-century northern field ditch) Medieval Fabric A, 4 sherds, Medieval Fabric B, 1 sherd.

Medieval

Medieval Fabric A: Dyfed Gravel-Tempered Ware, unglazed (816 sherds, weight 5.8kg). Unglazed cooking pots/jars with inturned flaring rims in predominantly oxidised soft fabric, sometimes with reduced core. Inclusions include abundant rounded quartz under 0.5mm and moderate to abundant sub-rounded siltstone up to 3mm. The most common form has inturned bell-shaped rims with occasional traces of sooting surviving. Some club-like rims also occur. Of the latter form one had external sooting below the rim and another traces of a probable handle. One sherd from a thick-walled ?storage vessel had stamped decoration on the shoulder.

Medieval Fabric B: Dyfed Gravel-Tempered Ware, glazed (288 sherds, weight 2.2kg). Glazed jugs and internally-glazed vessels of uncertain form possibly bowls (13 sherds). All were in a predominantly oxidised soft fabric mostly with thin pitted green to yellowish-brown glaze. Some of the internally glazed vessels seem to have lid-seatings below the rim and a fragment of a glazed lid was identified. A couple of internally-glazed rim sherds also had applied thumbed strips on the outside of the rim. The internally glazed vessels could be late medieval (?late 14th- to 15th-century), or even conceivably post-medieval, but the fabric was identical to the medieval jug fabric. Inclusions were rare to abundant rounded quartz and rare to moderate sub-rounded siltstone fragments up to 3mm. A common source with the cooking pots/jars seems likely.

Medieval Fabric C: ?Dyfed Gravel-Tempered Ware, glazed. A single unglazed rim sherd from a jug in a hard partly-reduced Dyfed-type fabric, possibly from elsewhere in the region.

Medieval Fabric D: Newport-type Jugs (2 sherds). Two small sherds in a hard predominantly oxidised fabric with a few siltstone inclusions and splashed brown glaze. These are probably from late medieval (?15th-century) Newport-type jugs.

Medieval Fabric E: Saintonge Mottled Green Ware (1 sherd). A single sherd from a jug in a pale off-white, micaceous fabric with reduced core and pitted mottled green glaze. Late 13th- to 15th-century.

Ridge Tiles (2 sherds). Two sherds from glazed ridge tiles were found in a fabric identical to Dyfed Gravel Tempered, glazed fabric, and presumably of local manufacture.

Post-medieval

Frechen (1 sherd). Rhenish stoneware flask, 17th-century.

Westerwald (1 sherd). Rhenish stoneware blue-decorated mug, late 17th- to early 19th-century.

North Devon Gravel-Tempered Ware and gravel-free coarsewares (115 sherds). ?Late 16th- to 18th- or even 19th-century, exported from Bideford and Barnstable in North Devon.

North Devon slipped/sgraffito ware (10 sherds). Jugs and dishes, 17th to 19th-century, though sgraffito wares end *c*. 1700.

North Devon Ridge Tile (3 sherds). 17th- to 18th-century.

Lead glazed red earthenwares (7 sherds). Bowls or dishes, some with slip decoration, probably Glamorgan or Somerset; and one micaceous example, possibly from Gwent area. ?17th- to 18th-century.

Coal-Measures coarsewares (67 sherds). Red fabrics (often with white clay streaks), and black glazes. Probably from Buckley or Lancashire, 17th- to 19th-century.

Coal-Measures press-moulded dishes (14 sherds). Buff fabric with slip decoration. Probably Buckley or Lancashire, mid 17th- to 18th-century.

Bristol/Staffordshire yellow slipped (3 sherds). Coal Measures buff fine-wares, wheel-thrown hollow wares with red-slip decoration; *c.* 1680–1750.

Mottled wares (12 sherds). Coal Measures buff fabrics with brown mottled glazes, mostly tankards, *c*. 1680–1750.

Cistercian ware (1 sherd). 16th-century drinking vessel.

Cistercian/Blackware (1 sherd). 16th- to 17th-century drinking vessel.

Blackware (3 sherds). 17th-century or later drinking vessel, probably Buckley or Lancashire.

English Brown stoneware (6 sherds). 18th- to 19th-century.

Tin-glazed Earthenware (2 sherds). English, *c*. 1650–1750.

Creamware (6 sherds). Cream-coloured earthenware, *c.* 1750–1820.

