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Astronomical Alignments of Ales Stenar along Sunset and Moonset Directions

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Abstract

The Ales Stenar, known in English as the Ale's Stones, is an ancient megalithic monument of Sweden. The stones are outlining a ship. Here we show the well-known alignment of this ship along the sunset direction on summer solstice. We propose also alignments of the stones along the northern possible moonset on major and minor lunar standstills. These astronomical alignments are shown using the Photographer's Ephemeris. It is possible that this megalithic monument was used for observing the cycles of the moon.

Keywords: *Archaeoastronomy, Modern Ephemeris, Photographer's Ephemeris.*

Stone ships were early burial structures of the ancient Scandinavian and Baltic regions [1,2], where the graves were surrounded by tightly or loosely fit stones, aligned to outline a ship. These funerary monuments, that the archaeological excavations have shown being of the late Nordic Bronze Age, were structures of varying sizes, some of large proportions. The stone ship at Blomsholm, near Strömstad in Sweden for instance, measures more than 40 meters in length and consists of 49 large menhirs (Figure1). This is one of the monuments of a large megalithic site, which is also comprising a stone circle. The stones of the bow and stern are about 4 metres high. Another major Viking burial site is Lindholm Høje (Lindholm Hills, from the word for hill or mound), near a Viking settlement situated to the north of city of Aalborg in Denmark. The southern part of Lindholm Høje dates to 1000 – 1050 AD (Viking Age), while the northern part is significantly earlier, dating back to the 5th century AD [3].



Figure 1: On the left, stone ship at Blomsholm near Strömstad ($58^{\circ} 58' 26.38''$ N, $11^{\circ} 14' 57.00''$ E). On the right, the stone circle of the same megalithic site ($58^{\circ} 58' 39.88''$ N, $11^{\circ} 14' 50.13''$ E).

Perhaps, the most famous monumental ship is the Ale's Stone Ship, which is 67 meters long (see the Fig.2, where some of the stones are marked for the following discussion).

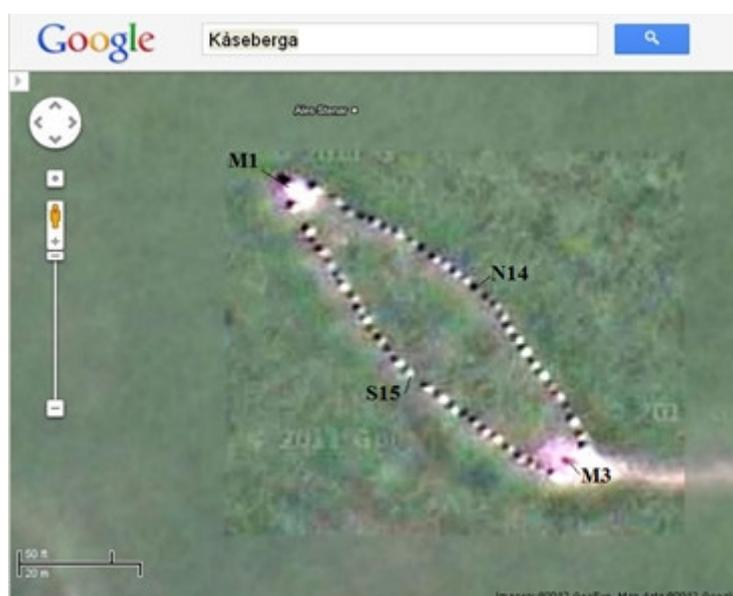


Figure 2: Ales Stenar as seen in the Google Maps, with some boulders denoted as in Ref.4.

The Ale's Stones ship (or Ales Stenar in Swedish) is near Kåseberga, a village in the Southern Sweden, located on a flat headland over the Baltic Sea, with a complete open view of 360° . It is made of 59 boulders, weighing up to 1.8 tons each. According to a local lore, this is the tomb of a legendary ruler, the King Ale. At this site, the carbon-14 dating system for organic remains has provided different results. One result indicates that the material is around 5,500 years old whereas some others give a date about 1,400 years ago. The latter is considered to be the most

likely time for Ales Stenar to have been created, that is, towards the end of the Nordic Iron Age [4-6].

