The «Petre de la Mola» megalithic complex on the Monte Croccia (Basilicata)

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Introduction

Apart for the Apulia area (Tunzi et al., 2008), the presence of astronomically oriented megalithic structures is scarcely documented in southern Italy. However, the case of an oriented megalith, the «Preta 'ru Mulacchio» («Bastard Child Rock» in local dialect) on Monte della Stella in Cilento (see Fig.1), that satisfies the three Schaefer (2006) tests of intentionality, has been recently published (Polcaro & Ienna, 2009). The «Preta» is basically composed of three rocks that originated naturally from a single block of sandstone in its upper part and of a rough conglomerate in the lower one. Between the three rocks, two galleries were thus formed. However, it is easy to see that the «Preta» was deeply modified by human intervention: large stones were wedged in an exact position between the three original blocks or were positioned as a cover. One gallery has an astronomical azimuth of 359° and the other of 240°: within the measurement precision (□1°), the galleries are thus respectively oriented to the meridian and to the sunset of the winter solstice. Furthermore, modern folklore associated with the rock seems to suggest ancient fertility rites. From a statistical analysis of the alignments and an archaeological study of the complex, it was thus concluded that «Preta 'ru Mulacchio» is most probably a monument, dated to an epoch presently unknown but possibly preceding the Hellenic colonization of Cilento, built in order to determine with a high precision the winter solstice because of ceremonial reasons, probably connected with fertility rites.
Following the publication of these results, a very similar megalithic complex was noticed near the Croccia Cognato archaeological site, only 97 km from «Preta 'ru Mulacchio».

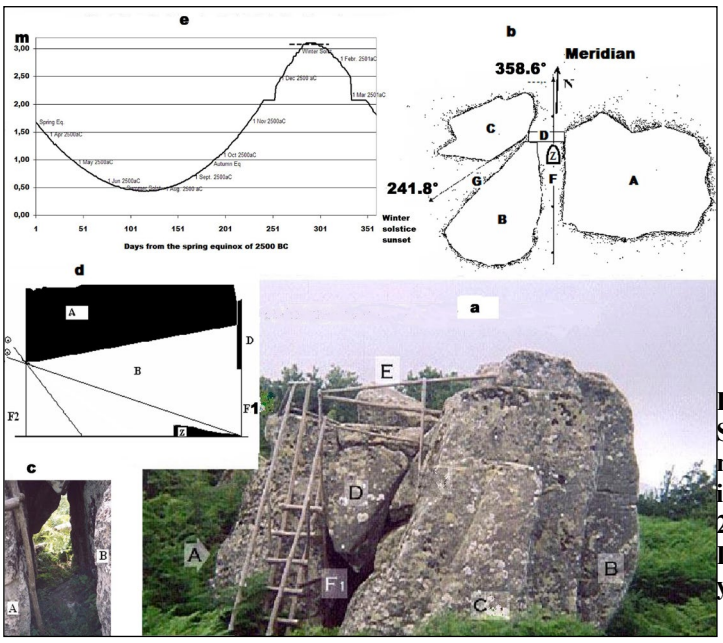

Fig. 1 The «Preta 'ru Mulacchio» on Monte della Stella; a: the megalith seen from N; b: Relief of the megalith (section at 1m from ground); c: "Sun blade" inside F gallery at noon (picture taken on August 18th, 2006, h12 CEST); d: Schematic section of F gallery; e: Length of the "Sun blade" inside F gallery during the year, computed for 2500 BC

The Croccia Cognato Archaeological Site.

The Croccia Cognato archaeological site (40° 33' 02" N, 16° 11' 39" E) is sited at 1150 m above sea level on a mountain belonging to the Lucanian Dolomites range, dominating the Basento Valley and the upper flow of the Cavone river. Traces of human frequentation go back to Neolithic Age (12,000 – 8,000 BCE) and also during the Bronze Age when the area was frequented. The first archaeological investigations of the area were performed by Michele Lacava (1887) at the end of the 19th Century; later, Vittorio Di Cicco performed five excavation campaigns, uncovering an osco–samnite settlement, dated between the 6th and the 4th Century BCE, with a double surrounding wall and various structures sited on the acropolis Thebuilding technique was similar to the Hellenic one (Di Cicco,1896). Last excavations at the site were performed in 1998 by the Basilicata Superintendence: the southern side of the fortification was explored for a length of about 60 m and the southern and the eastern part of external wall, joining the acropolis, was reconstructed (Russo, 1999). The external wall, dated between the end of the 8th and the end of 6th Century BCE[1], is partly of squared and partly of polygonal huge sandstone blocks, alternating with natural outcrops of the bedrock. The acropolis is sited on the top of the mountain; it is surrounded by a double circuit of walls in opus quadratum madewith square blocks. The outer walls is about 700 meters long and is dated, according to archaeological finds, at the beginning of the 4th century BC.
The southern front of the double curtain wall uses the natural rocky outcrops, here particularly suited to the defense of this side. Five posterns are sited on the northern, eastern and southern side of the internal wall, whose well preserved main entryway is made by two doors closing a small courtyard.