Pearlware (15 sherds). Blue-tinged whiteware, mostly painted, *c*. 1775–1840.

Developed whitewares (33 sherds). Painted or transfer decorated, probably all mid-late 19th-century.

Miscellaneous Industrial wares. 2 sherds, one with brown glaze over fine brown, cylindrical earthenware-body with lathe-turned decoration, and another with dark-green glaze over fine buff, earthenware-body (?teapot); 19th-century.

Discussion of the medieval and later pottery

Medieval Fabrics A and B are typical local west Welsh siltstone-tempered wares defined by O'Mahoney (1985) and Papazian and Campbell (1992, 56–9) as 'Dyfed Gravel tempered fabric'. They were probably produced at various kiln sites in Dyfed and local production along the north Pembrokeshire coast seems likely. The only medieval kiln site to be identified so far in Dyfed was in the nearby suburbs of Newport (Talbot 1968, 122–5). It produced amongst other products squat, thick walled jugs with patchy glaze believed to be around fifteenth-century in date. Only a couple of small sherds (Medieval Fabric D) seem likely to be products in the current assemblage.

The medieval wares should date to the thirteenth to fifteenth or even sixteenth century, though precise dating is not possible. However, the rarity of Newport-type late medieval jug sherds may indicate a break in occupation. The Carreg Coetan assemblage was marked by a lack of variety in the range of fabrics and absence of medieval imports, apart from a single sherd of Saintonge jug. This combined with the small percentage of glazed wares (26% of medieval sherds) tends to suggest peasant occupation. Excavations on three burgage sites in Newport produced 7337 sherds from the medieval phases (III–VII) of which 7.6% of the sherds were English or Continental imports. Of the local wares from these phases 15.5% were glazed. However, the mud-built structures associated with these burgage plots were more characteristic of rural than core urban settlement (Brennan 1994; Brennan and Murphy 1993–94).

The quantity of pottery found at Carreg Coetan suggests a nearby medieval peasant farmstead or settlement. It further suggests that the prehistoric monument may have been used as a convenient midden. There seems to be relatively little late medieval pottery, which may point to a phase of abandonment. The post-medieval wares date from the sixteenth to twentieth centuries but are dominated by North Devon and Buckley coarse wares probably of the seventeenth to eighteenth centuries though both wares may carry on into the nineteenth century. This is typical of coastal assemblages from west Wales, for example, Haverfordwest Priory (Courtney forthcoming), Carmarthen Priory (O'Mahoney 1995) and Machynlleth (Courtney 1997). Smaller quantities of late eighteenth- and nineteenth-century pottery were recovered but this may reflect a change in manuring patterns or waste disposal rather than a change in settlement. Assessing status from ceramics alone is still imprecise but the range of post-medieval pottery is what one might expect from a rural cottage or farmstead of a small tenant farmer. In particular there were few display wares such as tin-glazed earthenware or later porcelain.

CLAY PIPES

By Gill Evans[17]

A small assemblage of clay pipes was found in the topsoil.

1. Brosely; base of bowl, stamped heel and part of stem. Stamp has three lines of relief: IOS(?)/HUG/HES – John Hughes? Cf. Greyfriars, Carmarthen no. 65 (Brennan *et al*. 1993–94, fig. 13, 65, 70). (Find no. 61).
2. Heel of bowl, no stamp. (Find no. 101).
3. Four sections of work pipe with leaf pattern along mould line of bowl. On right is letter C and a small part of ornamentation (of Royal Cypher); on left is a very worn crowned bust. Spur with no pattern or stamp, (cf. Greyfriars, Carmarthen (Brennan *et al*. 1993–94), two similar pipes described as commemorating the coronation of Queen Victoria in 1838, made by Edward and Nicholas Kennicot of Swansea). (Find no. 160).
4. Heel of bowl, no stamp. (Find no. 242).
5. Stem and part of bowl. (Find no. 1095).
6. Heel and side of bowl spur stamped RR. Leaf decoration on front and back mould lines and bowl decorated with narrow 'flutes', lines emanating from stem. Made by Richard Ring of Bristol, 1850-65. (cf. Church Street, Carmarthen, nos 192–95, Brennan *et al*. 1993–94, fig. 28, 84). (Find no. 1188).

7. Half of bowl, stamped heel and section of stem, milled rim of bowl. Stamp in three lines relief / /. (Un-numbered).
8. Thirteen undiagnostic sections of pipe stem, 166 being the end of a stem, slightly indented. (Find nos 62, 166,167, 225, 229, 272, 292, 299, 851,115).

