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Reckoning Time at Stonehenge

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Etruscan Black Figure Vases

Myth on Mosaics in Roman Britain

Portraits of the Caesars

Contents

Volume 4 | Number 2 | Spring 2022

Cover: Shiva Nataraja, c. eleventh century, Chola period, Tamil Nadu, copper alloy. The Metropolitan Museum of Art (page 42).
This page: Shiva Tripuravijaya, ninth century, Chola period, Tamil Nadu, bronze. National Museum, New Delhi (page 42).

Stonehenge Mean Time: Synchronising Polity and Cosmology

Tim Darvill unravels the extraordinary secrets of this iconic monument

My recent research has identified how the design of Stonehenge, located on the chalk downlands of southern Britain, may have represented a calendar, helping people track a solar year of 365.25 days calibrated by the alignment of the solstices. Although it had long been thought to be a calendar, as first suggested by the antiquarian William Stukeley (1687–1765), pinpointing how it functioned was only possible thanks to modern discoveries. The large sarsen stones that dominate the site appear to reflect a calendar with twelve months of thirty days, divided into ten day 'weeks'. An intercalary month, and leap days aligned it with the solar year. Calendars of this kind had been developed in ancient Egypt, raising the possibility Stonehenge's calendar system had an external influence.

Recent remodelling of how Stonehenge developed shows that the three sarsen structures – the Trilithons, Sarsen Circle, and the Station Stone Rectangle – all belong to Stage 2 and were set up in the late Neolithic period, 2620–2480 BC. Once in place these components remained fixed and unmodified. A recent analysis by D. J. Nash and others (2020), indicated that the sarsens mainly derive from a single source at West Woods about 24km north of Stonehenge on the Marlborough Downs.

Understanding the sarsen elements as a unified group and recognising their numerical significance presents the possibility that they constitute a perpetual calendar based on the 365.25 solar days in a mean tropical or solar year. My latest research at Stonehenge focuses on how this may have worked, looks at its origins and development, and asks why such a calendar might be present in the architecture of this extraordinary monument.

The group of sarsen structures at Stonehenge is unique in north-western Europe, and its construction and design is unparalleled. Its three main components along its central axis are briefly described as follows. The most visually prominent structure is the ring of thirty upright sarsen stones (below; page 10), linked at the top with thirty lintels. The uprights are conventionally numbered clockwise S1 to S30 ('S' being an abbreviation of 'Stone'), starting at the north-east. Seventeen of the uprights are still standing in their original positions, seven are preserved but have fallen, and six are missing (their placement suggested through excavation and parch-marks as 'standard width' stones). Six lintels remain in place on top of their supporting uprights, while two fallen examples lie on the ground; twenty-two are missing. The missing sarsen uprights and lintels were robbed in antiquity. Two uprights stand out: S11, in the south-eastern area, is considerably narrower (1.1m wide), thinner, and shorter than the others (with the exception of S21), although recent research by M. Abbot

Above: location of Stonehenge on Salisbury Plain. Public Domain, modified by Mark Merrony.

Left: Stonehenge, showing the Sarsen Circle in all its glory, viewed from the east at sunset. © English Heritage.

Stonehenge, viewed from the north-east, showing the post-and-lintel construction of the Sarsen Circle. Photo by of Tim Darvill.

and H. Anderson-Whymark (2012) suggests that its top has been broken off (below left). S21 in the western area appears complete but is also narrower (1.5m wide), and thinner (below right). The pattern of original stone widths and gaps around the circumference of the Sarsen Circle has been recorded (page 11).

The existing Sarsen Circle demonstrates the intricacy of its construction, with a fairly regular spacing of pillars, but the gap between S1 and S30 to the north-east is larger than average, at 1.38m, indicating that it was an entrance. Most of the uprights are uniform in shape and size, and the 'standard width' is approximately 1.9m, measured 1.5m above ground level. Counting clockwise from S1, there appear to be three distinct groups of ten uprights: S1–10, S11–20, and S21–30. Each group is preceded by a slightly wider-than-usual gap. All the existing stones have been shaped and dressed. The lintels are secured to the uprights with hemispherical protuberances known as stub-tenon joints and corresponding hollows; tongue-and-groove joints lock the ends of the lintels together in a continuous ring.