Fig. 2 The external wall of the Croccia Cognato settlement

1 Due to the presence of "curtain ceramics" and fragments of B2 type Ionic cups.

The lack of systematic excavations does not allow a precise dating of the settlement. However, it seems sure that it had two phases - the first one in Archaic Epoch at the time of the building of the first wall, and the second around the 4th Century BCE, when the settlement is localized on the top of the mountain. Actually, during the excavation performed at the end of the 19th Century by Di Cicco, the remains of a relatively large squared building, divided in a number of rooms, located inside the internal wall were discovered: inside, a Republican Age bronze coin, an iron spear head and a little bronze fibula, were found, together with the remains of tiles and rough pottery, strongly suggesting the housing use of the building. The same archaeologist reported the presence of the remains of a possible small temple in the acropolis, though the present state of this building does not allow a precise determination of its use.

The data collected to date suggest that the settlement was abandoned in the 3rd Century BCE, when, due to the Roman pressure, most of the small Lucano fortified settlements were abandoned (Osanna, 2001).

On the eastern slope of the mountain, not far from the previously described settlement and on the opposite side with respect to the megalithic complex described in next section, a number of elite graves, contemporary with the fortification walls, was found inside an area employed as a quarry and for rock blocks working. One of these graves contained funerary equipment, made by a Corinthian beaver, iron weapons and a red figures proto – Lucano crater, restored with lead hooks and bitumen. The necropolis was built over a previous settlement and the stratigraphical sequence goes from the end of the 8th to the end of the 4th Century BCE, though some traces seem to testify a frequentation starting in the proto-Villanovian B (Di Cicco, 1919).

The «Petre de la Mola» on Monte Croccia

At a distance of about 200 m east of the main gate of the settlement, an imposing group of rocks is sited on a small, rather flat area of the mountain slope, at a height of 1049 m. These rocks, named in local dialect «Petre de la Mola» («Grindstone Rocks»), are natural outcrops of the limestone bedrock, and cracked in various boulders because of the rain and wind erosion (Fig. 3).

Fig.3 The «Petre de la Mola» megalithic complex

The fortuitous discovery by one of the authors (M.M.) of a singular light effect due to the sunlight at noon let us suppose that these rocks too, as in the case of the «Preta ‘ru Mulacchio» were modified by human intervention, in order to be transformed into an instrument for calendrical measurements. In this regard the smoothed surfaces of the rock walls that form the vertical cut oriented East-West, as well as being perfectly parallel show clear signs of human workmanship, in addition to a recent survey showed the presence around the stone slurry of ceramic material dating back to the Bronze Age
Because of this reason, a laser scan of the megalith was performed in July 2008. Two clear astronomical alignments where found from a single observation point, a break on the natural platform on the North side of the megalith, as it is illustrated by the horizontal section of this scan, shown in fig. 4.

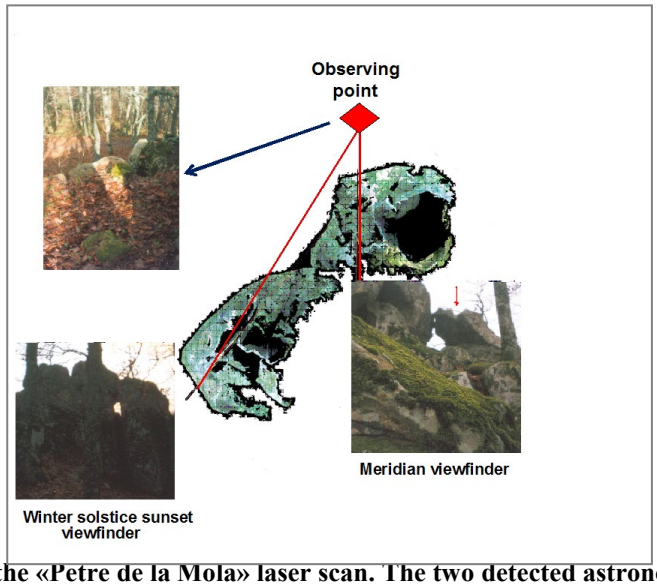

Fig. 4: Horizontal section of the «Petre de la Mola» laser scan. The two detected astronomical alignments are shown as red lines; pictures of the related viewfinders are shown at the end of the lines

In order to verify these proposed alignments, we visited the site on the winter solstice of 2008. As it was foreseen by our measurements, the Sun appeared at the meridian viewfinder at noon and in the SW one at the sunset, as it is shown in Fig. 5.