COINS

By Edward Besly

1. George III halfpenny. Date illegible, issue 1770–75. Likely to be a contemporary counterfeit. Very worn, either from use or from acid soil after deposition. Found at the base of F8, post-medieval pit outside chamber.
2. Victorian penny, 1861. Bronze issue, with some circulation wear. Topsoil.

METAL AND CERAMIC OBJECTS

By Sian Rees

1. Iron fragments (nails, rivets, slag, lumps), from topsoil.
2. Folded piece of waste lead sheet (No. 133).
3. Small fragments of copper alloy (No. 305).
4. Broken ceramic chess piece (bishop) or statuette, head missing. Pipe clay, white exterior, dark grey fabric. Possibly Victorian, from topsoil. (No. 1491).

RADIOCARBON DATING

Four conventional radiocarbon dates from charcoal samples were submitted to the Radiocarbon Dating Laboratory, Department of Plant Science, University College Cardiff in 1980 (for methodology see Dresser 1985, 381).[18] More recently, Tatjana Kytmannow submitted a sample of cremated bone from the 1979–80 excavations to the Radiocarbon Laboratory, Queen's University, Belfast, for pre-treatment and processing, from which graphite targets were sent to the Oxford Radiocarbon Accelerator Unit for AMS dating (Kytmannow 2008, 103–4). The calibrated dates given below have been obtained from OxCal v.4.2.2 Bronk Ramsey (2013), r:5 using atmospheric date from Reimer *et al.* (2009) and are quoted at 95% confidence (see plots given in Fig. 41). The calibrated date ranges cited are quoted in the form recommended by Mook (1986), with the end points rounded outward to 10 years for errors greater than 25 years.

CAR-391
Material: charcoal (Sample 1)
Context: from old ground surface sealed beneath forecourt blocking material, contemporary with blocking of forecourt over final burial (Fig. 27)
Radiocarbon age: 4560±80 BP
Calibrated date (95% confidence): 3620–3610 and 3521–3020 cal. BC

CAR-392
Material: charcoal (Sample 2)
Context: from area of burning F36, below stone kerb, ante-dating positioning of kerb (Fig. 27)
Radiocarbon age: 4830±80 BP
Calibrated date (95% confidence): 3780–3500 and 3460–3380 cal. BC

CAR-393
Material: charcoal (Sample 3)
Context: from within forecourt blocking material, dating blocking of forecourt (Fig. 27)
Radiocarbon age: 4470±80 BP
Calibrated date (95% confidence): 3360–2920 cal. BC

CAR-394
Material: charcoal (Sample 4)
Context: from F44, stone-hole for chamber orthostat S3, contemporary with erection of chamber (Fig. 27)
Radiocarbon age: 4700±80 BP
Calibrated date (95% confidence): 3650–3340 and 3200–3190 cal. BC

UB-6751
Material: Sample of cremated bone from Specimen 11 (see Wilkinson, above) (Sample 1)
Context: from scatter, Site B, Layer 9, old ground surface SW of chamber (Fig. 27). One single entity, human long bone, probably adult, was used for the AMS date.
Radiocarbon age: 4361±36 BP
Calibrated date (95% confidence): 3090–3050 and 3030–2900 cal. BC

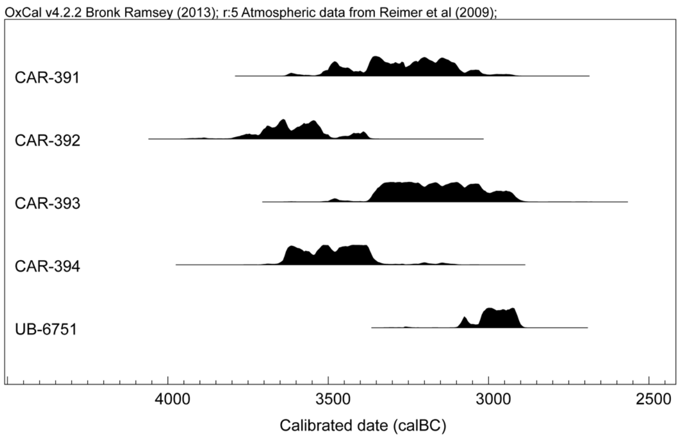


Fig. 41. Calibrations of radiocarbon dates from Carreg Coetan Arthur.

