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Abstract

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In some previous articles concerning archaeoastronomy, we have used some software for investigating the alignments of buildings and other structures with respect to the directions of rising and setting of sun and moon, on the solstices and the lunar standstills (see for instance Refs. 1-8). The first software I used was Sollumis.com [1-3] and then SunCalc.net [4-6] for the sun, and the Photographer's Ephemeris for the moon [7,8]. Another software that we can use in specific applications concerning archaeoastronomy is the excellent SunCalc.org, created by Torsten Hoffmann (analogous site for the Moon exists at MoonCalc.org). Like the above-mentioned software, SunCalc.org allows to see the direction of sunrise and sunset on any day of year depicted on Google Earth satellite images. However, SunCalc.org has a specific tool that we can appreciate: it is able of giving the shadow cast by an obstacle, like a column, an obelisk or a menhir, at any given time of the day. It is enough to know the height of the obstacle, and the software estimates the length of the shadow cast by it. The shadow is shown on the satellite image. Moreover, all of the information concerning location, date, time of sunrise and sunset, altitude and azimuth of the sun and shadow length are reported in the left part of the page of the web site.

The shadow cast by an object and depicted by SunCalc.org allows us to study, in a different manner, some aspects of ancient buildings and stone monuments. Here we show an example concerning a Bronze Age monument in Cumbria. It is “Long Meg and her Daughters”, a huge stone circle, the Daughters, accompanied by a large menhir, Long Meg. Information about this structure are given in [9].

A very interesting article about this circle is [10], where we can find discussed alignments along sunset and sunrise on solstices, Samhain and Beltane. It is told in this article that Long Meg is a menhir around 3.8 m high, "the south-west face of which is encrusted with crystal" [10]. This fact is interesting; it means that, during the winter, the sunset is illuminating this face, making the crystals catching the light and shine. Another remarkable fact is concerning the shadow of Long Meg. "The

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effect of the Samhain sunset shadow-path of Long Meg is seen as the lengthening of the shadow through the standing portal stones reaching across the circle, where it covers the mid-lower portion of the inner face of stone 9 " [10]. The Ref.10 is also telling that the circle has four stones composed of quartz crystal; these stones are numbered 2, 7, 10 and 53 (see the Figure 1).

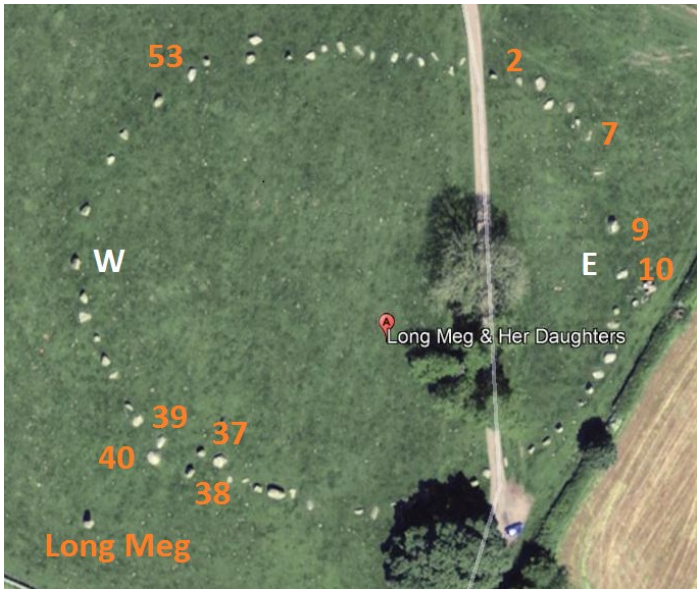

Figure 1: The stone circle of Long Meg in a Google Earth image Here we have also reported some of the stone numbers given in Ref.10. Stone 37, 38, 39 and 40 are creating the portal of the stone circle.

From the satellite image in the Figure 1, we see a remarkable fact about the position of Long Meg. The menhir is at the South/West corner of a rectangle in which the stone circle is inscribed. It means that the menhir had been places in its position after a careful project. This is exactly what we can see using SunCalc.org software.

Figure 2: The shadow of Long Meg as simulated by SunCalc.org, close to the sunset (about 16:10) on the first of November. The two extremal lines (orange and red) represent the directions of sunrise and sunset.

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Let us consider the first of November (Samhain) and simulate what is told in [10] by means of SunCalc.org. The result is given in the Figure 2: the shadow of Long Meg reaches the stone number 9, as described in Ref.10. We can also simulate the behaviour of the shadow of the menhir on the winter solstice, as in the following two images (Figure 3).

