Megaliths and Geology

Megálitos e Geologia

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Abstract: Stonehenge is famous for the distances moved by its stones, both sarsens and bluestones. In particular, the bluestones have their geological origins in West Wales, 225km away. Recent excavations at two of these bluestone sources – one for rhyolite and one for spotted dolerite – have identified evidence of megalith quarrying around 3000 BC, when Stonehenge's first stage was constructed. This remarkable movement of bluestones from Wales coincided with a decline in regional cultural distinctions between west and east, suggesting that building Stonehenge may have served to unify the Neolithic populations of Britain.

Keywords: Stonehenge; Megaliths; Bluestones; Quarrying; Neolithic

Paisagens longínquas: das pedreiras ao monumento em Stonehenge

Resumo: Stonehenge é famoso pelas distâncias percorridas pelas suas pedras, arenitos e pedras azuis. Em particular, as pedras azuis têm a sua origem geológica no ocidente do País de Gales, a 225 km de distância. Escavações recentes em duas dessas fontes - uma para riolito e outra para dolerito - identificaram evidências de extração de megálitos por volta de 3000 a.C., quando a primeira fase de Stonehenge foi construída. Este notável movimento de pedras azuis do País de Gales coincidiu com um declínio nas distinções culturais regionais entre o Ocidente e o Oriente, sugerindo que a construção de Stonehenge pode ter servido para unificar as populações neolíticas da Grã-Bretanha.

Palavras-chave: Stonehenge; Megálitos; Pedras Azuis; Pedreiras Neolítico

Stonehenge is unique amongst European prehistoric megalithic monuments for the distance moved by its stones (Fig. 1). Whereas the sarsens (blocks of silcrete weighing 4-30 tons) are likely to have come from 30 km away or even further (Parker Pearson, 2016), the smaller bluestones (a variety of igneous and sedimentary monoliths weighing 1-4 tons) were brought from west Wales to Salisbury Plain, a distance of at least 225 km as the crow flies (Fig. 2; Thomas, 1923; Atkinson, 1979; Parker Pearson *et al.*, 2011). Such distances are unparalleled for megalith-moving anywhere in Europe during the Neolithic or Chalcolithic; consequently, this extraordinary achievement demands explanation.

In contrast to many other megalithic monuments, the purpose of Stonehenge was not to erect a monument from the nearest available materials, but to bring specific stones across varying distances to a location which appears not to have been particularly favoured in terms of locally available stone resources (Fig. 3). It may be that the places of origin of these stones were an integral aspect of what was important about Stonehenge. By researching those origins we should come to a better understanding of what this iconic and unique monument was all about and how it helps our knowledge of prehistoric societies before the rise of early states.

Figure 1 – Stonehenge, viewed looking southwest towards the direction of midwinter solstice sunset (photo by Adan Stanford, Aerial-Cam Ltd.).

1. The Welsh bluestones at Stonehenge

Stonehenge's constructional sequence has been thoroughly reinterpreted since the threefold schemes of the 20th century (Atkinson, 1979; Cleal *et al.*, 1995). As a result of recent excavations and revisions of its stratigraphy, it is now understood as a sequence of five stages spanning the 3rd millennium BC and the first half of the 2nd, during Britain's Late Neolithic (c. 3000-2500 BC), Chalcolithic (c. 2500-2200 BC) and Early Bronze Age (c. 2200-1600 BC; Darvill *et al.*, 2012). The large, dressed sarsens with lintels were

erected in Stonehenge's Stage 2 (modelled as 2620-2480 BC) as the horseshoe of five trilithons and the outer ring of lintelled uprights. The bluestone pillars are now thought to have been arranged in a double arc or circle between the trilithons and the sarsen ring, in a setting known as the Q & R Holes within Stage 2.

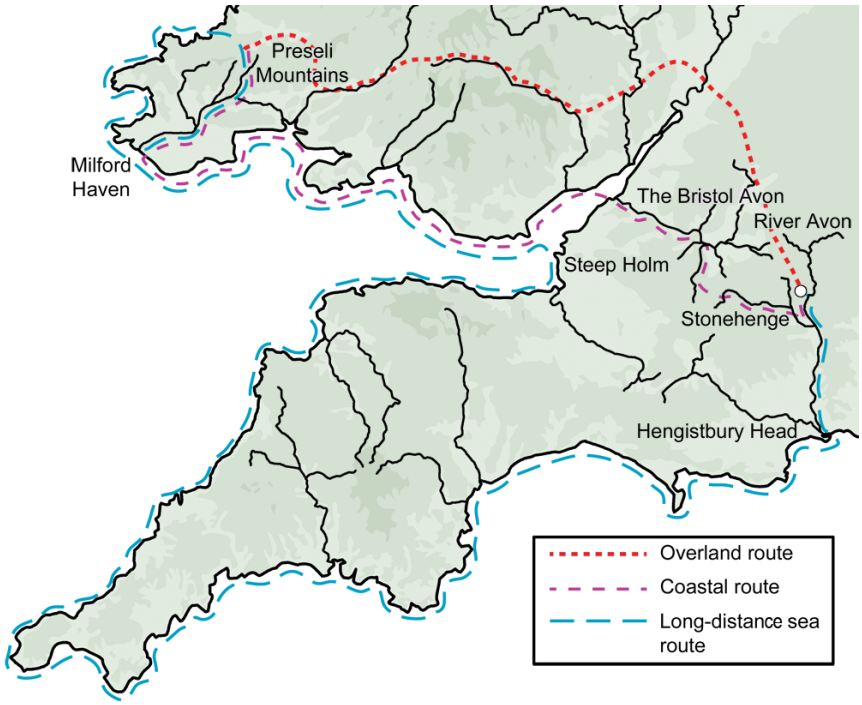

Figure 2 – Suggested routes for transporting the bluestones to Salisbury Plain; the route from Preseli to Milford Haven can now be ruled out for bluestones from Carn Goedog and Craig Rhos-y-felin (drawn by Irene de Luis).