ACKNOWLEDGEMENTS

Mr and Mrs Barclay Edwards, the former owners of Carreg Coetan Arthur, kindly gave the burial chamber into state guardianship and facilitated the excavation in many ways both during work and subsequently. Thanks are due to the staff, especially Tessa McCormick, John Cole and James Dinn, and to the volunteers, especially Tony Hawes, Nancy Reed, Larry Barnham and Hedd Lewis. The report has benefited from the specialist input from Helen Keeley and Maureen Girling, Leonard Wilkinson, Paul Courtney, Gill Evans and Quentin Dresser who provided assistance either during or immediately after the excavations. Staff and colleagues from Cadw (then the Welsh Office Ancient Monuments Branch) facilitated and funded the excavation, especially Michael Thompson, who requested that the excavation be undertaken. During the post-excavation phase of the project, specialist input has been indispensable, especially from Alex Gibson, Elizabeth Healey, Hubert Wilson (who drew the plans), and Brian Williams (who produced the artefact drawings). Peter Price, Ian Elliot and Phil Parkes, Archaeology Conservation Laboratory, University of Cardiff, undertook the conservation of artefacts and reconstruction of pottery. Bill Britnell has assisted considerably with making the report ready for publication and Frances Lynch and Stephen Briggs kindly read and suggested amendments to the report. Above all my thanks are due to Richard Avent who helped me with the recording and drawing of the chamber cross-sections, and who gave unfailing encouragement for the project throughout.

NOTES

1. Cardiff Central Library, Tour Journals of Sir Richard Colt Hoare, MS 4.302, VI, 5.
2. Salisbury and South Wiltshire Museum, Pitt Rivers papers, file AM2.
3. Unless stated otherwise, the calibrated dates given in this report have been obtained from OxCal v.4.2.2 Bronk Ramsey (2013), r:5 using atmospheric date from Reimer *et al.* (2009) and are quoted at 95% confidence. The calibrated date ranges cited are quoted in the form recommended by Mook (1986), with the end points rounded outward to 10 years for errors greater than 25 years.
4. The posterior density estimates and probabilities quoted by Whittle *et al*. 2011, 534–5 for the dates from Carreg Coetan Arthur are as follows: CAR-391, 3625–3600 cal. BC (2%) or 3523–3290 cal. BC (93%); CAR-392, 3780–3495 cal. BC (84%) or 3460–3375 cal. BC; CAR-393, 3505–3425 cal. BC (14%) or 3385–3270 cal. BC (81%); CAR-394, 3640–3360 cal. BC (95%).
5. See note 1.
6. 4390±70 BP (CAR-114).
7. 4590±70 BP (CAR-116).
8. 4970±80 BP (HAR-674).
9. 5050±70 BP (HAR-3932).
10. 4712±39 BP (UB-6754).
11. 4471±38 BP (UB-6753).
12. The dates are listed in Whittle *et al.* 2011, 606.
13. 4835±59 BP (UB-6694).
14. Reports received 1981 (see Girling 1981; Keeley 1981).
15. Report received 1981.
16. Report received 3 September 2005.
17. Report received 30 May 2005.
18. Report received from Dr Quentin Dresser, 29 September 1981.

BIBLIOGRAPHY

Barker, C. T., 1992. *The Chambered Tombs of South-West Wales. A re-assessment of the Neolithic burial monuments of Carmarthenshire and Pembrokeshire*, Oxbow Monograph 14 (Oxford: Oxbow Books).

Barnwell, E. L., 1872. 'Notes on some South Wales cromlechs', *Archaeologia Cambrensis*, 4th ser., 3, 81–143.

Barton, R. N. E., Berridge, P. J., Walker, M. J. C. and Bevins, R. E., 1995. 'Persistent places in the Mesolithic landscape: an example from the Black Mountain uplands of South Wales', *Proceedings of the Prehistoric Society* 61, 81–116.

Boyd Dawkins, W., 1901. 'On the cairn and sepulchral cave at Gop, near Prestatyn' *Archaeological Journal* 58, 322–41.

Brennan, D. F. M., 1994. ‘Medieval pottery’, in K Murphy, ‘Excavations in three burgage plots in the medieval town of Newport, Dyfed, 1991’, *Medieval Archaeology* 38, 75–6.

Brennan, D. F. M. and Murphy, K., 1993–94. ‘The pottery from excavations in three burgage plots in the town of Newport, Dyfed, 1991’, *Medieval and Later Pottery in Wales* 14, 1–8.

