POSSIBLE EVIDENCE OF TIME-RECKONING AT MNAJDRA[1]

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Purpose

The purpose of this short communication is to draw attention to two intriguing series of drilled holes at Mnajdra and to discuss briefly their possible significance. In 1913, Ashby and his co-workers described the holes as "...pit markings which run in curious lines on the lower part of the inner faces..." of two pillar slabs[2]. These orthostats flank the entrance to the central chamber of the small tre-foil shaped temple at the site. Interestingly, the chamber is blocked by three small standing stones in a way that is reminiscent of the six-chambered temple at Tarxien[3]. But at Mnajdra, the small temple dates from the Ġgantija phase.

The west pillar, which Ashby found fallen and which he re-erected, has some damage to a limited area of the inner face that interferes with the rows of holes in some places (Figure 1). The top three rows are made respectively of 12, 19 and 7 deeply incised holes; above them are 16 faint dots each about 5mm wide. The fourth and fifth rows are rather wavy but run fairly parallel to each other. In two places the face is eroded and so there is some uncertainty in the count. The fourth row clearly contains 30, but possibly 31 holes, while the fifth row contains 31, or possibly 32 holes. The next two rows are the most problematic since damage to the stone surface blots out the middle section of both rows and possibly the left-hand part of the seventh row. In the case of the middle sections, a careful estimate of the number of holes in the gap was obtained by measuring

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1. This is a concise version of a paper which was published in the *Journal for the History of Astronomy* (JHA), whose full reference is: F. Ventura, G. Foderà Serio, and M.Hoskin. Possible tally stones at Mnajdra, Malta, *JHA*, xxiv/3 (1993), 171-183.

2. T. Ashby, R.N. Bradley, Peet, T.E. and N. Tagliaferro, *Excavations in 1908-11 in various megalithic buildings in Malta and Gozo*, Papers of the British School in Rome, iv(1), Rome 1913, 91.

3. The existence of a slab that blocks the entrance to the inner chambers of the middle temple at Tarxien has been interpreted as a sign that during the late Tarxien phase the general public were excluded from the inner parts of the temples. Possibly they followed the ritual from the forecourt outside.

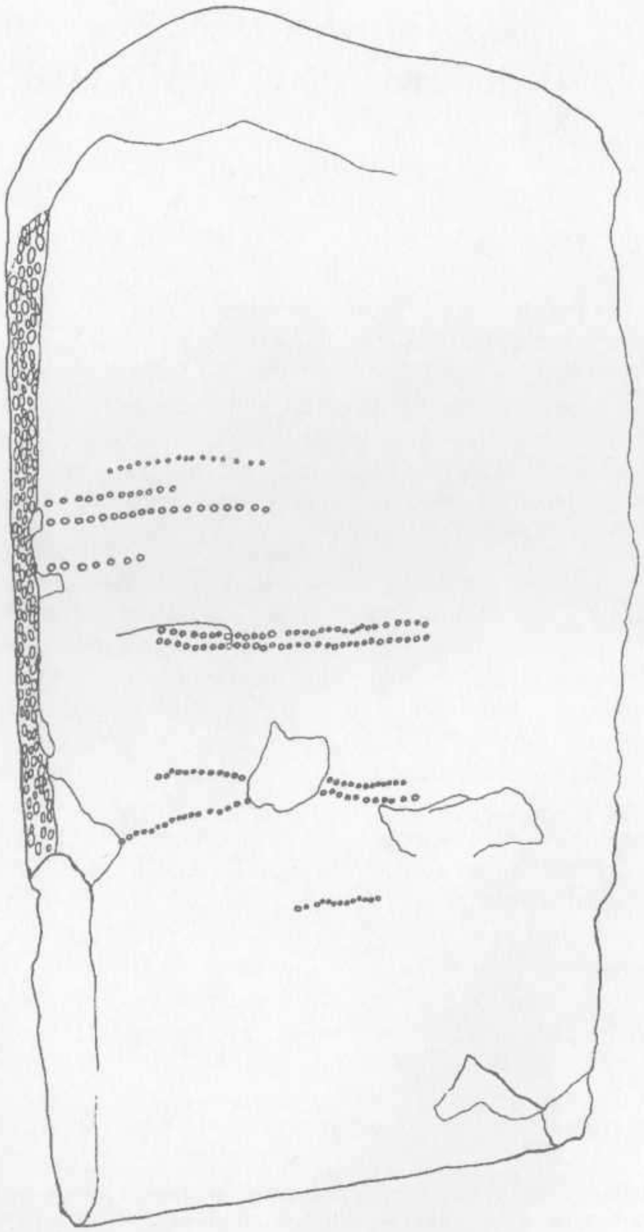

Fig 1: Sketch of the dots and drilled holes in the west pillar.

