The original Stonehenge? A dismantled stone circle in the Preseli hills of west Wales

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Keywords: Britain, Preseli, Stonehenge, megaliths, Neolithic, stone circle, legend

Introduction

In the oldest story of Stonehenge's origins, the *History of the Kings of Britain* (*c*. 1136), Geoffrey of Monmouth describes how it was built using stones from a stone circle in Ireland, originally erected by giants. The Giants' Dance (*Chorea Gigantum*), located on legendary Mount Killaraus, was dismantled by Merlin and shipped to Amesbury (*Ambrius*) on Salisbury Plain by a force of 15,000 men, who had defeated the Irish and captured the stones. According to the legend, Stonehenge was built to commemorate the deaths of Britons treacherously killed by Saxons during peace talks at Amesbury. Merlin wanted the stones of the Giants' Dance for their magical, healing properties; the giants cured their ills by throwing water on the stones and bathing in troughs beneath them.

This 900-year-old legend is clearly fantasy: there never were any giants, the Saxons arrived not in prehistory but only 700 years before Geoffrey's time, and none of Stonehenge's stones come from Ireland. Yet the fact that some of Stonehenge's stones – the 'bluestones' – derive from Wales, far to the west of Salisbury Plain, has led to speculation that there may be a grain of truth in Geoffrey's otherwise unreliable pseudo-history (Burl 2006: 19–21; Darvill & Wainwright 2009). This region of southwest Wales was considered Irish territory in the time that Geoffrey was writing about, a tantalising addition to the mystery (Davies 1982: 87–8, 95; 1990: 39; Thomas 1994: 51–112).

One such grain is the possibility that the bluestones did indeed derive from a stone circle in west Wales, dismantled and re-erected as Stonehenge. A similar conclusion was reached a century ago by geologist Herbert Thomas who established that the spotted dolerite bluestones at Stonehenge originated in the Preseli hills of west Wales where, he suspected, they had originally formed a 'venerated stone circle' (1923: 258).

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From the perspective of our *Stones of Stonehenge project* (Parker Pearson *et al*. 2015; 2019), the hypothesis that Stonehenge was built for the ancestors could be expanded to explain the significance of the bluestones as markers of ancestral identity, originally forming an ancestral circle or monument in Preseli (Parker Pearson & Ramilisonina 1998). Our excavations at Stonehenge provided evidence that the bluestones were first set up in the Aubrey Holes (the ring of pits that surround the stone circle we see today) during the monument's first stage beginning in *3080–2950 cal BC* (*95% probability*) when its bank and ditch were constructed (Parker Pearson *et al*. 2009; Darvill *et al*. 2012; Parker Pearson *et al*. in press). Thus a hypothetical original, dismantled stone circle in Wales would date to this period or earlier.

With identification and excavation of bluestone megalith quarries with evidence which suggests they date to *c*. 3400–3000 cal BC at Craig Rhos-y-felin and Carn Goedog in the Preseli hills, reported in *Antiquity* 89 & 93, the search for a dismantled stone circle in the region has been narrowed down to a setting of former standing stones at Waun Mawn (Parker Pearson *et al*. 2015a; 2019; Figure 1). These four monoliths, three of them now recumbent, originally stood in an arc, identified a century ago as remnants of a stone circle (RCAHMW 1925: 258–9). Later researchers classified this site as 'doubtful or negative' and 'destroyed or unrecognisable' (Grimes 1963: 150; Burl 1976: 371).

A dismantled stone circle at Waun Mawn

Our *Stones of Stonehenge project* identified Waun Maun as a site of interest in 2010 but magnetometer and earth resistance surveys in 2011 failed to locate any geophysical anomalies that might reveal the positions of stoneholes. Consequently, Waun Mawn was left unexplored in subsequent years during which we investigated other sites in the quarries' vicinity. Although numerous circular monuments were surveyed and excavated between 2012 and 2017, none turned out to be Neolithic (*e.g*. Casswell *et al*. 2018; Parker Pearson *et al*. 2017; 2018).

In 2017 we returned to Waun Mawn, excavating trenches at both ends of the arc to discover two stoneholes whose standing stones had gone (Figure 2). We realised that magnetometry was unsuitable on the non-magnetic substrate of glacial drift deposits and so undertook further surveys using earth resistance, ground-penetrating radar (GPR) and electro-magnetic induction (EMI) in 2018. The results were disappointing because of the minimally magnetic and conductive properties of the substrate, and it became clear that only archaeological excavation could reveal further stoneholes.

In September 2018, we extended excavations beyond each end of the arc of surviving stones in the northeast and northwest, and opened up further small trenches in the west, southwest and south, following the expected circumference of the circle as revealed by its arc (Figure 3). Of the 12 sub-surface features recovered, six (including the two located in 2017) turned out to be stoneholes with emptied sockets from which standing monoliths had been removed. We also excavated the stoneholes of two of the fallen stones at the ends of the arc. Together, these indicated that the diameter of this former stone circle was 110m (Figure 4). The six stoneholes and four surviving standing stones (ten in all) may have formed a circle of 30–50 stones, though only future excavation will allow this estimate to be refined.

Most of the stoneholes were shallow pits (0.80–1.20m diameter x 0.30–0.50m deep) containing stone packing around an emptied socket subsequently filled with sediment after removal of the standing stone along a shallow ramp (up to 0.50m long). The base of each socket bears the imprint of the monolith that once stood in it, preserving each stone's basal shape and size (Figure 5). The largest of these (Stonehole 91) left an unusual pentagonal imprint while four other stoneholes had rectangular or square imprints (Figure 6).

Dating Waun Mawn stone circle

Prehistoric artefacts recovered from Waun Mawn include a flint scraper, a flint chip and a trimmed circular mudstone disc. None are closely dateable although the disc is of a type found in Neolithic levels at the megalith quarry of Carn Goedog, 5km to the east. Prehistoric stone circles are exceedingly difficult to date, not only because of their paucity of material culture but also because of the lack of materials suitable for radiometric dating that can be retrieved from stoneholes. This problem is exacerbated by the acidic soils at Waun Mawn which prevent the survival of antler picks or animal bones. Radiocarbon dating in such contexts is restricted to samples of wood charcoal recovered by flotation of sediments but their small size (under 4mm long) renders them likely to have been affected by bioturbational displacement, intruding into earlier contexts, as well as being residual in later contexts.

To resolve this, radiocarbon dating of these small samples was carried out in conjunction with optically stimulated luminescence (OSL) dating of sediment within the packing deposits (from the monoliths' erection) and filled-in sockets (after the monoliths' removal). OSL dating determines the burial age of sediment – with the dating signals reset by daylight exposure at deposition. For sediments that have experienced more complex depositional histories, the true burial age can be obscured by materials which were poorly reset at deposition or by younger materials which infiltrate through the stratigraphies.

OSL dating

OSL dating was carried out on 11 feature profiles, consisting of 195 field- and 162 laboratory-profiling samples, enclosing 18 dating samples. Field profiling proved valuable in interpreting the site formation processes, and establishing the relationship between primary or 'constructional' fills and secondary fills that accumulated after monolith removal. The subsequent programme of laboratory characterisation and screening revealed more complex depositional histories to the socket fills than suggested in the field, indicating a complex mixing of archaeological materials and substrate in the basal layers, and the infiltration of young materials through the fills. Notwithstanding this, the stored dose distributions as obtained within discrete features showed good internal stratigraphic coherence, and indicate those parts of the fill that might return Neolithic or Early Bronze depositional ages.

