Highlights of Spanish Astrophysics VI, Proceedings of the IX Scientific Meeting of the Spanish Astronomical Society held on September 13 - 17, 2010, in Madrid, Spain. M. R. Zapatero Osorio et al. (eds.)

Archaeoastronomy: archaeology, topography and celestial landscape — From the Nile to Rapa Nui

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Abstract

Archaeoastronomy is a discipline apparently subject to controversy. The reason for this is that it is situated between astronomy, whose tools it uses; and anthropology, archaeology, and history, the disciplines archaeoastronomy serves and within whose epistemological framework should be integrated. Perhaps for this reason, until recently it has not received much attention by the specialists of human sciences, notably among the Egyptologist community. Hence, important issues such as the orientation of the ancient Egyptian temples and the importance of astronomy in this regard have never been addressed with the necessary seriousness and depth. The work of our group in the Nile Valley, developed between 2004 and 2010, had the intention to overcome this neglect, among many other objectives. Data from more than 400 temples have been analyzed to date to accomplish this objective. Egypt and Sudan have been scanned with the purpose of obtaining a statistically significant sample allowing us to respond clearly to the question: are the sacred buildings of ancient Egypt astronomically oriented? Our data, which confirm the hieroglyphic texts and other ethnohistorical sources, seem to undoubtedly imply this fact. We can even set up parallels for other cultures and places. Ethnographic sources are absent in modern Egypt but they are, however, available in other unique locations in the world like Easter Island or Rapanui. There, our fieldwork on island cyclopean buildings seems to confirm the information gathered from astronomical traditions still alive on site. In this essay, we will place the problem in a general context. We will focus on these two key examples afterwards. These should give evidence about how much archaeoastronomy can contribute to understanding our particular way of looking at the cosmos as human beings.

Figure 1: General view of the remains of Göbekli Tepe, in Turkish Mesopotamia, the oldest stone temple ever erected by human hands. Several of the big excavated circles are visible together with the huge, decorated T-pillars which are most representative of the site. Photograph by courtesy of M. Sanz de Lara.

1 Introduction: the unwritten record

Astronomy has played a major cultural role in human societies. On the one hand, it has been the principal tool, if not the only one, to obtain an appropriate orientation in time and space for generations. On the other hand, sky watching and the cosmos explanation have been the main generators of metaphysics in human mentality in such a way that, as astronomy progressed, the space for religious speculation was consequently reduced. Celestial objects, returning once again, provided a sense of security, allowing up, inferring by similarity, the possibility of transcendence of death. For this reason, people mapped the firmament from very early dates in an attempt to find the order where, only in appearance, chaos reigned. Thus, for example, the rock art in Lascaux perhaps show us some of the oldest constellations ever depicted on Earth [1, 9], where the ubiquitous Pleiades could have been already riding on the back of the great celestial bull during the Magdalenian Period, over 16 000 years ago.

Until very recent times, the megalithic monuments in Europe, and in particular Stonehenge, were the archaeological remains earning all the credits on any potential astronomical knowledge of our earliest ancestors, indeed put at the service of the first Neolithic societies.

Figure 2: General view of the dolmen of Cubillejo de Lara (Burgos, Spain). This is a fine example of a megalithic monument with a most probable astronomical (perhaps solstitial) orientation. Photograph by courtesy of M. Sanz de Lara.

However, a recent discovery in the steppes of southeast Anatolia has disrupted our previous ideas. There, on a barren isolated hill called Göbekli Tepe – Hill of the Navel – (Fig. 1), a team of German and Turkish archaeologists [12] are excavating a cluster of suggestive stone monuments erected with large pillars in the form of a T and dry-stone walls. They were built by a completely unknown hunter-gatherer society more than 11 000 years ago. These series of sanctuaries, built presumably one after and even upon the other, would have remained in use for centuries, perhaps millennia, but were deliberately buried by their own constructors for unknown reasons, a singular fact that contributed to their excellent state of preservation in spite of their great antiquity.