Inside the Sarsen Circle are five sarsen trilithons arranged in a horseshoe shape that opens to the north-east. All stones survive in this area, although some have fallen. The south-western trilithon (comprising uprights S55 and S56, and lintel S156) is the tallest and largest;

Sarsen stone S10 (left) in the Sarsen Circle, with the small-sized S11 to the right. View looking outwards from inside the circle. Scale = 2m. Photo by Tim Darvill.

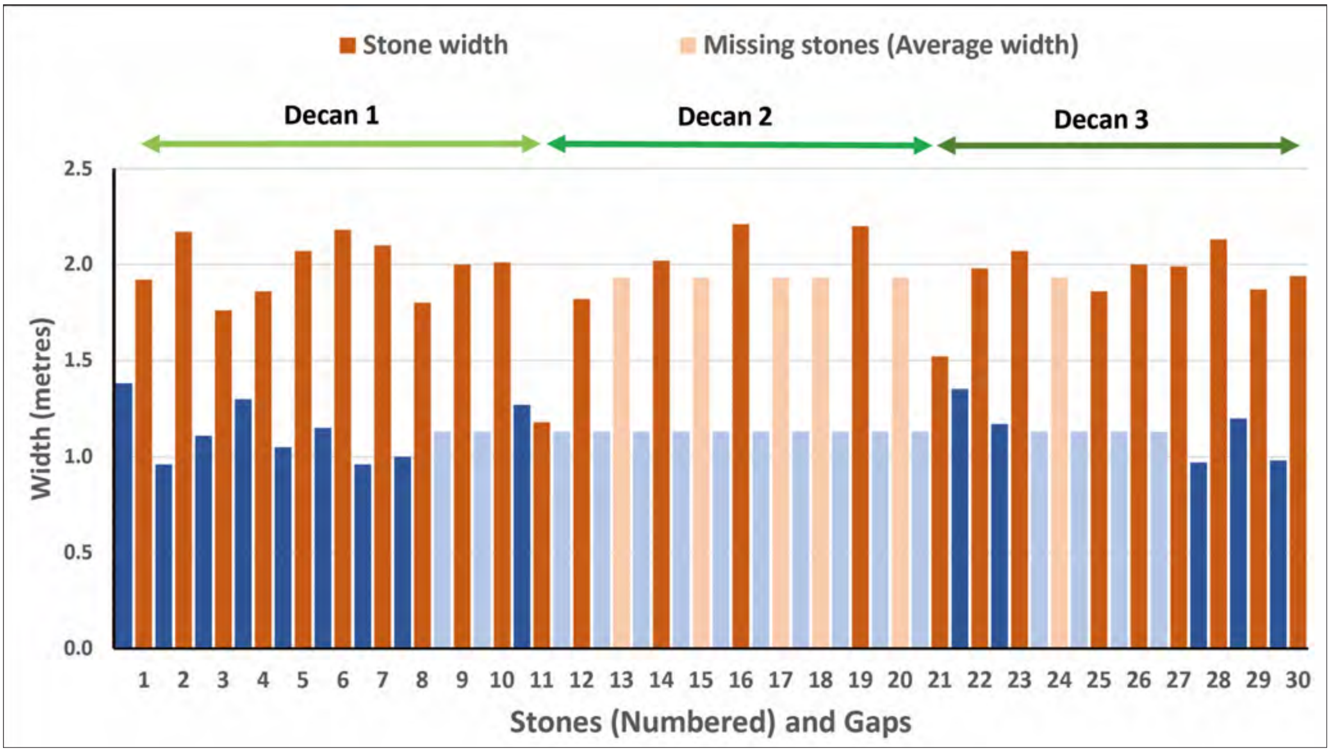
Small-sized sarsen stone S21 (left) in the Sarsen Circle, with the normal-sized S22 to the right. View looking outwards from inside the circle. Scale = 2m. Photo by Tim Darvill.

the others reduce in height towards the north-east, imparting both vertical and horizontal emphasis to the south-western trilithon. All the stones of the Trilithon Horseshoe have been shaped and dressed, with stub-tenon joints securing the lintels to the uprights, as in the case of the Sarsen Circle. A. Whittle (1997) observed an alternating rhythm to the dressing and shaping of the uprights, with one stone in each pair smooth and sharply dressed, while the other is rougher and more natural in appearance (page 12, left).