The work then progressed to full quantitative luminescence dating. All 18 samples were characterised by heterogeneous sensitivity and equivalent dose distributions, indicating complex depositional histories, with both low apparent doses (contamination from recent sediments) and high apparent doses (poor bleaching at deposition and/or *in situ* weathering of the substrate), obscuring the archaeologically significant doses. Individual ages fall in the range from AD 1900±20 to 6980±2120 BC, the large error reflecting the heterogeneous mixed-age equivalent dose distributions. Samples within the primary fills of the four sampled stoneholes have weighted combinations suggesting a probable date of construction of 3530±330 BC (5.55 ±0.33ka). Samples within the secondary fills, with weighted combinations from two stoneholes, suggest removal of the stones before 2120±520 BC (4.14 ±0.52ka). Of course, the moment of removal has left no dateable sediments since these could accumulate only once the monoliths had gone; these sediments could have accumulated at any time in the centuries or even millennia after stone removal.

Radiocarbon dating

Forty-three samples of wood charcoal were dated at radiocarbon laboratories in Oxford (ORAU) and Glasgow (SUERC; Table 1). Of these, 31 came from stoneholes and the remainder from other features. The majority of dates fall in the ninth–fifth millennia cal BC, broadly the Mesolithic, and can be excluded as residual in the stonehole fills since they fall outside the ranges provided by OSL dating. Those dates that are later than the OSL date range for construction (during the second and first millennia cal BC; the Bronze Age and Iron Age) can similarly be excluded as intrusive. That leaves a group of seven dates, four of them from stoneholes; all of these fall within the later part of the fourth millennium cal BC – the end of the Early Neolithic and during the Middle Neolithic (Figure 7). Since some of these samples could also have been either residual or intrusive, we propose that the stone circle was erected in *c*. 3600–3000 cal BC.

This would place Waun Mawn amongst the earliest stone circles in Britain, alongside Long Meg and her Daughters in Cumbria (107m diameter) and the stone circle underneath the passage tomb of Bryn Celli Ddu on Anglesey, north Wales (18m diameter). Hazel charcoal in one of the stoneholes of Long Meg and her Daughters is radiocarbon-dated to 3340–3100 cal BC (Archaeological Services Durham University 2016: 6). Cremated human remains from pits associated with stoneholes at Bryn Celli Ddu are dated to 3500–3100 and 3310–2900 cal BC (Burrow 2010: 258–61, table 2). Given that no stone circle in Britain dates before *c*. 3400 cal BC, a date in the later part of this range – *c*. 3400–3200 cal BC – is suggested for Waun Mawn. An end date of 3200 BC for construction of Waun Mawn is proposed since this is the limit of the OSL date. Additionally, the one Neolithic radiocarbon date from a stonehole at Waun Mawn that falls after 3200 BC is of 3340–3030 cal BC from the fill of emptied Stonehole 37, after the stone had been removed (Table 1). It thus may relate to the stone's removal and not its erection.

The geology of the stones at Waun Mawn

The four surviving stones at Waun Mawn are of unspotted dolerite, likely to derive from outcrops 3km away at Cerrigmarchogion and Craig Talfynydd, on the Preseli ridge southeast of Waun Mawn (Bevins *et al*. 2013). The only indication of the geology of the monoliths removed from the six other stoneholes was provided by a stone flake in the socket left by the standing stone with the pentagonal base (Figure 8). This flake of unspotted dolerite lay on the edge of the ramp, having become detached either during erection or removal of the monolith. It is likely to have the same source on the ridge to the southeast as the unspotted dolerite pillars at both Stonehenge and Waun Mawn.

Of the three bluestones of unspotted dolerite at Stonehenge (Stones 44, 45 & 62), Stone 62 has a pentagonal cross-section at the turf line, of similar shape and dimensions to the imprint in Stonehole 91. Potentially Stone 62 began its life in Preseli, standing in Stonehole 91 at Waun Mawn. The un-dressed Stones 44 & 45 at Stonehenge, in the outer circle of bluestones, are of similar size to the standing stone (2m long) and the stone associated with stonehole 9 (1.2m long) at Waun Mawn but are smaller than its two recumbent stones (3.2m long) which are likely to be slightly longer than Stone 62 at Stonehenge which stands 2m tall above ground. Thus the Waun Mawn stones's dimensions compare well with those of the three unspotted dolerite pillars at Stonehenge.

A solstitial alignment at Waun Mawn

Two stoneholes had neither packing stones nor ramp. One had formerly held the small recumbent stone at the east end of the arc, a stumpy monolith 1.20m long, 0.90m wide and 0.25m thick (Figure 9). The other lay 13m to its east, its former monolith now absent (Figure 10). There were no cut features in between the two stoneholes. These two stones had been set with their longer sides perpendicular to the circumference of the circle rather than parallel with it.

As a result, the two monoliths would have formed 'gunsights' to sight along. We interpret them as forming an entrance on the northeast side of the circle. Viewed from the stone circle's centre in the Neolithic, the midsummer solstice sun rose within this entrance, 2° to the right of the western of the two monoliths (see Figure 4).

Discussion

Waun Mawn is the third largest of Britain's great stone circles with diameters over 100m: Avebury outer circle (331m; Gillings & Pollard 2004), Stanton Drew (113m; Burl 1999: fig. 6), Long Meg and her Daughters (107m; Soffe & Clare 1988), the Ring of Brodgar (104m; Richards 2013: 90–118), and the north and south circles at Avebury (104m). By comparison the inferred bluestone circle of monoliths that stood within the Aubrey Holes – Stonehenge Stage 1 – is only 97m in diameter. Unlike that circle with its stoneholes spaced every *c*. 4.5m, Waun Mawn's stones appear to have been spaced more irregularly. Gaps in its perimeter where no stones were ever erected, especially on the northwest side, may be interpreted in two different ways. First, the absence of stones around the circuit may simply demonstrate non-completion. Alternatively, the spacing and frequency of stones was strategic in providing enhanced imagery of the circle when viewed or encountered from particular directions, as has been noted at other stone circles (*e.g*. Na Dromannan [Calanais X] and the Ring of Brodgar; Richards 2013: 114–18, 251–3). Under these circumstances, the change in architecture between Waun Mawn and the Aubrey Hole circle at Stonehenge testifies to an altered emphasis and perspective, the latter being one of regularity and homogeneity.

The midsummer solstice sunrise orientation of Waun Mawn's entrance provides a parallel with Stonehenge which is positioned at the southwest end of a geomorphological landform of parallel ridges bordering periglacial fissures coincidentally aligned on the solstitial axis (Allen *et al*. 2016). At the same time in Stage 1, however, Stonehenge's entrance was additionally aligned broadly with northernmost major moonrise, a direction that seems not to have been marked at Waun Mawn (Ruggles 1997).

Another link between the two sites is provided by their shared diameters: Stonehenge is enclosed by a circular ditch with a diameter of 110m, and Waun Mawn is the only known British Neolithic monument with the same diameter (Figure 11). The imprint of Stonehole 91 at Waun Mawn matching the basal cross-section of Stone 62 at Stonehenge further hints at a close relationship between the two monuments.