These monuments are mostly ellipsoidal in form and, although a favorite orientation may be established for the monument gates, there is no apparent selected pattern. However, between the group of monuments, there is one with nearly rectangular walls which were almost perfectly aligned according to the cardinal points. This circumstance alone would force us to think that we are faced with a society that had a look at the sky and used it as a guide to find appropriate ways of orientation in space and, almost certainly, also in time. Within this context, we could perform additional speculative exercises, analysing the profuse

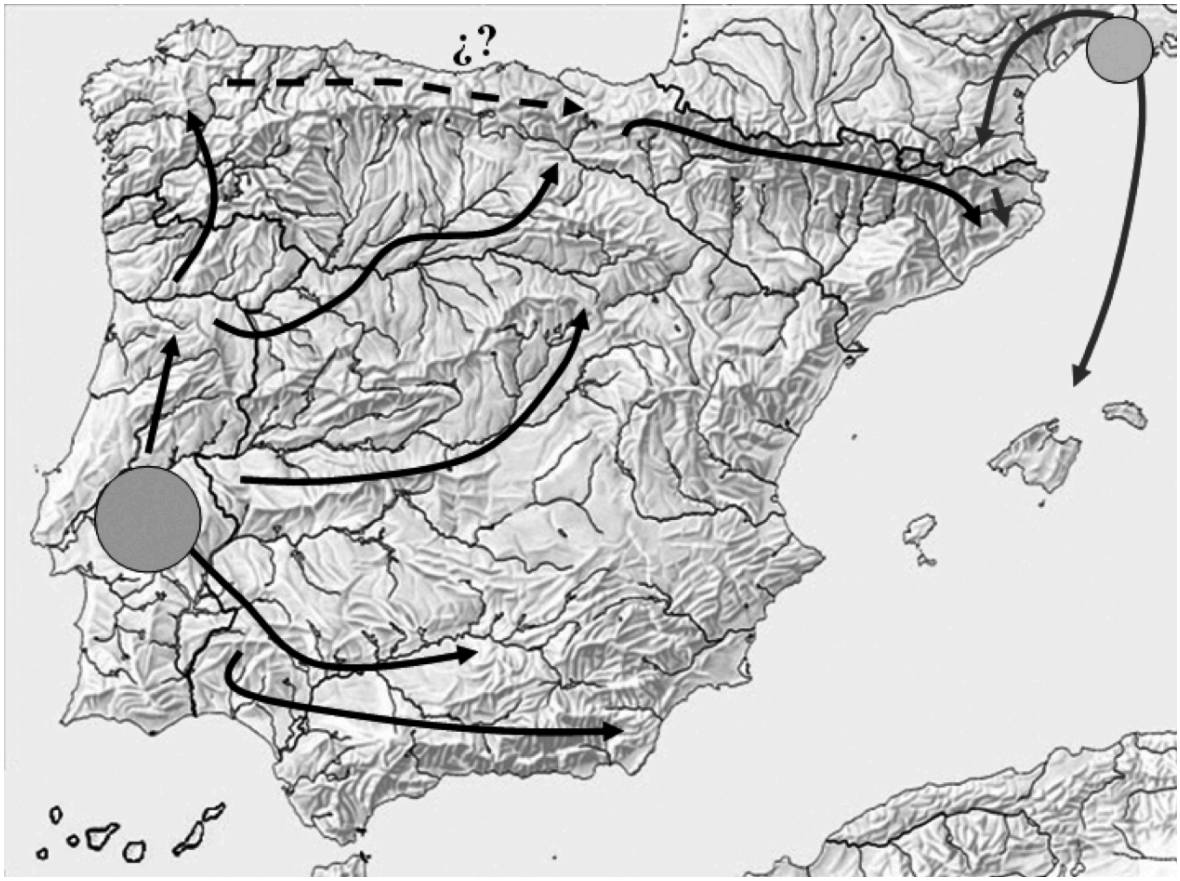

Figure 3: From a hypothetical nucleus in the southwest, the orientation practices related to the megalithic phenomenon spread all around the Iberian Peninsula, following the coast, river basins and mountain ranges, as recently shown by [6]. A different custom, however, was generated in Provence and spread to Catalonia and the Balearic Islands. For unknown reasons, the megalithic tradition did not reach eastern Iberia.

decoration of the T-pillars where we may already find astronomical representations such as the crescent and the star, so common in later cultures of the Middle East and beyond, or even totemic representations of animals which, allowing a little speculation, would remind us of constellations such as Leo, Taurus or Scorpius, that we can recognize in the skies of other evolved cultures in the region several centuries later.