Yet there is evidence that the bluestones were already present at Stonehenge in Stage 1, when the monument was first constructed in 3000-2920 BC. This first stage consisted of a banked and ditched circular enclosure with a variety of cut features interpreted as pits, postholes and emptied stoneholes (Fig. 4). Some of the stoneholes within the centre of the monument and outside its northeast entrance may have held sarsen monoliths. In addition, the circle of 56 Aubrey Holes inside the bank may well have held the bluestones during Stage 1.

Although Richard Atkinson was convinced from his excavation of two Aubrey Holes that they had merely been pits, the earlier excavator William Hawley concluded that 'there can be little doubt that they once held small upright stones' (Hawley, 1921: 30-31). Hawley excavated 32 Aubrey Holes and observed instances in which the basal chalk at the bottom of pits had been crushed under pressure that could only come from a stone upright, and in which the sides of the pits had been crushed during removal of standing stones. He also observed that cremation burials had been placed against the stones and in their 'packing' fills, before the stones were withdrawn, and also placed in Aubrey Holes after stones had been removed. Re-analysis of the depths and diameters of the Aubrey Holes reveals that they have the same dimensions as stoneholes in Stonehenge's later stages that contain bluestones (Parker Pearson *et al.*, 2009: fig. 8).

Stonehenge was by no means the first megalithic monument in the British Isles to incorporate a solstice alignment. Newgrange passage tomb in Ireland was built a few centuries earlier (c. 3300-2900 BC) and the rays of the midwinter-solstice sunrise famously shine down its long entrance passage (O'Kelly, 1982;

Hensey, 2015). Newgrange and its neighbouring passage tomb at Knowth incorporate rocks that are not from their immediate environs. Whilst the large kerb stones, passage stones and roof stones of greywacke come from Clogher Head, some 5 km away on the coast, other raw materials were gathered from further afield. Quartz blocks were brought from the Wicklow Mountains, some 70 km to the south, whilst granodiorite, gabbro, siltstone and granite stones probably came from up to 80 km to the north (Cooney, 2000: 136-138). The greywacke kerb stones weigh generally less than a ton, and the other rock types must have been brought in as basket-loads of cobbles and small blocks.

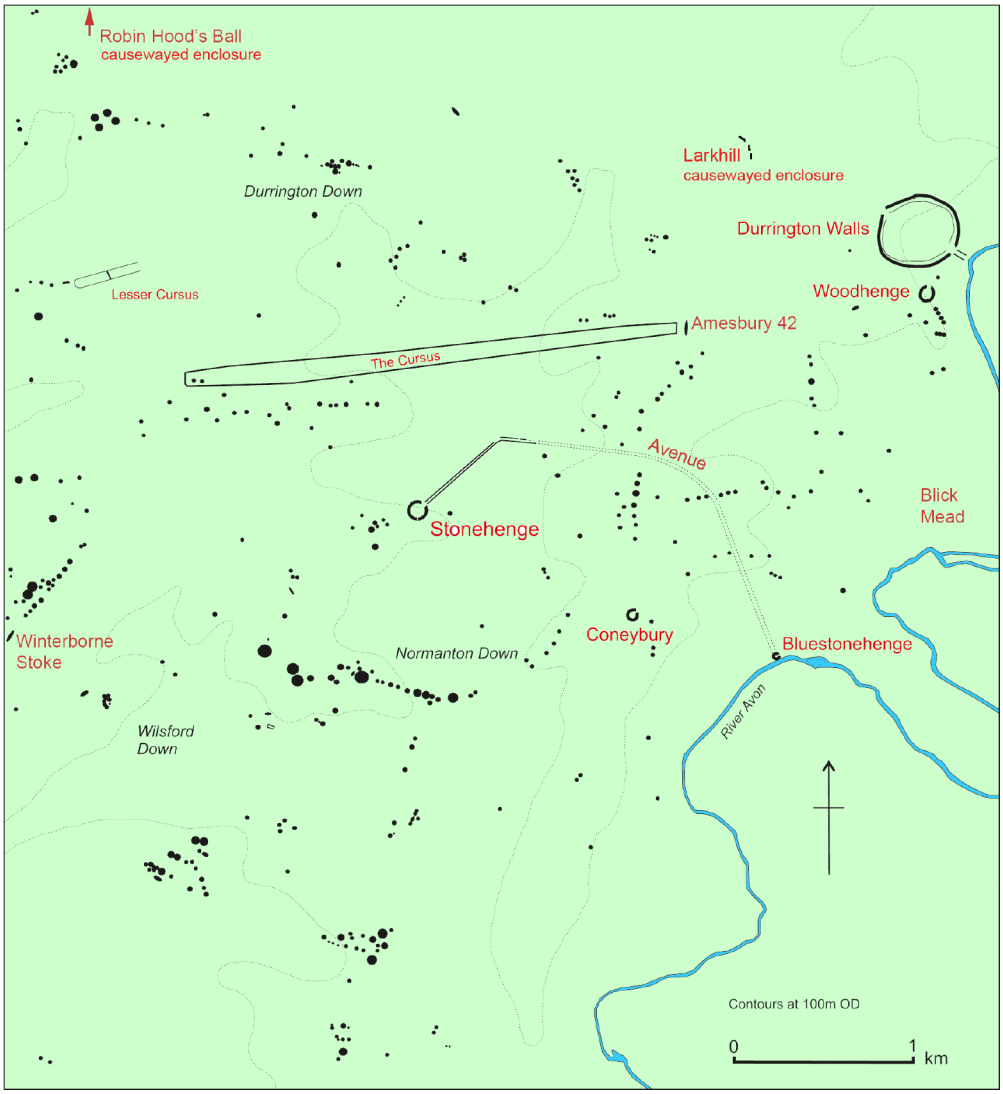

Figure 3 – The Stonehenge environs (drawn by Josh Pollard).