Whilst we believe a strong case can be made for Waun Mawn as the origin of at least part of Stonehenge, it is unlikely that its circle ever contained as many as 56 standing stones, the number indicated by the Aubrey Holes. An estimated 80 or so bluestones are thought to have been brought to Salisbury Plain, the 56 in the Aubrey Holes augmented by some 25 in the nearby circle of Bluestonehenge (Allen *et al*. 2016). During Stonehenge's Stage 2 (beginning in *2740–2505 cal BC*), a double arc of stoneholes (the Q & R Holes) held an estimated 82 bluestones, thought to be a rearrangement amalgamating the bluestones in the Aubrey Holes and in Bluestonehenge (Atkinson 1956: 49; Parker Pearson *et al*. in press).

The geology of the Waun Mawn stones – all unspotted dolerite, including the chip from Stonehole 91 – is also at odds with the proportions of the 44 bluestones surviving at Stonehenge today: only three of these are of unspotted dolerite, compared to 27 spotted dolerite stones. Of course, the fact that the four unspotted dolerite Waun Mawn stones were left behind may help to explain why there are so few such pillars at Stonehenge, but it seems more likely that Waun Mawn contributed only a small proportion of Stonehenge's 80 or so bluestones.

This raises the question of whether multiple monuments in Wales contributed monoliths that were moved to Stonehenge and Bluestonehenge. It is clear that the Altar Stone (Stone 80 at Stonehenge) comes not from Preseli but most likely from Devonian Sandstone of the Senni Formation about 100km to the east (Ixer *et al*. 2019). Similarly the two other sandstone pillars at Stonehenge (Stones 40g & 42c) are of Lower Palaeozoic sandstone which is found across a large area north and east of Preseli (Ixer *et al*. 2017). Both types of sandstone pillars could derive from circles or other megalithic monuments outside Preseli. It is possible, if not likely, that another or several stone circles were dismantled in the Preseli area to provide the full number of bluestones, with their varied range of lithologies that includes spotted dolerite and various types of rhyolite and volcanics (Ixer & Bevins 2011a & b; Bevins *et al*. 2013; Ixer *et al*. 2015; 2016).

Conclusion

Is Waun Mawn the Giants' Dance described by Geoffrey of Monmouth? Might there be any truth in the legend? Archaeology and myth make awkward bed-fellows at the best of times, and we have to reject the details of Geoffrey's story concerning the appropriation of the stones. The shared diameters of Waun Mawn and Stonehenge's enclosing ditch, as well as their midsummer solstice sunrise orientations, would suggest that key aspects of the circle's architecture were brought by the people of west Wales to Salisbury Plain, there to be both transformed and reinstated, not taken by force as a trophy by a Neolithic Merlin and his army.

This interpretation is supported by recent results of isotopic analysis on 25 of the *c*. 60 cremation burials from Stonehenge. Of these 25 cremated individuals, four (16%) have strontium isotope ratios that are consistent with having lived the last decades of their lives on the Ordovician/Silurian rocks of southwest Wales, including around the outcrops of the Preseli hills (Snoeck *et al*. 2018). The remainder have ratios consistent with living on the Chalk of Salisbury Plain or on the surrounding Mesozoic strata. If the sample of four out of 25 is representative of the total number of people buried at Stonehenge, we can extrapolate that, of the 150–240 people estimated to be buried there (Pitts 2000: 121; Parker Pearson et al. 2009: 23), 24–38 people could have had such origins. When we take into account the fact that remodelling of bone, approximately within ten years, causes strontium isotope ratios to alter to the levels found in the new environment, any long-distance migrants who then lived more than a decade on the Chalk would no longer be identifiable as such. Thus the figure of 24–38 could be doubled or even trebled to establish the real total of those who made the journey in their teens or young adulthood prior to death in their forties.

It is notable that the radiocarbon dates for the four incomers from Ordovician/Silurian geology encompass the very beginning of Stonehenge, when its standing bluestones and cemetery were first established around 3000 cal BC. Since these four represent a quarter of the earliest burials, given the estimates above, the number of migrants in this earliest stage could have been anywhere between 25% and 75%.

The isotopic analysis of the cremations reveals a chronological pattern entirely consistent with migration from the far west of first-generation settlers followed by local origins for their descendants living on the Chalk and its environs. This pattern of migration to Stonehenge may also have included livestock; the mandible of an elderly cow in Stonehenge's enclosing ditch, dating to 3350–2920 cal BC, has tooth enamel with a strontium isotope ratio consistent with having been reared in west Wales (Evans *et al*. 2019).

The complete absence at Waun Mawn of radiocarbon dates falling within the millennium after 3000 cal BC is in accordance with the scarcity of third-millennium dates from other sites in the Preseli region of north Pembrokeshire, despite decades of research into its Neolithic (Darvill & Wainwright 2016: 108–14). Equally, Waun Mawn did not become the core of a monument complex of the kind known around other great stone circles, such as Stanton Drew, Avebury, Long Meg and her Daughters, and Stonehenge; its development would appear to have been curtailed by early dismantling. Whilst the region was probably not entirely evacuated – the four remaining stones at Waun Mawn possibly symbolising the identities of those groups who stayed on – it may have been extensively depopulated. Only further research into settlement and land use making use of other lines of evidence such as palynology will provide answers to this.

It would seem, in conclusion, that Stonehenge Stage 1 was built, largely or wholly, by Neolithic migrants from Wales, bringing their monument or monuments as a physical manifestation of their ancestral identities to be re-created in similar form on Salisbury Plain at a locale already with a long tradition of ceremonial gathering (Parker Pearson *et al*.

2015b: 75–80). Yet Stonehenge's first stage may also have served to unite the people of southern Britain, bringing bluestones to the land of sarsen stones and installing them at a sacred *axis mundi* where the sky and the earth were in cosmic harmony and where people of different cultural and regional origins might gather for collective monument-building and feasting (Allen *et al*. 2016; Gron *et al*. 2018; Parker Pearson *et al.* in press; Figure 12).

Previous interpretations of Stonehenge have included its role as a monument of unification, bringing together the peoples of western and eastern Britain (Childe 1957: 331; Parker Pearson 2013; 2019; Parker Pearson *et al*. 2015b). This theory draws upon the notion that Stonehenge lay within a 'neutral' zone, marked by a north-south line of henges, stone circles and cursuses from the Thames valley to the south coast of England, and on regional differences in earlier Neolithic material culture and genetic ancestry between east and west (Pioffet 2017; Brace *et al*. 2019).

The evidence for a potential migration accompanying the movement of the bluestones opens a further line of enquiry into explaining Stonehenge. It raises new questions about why people from west Wales were moving themselves, their animals and sacred stones to Stonehenge. If this was the case, what were the drivers of such a migration? Were they climatic and economic or social and political? Was there a social and political vacuum on Salisbury Plain which left its ceremonial complex ripe for take-over? Any such event need not preclude the possibility that both migration and unification were involved.

Acknowledgements
We thank the Barony of Cemaes, Cyfoeth Naturiol Cymru (Natural Resources Wales) and the Pembrokeshire Coast National Park for permissions to excavate at Waun Mawn. The excavations and research in 2017 and 2018 were funded by the Gerda Henkel Stiftung (grant nos: AZ 11/V/17 & AZ 08/V/18), the Rust Family Foundation, the NERC Radiocarbon Panel and Raw-Cut TV. Geophysical surveys in 2018 were carried out by Jonathan Monteith and Ashely Green (Bournemouth University) and by Philippe De Smedt (Ghent University). Useful comments were received from the two reviewers, allowing our manuscript to be extended and improved.