Britnell, W. J. and Savory, H. N., 1984. *Gwernvale and Penywyrlod: Two Neolithic Long Cairns in the Black Mountains of Brecknock*, Cambrian Archaeological Monograph No. 2 (Cambrian Archaeological Association).

Burroni, D. B., Donahue, R. E., Pollard, A. M. and Mussi, M., 2002. ‘The surface alteration features of flint artefacts as a record of environmental processes.’ *Journal of Archaeological Science* 29, 1277–87.

Burrow, S., 2003. *Catalogue of the Mesolithic and Neolithic Collections in the National Museums and Galleries of Wales* (Cardiff: National Museums and Galleries of Wales).

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

Clark, J. G. D., 1932. ‘The date of the plano-convex flint-knife in England and Wales’, *Antiquaries Journal* 12, 158–62.

Cleal, R., 1988. ‘The occurrence of drilled holes in Later Neolithic pottery’, *Oxford Journal of Archaeology* 7, 139–45.

Courtney, P., 1997. ‘Post Medieval pottery’, in A. Gibson and J. Barfoot, ‘ The excavations of a malting house in the grounds of Plas Machynlleth’, *Montgomeryshire Collections* 85, 85.

Cummings, V. and Whittle, A., 2004. *Places of Special Virtue: megaliths in the Neolithic landscapes of Wales* (Oxford: Oxbow Books).

Daniel, G. E., 1950. *The Prehistoric Chamber Tombs of England and Wales* (Cambridge: Cambridge University Press).

Darvill, T., 2011. ‘Misty mountain hop: prehistoric stone working in south-west Wales’, in V. Davis and M. Edmonds (eds) *Stone Axe Studies III* (Oxford: Oxbow Books), 131–46.

Darvill, T., Davies, R. V., Evans, D. M., Ixer, R. A. and Wainwright, G., 2006. ‘Strumble-Preseli ancient communities and environment study (SPACES): fifth report 2006’, *Archaeology in Wales* 46, 100–7.

David, A., 2007. *Palaeolithic and Mesolithic Settlement in Wales with special reference to Dyfed,* British Archaeological Reports, British Series 448 (Oxford).

Davies, O., 1937. ‘Excavations at Ballyrenan, Co. Tyrone’, *Journal of the Royal Society Antiquaries* of *Ireland,* ser. 7, 67, part 1, 89–100.

De Valera, R., 1960. ‘The Court Cairns of Ireland’, *Proceedings of the Royal Irish Academy* 60 (C), 9–140.

Donahue, R. E., 1994. ‘The current state of lithic microwear research’, in N. Ashton, and A. David (eds), *Stories in Stone*, Lithic Studies Society Occasional Paper No. 4 (Oxford), 156–68.

——1999. ‘The microwear analysis of the flint artefacts from Upper Ninepence’, in Gibson 1999, 100–26.

Donahue, R. E. and Burroni, D. B., 2004. ‘Lithic microwear analysis and the formation of archaeological assemblages’, in Walker, E. A., Wenban-Smith, F., and Healy, F., (eds). *Lithics in Action: Papers for the Conference Lithic Studies in the Year 2000* (Oxford: Oxbow Books), 140–8.

Dresser, Q., 1985. ‘University College Cardiff Radiocarbon Dates I’, *Radiocarbon* 27, no. 2B, 338–85.

Dudd, S. N., Evershed, R. P. and Gibson, A. M., 1999. ‘Evidence for varying patterns of exploitation of animal products in different prehistoric pottery traditions based on lipids preserved in surface and absorbed residues’, *Journal of Archaeological Science* 26, 1473–82.

Fenton, R., 1811. *A Historical Tour through Pembrokeshire* (London: Longman).

Gibson, A. M., 1995. ‘First Impressions: a review of Peterborough Ware from Wales’, in I. A. Kinnes and G. Varndell (eds), *Unbaked Urns of Rudely Shape* (Oxford: Oxbow Books), 22–49.

——1999. *The Walton Basin Project: Excavation and Survey in a Prehistoric Landscape 1993–7,* CBA Research Report 118 (York: Council for British Archaeology).

——2001. 'Neolithic pottery from Ogmore, Glamorgan', *Archaeologia Cambrensis* 148, 56–67.

Girling, M. A., 1981. 'Informal report on site visit to Carreg Coetan, Dyfed', Ancient Monuments Laboratory Report 3374 (5/81).