the length of the gap and comparing it to the undamaged part of each row. The sixth row thus consists of two parts with 12 holes each, separated by a gap which could have contained 11 holes, for a total of 35 holes. The seventh row has a part with 17 holes, a gap which could have contained 9 holes, and another part with 11 holes, bringing the total to 37 holes. The last row consists of 12 or 13 narrower holes.

The east pillar is in its original position. The upper part of its inner face is still decorated with close-packed shallow pits. The middle part contains nine rows of deeply incised holes and a column of slightly shallower holes. In this case the record is generally very clear with an uncertainty of only two holes (Figure 2). The first three rows contain 19, 13 and 16 holes respectively. The fourth row has 3 holes and the fifth row consists of 4 holes, a long empty space, and three holes on the same level. The sixth row has 24 holes, but possibly it could have had 25. The seventh row has 11 and the eighth 25 holes. The ninth row runs from one edge of the slab to the other and it contains 53 holes. The column, part of which can be seen behind a smaller standing stone, contains 8, possibly 9 holes. (In a lower part of this pillar, there is a curious pattern of 6 smaller holes arranged in a roughly circular fashion. For reasons that will be given later, it is not impossible that this pattern represents the Pleiades, a star cluster of exceptional importance to early peoples in both the Old and the New World[4]).

Interpretations

Comparing the clarity, layout and uniformity of the rows on the two pillars, one gets the impression that the record of the east pillar, may be a 'fair copy' of that on the west stone. Certainly the rows convey the strong impression of being a tally - but a tally of what? The east pillar has 179 definite holes, and it may be that 1 or 2 holes have been lost due to erosion, so that the total could have been as high as 181. In the case of the west pillar, there are also 179 definite holes but there may have been as many as 23 more, giving a maximum of 202 holes and dots. Since the tally on the east pillar, and perhaps that on the west also, is very

4. This is amply recorded in R.H., Allen, *Star names: their lore and meaning*, New York: Dover Books 1963, 391-413. Interestingly, Aquilina records a Maltese saying which connects the Pleiades with time-reckoning: "*milli jidher għamel ħafna ħin għax diġà telgħet it-Trajja*" - 'it seems that it is getting late because the Pleiades have already appeared'. In J. Aquilina, *Maltese-English Dictionary, Volume Two*, Malta 1990.

