Astronomical Orientations of the Great Enclosure of Musawwarat Es Sufra

Astronomical Orientations of the Great Enclosure of Musawwarat Es Sufra

6 Pages • Posted: 16 Feb 2017

Amelia Carolina Sparavigna
Polytechnic University of Turin

Date Written: February 15, 2017

Abstract

Here we propose the use of Stellarium and Photographer's Ephemeris software to test a possible astronomical orientation of the Great Enclosure of Musawwarat es Sufra, in the heartland of the Kingdom of Kush. Using the Photographer's Ephemeris, we can see that the central part of the enclosure is aligned perfectly along the southern direction of the moonrise on a major lunar standstill, whereas the norther part of the enclosure has an orientation along the sunrise on the winter solstice. Besides the simulations, a discussion is also given about the plausibility of solar and lunar orientations.

Keywords: Archaeoastronomy, Winter Solstice, Major Lunar Standstill, Standstill of Venus, Stellarium, Photographer's Ephemeris, Satellite Images

Astronomical Orientations of the Great Enclosure of Musawwarat es Sufra

Amelia Carolina Sparavigna
Politecnico di Torino

Abstract: Here we propose the use of Stellarium and Photographer's Ephemeris software to test a possible astronomical orientation of the Great Enclosure of Musawwarat es Sufra, in the heartland of the Kingdom of Kush. Using the Photographer's Ephemeris, we can see that the central part of the enclosure is aligned perfectly along the southern direction of the moonrise on a major lunar standstill, whereas the norther part of the enclosure has an orientation along the sunrise on the winter solstice. Besides the simulations, a discussion is also given about the plausibility of solar and lunar orientations.

Keywords: Archaeoastronomy, Winter Solstice, Major Lunar Standstill, Standstill of Venus, Stellarium, Photographer's Ephemeris, Satellite Images.

Musawwarat es Sufra is the modern name of a great temple complex that we find in Sudan. The site is located about 190 kilometers northeast of Khartoum, 20 kilometers north of Naqa and 29 kilometers southeast of the Nile. It seems that the place had a purely religious function and that was also a pilgrimage center [1-5]. This thesis is supported by the large number of inscriptions made by the visitors that we can see there, including the only Latin inscription from Nubia, discovered so far [1].
Musawwarat es Sufra is a site of the Island of Meroe in the list of UNESCO World Heritage [6]. As told in [6], the Island of Meroe is a semi-desert landscape between the Nile and Atbara rivers. It was the heartland of the Kingdom of Kush, a major power from the 8th century BC to the 4th century AD. Besides Musawwarat es Sufra, the other archaeological sites of the Island are the royal city of the Kushite kings at Meroe, near the River Nile, and the nearby religious site of Naqa. As stressed in [6], these three sites comprise the best-preserved relics of the Kingdom of Kush, encompassing a wide range of architectural forms, including the famous pyramids, temples and palaces, and the productive areas that influenced the social and artistic scene of the Middle and Northern Nile Valley for more than a thousand of years. In the area, we can find also the water reservoirs of the Kushite people [7], which are also contributing to understand the paleoclimate in this area [6].

Figure 1: The Great Enclosure in Musawwarat es Sufra (Courtesy Google Earth).

Electronic copy available at: https://ssrn.com/abstract=2918176

In Musawwarat es Sufra we can find a great complex, the Great Enclosure, composed of several courtyards, whose center is a temple framed by columns. There are also other small temples. Near the complex, we can find two large water reservoirs (hafir).
In [8], we find a very interesting article on this archaeological complex. This article tells us that Linant de Bellefonds, explorer of Egypt and chief engineer of Egypt's public works, mentioned it in 1822. A first detailed description of the site is due to Carl Richard Lepsius. The German egyptologist Fritz Hintze was the first to carry out excavations. These excavations revealed that, several times in its history, the complex had been razed to the ground, re-erected and expanded, slightly changing its orientation [8]. The temple existed already in the Napatan period (c. 664- c.270 BC). Hintze argued that the orientation of the temple must have been determined by the rising of some stars, whose position in the sky changed over time due to the precession of the Earth's axis. This orientation was so quintessential that the temples needed to be re-erected [8]. It was therefore a religious necessity to follow the motion of the stars. Hintze also proposed that the site was a center of pilgrimage [8].
The idea that the enclosure had its axis oriented along the direction of the rising stars, and that this alignment changed to follow the effect of the precession, is very interesting. However, using the software Stellarium, in the direction of the axis of the temple (about 27° from East, Figure 2), we do not observe the rising of a specific bright star. We see Sirius, but it is rising about 18° from East. In the Figure 3, we show the sky simulated by Stellarium, for the site of the enclosure on 200 BC (other examples of the use of Stellarium are given in Refs.9-13). A remote possibility exists that the temple had been oriented to the southern direction of the rising of Venus (Figure 4), that is, along a standstill of Venus (an orientation along the standstill of this planet was used by the Mayan civilization [14]).