However, when analyzing the data of Göbekli Tepe, we are facing a problem: their singularity. There is no other preserved monument of the same type where data can be contrasted. From the authors' point of view, scientific research – as jurisprudence, from where the expression originates – should be guided by the premise *testis unus, testis nullus*. This rule confirms that a single proof of something is like a proof of nothing and we must be very cautious of risking in too adventurous conclusions. Stonehenge was a typical example of this reality. In the 1960s its singularity led to an interpretation as a Neolithic calculator

and a predictor of eclipses; in short, the oldest "observatory" known (see [10] for a critical discussion on the topic). However, more recent archaeological studies carried out on site, and in other similar planimetry monuments, have forced contemporary researchers to be much more cautious about their conclusions. Now Stonehenge is interpreted as a funerary monument which includes astronomical alignments among its design, linked to possible ritual purposes associated with the cosmovision of its builders [8].

Actually, when we look at illiterate, extinct cultures, the only way to get a certain degree of confidence in our conclusions is when we analyze multiple but similar items – either monuments or portable objects – within a same archaeological or cultural context, especially when we are able to find a pattern. In this sense, the earliest unmistakable evidence of an interest in the local landscape, including the sky, can be found throughout the megalithic monuments of the Iberian Peninsula (see Fig. 2). This is especially true in the south-western area of the peninsula. In these regions, Neolithic settlers built a series of monuments with a very similar architectural structure – they are almost clones of each other – known as Alentejan antas, for the name of the Portuguese region where they are a majority. They have been dated in the fourth millennium B.C. Most important, they show a pattern of orientation that clearly speaks to us of an unmistakable astronomical interest, because all the studied exemplars, without an exception (more than 170; [7]), are pointing at sunrise or moonrise in a nave alternative at a certain moment in the annual cycle.

It is difficult to uniquely establish if the pattern is solar or lunar, as the only movable elements found in the antas, the "plaque idols" – small schist plates with elaborated geometrical decoration –, show patterns illustrating the interest of their builders in both the sidereal month and the seasonal cycle. Summarizing, Alentejan antas certainly show a clear, statistically significant, intention for an orientation in space – for whatever purposes possibly related to an astral eschatology – and time – perhaps associated with the existence of a lunisolar calendar – for the first time in human history [2]. We think that this simple pattern of orientations was in the origin of megalithic monuments design in the Iberian Peninsula in the 4th millennium B.C., if not earlier, and that construction methods, and overall orientation patterns lately evolved and changed when the megalithic tradition moved across new and different territories (see Fig. 3), as our research group has recently postulated [6]. However, the lack of written texts, or any other sort of ethnographic or ethnohistoric information, prevents us from going much further in our conclusions.

2 People speaking: textual and ethnographic sources

Fortunately, there are cultures where we are lucky enough to have such important information. Indeed, there are a certain number of ancient civilizations, with close ties to sky-watching practices, which fortunately left written texts that thanks to the expertise of linguists we are now able to read and understand. A unique and illustrative cases would be that of ancient Egypt, where the first author has taken some time studying the rudiments of its writing and has carried out several archaeoastronomical missions in the country.

For various reasons, archaeoastronomy has not been one of the favorite disciplines