Glenn, T. A., 1926. 'Rhyl foreshore finds', *Archaeologia Cambrensis* 81, 199–203.

Grimes, W. F., 1936. 'The megalithic monuments of Wales', *Proceedings of the Prehistoric Society* 2, 106–39.

——1939a. 'The excavation of Ty-isaf long cairn, Brecknockshire', *Proceedings of the Prehistoric Society* 5, 119–42.

——1939b. 'Notes on excavations', *Proceedings of the Prehistoric Society* 5, 258.

——1949. 'Pentre-ifan burial chamber, Pembrokeshire', *Archaeologia Cambrensis* 100, 3–23.

Hamilton M. and Aldhouse-Green, H. S., 1998. 'Ogmore-By-Sea', *Archaeology in Wales* 38, 113–15.

Healey, E., 1987. 'Lithic technology', in Smith and Lynch 1987, 50–9.

Healey, E. and Green, H. S., 1984. 'The lithic industries' in Britnell and Savory 1984, 113–32.

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

Hyde, H. A., 1949. 'Appendix. Charcoals from Pentre-ifan, Nevern, Pembrokeshire', in Grimes 1949, 23.

Jackson, R. and Ray, K., 2012. 'Place, presencing and pits in the Neolithic of the Severn-Wye region', in H. Anderson-Wymark and J. Thomas (eds), *Regional Perspectives on Neolithic Pit Deposition. Beyond the Mundane*, Neolithic Studies Group Seminar Papers 12 (Oxford: Oxbow Books), 144–170.

Jacobi, R. M., 1980. 'The early Holocene settlements of Wales', in J. A. Taylor (ed.), *Culture and Environment in Prehistoric Wales*, British Archaeological Reports, British Series 76 (Oxford), 131–206.

Jenkins, D. A., 1987. 'Report on the petrography of pottery from Trefignath and Din Dryfol, Anglesey', in C. A. Smith and F. M. Lynch, *Trefignath and Din Dryfol: the excavation of two megalithic tombs in Anglesey,* Cambrian Archaeological Monograph No. 3 (Cambrian Archaeological Association), 60–73.

Jenkins, D. A. and Owen, A., 2003. 'Phosphate redistribution within the fabric of 5 prehistoric pottery sherds from North Wales', in K. A. Robson Brown (ed.), *Archaeological Sciences 1999. Proceedings of the Archaeological Sciences Conference, University of Bristol, 1999*, British Archaeological Reports, International Series 111 (Oxford), 59–63.

John, B., 2013. 'Devensian limit in west Wales', posted 20 March 2013 on *Stonehenge and the Ice Age* <Brian-mountainman.blogspot.co.uk>.

Keeley, H. C. M., 1981. 'Soil Report for the site of Carreg Coetan, Dyfed', Ancient Monuments Laboratory Report 3383 (8/81).

Kokelaar, B. P., Howells, M. F., Bevins, R. E., Roach, R. A. and Dunkley, P. N., 1984. 'The Ordovician marginal basin of Wales, in B. P. Kokelaar and M. F. Howells (eds), *Marginal Basin Geology*, Special Publication of the Geological Society of London No. 16, 245–60.

Kytmannow, T., 2008. *Portal Tombs in the Landscape. The Chronology, Morphology and Landscape Setting of the Portal Tombs of Ireland, Wales and Cornwall*, British Archaeological Reports, British Series 455 (Oxford).

Le Brun-Ricalens, F., 2006. 'Les pièces esquillées: état des connaissances après un siècle de reconnaissance', *Paléo* 18, 95–114.

Levi Sala, I., 1986a. 'Experimental replication of post-depositional surface modification on flint', in L. Owen and G. Unrath (eds), *Technical Aspects of Microwear Studies on Stone Tools. Early Man News* 9/10/11, 103–9.

——1986b. 'Use wear and post-depositional surface modification: a word of caution', *Journal of Archaeological Science* 13, 229–44.

Lynch, F. M., 1969. 'The contents of excavated tombs in North Wales', in T. G. E Powell, J. X. W. P. Corcoran, F. Lynch and J. G. Scott (eds), *Megalithic Enquiries in the West of Britain* (Liverpool: Liverpool University Press), 149–74.

——1972. 'Portal Domens in the Nevern Valley, Pembrokeshire', in F. M. Lynch and C. Burgess (eds), 1972, *Prehistoric Man in Wales and the West* (Bath: Adams and Dart), 67–82.

