The Temple of Apollo Lairbenos in Hierapolis and Its Orientation to the Sunrise on Summer Solstice

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Abstract

Using SunCalc.org software and the elevation profile of Google Earth, we can easily see that the temple of Apollo Lairbenos in Hierapolis, the ruins of which are adjacent to the modern Pamukkale in Turkey, was probably oriented to the sunrise on the summer solstice. This orientation is given according to the local natural horizon.

Keywords: **Archaeoastronomy, Software, Archaeology, Worship of Apollo, Phrygia.**

Subject Areas: **Archaeology.**

A recent archaeoastronomical analysis of the orientation of some temples dedicated to the worship of Apollo has indicated a possible alignment of them with the heliacal rising of the constellation of the Crow [1]. Among the seventeen temples-altars chosen for the survey proposed in [1], we find a temple of Apollo Lairbenos, located in Phrygia, Turkey. The remains of this shrine were discovered by Ramsay and Hogarth in 1887, not far from the ancient Dionysopolis [2,3] (coordinates are 38°12'51.65" N, 29°16'49.48" E, in Google Earth). This temple is not the temple of the Apollo Lairbenos that we can find in the ancient city of Hierapolis, the ruins of which are adjacent to the modern Pamukkale, famous for its ancient hot springs. The evidence of the cult of the Lairbenos in this town consists of several inscriptions found "in situ", among the remains of the temple [4].
As told in [5], Lairbenos was the usual epiclesis of Apollo in Phrygia. "The missing Greek etymology as well as the variants point to the fact that this is the Greek interpretation of an indigenous name". Therefore, it means that Apollo was linked to an ancient Anatolian sun god, who was named Lairbenos [3,6]. That the Lairbenos was a sun-god is demonstrated by the coins representing him having a radiated head [3]. Moreover, the large amount of coins from Hierapolis with the effigy of Apollo Lairbenos shows that he was the principal god of the town during the late Hellenistic period [6].
Today, in Hierapolis, only the foundations of the Hellenistic temple remain. The temple of Apollo was surrounded by an enclosure wall, a temenos, as we can see in the Figure 1. The temple "was deliberately built over an active fault. [7] This fault was called the Plutonium". This Gate of Pluto "was the oldest religious centre of the native community in Hierapolis and represented the place where Apollo met with Cybele". In [6], it is also noted that the temples dedicated to Apollo were often built over geologically active sites. Among these temples, we find the most famous one, the temple of Apollo in Delphi [8].

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Figure 1. The temenos of the temple of Apollo Lairbenos in Hierapolis and the Nympheum, as given in Wikimapia. Site A indicates the temple as considered in Ref.7.

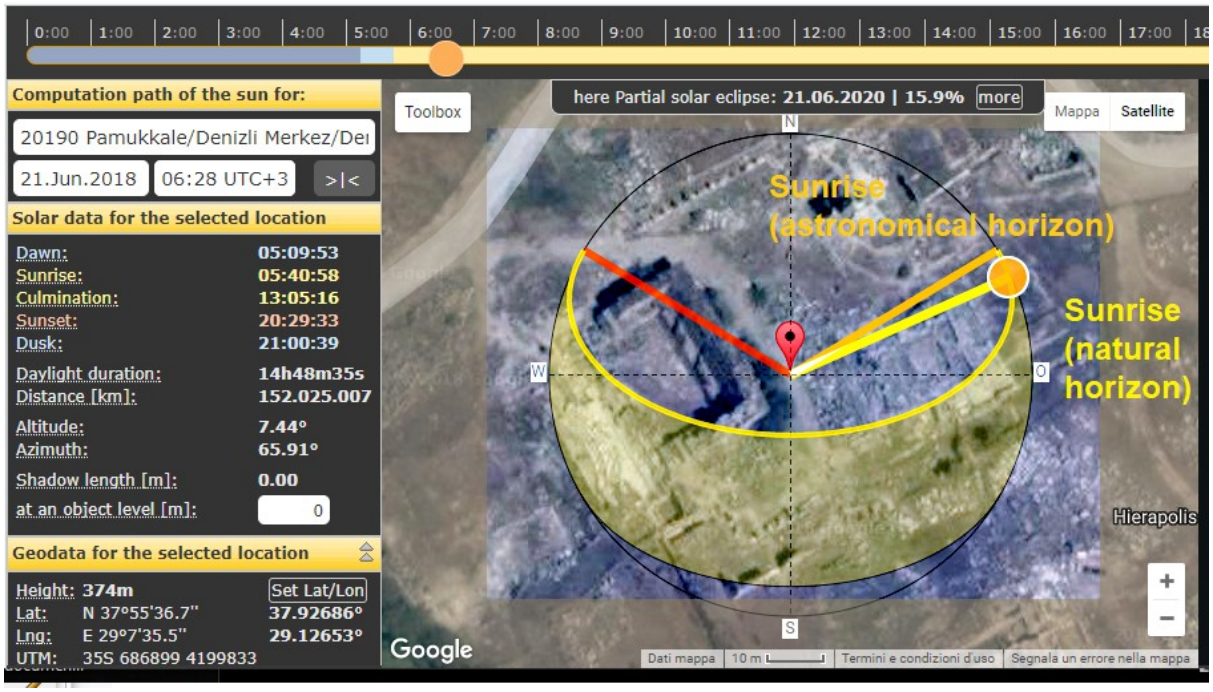

Figure 2. SunCalc.org software screenshot, for the temple of Apollo Lairbenos, on June 21. We can see the directions of sunrise and sunset on the local astronomical horizon and the azimuth of the sun when it has an altitude of 7.44 degrees. This is also the direction of the sunrise according to the natural horizon.