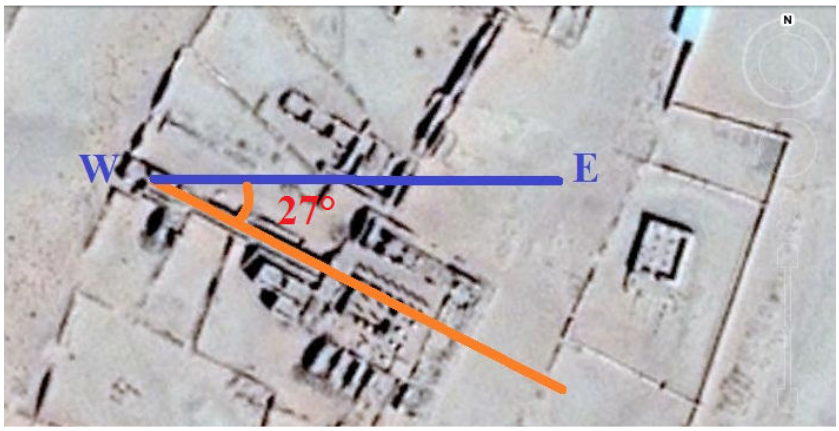

Figure 2: Axis of the central part of the Great Enclosure in Musawwarat es Sufra.

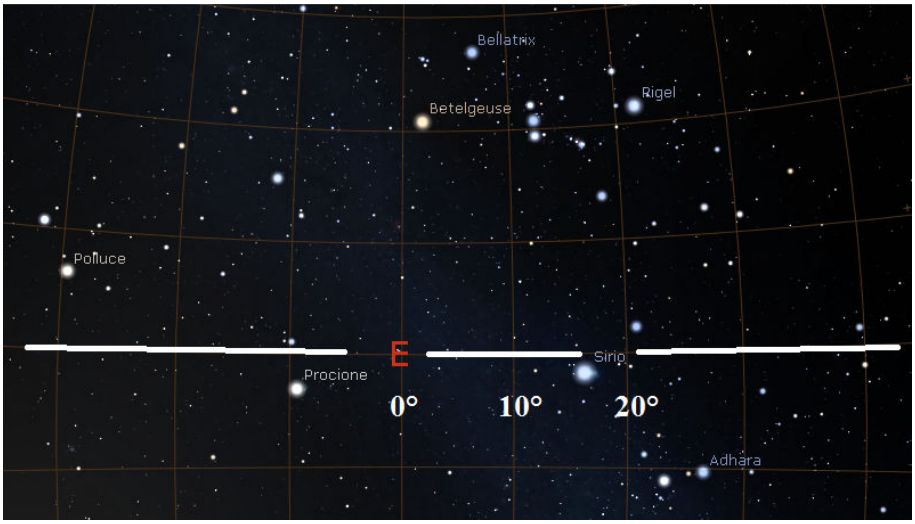

Figure 3: Using Stellarium, we can simulate the sky seen from the site of Musawwarat es Sufra, 200 BC. The white line is the astronomical horizon. In the image, Sirius is just below the horizon. Note the stars of the Orion constellation.

Electronic copy available at: https://ssrn.com/abstract=2918176

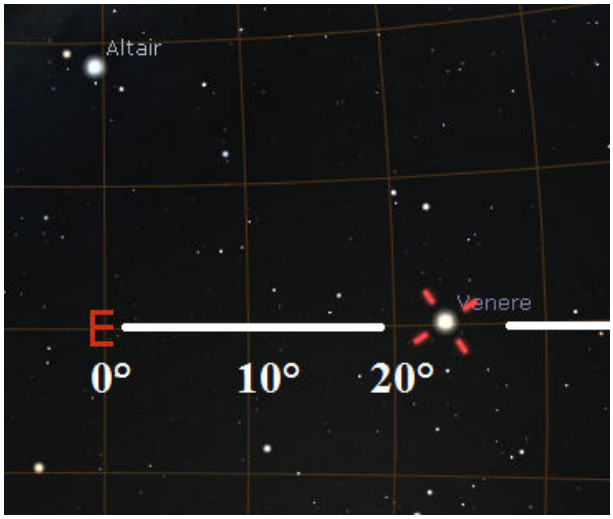

Figure 4: The rising of Venus (Courtesy Stellarium) seen from the site of Musawwarat es Sufra, 200 BC. The white line is the astronomical horizon.