Fig. 5: Light effects at the «Petre de la Mola» at winter solstice: A) Noon B) Sunset. Both pictures have been taken from the same observing point: the break on the natural platform on the North side of the megalith shown in Fig.4

It is worth the effect shown in Fig.5b does not happens at the time of the astronomical sunset, but a few minutes before, when the Sun's altitude is about 5 deg. Actually, the field of view seen through the viewfinder shown in the upper panel of the figure is due to the intersection of a narrow gallery in the rocks with the local horizon given by the mountain chain west of the complex.
A further visit was made at the summer solstice 2009, in order to identify other potential calendrical marks. It was actually found that, at noon, sunlight falls into a hole carved in the rock, repeating the shape of the projected light beam (Fig. 6), though it is difficult to prove that this hole is artificially carved. Furthermore, it seems that the summer solstice sunset from the same observing point points the mountain top (not yet completely proven because of the heavy forest trees coverage to date).
We have now to evaluate if this situation is intentional, following Schaefer's (2006) standards.

Fig. 6: The sunlight passing through the meridian viewfinder is projected inside a hole with a shape similar to the sunbeam at noon of the summer solstice

In this case, archaeological proofs of the intentionality of the alignments is more difficult to find in respect of «Preta 'ru Mulacchio», where clear evidences of human intervention are visible. Actually, in the case of the «Petre de la Mola», only minor modifications of the natural rock were necessary in order to obtain the detected alignments and the traces on the sandstone are very difficult to identify after a such long exposure to atmospheric agents, though it is possible that some traces on the blocks where the viewfinders are found may be attributed to human actions.
To date, the only unequivocal proof of human intervention on the complex are a dry-stone wall on the right of the observing point, probably made in order to obtain a relatively flat area around it by means of landfill and two basins, which is very similar to the ones carved on the top of the «Petra 'ru Mulacchio» complex.
From the ethnological point of view, the Proto-Lucani élite graves demonstrate that the megalith was considered, at least at that epoch, a sacred place. Furthermore, the megalith is seen exactly east from the main entryway to the Lucani settlement. These facts could indicate that the sacred value of the megalith lasted a long time. Another indicator of the cult use of the megalith is given by the two basins carved in its top, collecting the rain water. However, none of these elements give secure evidence that the megalithic complex was used for calendric purposes and only dedicated excavations can solve this point.

A statistical analysis shows that the detected alignments have a very low probability to be due to chance. Actually, with respect to the null hypothesis (random orientation), the probability that the length of the sunlight beam at the winter solstice is equal to the distance between the meridian viewfinder and the break in the rock platform is □1/365. This is the solstice equivalent, from the statistical point of view, to any other day of the year taking into account the fact that the sunbeam projection could also never reach the break in the rock. This probability, in Gaussian statistics, corresponds to 3.25 □. Furthermore, being the probability of a single solar alignment equal to 1/22 □2.08 □ (Schaefer 2006), the probability of 2 coexisting solar alignments (as in our case the meridian and the azimuth of the sunset at the winter solstice) from the same observing point corresponds to 2.94 □. Last, we have to evaluate the probability that the local sunset happens, inside a □1 deg^2, at a Sun height equal to the one defined to the angle under which the viewfinder is seen by a defined observing point. Respect to the null hypothesis of chance orientation this probability is equal to 2/90, corresponding, in Gaussian statistics, to ~2.5 □. The total probability of the simultaneous chance occurrence of the detected independent events can thus be evaluated to be □ 5.05 □ corresponding to about 1 over 8,000,000. The intentionality probability is further increased by the presence of the «mark» hole corresponding to the summer solstice.
Despite of this statistical evidence, the final proof of the intentionality of the detected astronomical alignments will be given only by a dedicated archaeological campaign, confirming the human intervention on the complex and proving the calendrical and cult use.

On the other hand, we have now two similarly oriented megaliths separated by a distance of less than 100 km. A third one on the same area, sited at Cannilicchio di Calstelgrande, and presenting similar alignments and geographical position (at ~ 1000 m elevation on a mountain with a wide view), is presently under study. Though this study is at the beginning, it seems that astronomically aligned megaliths are relatively common in Basilicata and in the surrounding area. In absence of dedicated archaeological excavations, it is not yet possible to attribute these artefacts to a definite epoch or culture. However, it is reasonable to hypothesize their association with the Proto – Apenninean culture, whose nearby Trinitapoli Sacred Area clearly shown the interest for celestial phenomena, with its extraordinary astronomically oriented rows of holes, covering an area of more than 60, 000 m^2 (Tunzi et al., 2009).

2 Being the Sun an extended object with diameter of ±0.5 deg

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