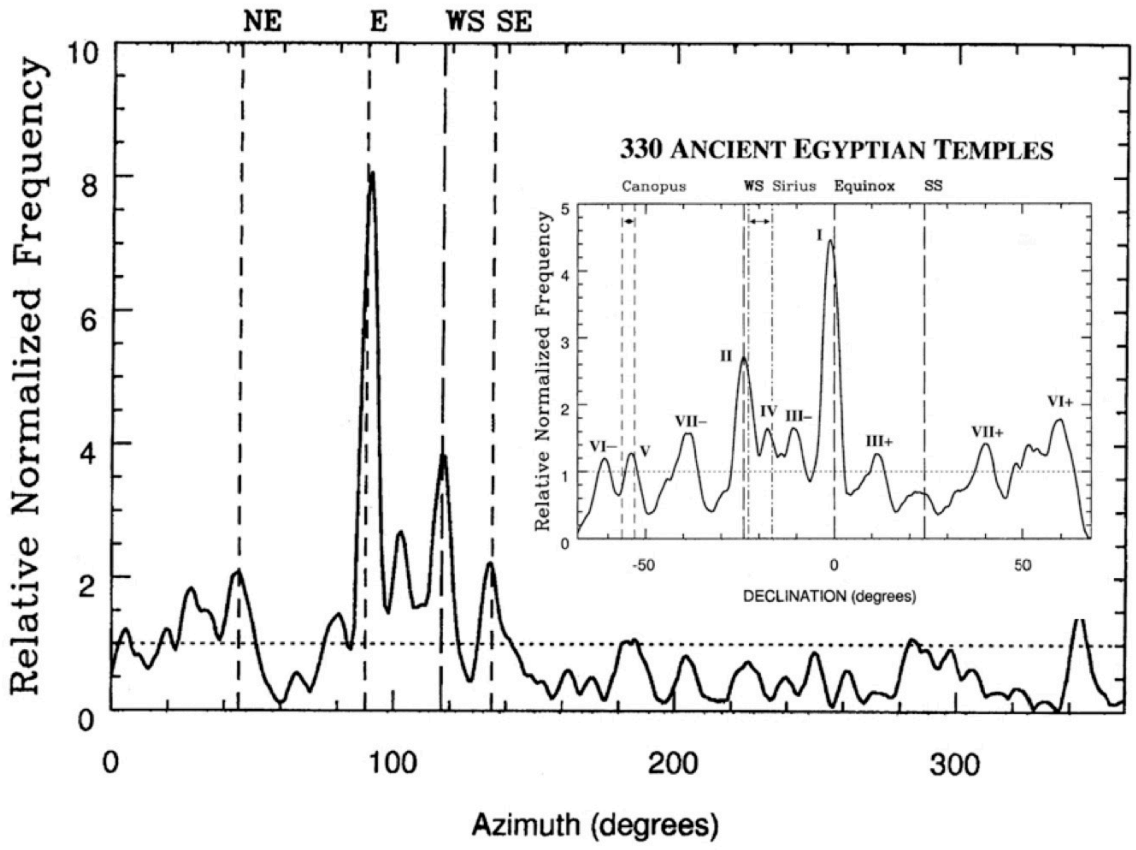

Figure 4: Orientation (azimuth) histogram of the 330 temples measured during five campaigns in Egypt between February 2004 and December 2006. Although there are temples orientated to each sector of the horizon, there are obviously clear preferences within statistically significant peaks at near due-East and winter solstice (WS) sunrise. There are also clear peaks at NE and SE. These are indisputable evidences of intentional astronomical orientations. These data derives in the core of the astronomical hypothesis shown in the declination histogram (small panel). Each peak is identified by a Roman numeral referring to the seven families of astronomical orientations – basically solar and stellar ones – as explained in detail in [3].