In 2006, a survey with magnetic sensors and radar mapped the underground of this site, finding a larger circular structure about 165 m in diameter, with a rectangle at its center. At the end of 2012, B. Söderberg's team of the Swedish National Heritage Board dug at the center of the circle and unearthed the imprints of giant boulders, which had been removed long time ago [7]. These imprints suggested the site of Ales Stenar was previously occupied by a Neolithic site with a dolmen burial chamber [7].

On Ales Stenar, a very interesting article is given in a web page at Ref.4, rich of discussions, references and images. It is told there that a large part of the investigations on this structure had been made by the archaeologist Märta Strömberg, of the University of Lund, and Curt Roslund, astronomer of the Chalmers Technical University in Göteborg [8,9]. A research made by J. Bergström, a geologist working with Märta Strömberg, determined that four boulders are of white sandstone, including M1 and M3 boulders (Fig.2), while all the remaining ones are various sorts of granite, gneiss, porphyry, and amphibolites. Ref.4 tells that the geologists were able of determining the origin of some of the Ale boulders, which required to be moved on considerable distances to reach their final positions. According to Strömberg [8], the Ales Stenar monument was raised in the Viking Period, or perhaps a little earlier.

In [4] it is also discussed the alignment of the Ales Stenar: this ship-setting has been aligned according to the winter and the summer Solstices. "On the Winter Solstice day, an observer standing in the middle of this ship-setting will see the Sun rise over the 3.5 metre-high stern (M3, SE) boulder, and set behind the port board amidships S15 boulder. On the Summer Solstice day such an observer will see the Sun rise over the 1.5 metre-high starboard amidships N14 boulder, and set behind the 2.2 metre-high bow (M1, NW) boulder." [4]

As we have proposed for ancient monuments in some previous papers (see for instance [10-13]), to check the solar alignment of the Ales Stenar we can use the software that has been developed for solar energy applications. We used, for instance, sollumis.com and suncal.net, that are giving the sunrise and sunset directions on any day of the year, marked on a Google Earth satellite image (in a previous discussion of the solar alignment of Ale's Stones we used for instance sollumis.com [14]). However, another software exists, the Photographer's Ephemeris, which is giving, on maps and satellite images, besides sunrise and sunset, also the directions of moonrise and moonset. This well-known software has been created for helping the plan of outdoor photography shoots in natural light.

Let us start showing the alignments of Ales Stenar. We consider the summer solstice. The reason for choosing the summer is the following: summer was the best season for the navigation in ancient time.