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Table 1. Radiocarbon dates from Waun Mawn, shown in chronological sequence. Calibrated dates are given at 95.4% probability.

Context	*Context type*	*Date cal BC/AD*	*Date BP*	*Sample number*	*Material*	*Species*
Stoneholes						
10	Stonehole 9 (removal)	170 BC–AD 10	2058±28	OxA-38670	Wood	*Quercus* sp.
39	Stonehole 37 (erection)	360–160 BC	2171±20	SUERC-82810	Wood	*Corylus avellana*
16	Stonehole 3 (fall)	1050–900 BC	2816±28	OxA-38284	Wood	*Corylus avellana*
16	Stonehole 3 (fall)	1220–1020 BC	2924±28	OxA-38283	Wood	*Quercus* sp.
70	Stonehole 91 (removal)	1620–1500 BC	3289±23	OxA-38475	Wood	*Quercus* sp.
19	Stonehole 3 (erection)	2140–1940 BC	3646±23	OxA-38428	Wood	*Quercus* sp.
38	Stonehole 37 (removal)	3340–3030 BC	4480±25	OxA-38436	Wood	*Quercus* sp.
23	Stonehole 21 (erection)	3500–3340 BC	4607±24	OxA-38433	Wood	*Quercus* sp.
18	Stonehole 17 (removal)	3650–3520 BC	4804±24	OxA-38432	Wood	*Quercus* sp.
38	Stonehole 37 (removal)	3670–3520 BC	4827±28	OxA-38435	Wood	*Quercus* sp.
20	Stonehole 17 (erection)	4060–3820 BC	5179±36	OxA-38671	Wood	*Quercus* sp.
90	Stonehole 91 (erection)	4340–4230 BC	5413±26	OxA-38473	Wood	*Quercus* sp.
70	Stonehole 91 (removal)	4340–4240 BC	5428±26	OxA-38474	Wood	*Corylus avellana*
27	Stonehole 30 (removal)	4360–4260 BC	5468±26	OxA-38472	Wood	*Quercus* sp.
27	Stonehole 30 (removal)	4450–4270 BC	5509±28	OxA-38689	Wood	*Quercus* sp.
70	Stonehole 91 (removal)	4450–4320 BC	5507±24	SUERC-82812	Wood	*Corylus avellana*
90	Stonehole 91 (erection)	4510–4400 BC	5652±24	SUERC-82811	Wood	*Corylus avellana*
90	Stonehole 91 (erection)	4620–4370 BC	5671±42	OxA-38673	Wood	*Quercus* sp.
19	Stonehole 3 (erection)	4830–4700 BC	5881±25	OxA-38367	Wood	*Corylus avellana*

23	Stonehole 21 (erection)	5810–5670 BC	6891±26	OxA-38372	Wood	cf *Corylus avellana*
22	Stonehole 21 (removal)	6220–6070 BC	7280±27	OxA-38373	Wood	*Quercus* sp.
40	Stonehole 7 (erection)	6230–6080 BC	7302±27	OxA-38369	Wood	*Quercus* sp.
8	Stonehole 7 (removal)	6420–6250 BC	7467±28	OxA-38429	Wood	*Quercus* sp.
8	Stonehole 7 (removal)	6460–6390 BC	7548±24	SUERC-82805	Wood	*Quercus sp.*
40	Stonehole 7 (erection)	6470–6410 BC	7581±24	SUERC-82804	Wood	*Quercus* sp.
18	Stonehole 17 (removal)	6480–6410 BC	7585±28	OxA-38371	Wood	cf *Corylus avellana*
8	Stonehole 7 (removal)	6660–6500 BC	7779±29	OxA-38368	Wood	*Quercus* sp.
22	Stonehole 21 (removal)	6780–6460 BC	7782±63	OxA-38672	Wood	*Quercus* sp.
10	Stonehole 9 (removal)	7190–7050 BC	8129±30	OxA-38430	Roundwood	*Corylus avellana*
39	Stonehole 37 (erection)	7580–7460 BC	8428±31	OxA-38434	Wood	*Corylus avellana*
39	Stonehole 37 (erection)	7600–7520	8514±35	OxA-38690	Wood	*Corylus avellana*
Mound (accumulated beside Stonehole 9)						
34	Mound	50 BC–AD 60	1999±21	OxA-38370	Roundwood	cf *Quercus* sp.
35	Mound	810–770 BC	2588±22	OxA-38431	Wood	*Quercus* sp.
35	Mound	1220–1050 BC	2941±21	SUERC-82809	Wood	*Quercus* sp.
Pits (not considered stoneholes)						
94	Pit 49 (secondary fill)	2140–1920 BC	3645±29	OxA-38691	Wood	*Quercus* sp.
54	Pit 45 (primary fill)	3090–2910 BC	4376±23	OxA-39634	Wood	*Quercus* sp.
74	Pit 73 (primary fill)	3500–3110 BC	4568±26	OxA-38438	Wood	*Quercus* sp.
65	Pit 73 (secondary fill)	3520–3360 BC	4642±25	OxA-38479	Wood	*Quercus* sp.
80	Pit 81 (primary fill)	4780–4600 BC	5827±27	OxA-38478	Wood	*Quercus* sp.
46	Pit 45 (secondary fill)	5710–5560 BC	6716±26	OxA-38633	Nutshell	cf *Corylus avellana*
48	Pit 47 (primary fill)	5470–5320 BC	6400±27	OxA-38476	Wood	*Quercus* sp.

48	Pit 47 (primary fill)	5610–5480 BC	6574±27	OxA-38437	Wood	*Quercus* sp.
95	Pit 49 (primary fill)	8460–8280 BC	9139±33	OxA-38477	Wood	*Ulex/Genista/ Cytisus*