Reference [8] was discussed also by [15]. The authors of [15] are arguing that it is possible a solstitial orientation of the central shrine dominating the enclosure; "perhaps the "slight" changes in the orientation were due to various successive attempts to find a satisfactory orientation for this important enclosure, only reached in the final construction phase" [15].

Figure 5: The Photographer's Ephemeris is showing sunrise/sunset directions (yellow and orange) on satellite maps. The blue lines are the moonrise/moonset directions. Here we see the central part of the enclosure and the sunrise on the winter solstice.

The Figure 5 shows the simulation of the Photographer's Ephemeris software. The simulation is giving the sunrise/sunset directions (yellow and orange) on satellite maps. The blue lines are the moonrise/moonset directions. Here we see the central part of the enclosure on the winter solstice. In fact, there is a very small difference between the axis of the central part of the enclosure and the sunrise direction.
In some previous investigations, we have used the Photographer's Ephemeris to determine if ancient temples and monuments, or even towns, had an astronomical orientation according to the lunar standstills [16-20].

Then, let us consider another possible astronomical orientation for the central temple, that along the direction of moonrise.
Before using the Photographer's Ephemeris software in this case, it is necessary to discuss shortly the apparent behavior of the moon, which is more complex than that of the sun. The sunrise/sunset directions oscillates between the 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 for instance, 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° [21]. The azimuths of sunrise on summer and winter solstices are between these lunar azimuths.

Figure 6: The Photographer's Ephemeris is showing that the central shrine in the enclosure is aligned perfectly along the southern direction of moonrise on a major lunar standstill.

The simulation using the Photographer's Ephemeris shows that the axis of the central part of the enclosure is aligned perfectly along the southern direction of moonrise on a major lunar standstill (Figure 6). Then, the simulation suggests us that the astronomical orientation of this shrine was referring to the moon.
We have to tell that Ref.15 does not consider a lunar orientation for the shrine. Nevertheless, the difference between the sunrise direction on solstices and the moonrise direction on the lunar major/minor standstills exists, and the ancient architects were able to determine in a precise manner the abovementioned directions (see for instance, the remarkable alignment of the Karnak temple [22]). Moreover, we see another part of the enclosure having a closer alignment to the sunrise on the solstice; it is the northern part, as we can see from the Figure 7.
We can conclude that, probably, the site as a whole had an astronomical orientation according to the winter solstice and the cycle of the lunar standstills about this solstitial direction, a sort of ceremonial site linked to the sun and the moon as companion of the sun. If we would consider also the cosmos, we should have represented the "Theban Triad", the three Egyptian gods that were the most popular in the area of Thebes. The group consisted of Amun (the sun), his consort Mut (the cosmos) and their son Khonsu (the moon), who were the primary deities of the temple complex at Karnak, where we find different shrines and precincts for them.
Actually, as discussed in [23], in the Great Enclosure of Musawwarat es Sufra we have an analog triad. In the Enclosure, there are three temples, the main of which is the central one. Tiradritti tells in [23] that in this temple the archeologists found a part of the lintel showing the god Amun represented with the head of a ram, flanked by Arensnuphis and Sebiumeker. The prominent position of Amun suggests that the central temple was devoted to him. Arensnuphis means in Egyptian, "the good companion" [24]. Sebiumeker was the god of procreation in the Meroitic pantheon, having his main center of worship in the temple complex at

Musawwarat [25,26]. Following the analogy, we could imagine Amun as the sun, Arensnuphis as the moon, companion of the sun, and Sebiumeker as the cosmos generating the life. Another link to procreation is the following. In this Enclosure, according to the archaeologist Steffen Wenig, the 'Holy Wedding' was celebrated. It was the union of the king and the queen to create the successor [27]. More or less, the cycle of the moon was lasting as long as the time necessary to grow and educate a new king for the kingdom. Therefore, it is plausible that a reference to the cycle of the moon, besides to that of the sun, was introduced by the architects that re-erected the Great Enclosure in its final form, to emphasize the link between the kingdom and the sky.

Figure 7: The Photographer's Ephemeris and the northern part of the enclosure on the winter solstice.