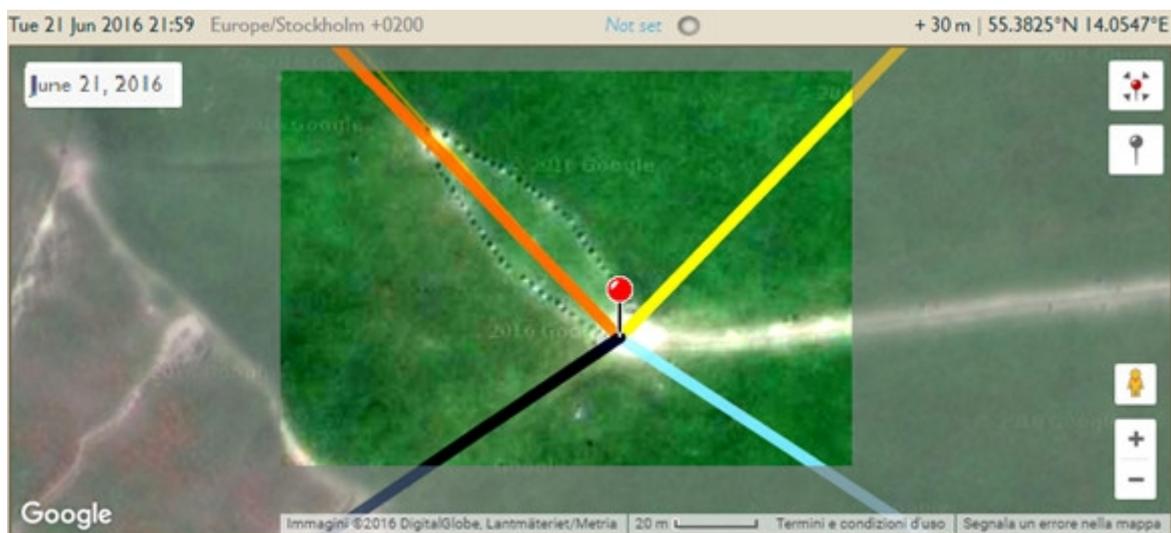


Figure 3: In this image, we can see the Ales Stenar and the direction of sunrise and sunset on the summer solstice. These directions are given by the yellow and orange lines. The blue lines represent the moonrise and moonset azimuths. The image has been obtained from a snapshot of the Photographer's Ephemeris result.

Figure 3 shows the solar directions determined by the software. We can easily see that, on the summer solstice, the ship is oriented precisely to the sunset. Of course, as stressed in [4], the alignment of the Ales Stenar could be accidental. "The orientations of the ship-settings in Scandinavia vary in all directions, although the ones along the South-North line is most common. (Perhaps the Viking mariner chieftains were supposed to navigate straight North to the realm of the dead.)... It is noteworthy that the Solstice driven alignments of several great megalithic monuments are acknowledged by some astronomers to have been purposeful." And [4] continues with a list of examples of worship sites linked to the solstices, including the Great Amun Temple in Karnak, Egypt [15].

Now, since the Photographer's Ephemeris is giving also moonrise and moonset directions, let us investigate them for the site of Ales Stenar. However, before showing the results we obtain, it is necessary to shortly discuss the apparent behavior of the moon, which is more complex than that of the sun. We have that the sunrise direction oscillates between the two solstitial positions during a year, whereas the moon does the same during a nodal period (about 27 days). Moreover, the moon has a period – the lunar standstill period (18.613 years) – on which the values of the extremal directions (standstills) are changing. In this manner there are major and minor standstills, of which we can calculate the directions that are depending on latitude. For a latitude of about 45° , like that of Torino, we have that the minor and major northern moonrise azimuths (directions) are 47.40° and 65.65° (angles are given from true north). The minor and major southern moonrise azimuths are 116.35° and 132.58° . The azimuths of sunrise on summer and winter solstices are between these lunar azimuths. For the calculation of moonrise azimuths, we can use the formula given by Jürgen Giesen at his web site <http://www.geoastro.de/sunmoonpolar/index.html#Mondwenden> (the reader can find detailed discussion and apps for simulate the moon apparent motion there), but it is simpler to

use the Photographer's Ephemeris.

We consider the simulation of the major lunar standstill of April 2025 and the minor lunar standstill of October 2015 (https://en.wikipedia.org/wiki/Lunar_standstill). Here in the following images the results. Let us start from the **major lunar standstill**. The alignments are given in the Figures 4 and 5.



Figure 4: In this image, we can see a side of the Ales Stenar and the direction of the **northern moonset** on a **major** lunar standstill, represented by the blue line. Note the alignment of the stones along this direction.



Figure 5: Another alignment of the Ales Stenar and the direction of the **northern moonset** on a **major** lunar standstill, represented by the blue line.

If we consider the **minor lunar standstill**, the alignments are given in the Figures 6 and 7.



Figure 6: In this image, we can see the other side of the Ales Stenar and the direction of the **northern moonset** on a **minor** lunar standstill, represented by the blue line. Note the alignment of the stones along this direction.



Figure 7: Another alignment of the Ales Stenar and the direction of the **northern moonset** on a **minor** lunar standstill, represented by the blue line.

In [16], where only the direction toward the sunset is described, the conclusion was that this stone ship was used for calendrical purposes. That is, it was a device to mark the time of the year. However, as we have shown here, we have also a reference to the moon and then it is possible that this megalithic monument was used to mark the cycles of the moon too.

Symbolically, the layout of the stones was given to represent a ship. This ship was imagined moving towards the setting of the sun, on the longest day of the year. Since there are also the alignments along the northern moonset directions on major and minor lunar standstills, the orientation and the geometry of this ship were astronomically determined for sure. Probably,

these astronomical alignments were imagined for helping the soul of King Ale to sail in his afterlife forever.

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