Outside the Sarsen Circle is a rectangular setting of four 'Station Stones', smaller than the other sarsens and minimally dressed. Only two survive: S91 at the north-east corner and S93 at the south-west corner (page 12, right), although empty sockets representing the other two (S92 and S94) are known through excavation. These four stones represent a relatively precise rectangle measuring 80 × 30m. Lines representing the two long sides would pass close to the outside faces of stones S1/S30 and S15/S16 on the outer circumference of the Sarsen Circle.

All three sarsen elements – the Trilithons, Sarsen Circle, and the Station Stone Rectangle – represent a coherent astronomical axis orientated north-east–south-west, joining the points on the locally visible horizons where the sun rises during the summer solstice to the north-east and sets during the winter solstice to the south-west. This seems to be the only major alignment embedded in the architecture of Stonehenge, however, C. Ruggles (1997) has suggested that the two long sides of the rectangle are approximately orientated on major extreme moonrise positions (major lunar standstill), but whether this is deliberate or by chance is unclear. The main axis runs through the entrance to the Sarsen Circle, which is flanked by S1 and S30 on the north-east side, and between S15 and S16 on the south-west side. The Trilithon Horseshoe symmetrically straddles the axis. The two short sides of the Station Stone Rectangle run parallel to the principal axis, but is displaced to the north-west and south-east. Beyond the central settings, the principal axis is perpetuated by two stones positioned in the entrance through the earlier earthwork enclosure, the Heel Stone (S96) and its now-missing companion (S97) (page 13), and by the embanked Avenue that was added in Stage 3.

At Stonehenge, the emphasis on the solstices which are embedded in the architecture in the form of the principal axis and its orientation strongly suggests a solar-based system fixed on a solar or tropical year of 365.25 solar days (page 14, left). The core of the year is represented by the Sarsen Circle where each of the thirty uprights represents a solar day within a repeating thirty-day month. Running sun-wise from the main axis, with S1 representing Day 1, S11 and S21 become significant, as they divide the month into three 'weeks' or 'decans', each of ten days; the anomalous stones mark the start of the second and third decans. Twelve monthly cycles of thirty days, represented by the uprights of the Sarsen Circle, gives 360 solar days. Completing the basic solar year of course requires an



Plot showing the spacing and size of stones forming the Sarsen Circle. Figure by Tim Darvill.

additional five days: an intercalary month of days, a role fulfilled by the five components of the Trilithon Horseshoe that dominate the centre of the structure, growing incrementally in stature from the north-east, with the tallest – the Great Trilithon (S55 and S56, and lintel S156) – to the south-west; adding the intercalary month gives 365 solar days.

As in our modern calendar, making the solar calendar perpetual, in which the days, decans, and months keep pace with the seasons and the movements of the sun to define a tropical or solar year with accuracy requires periodic adjustment with the addition of one day every four years to create a leap-year of 366 solar days (since the introduction of the Gregorian calendar to Catholic Christendom in 1582 and its progressive spread). The four Station Stones provide a means of keeping tally so that a sixth day could be added to the intercalary month every fourth year.

Taking all of these factors into account, the basic shape of a late Neolithic solar calendar emerges. Beginning at the winter solstice the year starts with the first movement of the setting sun away from its most extreme south-westerly setting point. New Year's Day, or Month 1/Day 1 (the equivalent of 24 December in the modern calendar), is physically symbolised by

Trilithon S53 and S54, with lintel S154, showing contrasting pairs of smoothed and rough uprights. View looking outwards from the inside of the Trilithon Horseshoe. Photo by Tim Darvill.

Surviving Station S91 at the north-east corner of the Station Stone Rectangle. Photo by Tim Darvill.

Surviving Station S93 at the south-west corner of the Station Stone Rectangle. Photo by Tim Darvill.