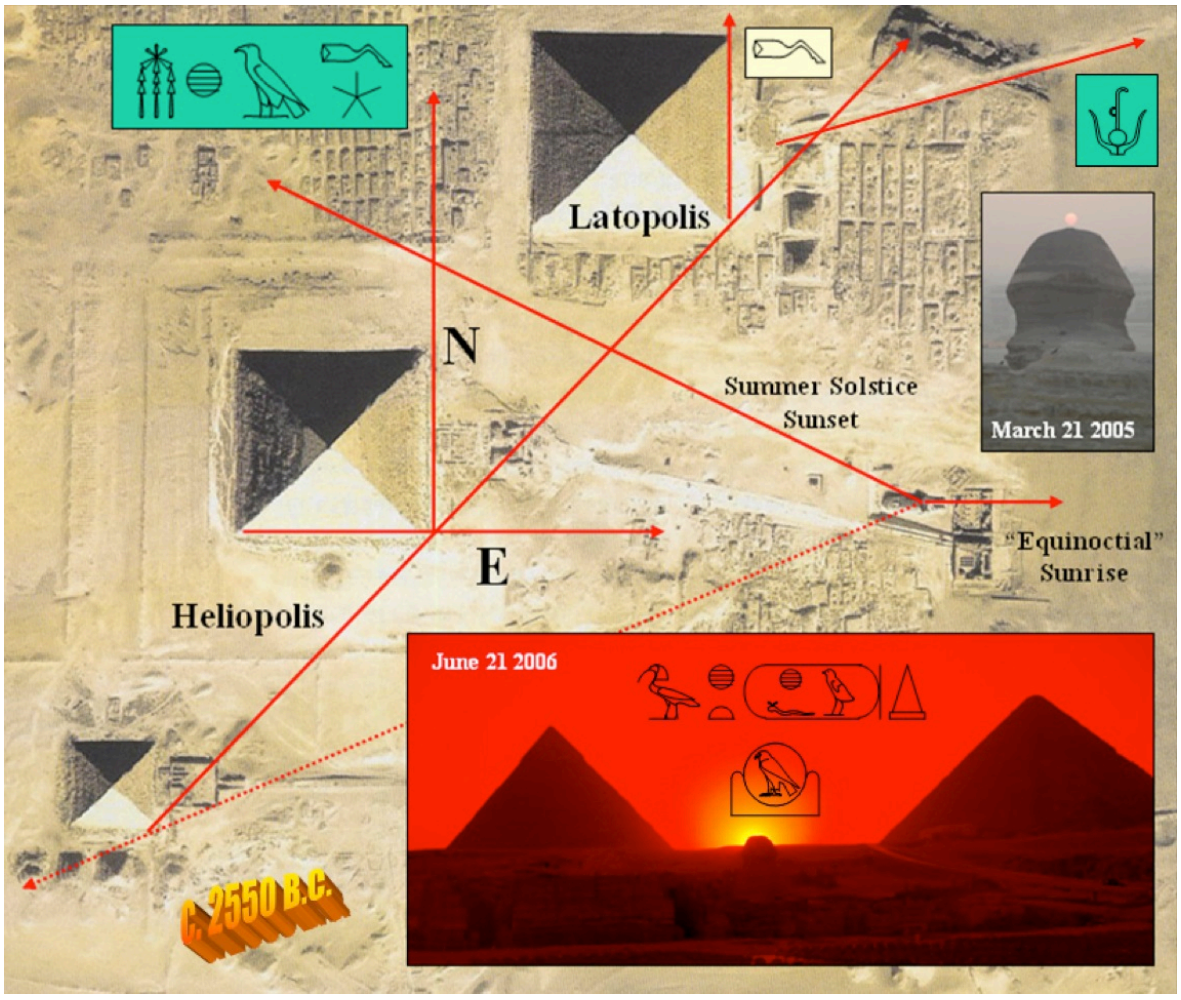

Figure 5: Schematic diagram where we show the astronomical and topographical relationships between the different monuments erected in the Giza Plateau, notably the Sphinx and the pyramids, and certain elements of the sky or nearby geography. Astronomical connections of the Sphinx with equinox sunrise and summer solstice sunset (behind *Akhet Khufu*, the Horizon of Khufu) are also stressed. Finally, the alignment of Khufu's causeway to *Wepet Renpet* – New Year's Eve – during his reign is emphasized. These series of astronomical alignments offer a date close to 2550 B.C. as the presumable date of original planning of the area. Photographs by Juan A. Belmonte. Adapted from [3].

of Egyptologists in the past. Probably because of this, important questions such as the orientation of Egyptian temples and the relevance of astronomy in this respect had never been afforded with the requisite seriousness and depth. The "Egyptian-Spanish Mission for the Archaeoastronomy of Ancient Egypt" [3] has contributed to the solution of this problem. In order to achieve this, the Mission has measured in five years the orientation of some 330 temples in the Valley, the Delta, the Oases, and the Sinai (reaching 400 if we include Sudan; [4]). The aim was to find a correct and almost definitive answer to the question of whether the ancient Egyptian sacred constructions were astronomically aligned or not. The data seem to answer this question in the affirmative (see Fig. 4). In addition, they offer a very interesting new perspective both in chronology and in the field of landscape archaeology, a new discipline in which few have engaged so far in Egypt, and in which terrestrial landscape, dominated by the Nile, and celestial landscape, dominated by the sun and the stars, combine in order to permit the establishment of Ma'at, the Cosmic Order, on Earth.

Thanks to the texts of the pyramids – a collection of religious literature of the Old Kingdom –, it is now known that the ancient Egyptians had already mapped the sky, recognized constellations, asterisms and unique stars, early in the historical period. Furthermore, they saw these objects as celestial destinations of the late king in a real paradigm of stellar eschatology. One of these groups of stars was *Meskhetyu*, equivalent to the Plough – or Big Dipper – asterism in the constellation Ursa Major. This group of stars was circumpolar during the Old Kingdom and the ancient Egyptians recognized this nature by including it among the "imperishable" stars (the ikhemu sek of the texts) par excellence, involving this fact to the transcendence of the afterlife, to the extent that the two interchangeably recognized elements in the asterism (a bull's foreleg or an adze) were intimately related to certain funerary cult ceremonies such as the "opening of the mouth", leading to provide immortality for the deceased. The archaeoastronomy mission fieldwork in the country, particularly in the fields of pyramids, seem to confirm this fact, provided *Meskhetyu* could also be the principal celestial object used to align these imposing monuments as well as many other imposing temples along the Nile Valley, such as Dandara or Edfu. Consequently, the architectural arrangement of the pyramids could be a transfer on Earth of the cosmic order prevailing in the sky (see Fig. 5). Unfortunately, ancient Egyptian tradition was first relaxed by the conversion to Christianity of most Egyptian population and fully obliterated with the Muslim invasion in the 7th century. Consequently, there is nobody today who can speak in the name of the ancient Egyptians but their own texts.