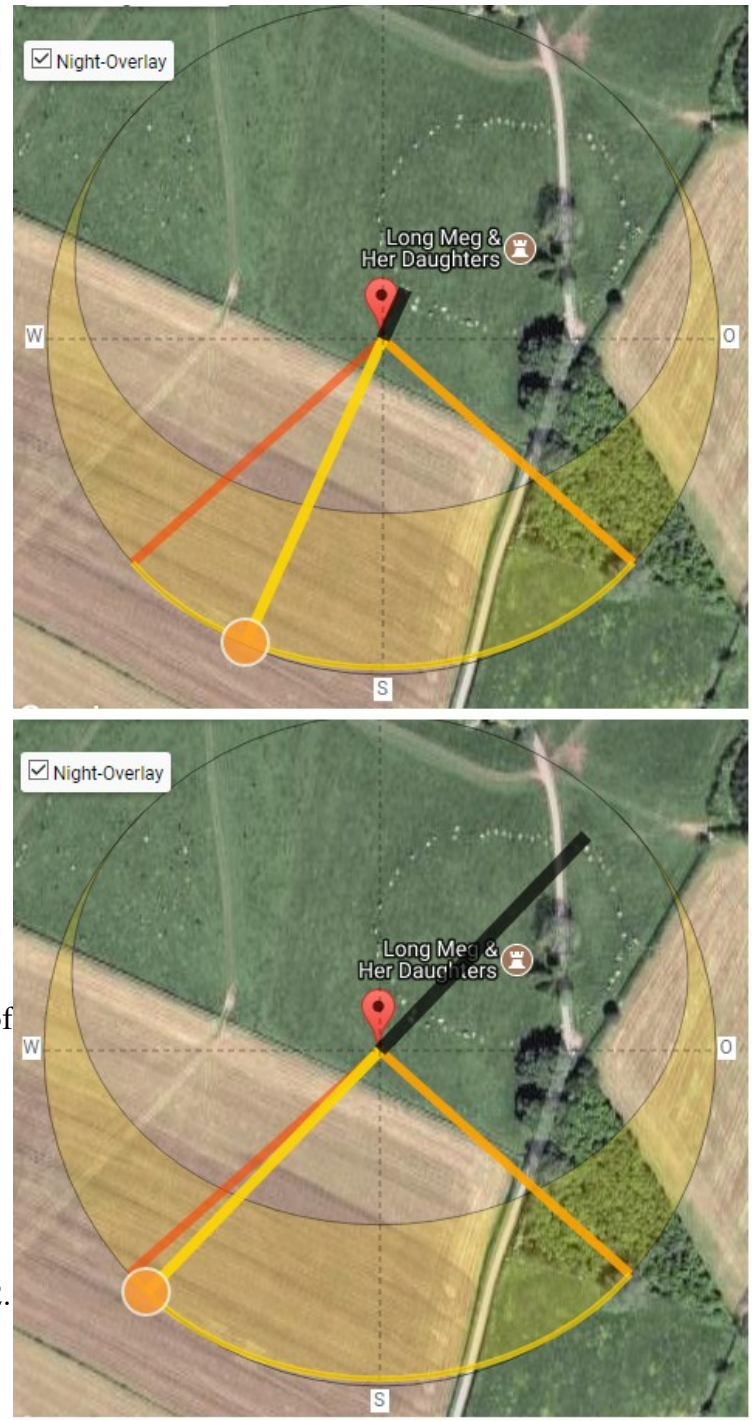

Figure 3: The behaviour of the shadow of Long Meg during the winter solstice. In the afternoon, about 2 p.m. (upper panel), the shadow enters the stone circle through the portal. At the sunset (lower panel), it reaches stone number 2. This is one of the quartz stones, which had probably some specific calendrical features.

The fact that the simulations which we can obtain using SunCalc.org software are in agreement with the observations of Ref.10 means that we can use this software to study the role of shadows in ancient monuments. Of course, it is the direct observation of the phenomenon which is necessary

for an accurate study of alignments, because they depends on the local features of the ground; however, the use of simulations is important to have some preliminary results.

Let us show another very interesting simulation. In the Figure 4, we can see that, at equinoxes (in the figure it is shown March 21), the shadow of Long Meg no longer enters the stone circle; it becomes tangent to it. This behaviour is stressing the fact that the position of the stone was carefully planned.

Figure 4: On equinoxes, the shadow of Long Meg at the sunset is tangent to the stone circle.

Let us conclude noting that, to the shadow of Long Meg, we should have to add also the shadows of "her daughters", the stones of the circle. Assuming them less than a meter high, we can imagine a picture like that given in the Figure 5, which is showing the sunset on winter solstice. The brightness of the image is reduced and the colour tone changed to simulate the sunset.

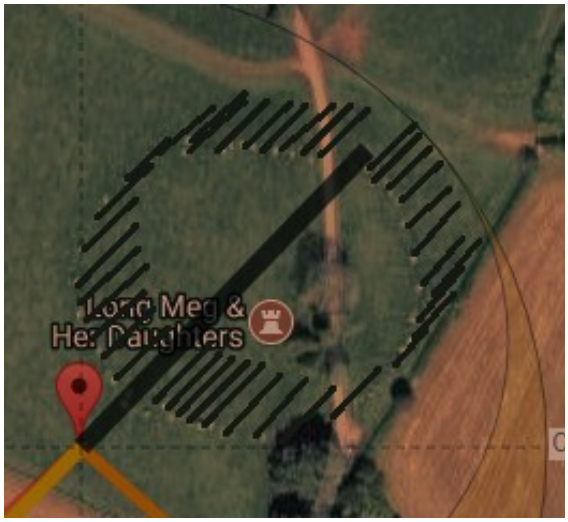

Figure 5: The shadows of Long Meg and her Daughters at the sunset on winter solstice.

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