OxA-39634	4376	23	3086-2914 BC	54-37-151	54	Pit 045 primary fill

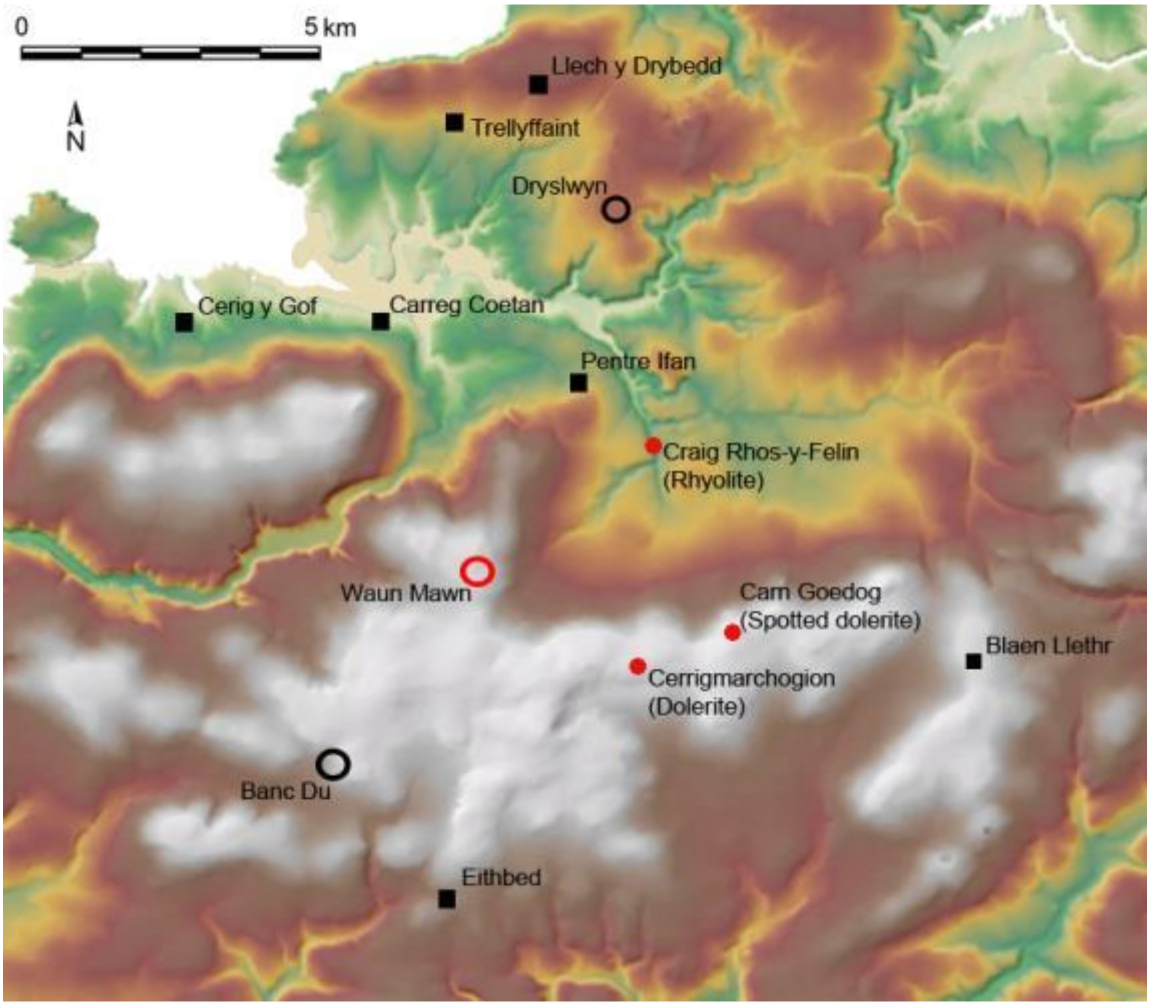

Figure 1. Location of the dismantled stone circle of Waun Mawn (red-ringed circle) as well as the bluestone sources of Carn Goedog (spotted dolerite), Craig Rhos-y-felin (rhyolite) and Cerrigmarchogion (unspotted dolerite). The locations of the Neolithic causewayed enclosure of Banc Du and palisaded enclosure of Dryslwyn (black-ringed circles), and Early Neolithic portal tombs (black squares) are also shown.

Figure 2. The arc of former standing stones at Waun Mawn during trial excavations in 2017, viewed from the east. Only one of them (third from the camera) is still standing. Recumbent stone 13 is in the foreground.

Figure 3. Waun Mawn during excavation in 2018, viewed from the north. The stone circle sits on the side of the hill Cnwc yr Hŷ (‘the hillock of the deer’) at 311m OD with distant views of Ireland to the west and the mountains of Snowdonia to the north.

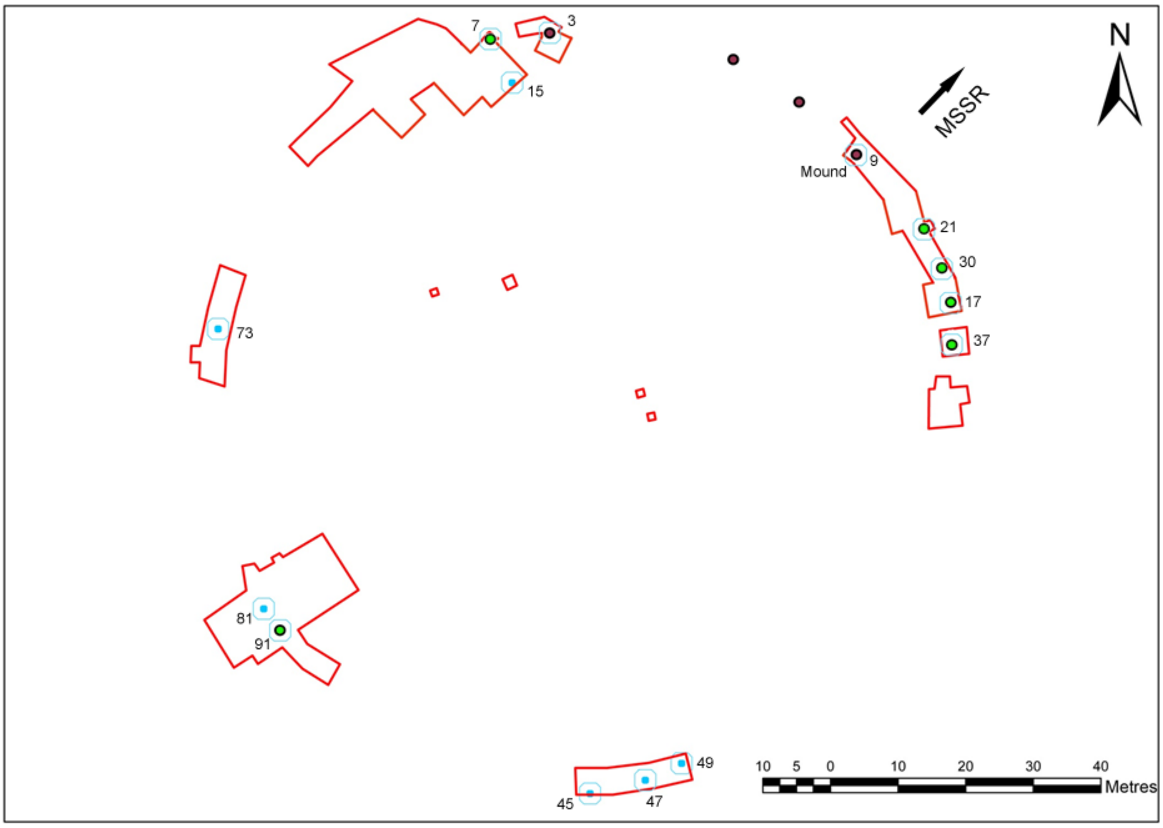

Figure 4. The excavation trenches (in red) showing the locations of the four remaining standing stones (in red and black), the additional stoneholes (in green and black) and other features (in blue). From the centre of the circle, the midsummer solstice sun rose within the entrance formed by Stoneholes 9 and 21.

Figure 5. Stonehole 7, after removal of sediment filling the emptied socket but with the stone packing still in place, viewed from the east. The packing stones were created from a single boulder, split into pieces before being packed against the side of the monolith. Its imprint in the base of the stonehole reveals that this monolith had a square cross-section.