There was no shortage of stone materials within 5 km - 10 km to build the large, complex passage tombs of the Bend in the Boyne from local materials, so the importation of stones from long distances is likely to have been a deliberate and symbolic act. The various types of stone, especially quartz, may well have had a significance and colour that the builders sought. They may also have embodied a sense of place from their different origins, literally and metaphorically constructing the tombs out of the substance of far-off domains brought together into a single home for the ancestors whose cremated remains were placed inside.

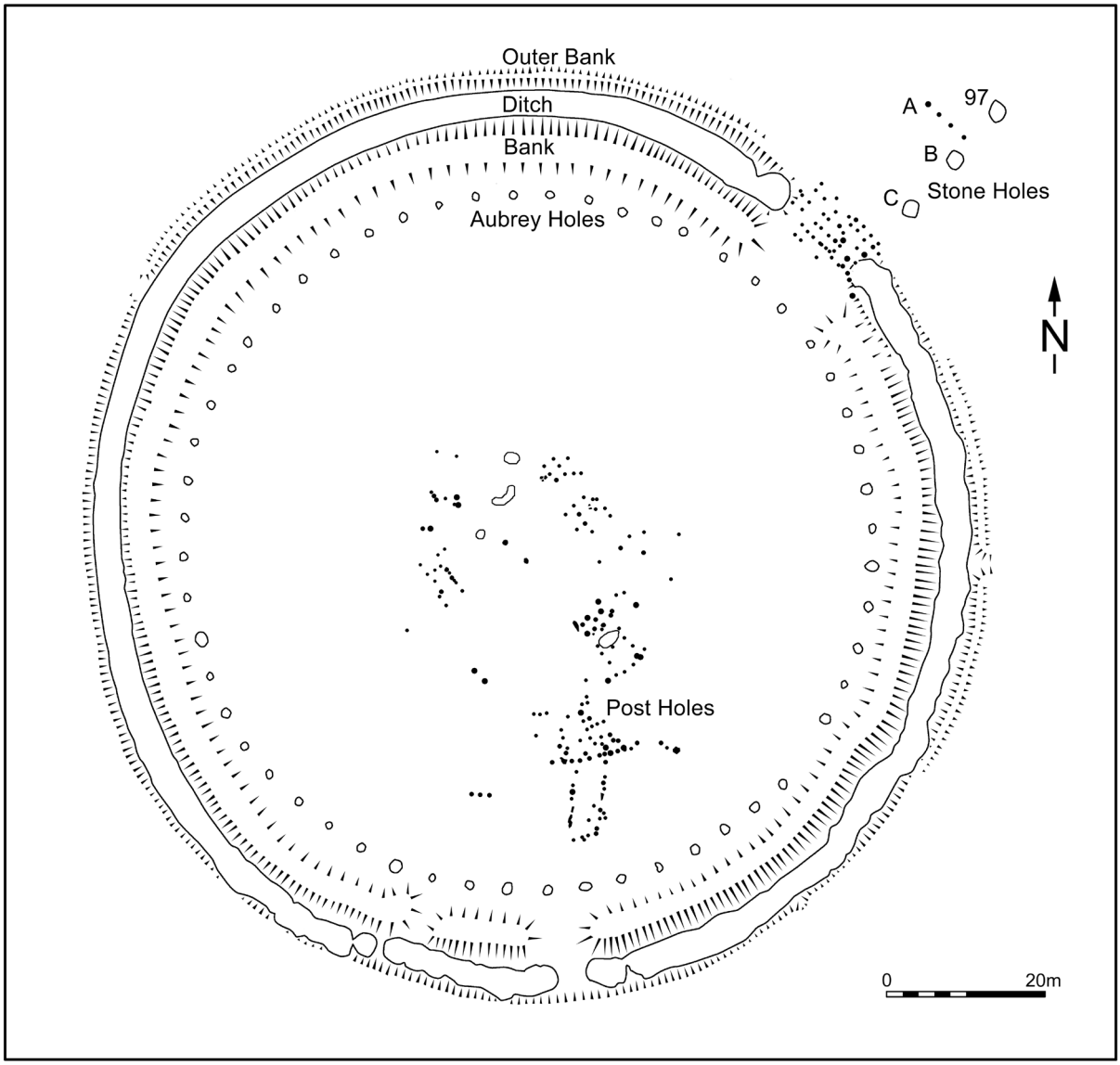

Figure 4 – Stonehenge Stage 1, 3000-2620 BC; the bank and ditch were constructed in 3000-2920 BC, around the same time as the Aubrey Holes (drawn by Irene de Luis)

2. Sources of the bluestones

Recent geological research into the geochemistry and petrography of Stonehenge's bluestones (by Richard Bevins and Rob Ixer) has revealed that they constitute at least 13 different types of rock (Table 1). All of these are likely to originate within the Fishguard district of Pembrokeshire, west Wales, with the possible exception of the Altar Stone, so-called because of its recumbent position inside the horseshoe of trilithons (Fig. 5). The Altar Stone is a 5 m-long monolith of Devonian Old Red sandstone from the enni Beds of south Wales, possibly even from the Brecon Beacons, 110 km east of the Fishguard district (Ixer & Turner, 2006). This corrects a previous, erroneous association of this stone with the Cosheston Beds near Milford Haven on the south coast of Wales.

Table 1 - Rock types of the Stonehenge bluestones and their geological sources.