Stone 1. Six months (18 decans or 180 solar days) later, Month 6/Day 29 (19 June), is the start of the summer solstice, whose five days of standstill span the last three days of Month 6 and the first two days of Month 7 (19–23 June. Six months on again, Month 12/Day 30 (18 December) marks the start of the intercalary month (of five epagomenal days), forming the period of the winter solstice (19–23 December), the end of the old year. An additional day would be added to the intercalary month every four years to keep the solstices aligned with observations of the sun's movements in relation to the principal axis of Stonehenge. This alignment ensures that the calendar was synchronised with celestial movements and the changing of the seasons. Arranging the whole complex around a principal axis might relate to processional movement, and a sense of order, sequence, and meaning played out in the way the site was used.

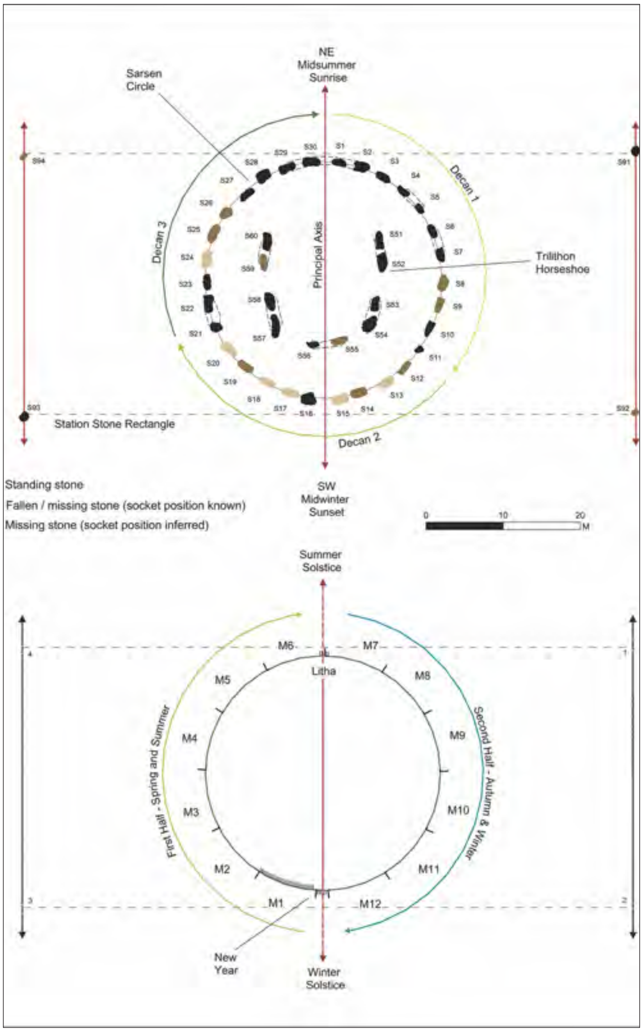
Fragments of this prehistoric calendar survive into recent times. R. Hutton (1996), for example, revealed a major pre-Christian festival marking the opening of the New Year when the sun had reached the winter solstice and its strength was renewed. The Northumbrian monk and scholar Bede provides an important piece of supporting evidence in a work written around 725 (*De temporum ratione*), which records that the pre-Christian New Year was marked by the midwinter festival of Yule; combined with a midsummer festival known as Litha, the year was divided into two parts. Using linguistic evidence, J. P. Mallory and D. Q. Adams (2006) have reconstructed two words for 'year' that express the notion of 'new season' in the proto-Indo-European language thought to be current during the third millennium BC. At Stonehenge, the principal axis naturally divides the monument and the calendar it represents into two halves with both the winter and summer solstices clearly embedded in the architecture of the structure.