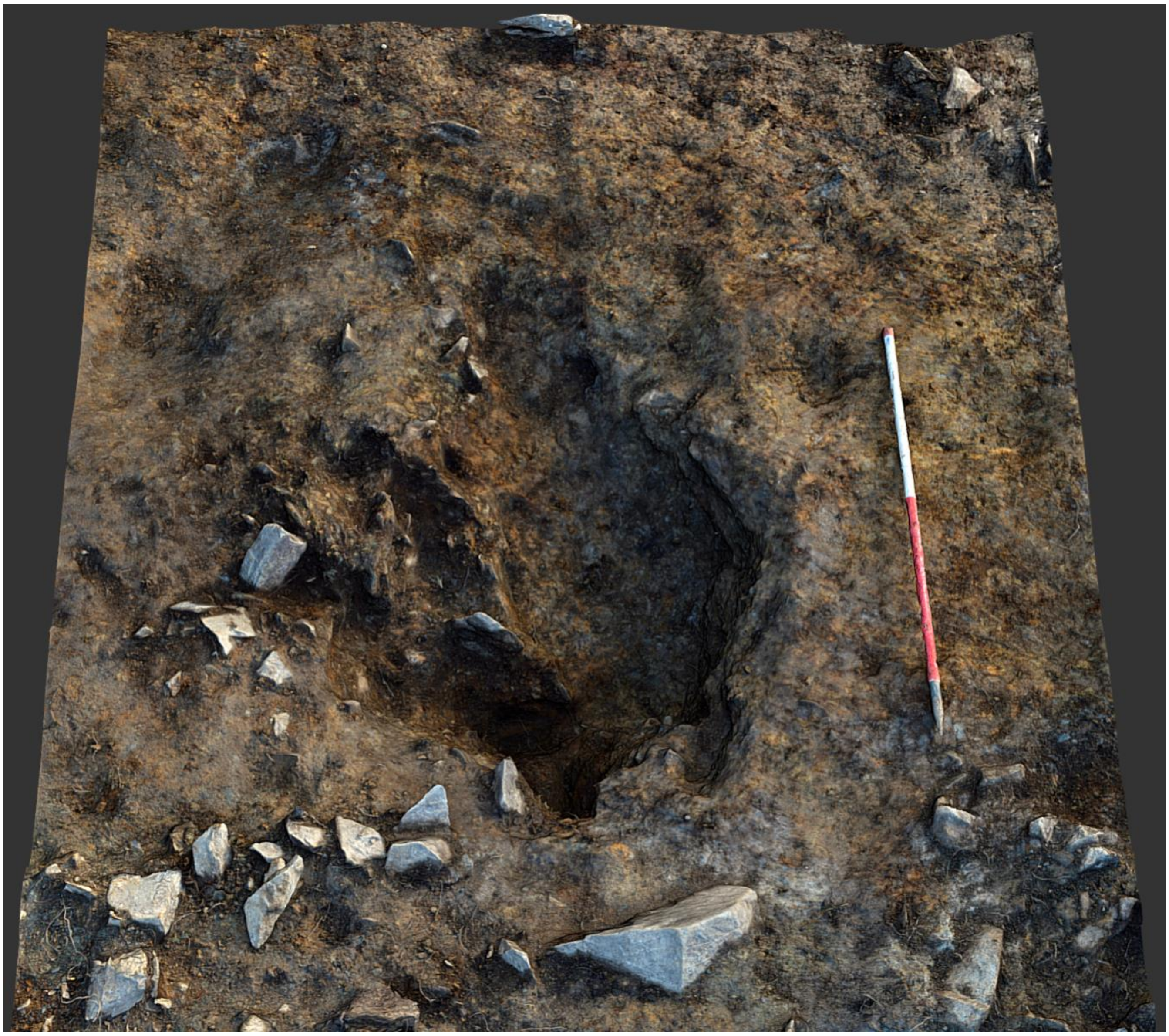

Figure 6. A 3-D photogrammetric image of Stonehole 91 after excavation of the socket left by the standing stone's removal (but with the packing fill remaining *in situ*), viewed from the north. The imprint of this stone (in the right half of the stonehole) reveals that the base of this stone had a pentagonal cross-section. The ramp, along which the stone was erected and removed, is at the top of the picture.

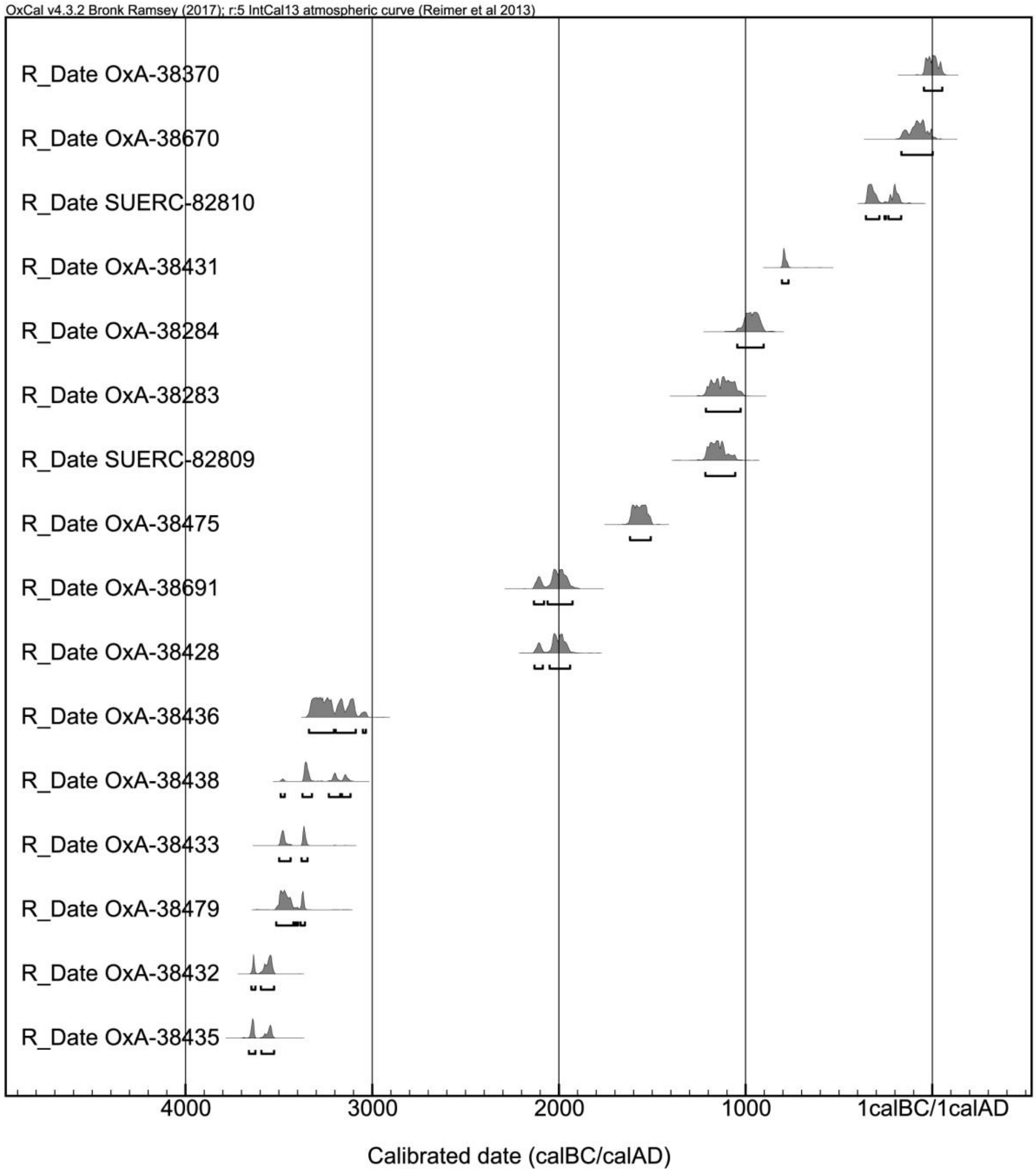

Figure 7. Radiocarbon determinations of Neolithic and later date from all features at Waun Mawn (dates from the Mesolithic period have been excluded). Note the absence of dates within the third millennium cal BC.