Curiously, the situation is just the contrary in a small island at the other corner of the world, Rapa Nui (or Easter Island). In this respect, the partnership between archaeoastronomical fieldwork along with decades of ethnographic information, collected by the second author, have allowed us to establish, without doubt, the importance of certain asterisms in the island traditional culture singularly *Matariki* (the Pleiades) or *Tautoru* (Orion's Belt), which is still alive despite the terrible circumstances of Easter Island history during the last two centuries. This partnership would be reflected in the related orientation of some of Rapa Nui's major ceremonial platforms, the *ahus*, with their huge statues called *moais* (see Fig. 6), in the symbolism of the local art or in the creation of a calendar that, both in its sacred and profane character, came determined by the visibility or invisibility of these celestial bodies

Figure 6: The authors, serving as a reference scale, in front of the seven moai of Ahu A Kivi. These are facing the sea and possibly orientated towards the helical setting of Tautoru (Orion's Belt) as would have occurred c. 1300 A.D. This astronomical event was one of the markers of the New Year starting in the following new moon of the rapanui calendar. Photograph by courtesy of J. R. Belmonte.

at certain epochs of the year [5]. Part of these conclusions may be nuanced, however, by the chronological difference between the last *ahu* constructors, in the 17th century, and their current descendants, sources of the ethnographic information. Unfortunately, the original rapanui texts in rongorongo tablets, remain undeciphered so that we cannot "speak" to the sculptors of the moais.

Currently, we are examining other important elements of Rapa Nui's archaeological record. These are the cyclopean towers known as *tupas*. According to ethnographic information obtained at the end of the 19th century and the beginning of the 20th, these fascinating structures were considered as "observatories", whatever meaning this word may have had for the local informants. Invariably, this tradition has been translated as "astronomical observatories" in the present inhabitant minds. We are actually trying to confirm or deny this aspect thanks to our archaeoastronomical fieldwork in the island. Very preliminary results

Figure 7: A view of a distant tupa from the gate of another one signalling a possible astronomical alignment on the southern cliffs of Poike Peninsula, where *Matariki*'s (the Pleiades) heliacal rising would have been observed. This event was the most important marking the beginning of the rapanui year. Photograph by J.A. Belmonte.

seem to indicate that some *tupas* were placed at suggestive locations where astronomical alignments may have played a role (see Fig. 7). However, the situation is far from clear when the complete group is analysed as a whole and indeed much more work is needed before a final conclusion could be achieved.

We could continue our tour of the various forms that have been used to link astronomy and various aspects of culture in the thousands of years of human development (a good, still alive, example, would be the Islamic civilization). These connections have been manifested in an extremely reach heritage that only recently international and national institutions have started to recognize as such. Following this idea, UNESCO and IAU have recently allied to defend the "astronomical world heritage initiative", which have just been approved by the former international organism [11]. This will certainly be the starting point for a new recognition for archaeoastronomy and the beginning of a new chapter of the discipline story. However, we believe that two basic ideas have clearly been expressed in the short essay that the authors would like to stress once more as arguable conclusions, indeed open to debate. On the one hand, that the observation of the sky has been, and remains, one of the main generators of metaphysics in human thought and, on the other hand, that astronomy has traditionally been the most powerful tool of human beings to reach a proper orientation in

time and space. As a matter of fact, this discipline is certainly one of the best guides that humanity had, since the dawn of the species, to find our correct place in the cosmos. The discipline of archaeoastronomy, straddling between human and physical sciences, undoubtedly helps in understanding the multiple ways humans have faced this not always easy task.

Acknowledgments

The authors would like to acknowledge José Ricardo Belmonte and Roberto Glaría for their most useful assistance during fieldwork in Easter Island, and Margarita Sanz de Lara for the images of Figures 1 and2. The first author is indebted to his colleagues César González and Mosalam Shaltout for allowing him the reproduction of some of the material coming out of their common research in the Iberian Peninsula and ancient Egypt, respectively. This work is partially financed in the framework of the projects Arqueoastronomía (P310793) of the IAC, and Orientatio ad Sidera II (AYA2007-60213) of the Spanish MICINN.

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