Rock types	Source	Stonehenge stone
Spotted dolerite Group 1	Carn Goedog	Stones 33, 37, 49, 65, 67
Unspotted dolerite Group 2	Cerrigmarchogion or Craig Talfynydd	Stones 45, 62
Spotted dolerite Group 3	Carn Breseb, Carn Gwfry, outcrop near Carn Alw or outcrop w of Carn Ddafad-las	Stones 34, 42, 43, 61
Spotted dolerite ungrouped	Most likely Mynydd Preseli	Stones 31, 32, 35a, 35b, 36, 39, 41, 44, 47, 61a, 63, 64, 66, 68, 69, 70, 70a, 70b, 71, 72, 150
Rhyolite Groups A-C	Craig Rhosyfelin	Stones 32d & 32e
Rhyolite Group D	?Fishguard Volcanic Group	No stone identified; from debris only
Rhyolite Group E	?Fishguard Volcanic Group	Stone 48
Rhyolite Group F	?Fishguard Volcanic Group	Stone 46
Rhyolite Group G	?Fishguard Volcanic Group	Stone 40
Volcanics Group A	?North Pembrokeshire	Stones 32c, 33e, 33f, 40c, 41d
Volcanics Group B	?Fishguard Volcanic Group	Stone 38
Sandstone (Devonian)	Senni Beds, South Wales	Stone 80 (Altar Stone)
Lower Palaeozoic Sandstone		Stone 40g, 42c

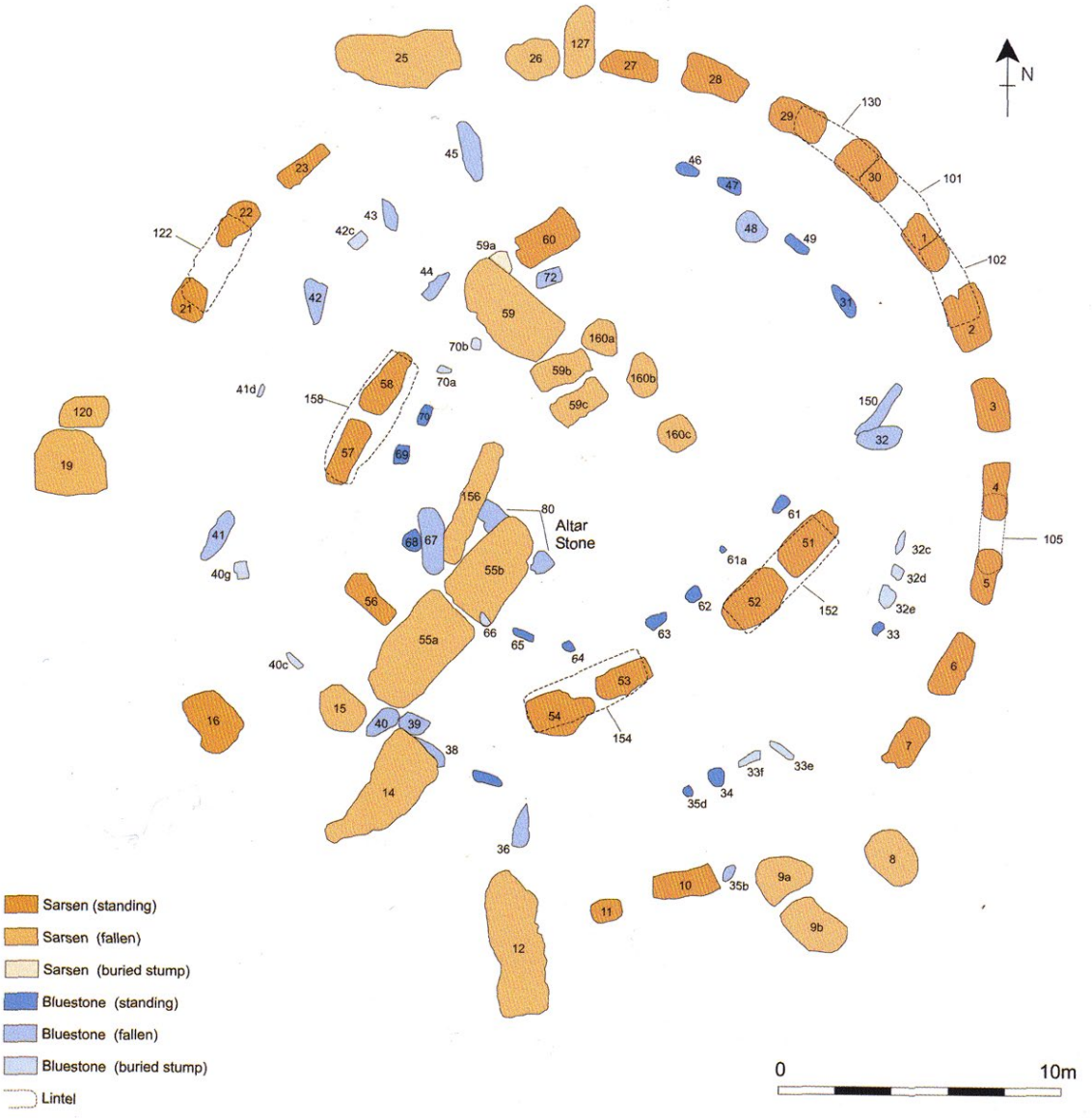

Figure 5 – Plan of Stonehenge's stones, showing the locations of the bluestones (© English Heritage).

Four of Stonehenge's types of bluestone have been more closely provenanced to source, all in the area of Mynydd Preseli and the lowland to the north (Fig. 6). One of these is a group of rhyolites (Rhyolite Groups A-C; Ixer & Bevins, 2011), pinpointed to the stream-side outcrop of Craig Rhos-y-felin within the Brynberian valley, a tributary of the River Nevern on the north side of Preseli (Fig. 7). Another is unspotted dolerite (Dolerite Group 2; Bevins *et al.*, 2013), derived from outcrops along the Cerrigmarchogion ridge that forms the central east-west spine of these hills, 4 km south of Craig Rhos- y-felin. The main source of the spotted dolerites (Dolerite Group 1 and possibly Group 3; Bevins *et al.*, 2013) is Carn Goedog, an outcrop halfway up the north flank of Preseli, just east of Cerrigmarchogion and 3 km south of Craig Rhos-y-felin. Finally, dating of palynological microfossils in Stonehenge's Lower Palaeozoic Sandstone rocks links them to Lower Palaeozoic metasediments to the north of Preseli (Ixer *et al.*, 2017).