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The Figure 1 shows the temenos of the temple and the Nympheum as given in Wikimapia. Since the temple of Hierapolis is told to be dedicated to a sun god, we can investigate if this temple had an astronomical orientation linking it to the sunrise or to the sunset. Actually, the possibility exists. Probably the temple had been aligned along the direction of the sunrise on summer solstice.

To see this alignment we can use software SunCalc.org. It is an online application which can be used to ascertain the sun movement with an interactive map. It gives sunrise, sunset, shadow length, sun position, azimuth and altitude of the sun. The alignment of the temple is given in the Figure 2. The image is a screenshot of the software, given for a simulation on the summer solstice. In the image we see three lines: the directions of sunrise and sunset for the local astronomical horizon, and the azimuth of the sun when it has an altitude of 7.44 degrees above this horizon. Let us note that the astronomical horizon is the horizon that would be seen if the earth's surface were perfectly smooth; it is given by the intersection with the celestial sphere of the local horizontal plane which is passing through the observer. Let us note that the natural or sensible horizon, that is the line at which the sky and Earth appear to meet, is different from the astronomical horizon. In the Figure 2, the line giving the azimuth of the sun when it has an altitude of 7.44 degrees is representing the direction of the sunrise when the natural horizon is considered. It means that the sun must have an altitude of about 7.5 degrees to see the sunrise from the temple, according to the local natural horizon. We can deduce this altitude using the local elevation profile given by Google Earth.

In the Figure 3, we see a red line which is the prolongation of the axis of the temple and the corresponding elevation profile given by Google Earth. The sun, for being visible by an observed at the site of the temple, must have an altitude greater than the angle given by arctan [(1035-370)/4990] = 7.59 degrees (we have used this approach for investigating alignments along sunrise in [9]; for the Moon we used the same approach with MoonCalc.org software [10]).

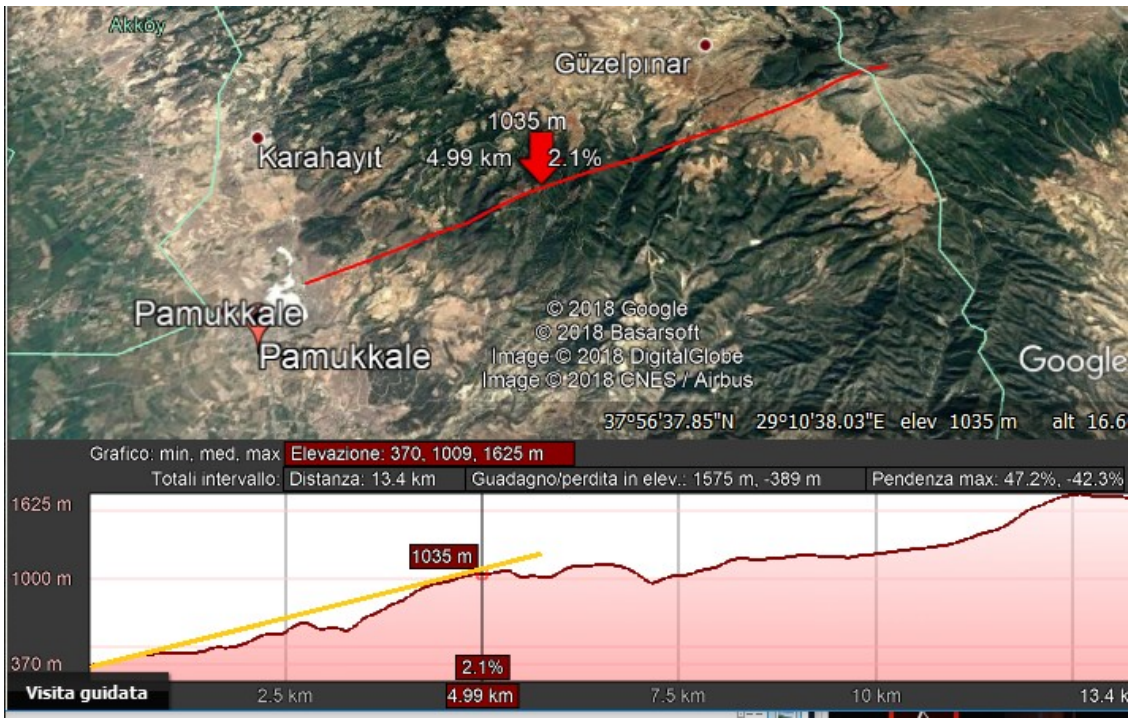

Figure 3. We can use Google Earth and its tool for showing the elevation profile. So, let us consider a straight line passing through the temple (red line). The sun, for being seen by an observed in the temple, must have an altitude greater than the angle between the yellow line and a horizontal line (lower part of the figure). This angle is given by: arctan [(1035-370)/4990] = 7.59 degrees.

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Since the apparent diameter of the sun is half a degree, the angles given in the Figure 2 and Figure 3 are in agreement. Therefore, using a "remote archaeoastronomical analysis", made by means of SunCalc.org and Google Earth software as in [9], we can conclude that it is possible that the temple of Apollo Lairbenos in Hierapolis had been oriented to the sunrise on the summer solstice, according to the local natural horizon.

Let us note that alignments along the directions of sunrise and sunset on solstices are present in architectonic structures since very ancient times (see for instance [11-16], and references therein). For this reason, it would be interesting to investigate the orientation of other temples of the Lairbenos in Phrygia, for evidencing other possible astronomical alignments of them, besides that mentioned in [1] and the solar orientation that we have shown in this work.

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