It is plausible that communities living in north-western Europe during the late fourth and third millennia BC developed a solar calendar of the type suggested as part of their own tradition, as suggested by the alignment of several passage graves to celestial events during the winter solstice, as at Newgrange in Ireland and Maes Howe in Orkney. However, the uniqueness of Stonehenge suggests that external influences may have been a factor, notably during the early third millennium BC when an increased interest in solar deities occurred, such as the cult of Ra, which led to the development in Egypt of a 365-day solar calendar, known as the Civil Calendar. As at Stonehenge, the calendar comprises twelve thirty-day months, together with an intercalary month (of five epagomenal days), the months are each divided into three weeks of ten days. Less secure, but tantalising nonetheless, is the distorted reworking of eleventh-century AD oral traditions recorded by Geoffrey of Monmouth. In his *History of the Kings of Britain*, he records that Africa was the original source of Stonehenge's stones, which were taken first to Ireland to form the *gigantium chora* (the Giants' Ring) and then to Stonehenge; a similar myth was written in *Roman de Brut* by Wace in the twelfth century, preserved in a manuscript of the fourteenth century in the British Library (page 14, right).

Why build a calendar? First, the routine of everyday life where farmers and farming are concerned: knowing when to celebrate the harvest festival for best effect, or when to please the gods with their presence at key ceremonies. Second, ancient calendars were a way for political elites to legitimise power – controlling people and life on earth as well as the cosmos. Third, time-reckoning systems give substance to cosmological events, so that narratives could be understood in ways that structured behaviours and relationships in society. By combining the solar cycle and the natural cycle of life in the form of a monument, the days, weeks, months, and years structured ritual cycles of responsibility and obligation. Finally, time-reckoning systems bring communities closer to their religious beliefs by ensuring that events occur at favourable moments. Elsewhere, I argued (2007) that the Bluestone elements at Stonehenge,

Stonehenge viewed from the north-east near the Heel Stone (S96), its original neighbour (S97), which would have stood to the right of it, was robbed in antiquity, as in the case of a number of lintels and pillars. Public Domain.

Summary of the way in which the numerology of sarsen elements at Stonehenge combine to create a perpetual solar calendar. Non-sarsen elements have been omitted for clarity. Drawing by V. Constant.



imported to the site from west Wales represent the power of the place and were intimately connected with healing rituals. Ensuring that healing ceremonies happened at the right time is why Stonehenge from Stage 2 onwards enabled its user-communities to literally make, mark, and keep pace with time.

Future research might shed light on the idea that the concept of a solar calendar at Stonehenge spread from Egypt or elsewhere, particularly ancient DNA and archaeological artefacts could reveal connections between these cultures. Nevertheless, the identification of a solar calendar at Stonehenge should transform how we see it. Finding a solar calendar represented in the architecture of Stonehenge opens up a whole new way of seeing the monument as a place for the living; a place where the timing of ceremonies and festivals was connected to the very fabric of the universe and celestial movements in the heavens.

Timothy Darvill, OBE, is Professor of Archaeology in the Department of Archaeology and Anthropology at Bournemouth University.

Further Reading

This article is based on a more comprehensive research paper published online, 2 March, and the printed publication in April, by Cambridge University Press (other relevant publications are referenced below this):

Darvill, T. (2022). 'Keeping Time at Stonehenge', *Antiquity*, 96.386, 1–17.

Darvill, T. (2006). *Stonehenge: The Biography of a Landscape*, Stroud: Tempus.

Darvill, T., and Wainwright, G. (2014). 'Beyond Stonehenge: Carn Menyn Quarry and the Origin and Date of Bluestone Extraction in the Preseli Hills of South-West Wales', *Antiquity*, 88.342, 1099–1114.

Darvill, T. (2016). 'Roads to Stonehenge: A Prehistoric Healing Centre and Pilgrimage Site in Southern Britain', in A. Ranft and W. Schenkluhn (eds), *Kulturstraßen als Konzept. 20 Jahre Straße der Romanik*, Regensburg: Schnell & Steiner, 155–166.

Roman de Brut by Wace, written in the twelfth century, preserved in a later manuscript of 1300–1325 (f. 30r), the earliest known depiction of Stonehenge. The chronicle describes how King Aurelius decided to erect a monument to British fighters killed by the Saxons. The wizard, Merlin, suggests that Aurelius should create a stone circle like one in Ireland known as the 'Giants' Ring'. With Aurelius's permission, Merlin leads the British men to Ireland. Courtesy of the British Library. Public Domain.