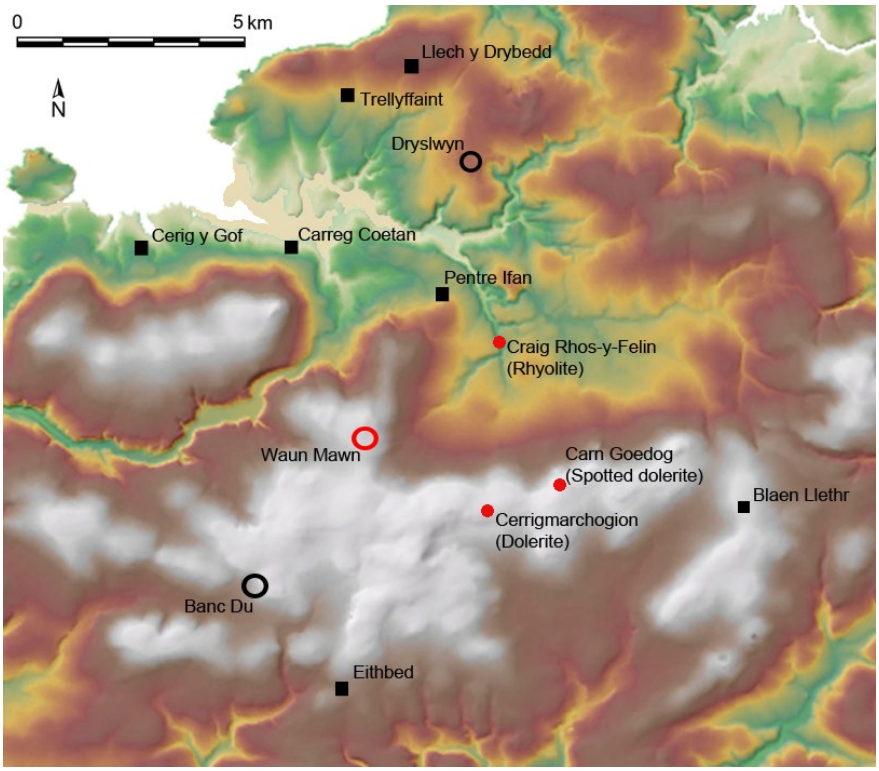

Figure 6 – The locations of Craig Rhos-y-felin and Carn Goedog within the watershed of the Nevern valley, Pembrokeshire, Wales; Neolithic dolmens are black squares and enclosures are black circles (drawn by Mike Parker Pearson).

Figure 7 – Known sources of Stonehenge bluestones in Preseli (yellow) and prehistoric sites (red) in their vicinity (from Google Earth).

For a hundred years now, geologists and archaeologists have known that Stonehenge's spotted dolerite derives from the Preseli hills (Thomas, 1923). Yet until recently, it was assumed that most or all of the spotted dolerite monoliths (of which there are 29) came from Carn Meini (also known as Carn Menyn), the most impressive of the outcrops, lying 2km southeast of Carn Goedog. Bevins et *al.*'s geochemical re-analysis of the 12 spotted dolerite monoliths at Stonehenge that have been sampled now reveals that five of them (Dolerite Group 1) can be sourced to Carn Goedog, and another four can be sourced to Carn Goedog or its vicinity (Dolerite Group 3). The recent provenancing of these various dolerites, rhyolites and sandstones found at Stonehenge restricts the distribution of their sources on current evidence to an area that may be no larger than 5 km east-west by 5 km north-south against the north flank of the Mynydd Preseli. However, a number of bluestone lithologies remain to be sourced with confidence.

3. Carn Goedog megalith quarry

Between 2011 and 2016, archaeological excavations were carried out at two outcrops revealed by geochemical and petrographic analysis to be sources of Stonehenge's bluestones. Excavations at Carn Goedog were commenced in 2014 with three test trenches along the north side of the outcrop, the only part with access to tall pillars suitable as standing stones (Parker Pearson *et al.*, 2019). The circumstances of formation of these dolerite pillars, with their characteristic white spots, some 482 million years ago were such that the magma cooled slowly to form tall, thin pillars separated from each other by narrow joint planes best exemplified by those on Carn Goedog's north side.

Test trench 1, the most easterly of the three trenches at Carn Goedog, revealed the most promising deposits and stratigraphy, commencing with a buried soil covered by flat slabs which had been laid, mostly with their fresh faces uppermost, to form an artificial platform. Roundwood charcoal of Pomoideae and *Corylus avellana* from this buried soil between and beneath the stone slabs yielded radiocarbon dates ending in 3020-2880 BC. Later activity here dated principally to the medieval period when the area was used as a seasonal settlement (*havod*), and the post-medieval period when the western part of the outcrop was quarried. Fortunately, this later quarrying had not extended into the eastern area with Neolithic deposits.

In 2015 and 2016, Trench 1 at Carn Goedog was extended to reveal not only the extent of the stone-slabbed platform but also its 1 m-high drop onto surrounding subsoil, a stone-filled, 11 m-long ditch (dating to 3020-2880 BC) beyond the southern edge of the platform, and a layer of upcast from the ditch spread on its southern side (Fig. 8).

On the north face of the outcrop, immediately above the platform (and unaffected by later quarrying which was marked by a 'skirt' of broken blocks further west) was a series of embayments or niches from which multiple pillars had been entirely removed, leaving no trace of any such pillars at the foot of the outcrop. Roundwood charcoal of *Corylus avellana* from the base of sediments in one niche included one piece with a date of 2125-1906 BC, suggesting that pillars had been removed from this niche by *c.* 2000 BC or earlier.

Acidic soils in west Wales prevent the survival of bone and antler, in addition to wood and other organic materials. Consequently, most of the expected material culture of Neolithic megalith-extraction – wooden wedges to insert into joint planes (and to expand when wet), antler and wooden hammers to drive in the wedges, and ropes to manoeuvre the pillars – cannot be expected to survive. The only finds from Carn Goedog were of stone: among the finds was a flint blade beside the ditch and several wedge-shaped blocks of sandstone with batter damage on both the blade and the head end. One of these wedges also exhibited a 'skid mark' caused by contact with a harder stone (Fig. 9).

