PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

Contributions to the Discussion on Ancient Astronomy: The Unwritten Evidence

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Contributions to the discussion on ancient astronomy: the unwritten evidence

A. H. A. Hogg (*Royal Commission on Ancient and Historical Monuments in Wales and Monmouthshire, Aberystwyth*) referred to Professor Thom's hypotheses. These were not inseparable; some could be accepted while rejecting others. There was, for example, nothing inherently unlikely in the existence of markers related to astronomical events which could be observed during a single adult life, but it was very hard to believe that in an illiterate society numerical information could be stored up and transmitted to successive generations. The credibility of a theory could properly be taken into consideration, as well as the statistical evidence. For example, a very significant statistical correlation appeared to exist between the occurrence of severe earthquakes and the position of Uranus (Tomaschek 1959), but few people would accept this as other than accidental.

Turning to particular points, he said that, even after Professor Kendall's demonstration that a quantum of 5.44 ft apparently existed, he still felt some doubts. To accept the existence of an approximate quantum was not difficult; what seemed incredible was the extreme accuracy with which it was established, a few hundredths of an inch – and which was supposed to have been maintained over several centuries. He asked what standard deviation for the quantum was indicated by the new investigation† and whether the appearance of a quantum could perhaps arise out of the occurrence of a relatively few circles set out using some standard unit, mixed with a larger number where no standard was used. Referring to 'flattened circles' and 'eggs': the apparent ratio of 3:1 for the ratio of circumference to major diameter did not necessarily imply that the builders were aiming at this. Any slight flattening, for whatever reason, would cause the ratio to approach 3:1. Similarly, the wide range of possible geometrical constructions and of Pythagorean or near-Pythagorean triangles, combined with the inevitable uncertainty of setting-out a ring of large stones, would almost always make it possible to fit some 'theoretical' layout to the remains (*Archaeologia Cambrensis* 1968).

Finally, on the subject of 'fans' which were claimed as providing 'charts' for correcting lunar observations, he pointed out that the stones in some of these did in fact depart widely from the theoretical grid. Whereas this might be acceptable for truly megalithic structures owing to the difficulty of adjustment, for those where the stones were small and could easily have been moved to the required positions such differences could not be reconciled with the desire for extreme accuracy credited to the builders.

References

Tomaschek, R. 1959 *Nature, Lond.* **184**, 177 (criticized by E. J. Burr 1960 *Nature, Lond.* **186**, 336) with reply by R. T. E. J. B. accepts that the result appears significant at the 1% level.
Archaeologia Cambrensis 1968 **117**, 207–210.

L. E. Maistrov (*Kaliningrad, Moscow*). As late as the beginning of this century in North Ossetia there was a place in each village or settlement where the inhabitants met to discuss matters of general interest. Even now there are some old people still alive who used this calendar in their

† See p. 259.

youth. This was located next to the house of worship, the entrance of which was always at the northern side. Near the door stood a bench on which the village elders would hold their discussions. In some villages these benches have been preserved to the present day. This entire area was known as 'Nykhas'. From this bench one can see the Sun disappearing behind the mountain range in the evening. In each village there was a man who would observe the Sun set each day. In the summer the Sun set farther and farther to the right every day. It then reached the farthest point to the right and started to set at points farther and farther to the left. The silhouette of a mountain range is so individual from every view angle that it is not difficult to memorize the place of the sunset at the farthest point to the right. When the sun returns to this point – a year has passed. The sun sets at this point on the longest day (summer solstice). Winter solstice occurred on the day when the sun set at the point farthest to the left. However, these were not the only days which were fixed in relation to the mountain silhouette. All holidays were similarly fixed in this way; in some villages there were many of these – in others less.

Days of equinox were established by fixing the position of the setting Sun on the day half way through the period between the solstices. If the sunset took place at a certain spot before the next movement of the point of sunset from right to left, this occurred on the day of the autumn equinox. In some villages the space between mountain peaks where solstice occurred, was halved and this point was fixed on the mountain profile. The day on which the Sun passed that point, while setting, was the day of the equinox.

About 40–50 days were fixed in this way; these were basically holidays. The method of fixing days was handed down from one generation to the other. This original mountain calendar contained 365 days (on an average). There was no division into weeks and months but the number of days which occurred between the various holidays was thus established.