References

[1] Vv. Aa. (2017). Wikipedia: Musawwarat es Sufra. Available at https://en.wikipedia.org/wiki/Musawwarat_es-Sufra
[2] Wolf, P. (1997). Recent fieldwork at Musawwarat es Sufra. Sudan & Nubia, 1, 20-29.
[3] Hintze, Ursula (1979). The graffiti from the Great enclosure at Musawwarat es Sufra. Africa in Antiquity, Meroitica, 5(8), p135-150.
[4] Hintze, F. (1962). Die Inschriften des Lowentempels von Musawwarat es Sufra. Akademie-Verlag.
[5] Edwards, D. N. (2004). The Nubian past: an archaeology of the Sudan. Routledge.
[6] UNESCO, Archaeological Sites of the Island of Meroe, available at http://whc.unesco.org/en/list/1336
[7] Näser, C. (2006). The Great Hafir at Musawwarat Es-Sufra. Fieldwork of the Archaeological Mission of Humboldt University Berlin in 2005 and 2006. In Between the Cataracts. Proceedings of the 11th Conference of Nubian Studies, Warsaw University (Vol. 27, pp. 39-46).
[8] Wenig, S. (2001). Musawwarat es Sufra, Interpreting the Great Enclosure. Sudan & Nubia, 5, 71-88.
[9] Sparavigna, A. C. (2016). The Stellarium Planetarium for the Simulation of the Astronomical Landscapes of Ancient Stargazers (November 19, 2016). SSRN. http://dx.doi.org/10.2139/ssrn.2872676
[10] Sparavigna, A. C. (2016). A Possible Role of Alpha Crucis in the Astronomical Landscape of Silbury Hill. Philica, 2016 (872). Available at SSRN: https://ssrn.com/abstract=2795708
[11] Sparavigna, A. C. (2012). Maria Reiche's Line to Archaeoastronomy. arXiv preprint arXiv:1210.1170.
[12] Sparavigna, A. C. (2012). The Nazca Frigatebird and Fomalhaut. arXiv preprint arXiv:1210.0355.
[13] Sparavigna, A. C. (2017). Stellarium software and the occultation of Aldebaran observed by Copernicus. Philica, 2017 (923). <hal-01435500>
[14] Penprase, B. E. (2010). The Power of Stars: How Celestial Observations Have Shaped Civilization, Springer Science & Business Media.
[15] Belmonte, J. A., Fekri, M., Abdel-Hadi, Y. A., Shaltout, M., & García, A. C. G. (2010). On the orientation of ancient Egyptian temples: (5) testing the theory in Middle Egypt and Sudan. Journal for the History of Astronomy, 41(1), 65-93.

[16] Sparavigna, A. C. (2016). The Temple Complex of Ggantija and the Major Lunar Standstill as Given by the Photographer's Ephemeris. SSRN. http://dx.doi.org/10.2139/ssrn.2828614
[17] Sparavigna, A. C. (2016). Augusta Emerita and the Major Lunar Standstill of 24 BC. Philica, 2016 (635). Available at SSRN: https://ssrn.com/abstract=2807544
[18] Sparavigna, A. C. (2016). An Astronomical Analysis of Some of the Diagonal Avenues of Washington. Philica, 2016 (613). Available at SSRN: https://ssrn.com/abstract=2789700
[19] Sparavigna, A. C. (2016). Megalithic Quadrangles and the Ancient Astronomy. SSRN. http://dx.doi.org/10.2139/ssrn.2862330
[20] Sparavigna, A. C. (2016). Winter Solstice and Lunar Standstills in the Gardens of Villa D'Este. Available at SSRN: https://ssrn.com/abstract=2844169 or http://dx.doi.org/10.2139/ssrn.2844169
[21] For the calculations we used the software by Jürgen Giesen at his web site http://www.geoastro.de/sunmoonpolar/index.html#Mondwenden
[22] Sparavigna, A. C. (2016). The Karnak Temple and the Motion of the Earth's Axis. SSRN. https://ssrn.com/abstract=2795239
[23] Tiradritti, F. (1995). Musawwarat es-Sofra, Enciclopedia dell' Arte Antica. Available at http://www.treccani.it/enciclopedia/musawwarat-es-sofra_(Enciclopedia-dell'-Arte-Antica)/
[24] https://en.wikipedia.org/wiki/Arensnuphis
[25] http://www.touregypt.net/godsofegypt/sebiumeker.htm
[26] Ancient Nubian gods, http://i-cias.com/e.o/nubia_rl_gods.htm
[27] Diab, O. (2013). Musawwarat es Sufra: A Unique Archeological Site in Sudan. https://oladiab.com/2013/11/03/musawwarat-es-sufra-a-unique-archeological-site-in-sudan/