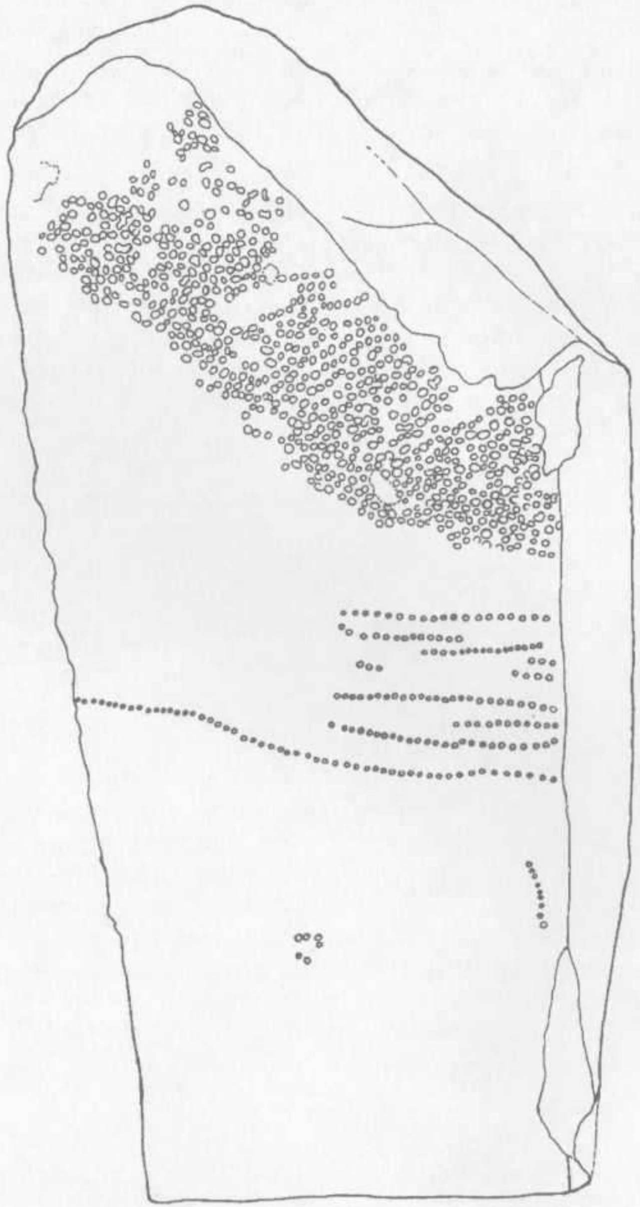

Fig 2: Sketch of the holes drilled in the east pillar.

close to the number of days in half a year, the possibility of a connection with the equinox orientation of the nearby lower temple immediately comes to mind.

More than 13 years ago, George Agius and I showed that this temple faced equinox sunrise with great precision. In spite of this accuracy, we had serious doubts whether the alignment was intentional because the equinox position is very difficult to determine[5]. However, with the tally at hand it is conceivable that the builders could have found the equinox arithmetically. Thus it was possible for them to note the arrival of the sun at the winter solstice on December 21 and then count off half the number of days on the tally, that is 90 days, to obtain the day of the spring equinox (March 21).

However, this way of determining the equinox runs into practical difficulties. Near the equinoxes the position of sunrise moves very rapidly along the horizon; by contrast, for several days around the solstices the position of sunrise is practically the same. This is analogous to the motion of a pendulum bob which moves fastest at the mid-point of its path and slowest at its extreme where it actually stops its forward motion and reverses direction. Thus it is easy to mistake the actual solstice (the day the sun stops) by several days. Such a difference would lead to a substantial error in the calculated date of the equinox resulting in a misalignment of the temple. For this reason, the arithmetical method does not provide a satisfactory explanation of how the builders found the equinox position.

The second possible astronomical motivation is that the lower temple was built to face the rising point of the Pleiades. This star cluster, which keen-eyed observers see as a tight group of six or seven stars, has been used by various people all over the world to mark the passage of time, and the same could have been true of Malta in the Temple Period. If the lower temple at Mnajdra was intended to face the Pleiades, there is no problem in explaining the accuracy of the orientation, since for about a hundred years or so around 3000 B.C. the cluster rose practically from the point on the skyline where the equinox sunrise occurred. But how does the tally feature in this explanation of the orientation?

If, as seems likely, the tally is a tally of days, then the rows may well indicate the count of days from one event to the next; events which must have had great

5. G. Agius, and F. Ventura, *Investigation into the possible astronomical alignments of the Copper Age temples in Malta*, Malta 1980. This booklet was re-published in revised form in *Archaeoastronomy [bulletin]*, iv (1981), 10-21.

significance for the Temple people. The first sequence of events to be explored involves the rising and setting of the Pleiades in conjunction with the rising and setting of the sun. Thus the first event consists of the earliest visible rising of the Pleiades at day-break. The star group is seen to rise above the eastern horizon at early dawn and is then quickly blotted out by the rapidly brightening daylight. Calculations show that in 3000 B.C. this event, which is called the heliacal rise, occurred on April 6, although small variations in atmospheric conditions could change the date by a number of days. However, there are only four heliacal events involving the Pleiades[6], so that other hypotheses are needed to explain why there are so many rows in the tally. These difficulties lead to the exploration of a different method of using the tally.

It is well known that successive heliacal risings of stars and star groups were used for time-reckoning and calendar construction in ancient Egypt[7], and in determining the agricultural year used by Greek farmers in Hesiod's day[8] (8th Century B.C.). Calculations were therefore carried out of the heliacal risings of the 28 brightest stars (brighter than the present Pole star) visible from Malta during the Temple Period, as well as the Pleiades and the Hyades - another star cluster which Hesiod mentions in his Farmer's Year and which Homer places among the most significant stars and constellations[9]. The calculations took into consideration two different atmospheric conditions , corresponding to clear nights at a dry sea-level site and in a humid climate[10].