The mountain calendar had an advantage in that there was no accumulation of mistakes which may easily occur when fixing the point of sunset on a certain place on the mountain profile; in fact, any such mistake was put right. Thus, if any one year included less than 365 days, the following year would include more than 365 days. In this calendar the mountain profile is essentially outlined against the firmament; the position of the centre of the Sun is then fixed in relation to this profile against the firmament.

A. Penny and J. E. Wood. (*Admiralty Underwater Weapons Establishment, Portland, Dorset*). *Astronomical alinements associated with the Dorset cursus*. The purpose of this contribution is to describe the results of an investigation into the Dorset cursus (figure 1), which was mentioned by Professor Atkinson in his paper, and which has previously been described by him in detail (Atkinson 1955). We have attempted to study the cursus, not in isolation, but in its archaeological landscape. It is in an area noted for the number of barrows, both long and round. Chronologically it comes after, or at any rate at the end of, the spate of long-barrow building and before the round barrows. We have taken the date to be 2500 B.C.

The Thickthorn terminal is at the southwest end on a hill. It is the least damaged part of the cursus; unfortunately most of the rest has suffered badly from agriculture. Going northeast, the cursus descends a valley and then rises again to another hill, on which stands a prominent long barrow, Gussage St Michael III. The cursus banks actually pass on either side of this long-barrow, although not quite symmetrically, as there is a wider gap on the southern side. It

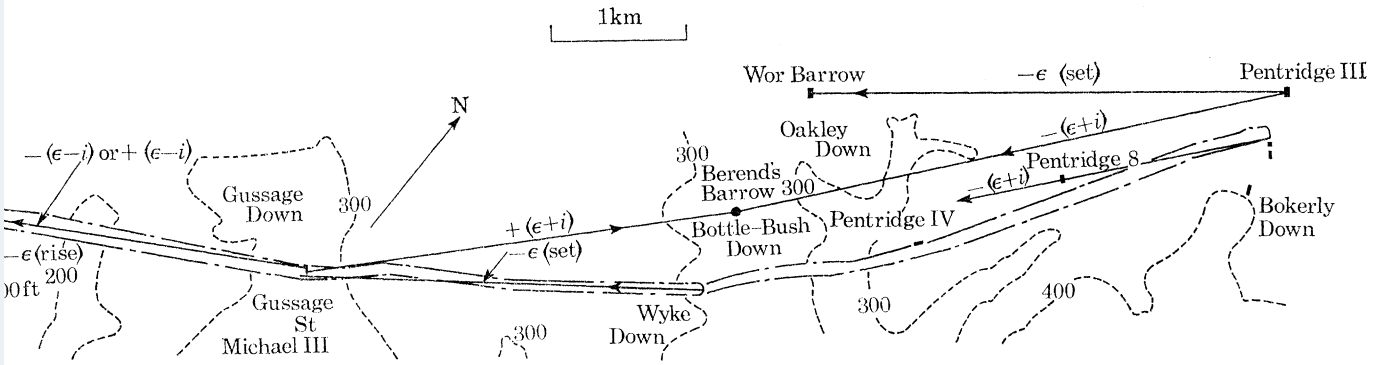

FIGURE 1

goes down another hill, with a distinct kink, and then rises slowly towards Wyke Down, where it is cut by a transverse bank. Continuing northward, the cursus changes direction, bends to incorporate another longbarrow, Pentridge IV, in one of its banks and finally, after one more deflexion, finishes on Bokerly Down just short of Bokerly Ditch. Not far from the last bend, Professor Atkinson discovered a long gap in the northern ditch and a smaller one in the southern ditch. Presumably there were corresponding gaps in the banks at these places, but here the cursus is totally destroyed and can only be followed on aerial photographs.

At the Bokerly Terminal the geometry is quite remarkable. The centre of the end of the cursus is at the intersection of lines along the axes of two very long longbarrows. Furthermore, the projection of one of these passes through yet another longbarrow, Pentridge III, and extended meets yet another nearly $2\frac{1}{2}$ km away.

The purpose of the cursus is obscure. It has been described as a processional way, associated with some funereal cult because of the number of longbarrows in its vicinity.