Figure 8 – The excavation of Carn Goedog in 2016 (north is at the top); in front of the outcrop where pillars were removed is the stone platform, the stone-filled ditch and, closer to the camera, the upcast from the ditch (photo by Adam Stanford, Aerial-Cam Ltd.).

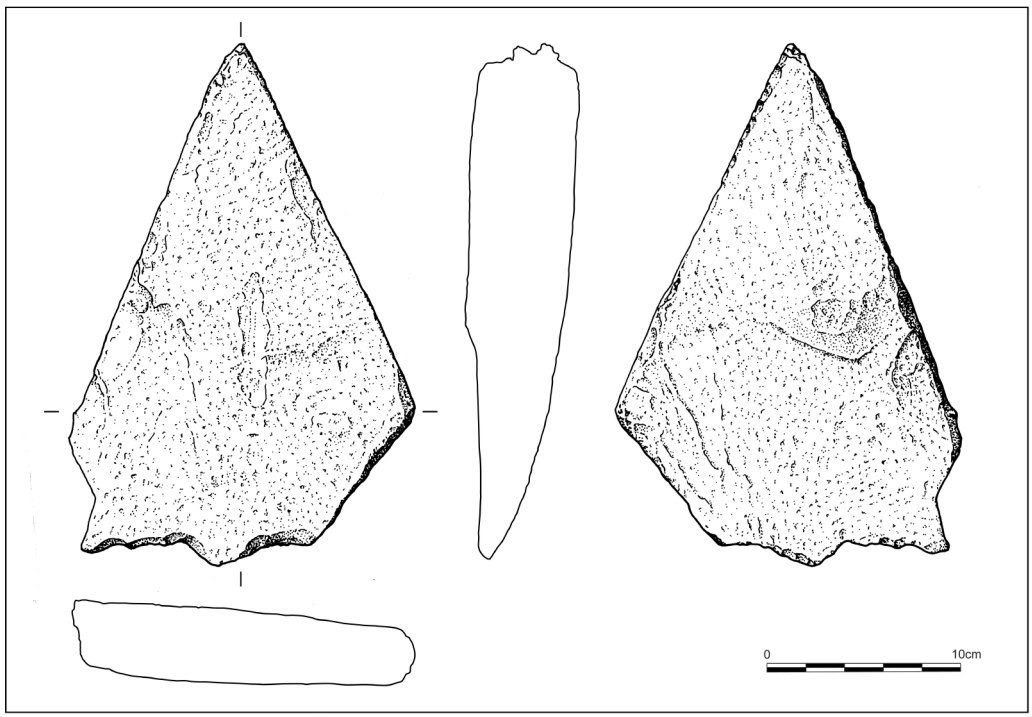

Figure 9 – A wedge-shaped stone tool found at Carn Goedog, from the spread upcast sediment beside the ditch (drawn by Irene de Luis).

4. Craig Rhos-y-felin megalith quarry

Extensive geological sampling of acid volcanic outcrops in the Fishguard district has led to the identification of Craig Rhos-y-felin as the source of foliated Rhyolites A-C among Stonehenge's bluestones. It is possible that all three of these types are actually derived from a single monolith, as yet unidentified but thought to be either or both Stones 32d and 32e (see Cleal *et al.*, 1995: 226, figs 120 and 141). More specifically, the variable petrography of the rock along the edges of the outcrop has resulted in a close match between Stonehenge Rhyolite C and just one particular location on the rock face. Thanks to this fortunate diversity along the sides of the outcrop, it is possible to ascertain the precise position where a monolith was removed and taken eventually to Stonehenge (Fig. 10). That position is visible as an embayment or niche for a pillar *c.* 2.5 m high x *c.* 0.4 m wide and *c.* 0.4 m thick (Parker Pearson *et al.*, 2015). As at Carn Goedog, the rock's formation has a strong jointing pattern which produces natural pillars which will have made extraction, through exploitation of pre-existing joint planes and the strong orthogonal foliation, an easy task.

Figure 10 – The outcrop at Craig Rhos-y-felin under excavation (viewed from the northwest): 1 a prone 4m-long monolith; 2 a threshold slab; 3 an artificial platform; 4 the recess left by the extracted monolith; 5 an orthostat beside the prone monolith; 6 an orthostat beside the recess of the removed monolith; 7 a Neolithic hearth; 8 a Neolithic occupation area; 9 Early Mesolithic hearths; 10 the lower platform and revetment; 11 the location of the close match for Stonehenge 'rhyolite with fabric' (photo by Adam Stanford, Aerial-Cam Ltd.).

The foot of the outcrop was occupied at various times in the past: an Early Mesolithic hearth, a Neolithic hearth, and an Iron Age open-air occupation area were located in close proximity to this niche. The Neolithic hearth and its associated remains of burnt stones, a flint flake and rhyolite flakes, lay just 2 m from the niche. Two radiocarbon dates on carbonised hazelnut shells from this deposit provide dates of 3500–3120 BC and 3620–3360 BC (Parker Pearson *et al.*, 2015: table 1).

Evidence of quarrying-related activities includes two artificial platforms, one just 4 m north of the outcrop and formed of sediment (associated with Early Bronze Age megalith quarrying activity), and another formed of two large, flat slabs held back by remnants of a drystone revetment wall from the

edge of a prehistoric palaeochannel. This second, lower platform is 4.3 m E-W x 3.5m N-S, up to 0.3 m deep, and made up of sediment and vertically pitched stones. A rhyolite end-scraper was recovered from its fill. The platform provided a vertical drop of 0.9 m to the base of the palaeochannel and a 2 m-wide x 0.2 m-deep hollow way containing wood charcoal dating to 3270-2910 BC (Parker Pearson *et al.*, 2019). Like the stone platform at Carn Goedog, we suspect that the lower platform at Craig Rhos-y-felin operated as a 'loading bay' where a monolith could be somersaulted onto a waiting wooden sledge and then slid away from the quarry by people pulling on ropes.