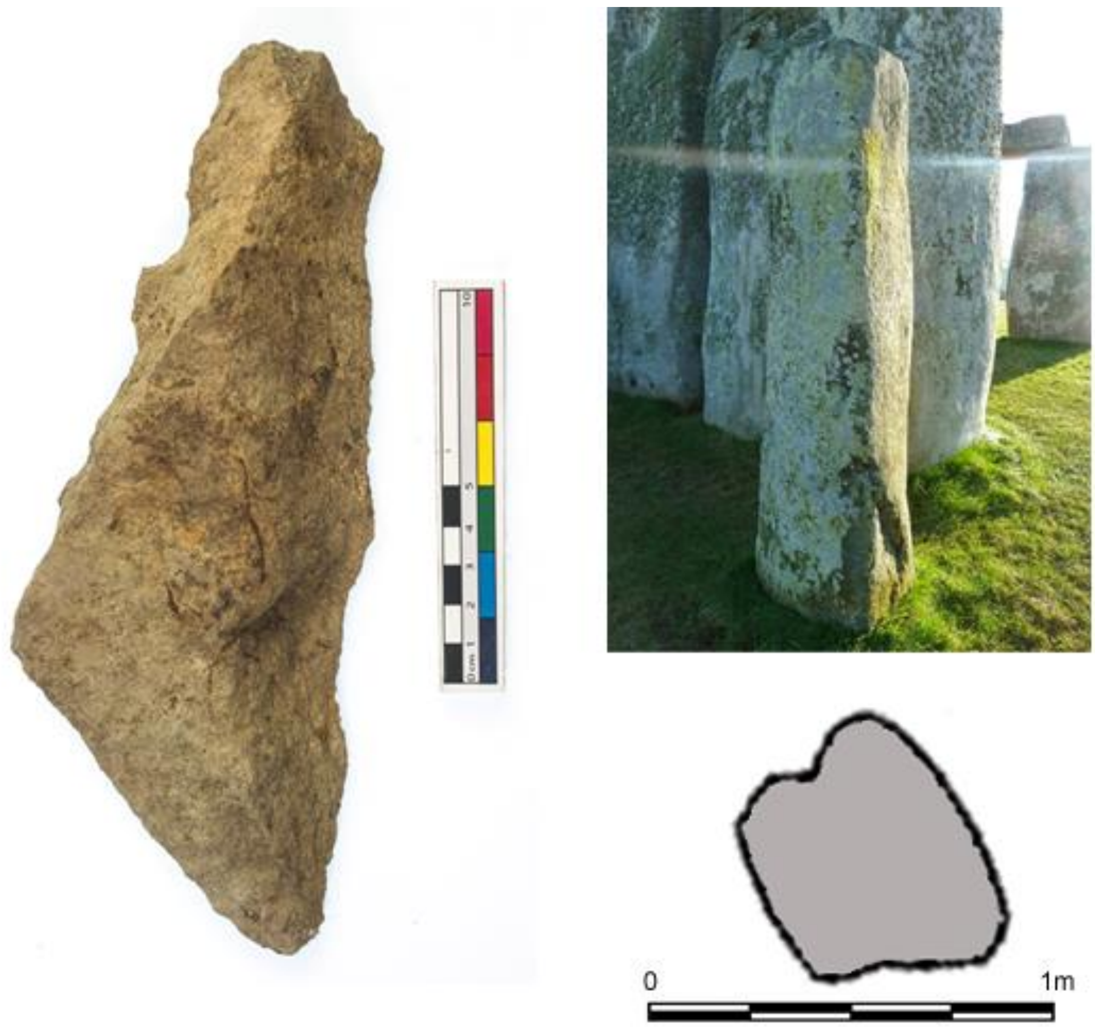

Figure 8. Left: a flake of unspotted dolerite from Stonehole 91 was recovered from the junction of the empty socket and the ramp. Top right: Stone 62 is one of the three unspotted dolerite pillars at Stonehenge. Bottom right: Stone 62’s basal cross-section matches the imprint of the pillar that once stood in Stonehole 91 at Waun Mawn.

Figure 9. Recumbent stone 013 lying beside its stonehole (9), viewed from the west. It formed the west side of the stone circle's northeast-facing entrance. Although the top of this pillar (left) is broken-off, its weathered surface indicates that this probably occurred long before the Neolithic.

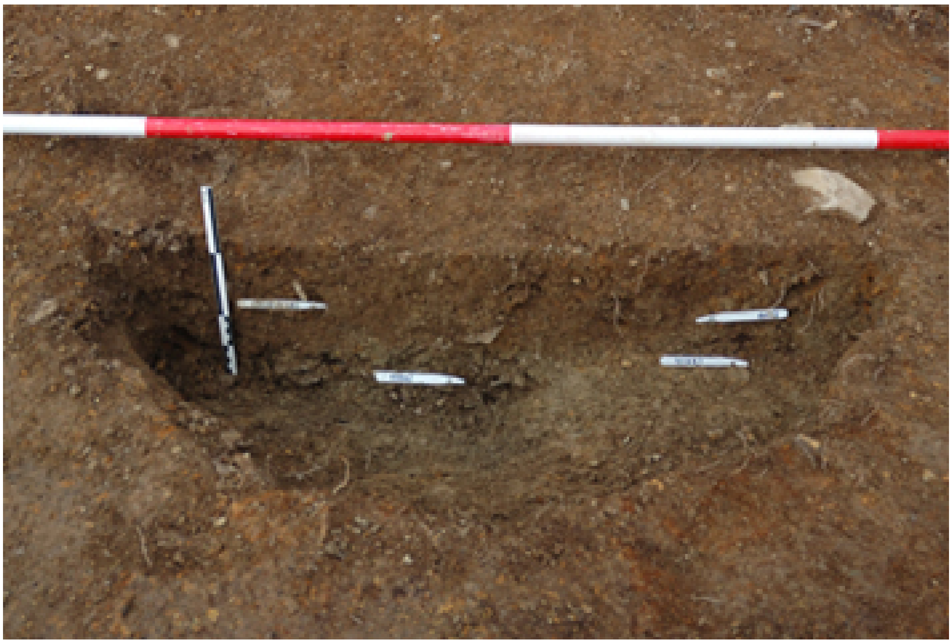

Figure 10. Stonehole 21 in half-section, viewed from the east. With its 'gunsight' arrangement, perpendicular to the circumference of the stone circle, the removed pillar would once have formed the east side of the northeast-facing entrance.