In this assembly, you will expect me to introduce astronomy, and indeed our results lead us to believe that there are astronomical alinements incorporated in the cursus. Using the conventional terminology we describe the alinements by labelling them with the declination of the Sun or Moon, corresponding to the rising or setting azimuths. Thus if one stands at the centre of the Wyke Down transverse bank and looks towards the Gussage St Michael III longbarrow this represents a $(-\epsilon)$ or midwinter sunset alinement. Last midwinter a few days after the solstice, the sun set slightly to the right of the longbarrow – in 2500 B.C. the Sun would have set in the gap between the east end of the barrow and the eastern bank of the cursus.

There is not time to describe the other seven alinements in any detail. From the Thickthorn terminal to Gussage St Michael III appears to be a lunar $(\epsilon - i)$ sighting; this alinement, incidentally, unlike the others could have been used in both directions. From the Bokerly Terminal to a barrow just outside the cursus is a $-(\epsilon + i)$ alinement. This barrow, Pentridge 8, is catalogued as an oval roundbarrow but ground inspection shows it to be almost certainly a longbarrow. Atkinson's gap in the north bank now appears to be to permit the sighting. The sight-line here is almost along one bank of the cursus. It would not have been possible to sight from the centre of the terminal and retain its meticulous geometrical layout.

Of all the roundbarrows in this area, only one is prominent on the horizon, Berends Barrow. It is tall and conical; we suggest it is not a conventional roundbarrow, but a deliberate lunar foresight. It is carefully placed to give two alinements, one from Gussage St Michael III, one from Pentridge III. When it was dug into by Colt Hoare in 1800 it contained a quantity of charred wood. Possibly it was a beacon to facilitate the lunar sighting. We must record that

Pentridge III to Worbarrow seems to be a solar alinement, somewhat to our surprise. If it is genuine and not accidental it must be the first in the area and precede the building of the cursus by even 1000 years.

Let us now speculate on a possible sequence of events:

In its first phase, the cursus shows both lunar and solar alinements, the three terminals each being backsights and existing longbarrows being used as foresights. The banks serve to emphasize the direction one should observe and may also delineate the area to be kept clear of trees and scrub so as to preserve the sighting. They may also symbolically link the backsights. The incorporation of Pentridge IV in the cursus is presumably to obscure it – for it would otherwise be the only prominent skyline object not part of the system.

Later, the observational scope was extended by constructing Berends Barrow in such a position as to give two alinements. This would not have been possible if the Bokerly terminal was to be one of the backsights, and so an adjacent longbarrow, Pentridge III, was used. Finally, the Neolithic period ended and the Bronze Age roundbarrows were built, not on hill tops as elsewhere, but on low ground, so that they did not confuse the sight-lines. Was this purely out of respect for the earlier function of the cursus, or does it imply a continued interest on into the Early Bronze Age?

Reference

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H. L. Porteous (*Department of Pure Mathematics, Liverpool University*) mentioned a hypothetical experiment he had performed to see whether Thom's statistical analysis of the data on which he had based his faith in the megalithic yard was sufficiently sophisticated to distinguish between an accurate quantum and pacing as a method for laying out stone circles. The conclusion drawn from this was that pacing had not been satisfactorily eliminated as a possible method, but further studies would be needed to clarify the position. (cf. Megalithic yard or megalithic myth *J. Hist. Astron.* February 1973).

W. S. Reith (6 *Baronsmead Road, Barnes, London S.W.*13). Professor A. Thom found a linear unit of 2.72 ft (32.64 in), which he called a megalithic yard, as a basic unit of construction of megalithic sites in Britain. Professor D. G. Kendall discussed and found acceptable a quantum of 5.44 ft (2 megalithic yards) as a unit of dimensions of megalithic sites based on Thom's measurements.

It is interesting, I think, to point out that in Assyria of Sargon's time (2300 B.C.) – which is roughly contemporary with the construction of the British megalithic sites – Oppert (1872, 1874) found evidence at Khorsabad of the use of a linear standard, named U (ahu) in the cuneiform script, which was equivalent to 10.8 in. Furthermore, Flinders Petrie (1934) reported a similar unit of 10.9 in used at Ushak, a unit 'eastern foot' of 10.8 in, and 'oscan foot' of 10.85–10.95 in.

One megalithic yard is equivalent to three such 'feet' ($3 \times 10.9 = 32.7$ in), and six such 'feet' are equivalent to the quantum of 5.44 ft discussed by Kendall as an acceptable unit from Thom's measurements of British megalithic sites.

I think it is interesting to point out this equivalence of linear measures used at a similar time of construction of a number of sites in Assyria and in megalithic Britain.

References

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