5. Where did the monoliths go from the bluestone quarries?

Although there have been theories that the bluestones were fetched from their outcrops directly to Stonehenge, perhaps because of supposed properties of healing (Darvill & Wainwright, 2008) or acoustics (Devereux & Wozencroft, 2013) of the stones themselves, there is a line of thought that it was the monument, rather than its individual stones, that was significant. If that were the case, the bluestones may have formed a pre-existing Neolithic stone circle in Preseli, this monument being dismantled and taken to Salisbury Plain to be erected at Stonehenge.

The first account of why Stonehenge was built comes from Geoffrey of Monmouth who wrote in *c.* 1136 that the wizard Merlin built Stonehenge out of a stone circle that he and his men brought from Ireland. The circle, known as *Chorea Gigantum* ('the dance of the giants'), was supposedly built by giants on Mount Kilaurus. According to Geoffrey, Merlin wanted this monument moved to Salisbury Plain to commemorate Britons massacred by Saxons because the stones had healing properties.

In 1923, Herbert Thomas was the first geologist to conclude that the bluestones had been carried to Salisbury Plain not by glaciers but by human agents. He also surmised that 'the removal of a venerated stone circle from Preseli to Salisbury Plain' was the reason for their transport some 240 km (Thomas, 1923: 258). Yet no trace of a dismantled stone circle had been recognised in the area of the megalith quarries, even though, in general, distances moved between quarry and monument in Neolithic and Chalcolithic western Europe were no more than a few kilometres (see other contributions to this volume). There are several extant stone circles in the Preseli region (Darvill & Wainwright, 2003) but their small sizes and generally short megaliths make them most likely to date to the Early Bronze Age than to the Neolithic. Similarly, the five henges known in the region are small and likely to date to after 2800 BC on the basis of their forms (Darvill & Wainwright, 2016: 113-114).

Since 2011, the Stones of Stonehenge Project, led by the authors of this paper, has explored other sites in the Preseli area to find out if they were monuments contemporary with the megalith quarries and whether they might have once included standing bluestones. Excavations in 2012-2013 of a suspected henge at Castell Mawr (Gibson, 2012: 117) revealed no trace of any Neolithic remains amongst the largely Iron Age features of this hillfort (Parker Pearson *et al.*, 2017). A henge-like ditched circular enclosure at Bayvil Farm turned out in 2014 to be a Late Bronze Age ringfort (Parker Pearson *et al.,* 2018), and a circular enclosure at Felindre Farchog was revealed on excavation in 2015 to be an early medieval cemetery (Casswell *et al.*, 2016). A suspected passage tomb and henge at Pensarn were found on excavation in 2016-2017 to be an Early Bronze Age burial cairn and an Iron Age enclosure

The only suspected candidate for a dismantled stone circle in the Preseli hills is an arc of dolerite pillars at Waun Mawn, *c.* 4 km west of the bluestone outcrops (Grimes, 1963: 150, fig. 36).

Located on a natural saddle at 310 m OD with views to the sea and to the eastwards sweep of the Preseli hills, these four stones (only one of which is still standing) form an arc which is all that is left of a robbed-out stone circle (Fig. 11). Six sockets, from standing stones removed in antiquity, were excavated

in 2018, revealing the circle's diameter of 110 m. Not only is Waun Mawn the sole circle in Preseli with standing stones comparable in size to those at Stonehenge but it is also the third largest stone circle in Britain. Additionally, its diameter of 110 m is the same as Stonehenge's Stage 1 circular enclosure (Cleal *et al.*, 1995: 67). Together with a Neolithic causewayed enclosure at Banc Du, a Neolithic palisaded enclosure at Dryslwyn, and seven Neolithic dolmens (Darvill & Wainwright 2016; see Fig. 6), it forms a major ceremonial complex within the Preseli hills.

Figure 11 – Waun Mawn dismantled stone circle, looking southwest. The four remaining pillars are in the lower right of the picture. Another six empty stone sockets were found around the circle's perimeter (photo by Adam Stanford, Aerial-Cam Ltd.).

6. Mobility and contact between Stonehenge and the west of Britain

The bluestones are not the only evidence of contacts between west Wales and Salisbury Plain. Earlier Neolithic stone axes of Group VIII (Cummins, 1979: fig. 4a) originated in west Wales, and are found throughout south Wales and eastwards into southern England. This demonstrates a network of movement and exchange that was in place before the bluestones were moved.

Styles of monuments and ceramics also changed in their distributions after the Early Neolithic (*c.* 4000-3400 BC). Whereas ceramic styles had been regionalised between east and west (Darvill, 2010: fig. 33), Middle Neolithic impressed ceramics known as Peterborough Ware are found right across southern Britain (Ard & Darvill, 2015). Similarly, Early Neolithic funerary monuments reveal something of an

east-west split, with oval barrows, round barrows, timber mortuary structures and pit graves in the east, and simple passage graves and – to a lesser extent – portal dolmens in the west (Darvill, 2010: fig. 37). During the Middle Neolithic, a Scottish-derived monument type – the cursus – was adopted throughout Britain (Loveday, 2006; Brophy, 2015). This was followed in the final centuries of the fourth millennium BC by the first henges, known as 'formative' henges because their banks were placed outside their ditches rather than inside them, as was the case after c. 2800 BC (Burrow, 2010). Llandygai henge A (Lynch & Musson, 2004) and Castell Bryn Gwyn (Wainwright, 1962) are examples of formative henges in north Wales, similar to examples in southern England: Stonehenge stage 1 (Cleal *et al.*, 1995; Darvill *et al.*, 2012); Flagstones, Dorchester (Healy, 1997); Priddy circles, Somerset (Lewis & Mullin, 2010); and Norton, Hertfordshire (Fitzpatrick-Matthews, 2015: 71-74).