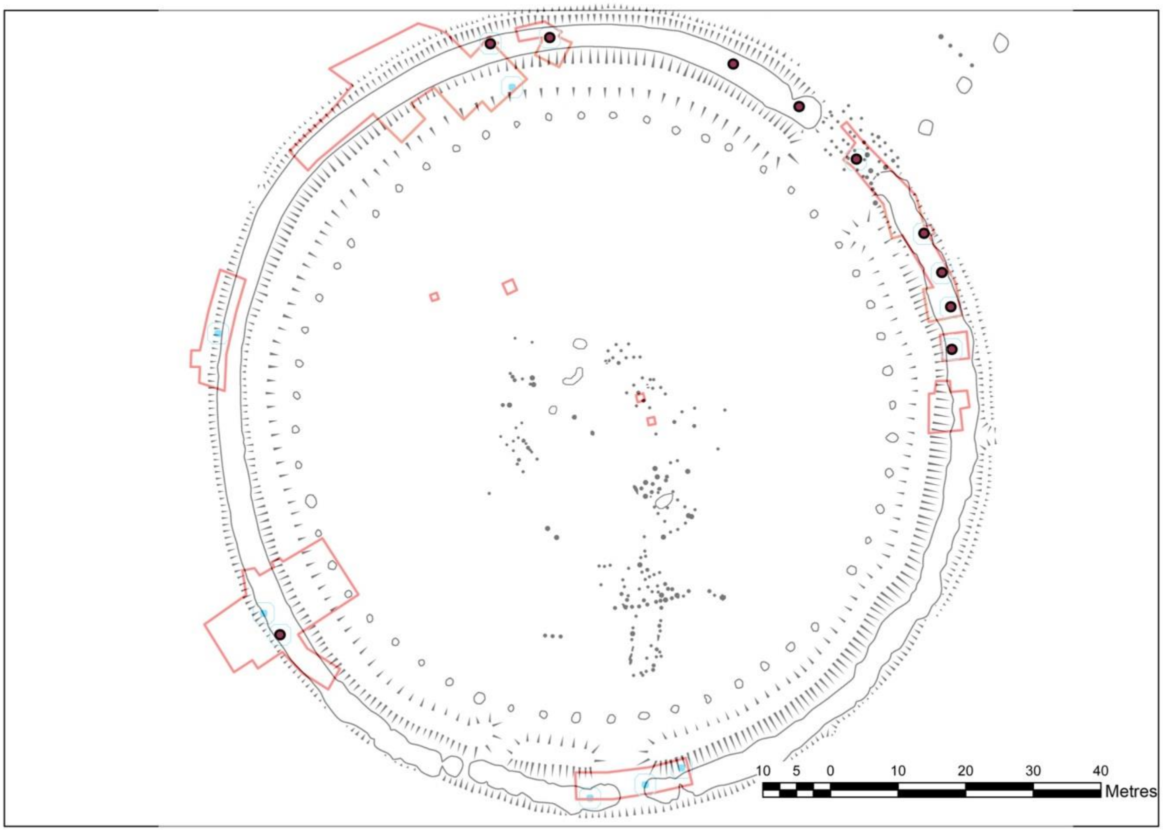

Figure 11. The plan of Waun Mawn overlaid on Stonehenge Stage 1 (beginning in *3080–2950 cal BC* and ending in *2865–2755 cal BC*), showing their similar diameters. Stonehenge's enclosing ditch and bank were constructed in *2995–2900 cal BC* (at *95%* probability).

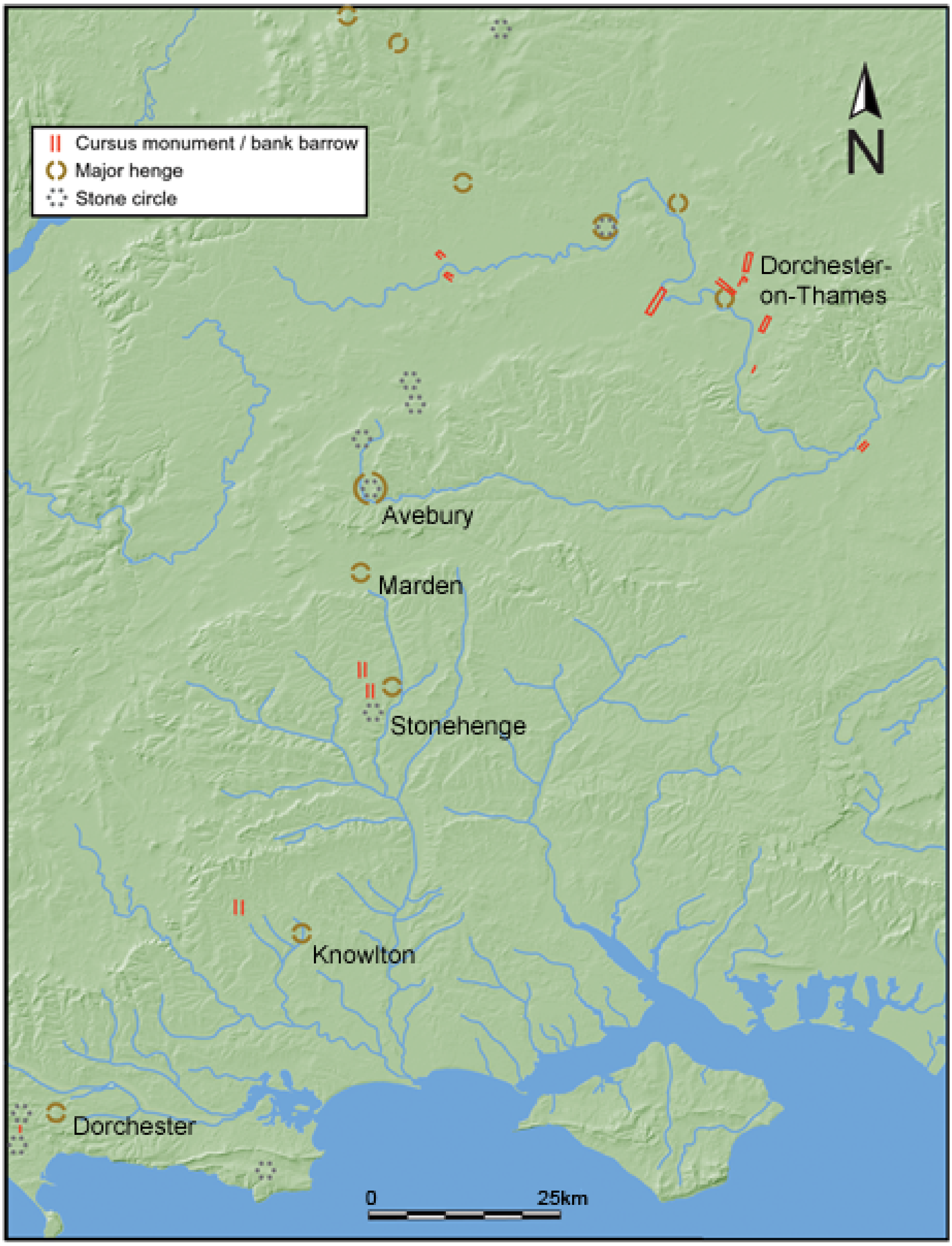

Figure 12. The location of Stonehenge and other major monument complexes of the Middle–Late Neolithic (*c*. 3400–2500 BC) that may have formed a neutral zone or territorial boundary between the west and the southeast of Britain.