——1975. 'Excavations at Carreg Samson megalithic tomb, Mathry, Pembrokeshire', *Archaeologia Cambrensis* 124, 15–35.

——1997. *Megalithic Tombs and Long Barrows in Britain* (Colchester: Shire Publications).

Lynch, F. and Musson, C., 2001. 'A prehistoric and early medieval complex at Llandegai, near Bangor, North Wales', *Archaeologia Cambrensis* 150, 17–142.

Manby, T. G., 1974. *Grooved Ware Sites in the North of England*, British Archaeological Reports, British Series 9 (Oxford).

Mook, W. G., 1986. 'Business meeting: Recommendations/Resolutions adopted by the Twelfth International Radiocarbon Conference', *Radiocarbon* 28, 799.

Murphy, F. and Wilson. H., 2012. 'Scheduling Enhancement Project 2011: Prehistoric Sites Fieldwork – Pembrokeshire Additional Sites', unpublished report, Dyfed Archaeological Trust.

Nash, G., 2006. *The Architecture of Death. Neolithic chambered tombs in Wales* (Little Logaston: Logaston Press).

O'Mahoney, C., 1985. 'West Wales fabrics – an interim note', *Medieval and Later Pottery in Wales* 8, 20–4.

——1995. 'Pottery, ridge tile and ceramic water pipe', Excavations at Carmarthen Greyfriars 1983–1990, Topic Report 2, unpublished report, Dyfed Archaeological Trust.

Owen, H. (ed.), 1892. *The Description of Penbrokshire, by George Owen of Henllys*, Cymmrodorion Record Series No. 1, vol. 1 (London: Honourable Society of Cymmrodorion).

Papazian, C. and Campbell, E., 1992. 'Medieval pottery and roof tiles in Wales AD 1100–1600', *Medieval and Later Pottery in Wales* 13, 1–107.

Peterson, R., 2003. *Neolithic Pottery from Wales: Traditions of Construction and Use*, British Archaeological Reports, British Series 344 (Oxford: Archaeopress).

Pollard, J., 1994a. 'Worked flint', in Whittle 1994, 40–4.

——1994b. 'Appendix 2: Dating, associations and context of flint polished-edge blade knives', in Whittle 1994, 51–2.

Powell, T. G. E., 1973. 'Excavation of the chambered cairn at Dyffryn Ardudwy, Merioneth, Wales', *Archaeologia* 104, 1–49.

RCAHM 1925. *An Inventory of the Ancient Monuments in Wales and Monmouthshire. VII. County of Pembroke*, Royal Commission on the Ancient and Historical Monuments in Wales and Monmouthshire (London: HMSO).

Reimer, P. J., *et al*. 2009. 'INTCAL09 and MARINE09 radiocarbon age calibration curves, 0–50,000 years cal BP', *Radiocarbon* 51(4), 1111–50.

Saville, A., 1990. *Hazelton North. The excavation of a Neolithic long cairn of the Cotswold-Severn Group*, Historic Buildings and Monuments Commission for England, Archaeological Report 13 (London: English Heritage).

Savory, H. N., 1955. ‘The excavation of a Neolithic dwelling and a Bronze Age Cairn at Mount Pleasant Farm, Nottage (Glam.)’, *Transactions of the Cardiff Naturalists’ Society* 81, 75–89.

——1956. ‘The excavation of ‘Twlc-y-filiast’ cromlech, Llangynog (Carm.)’, *Bulletin of Board of Celtic Studies* 16, 300–8.

——1962. ‘The excavation of a Bronze Age cairn at Sant-y-Nyll, St Brides-super-Ely’, *Transactions of the Cardiff Naturalists Society* 89, 9–30.

——1980. *Guide Catalogue of the Bronze Age Collections* (Cardiff: National Museum of Wales).

Schoch, W., Heller, I., Schweingruber, F. H. and Kienast, F., 2004. *Wood Anatomy of Central European Species*, online version at <www.woodanatomy.ch>.

Schwarz, G. T., 1967. ‘A simplified chemical test for archaeological fieldwork’, *Archaeometry* 10, 57–63.

Schweingruber, F. H., 1978. *Microscopic Wood Anatomy* (Birmensdorf: Swiss Federal Institutute of Forestry Research).