The changes in ceramics and monument styles suggest a growing commonality of material culture throughout southern Britain across the east-west divide that had been a feature of the Early Neolithic. In addition, people moved too. Strontium isotope analysis of tooth enamel reveals that many individuals buried at or around Stonehenge had ratios consistent with growing up on the Silurian/Devonian rocks of south and west Wales and/or north Devon. Evidence for migration from west to east is found in the Stonehenge landscape as early as 3630-3360 BC, the same period as the cursuses were built; an adult male buried in a single, primary grave beneath Winterbourne Stoke long barrow, less than 2 km from Stonehenge, has strontium isotope ratios consistent with growing up in western Britain (Alistair Pike pers. comm.). A proportion of those people cremated and buried at Stonehenge during *c.* 3000- 2400 BC also have strontium isotope ratios consistent with origins in the far west of Britain (Snoeck *et al.*, 2018). A single adult human tooth from Durrington Walls, dating to c. 2500 BC, has similar likely origins. During the Beaker period and Early Bronze Age (*c.* 2450-1500 BC), more than a third of all migrants to the Wessex chalklands around Stonehenge – some nine individuals – have strontium isotope ratios that imply they came from Silurian/Devonian areas of the West (Parker Pearson *et al.*, 2016).

7. Ancestors and stones

These trends towards greater commonality in material styles and increasing human mobility between east and west in the Middle Neolithic are just part of a wider range of evidence for social transformations across the transition *c.* 3400 BC between the Early Neolithic and the Middle Neolithic. Violence and even warfare were present during the Early Neolithic up to *c.* 3400 BC with a major focus in the area between south Wales and southwest England on the one hand and Stonehenge on the other (Mercer, 1999; Schulting & Wysocki, 2005). With evidence for violence less evident than before, the Middle Neolithic (c. 3400–3000 BC) appears to have been the start of a population decline throughout Britain (Shennan et al., 2013), associated with woodland regeneration (Woodbridge *et al.*, 2014).

It was within this context of change that around 80 bluestone monoliths were transported to Salisbury Plain around 3000 BC. Just how to explain such a momentous and conspicuous feat of pointless bravado has defeated scholars unable to conceive of such large stones having any value greater than as unusual rocks. Gordon Childe considered this fantastic feat to 'illustrate a degree of political unification or a sacred peace' (Childe, 1957: 331) and the evidence gathered in recent decades would certainly be consistent with this interpretation. We can elaborate on Childe's hypothesis to suggest that the bluestones (and very possibly the cremated remains of some of the people buried with them at Stonehenge) were symbols of the ancestral origins of Neolithic groups in west Wales, combining their stones with the sarsens of southern and southeast England.

There is growing evidence that Stonehenge may have been an axis mundi, a centre of origin for the

people of southern Britain. A large hunter-gatherer settlement at Blick Mead, 3 km east of Stonehenge, has the longest sequence of radiocarbon dates of any persistent place in the British Mesolithic, spanning the 8th- 5th millennia BC, and providing a long-term focus for movement within the region (Jacques & Phillips, 2014). Three monumental posts – almost unique for the European Early Mesolithic – were erected during the 8th millennium BC just 150 m from where Stonehenge would be built 5,000 years later (Allen & Gardiner, 2002). Their presence suggests that this was a special place long before Neolithic farmers, possibly connected with an unusual natural phenomenon discovered during excavations by the Stonehenge Riverside Project in 2008 (Allen *et al.*, 2016). The sockets for these 1 m-diameter wooden posts lie close to a geomorphological feature of parallel chalk ridges with unusually large parallel periglacial fissures running between them. This entirely natural earthwork is coincidentally aligned on the solstitial axis of midsummer sunrise/midwinter sunset. It was evidently recognised during the Neolithic because Stonehenge Stage 1 was placed at its southwest end and the ditches of the Stonehenge Avenue were cut against the outsides of the two ridges.

Stonehenge also appears to have been on a boundary between west and east during the Early Neolithic: not only were there differences in styles of ceramics and monuments on either side of Salisbury Plain and the Wessex chalkland, as discussed earlier, but this area also contains one of the highest densities of Early Neolithic causewayed enclosures. Causewayed enclosures are interpreted as gathering sites where people came from different regions to feast and exchange (Mercer & Healy, 2008; Whittle *et al.*, 1999). More than half of British causewayed enclosures are located within a 30-mile wide corridor extending from the south coast to the Wash on the east coast. If cursuses, henges and stone circles were also places of gathering during the Middle-Late Neolithic, then this same corridor also attracted people from their home ranges in the river valleys on either side.

This movement of people and their ancestral stones to an *axis mundi* on Salisbury Plain, thereby creating Stonehenge, could have constituted a religious and/or political union, or colonization by people of the west, or both. Analysis of ancient DNA is revealing the genetic origins of Neolithic farmers in Britain to lie in continental Europe. Also Neolithic farmers in Wales had different genetic admixtures from those in southeast Britain (Brace *et al.*, 2019). Such genetic differences could have been significant in defining separate ancestries for western and southeastern Neolithic populations within Britain.

Bringing ancestral bluestones to this *axis mundi* from the far west could thus have served to unite the people of west and east in southern Britain around 2900 BC, after a thousand years of difference and even dispute between the two regions. Such differences may even have extended back to Neolithic farmers' origins within continental Europe; whilst farmers may have brought the farming package to southeast England from northern France (Whittle *et al.*, 2011), other farming communities may well have colonised western Britain and Ireland – including west Wales – from Brittany (Sheridan, 2010). If the bluestones represented the ancestry of the western British at Stonehenge then the sarsens – the solid geology first encountered by earliest Neolithic farmers settling in Kent and the Thames estuary (Whittle *et al.*, 2011) – could have represented ancestries of those in the east. Stonehenge's stones thus encapsulate and embody the potential places of arrival, foundation and establishment of the two main groups of Early Neolithic farmers into southern Britain.

Note

All cited radiocarbon dates are calibrated and given at 95% confidence. Full details of those from the Welsh quarries are already published (Parker Pearson et al., 2015; 2019).

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