With this information, it is possible to suggest a number of sequences of heliacal risings at intervals which could correspond to the rows of drilled holes on the east pillar. However, only one particular sequence fits all the rows of the tally remarkably well in all details. The scenario is as follows.

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6. The four heliacal events consist of the group of stars (1) rising and (2) setting with the sun, (3) rising at sunset and (4) setting at sunrise.

7. O. Neugebauer, *The exact sciences in antiquity,* 2nd. edn., New York 1969, 80-89.

8. Hesiod, *Works and days,* translated with commentary in A.W. Mair, *Hesiod: the poems and fragments,* Oxford 1908, 104-147.

9. In *Iliad,* xviii, 483 we find that when Hephaistos made the shield of Achilles, "he wrought thereon Earth and Heaven and Sea, and the unwearied sun and the full moon and all the signs wherewith the Heaven is crowned, the Pleiades and the Hyades and the might of Orion and the Bear which also men call the Wain...".

10. Heliacal risings were calculated with the computer program by B.E. Schaefer, 'Predicting heliacal rising and settings", *Sky and Telescope*, lxx (1985), 261-3. I would like to thank Mr T. Tanti for help in obtaining this programme.

The sequence starts with the heliacal rise of the Pleiades, which on a clear dry night occurred on April 6. Nineteen days later, on April 25, the heliacal rise of the red star Aldebaran (the brightest star of our constellation Taurus) is observed and the interval between the first and second observation is recorded as the first row of drilled holes on the east pillar. The next observation is that of the Hyades, whose estimated heliacal rise took place thirteen days later, on May 8. The observations continued with the heliacal risings of the brightest stars of the constellation Orion starting with the bright orange Betelgeuse (the Hand of Orion) on May 24, followed by Gamma Orionis on May 27 and seven days (4+3 holes) later by Rigel (the Foot of Orion) and the stars of the Belt of Orion.

The next heliacal rise of importance came 24 days later when the brightest star in the sky, Sirius (the Dog star) rose on June 27, close enough to the summer solstice that the coincidence could have been noted by the observers. Eleven days later, on 8 July, Beta Canis Majoris joined Sirius in the pre-dawn sky, and the rising of Arcturus (the brightest star of the constellation Bootes) was noted on August 2 after an interval of 25 days. A long period of 53 days then passed before the next notable helical rising, which was of Gacrux (the first star of the Southern Cross to become visible) on September 24. This event must have been of particular importance because the star marked the rising of the Crux-Centaurus group of bright stars which could have been of special interest to the temple builders[11], and also because it occurred so close to the autumnal equinox.

The record of the rows of drilled holes on the east pillar stops at this point which could also correspond to the end to the sequence. However, the column of 8 (or possibly 9) smaller holes on another part of the stone could correspond to the heliacal rising of Beta Centauri, which was observed on October 2 or a day later.

Of course, with the present knowledge it is impossible to prove that this is a correct interpretation of the tally. It can be shown, however, that the congruence between the tally and the intervals from one heliacal rise to another is unlikely to be a chance occurrence, even though it is not possible to use standard statistical analyses to check this complex hypothesis[12].

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11. This special interest was highlighted in G. Foderà Serio, M. Hoskin, and F. Ventura, 'The orientations of the temples of Malta', *Journal for the History of Astronomy*, xxiii (1992), 107-19.

12. Refer to the original paper for more details

Conclusion

In conclusion, therefore, it is suggested that the holes are a tally, probably of days of a regular and significant sequence of events that occurred annually, possibly connected with a series of festivals. It appears that these events consisted of the heliacal risings of the Pleiades and of other stars or asterisms. Furthermore, it is suggested that once this sequence of observations was established, it motivated the temple builders to record it permanently on stone at the old temple - the tre-foil temple - and to orientate their new temple - the lower temple - to face the heliacal rising of the Pleiades. Unfortunately it is not possible to prove these hypotheses with the available information.

However, the mere existence of a tally at so early a date - around 3000 B.C. - is a matter of great interest. Besides showing that the Temple people attained a certain level of numeracy, the tally could also be described as the earliest 'written' record in the Maltese islands, if we define writing as the tracing or inscription of letters or other symbols on a surface, as most dictionaries do, and accept the holes as symbolic representations of days. Moreover, if the interpretation is correct, then heliacal risings were being carefully monitored in Malta hundreds of years before the first record of similar phenomena appeared in Egypt. Finally, the tally stones could be a further testimonial of the achievements of the Temple people and should be preserved with due care.