Scott, N. P., 2002. ‘Pollen Analytical Investigation of Middle to Late Flandrian Peats from the Intertidal Zone of the Nyfer Estuary, Newport, Pembrokeshire’, unpublished undergraduate dissertation, University of Wales, Lampeter.

Scott, W. L., 1933. ‘The chambered tomb of Pant-y-Saer, Anglesey’, *Archaeologia Cambrensis* 88, 185–228.

Seymour, W. P., 1985. ‘The environmental history of the Preseli region of South-West Wales over the past 12,000 years’, PhD thesis, Institute of Geography and Earth Sciences, University of Aberystwyth.

Sheridan J. A., 2007. ‘From Picardie to Pickering and Pencraig Hill? New information on the ‘Carinated Bowl Neolithic’ in northern Britain’, in A. W. R. Whittle and V. Cummings (eds), *Going Over: the Mesolithic – Neolithic Transition in North-West Europe,* Proceedings of the British Academy 144 (Oxford: Oxford University Press), 441–92.

Smith, C. A. and Lynch, F. M., 1987. *Trefignath and Din Dryfol. The Excavation of Two Megalithic Tombs in Anglesey*, Cambrian Archaeological Monograph No. 3 (Cambrian Archaeological Association).

Stace, C., 1991. *New Flora of the British Isles* (Cambridge: University Press).

Talbot, E. J., 1968. ‘Welsh ceramics: a documentary and archaeological survey’, *Post-Medieval Archaeology* 2, 119–39.

Taylor, J. A., 1980. ‘Environmental changes in Wales during the Holocene period’, in J. A. Taylor (ed.), *Culture and Environment in Prehistoric Wales*, British Archaeological Reports, British Series 76 (Oxford).

Thomas, R., 1923. ‘Pygmy flints found at Newport (Pemb.)’, *Archaeologia Cambrensis* 78, 324–6.

Thomas, C. and Wailes, B., 1967. ‘Sperris Quoit: the excavation of a new Penwith Chamber’, *Cornish Archaeology* 6, 9–23.

Tilley, C., 1994. *A Phenomenology of Landscape* (Oxford: Berg).

Topp, C., 1962. ‘The Portal Dolmen of Drumanone, Co. Roscommon’, *Bulletin of the University of London Institute of Archaeology* 3, 38–46.

Vergès, J. M. and Ollé, A., 2011. ‘Technical microwear and residues in identifying bipolar knapping on an anvil: experimental data’, *Journal of Archaeological Science* 38, 1016–25.

Walker, E., 2003. ‘Lithics’, in S. Burrow, *Catalogue of the Mesolithic and Neolithic Collections in the National Museums and Galleries of Wales* (Cardiff: National Museums and Galleries of Wales), 10–14, 21–2, 89–91.

Wainwright, G. J., 1963. ‘A reinterpretation of the microlithic industries of Wales’, *Proceedings of the Prehistoric Society* 29, 99–132.

——1967. *Coygan Camp. A Prehistoric, Romano-British and Dark Age Settlement in Carmarthenshire* (Cambrian Archaeological Association).

Whittle, A., 1994. 'Excavations at Millbarrow Neolithic chambered tomb, Winterbourne Monkton, North Wiltshire', *Wiltshire Archaeological and Natural History Magazine* 87, 1–53.
——2004. 'Stones that float to the sky: portal dolmens and their landscapes of memory and myth', in V. Cummings and C. Fowler (eds), *The Neolithic of the Irish Sea: materiality and traditions of practice* (Oxford: Oxbow Books), 81–90.
Whittle, A., Healy, F. and Bayliss, A., 2011. *Gathering Time. Dating the Early Neolithic Enclosures of Southern Britain and Ireland* (Oxford: Oxbow Books).
Wilkinson, J. G., 1871. 'Cromlechs and other remains in Pembrokeshire', *Collectanea Archaeologia* 2, part 2, 219–40.
Williams, A., 1953. 'Clegyr Boia, St Davids (Pemb)', *Archaeologia Cambrensis* 102, 20–47.
Williams, J. Ll. W. and Jenkins, D. A., 2004. 'Petrographic analysis and classification of prehistoric pottery from northern Wales: Neolithic and Bronze age', *Studia Celtica* 38, 1–48.
Wyndham, H. P., 1775. *A Gentleman's Tour through Monmouthshire and Wales in the Months of June and July, 1774* (London: T. Evans).

Published with the aid of a grant from Cadw – Welsh Government