Mediterranean Archaeology and Archaeometry, Vol. 16, No 4,(2016), pp. 93-101

10.5281/zenodo.220905

ORIENTATIO AD SIDERA (OAS): HIGHLIGHTS OF A DECADE OF ARCHAEOASTRONOMICAL RESEARCH IN THE MEDITERRANEAN REGION AND BEYOND

Juan Antonio Belmonte[1], A. César González-García[2], Andrea Polcaro[3], Andrea Rodríguez-Antón[1] and Mosalam Shaltout[4*]

[1]Instituto de Astrofísica de Canarias and Universidad de La Laguna, Tenerife, Spain
[2] Instituto de Ciencias del patrimonio, Incipit-CSIC, Santiago, Spain
[3]Università degli Studi di Perugia, Italy
[4] N.R.I.A.G., Helwan, Cairo, Egypt

Received: 01/02/2016
Accepted: 15/02/2016
Corresponding author: Juan A. Belmonte (jba@iac.es)

ABSTRACT

The OAS Project has been run with the support of the Spanish research funding agencies during the last dozen years. Within its framework, research on cultural astronomy has been developed for a series of ancient civilizations, from the Atlantic Islands to the Arabian Peninsula and beyond, with the Meditterranean Sea as the principal axis of action of the project. A catalogue of studies has been performed in a set of cultures such as the Megalithic Phenomenon (González-García and Belmonte, 2010; Belmonte; González-García and Polcaro, 2013a), ancient Egypt (Belmonte and Shaltout, 2009; Belmonte, 2012), Middle East Bronze Age (notably on the Hittites: González-García and Belmonte, 2011) and Iron Age (notably on the Nabataeans: Belmonte, González-García and Polcaro, 2013b) civilizations and the Roman World (e.g. González-García, Rodríguez-Antón and Belmonte, 2014), among many others. In this essay a general scope of the project and a series of most interesting highlights will be presented. The evolutionary ties of the megalithic monuments of the Iberian Peninsula and elsewhere, the pattern of orientation of Egyptian temples and skyscaping practices within the Hittite or Nabataean cultures, among others, will be briefly explored; including a comprehensive, statistical and comparative study of the orientation patterns of thousands of ancient monuments of the Mediterranean region (González-García and Belmonte, 2014). Finally, a sketch of our most recent, still ongoing, research will be a compelling and promising closing remark of our analysis.

KEYWORDS: Cultural astronomy, OAS Project, Göbekli Tepe, ancient Egypt, Nemrud Dag, Magan

***TO THE UNFORGETABLE MEMORY OF PROFESSOR MOSALAM SHALTOUT**
(Abu Hamad, 1946 – Cairo, 2015)

1. INTRODUCTION

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 state of the art explanations of the cosmos have been the main generators of metaphysics in human mentality in such a way that, for instance, as astronomy progressed in the Western World, the space for religious speculation was consequently reduced. Celestial objects, returning once and again, provided a sense of security, allowing up the possibility of transcendence of death, inferred by similarity. For this reason, people mapped the firmament from very early dates in an attempt to find the order where, only in appearance, chaos reigned, and constructed their sacred buildings in such a variety of aspects, forms and realities seeking for a reflection of their cultural worldview.

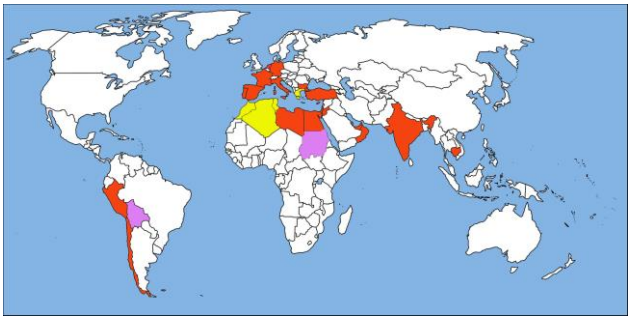

Figure 1. The international projection of the Orientatio ad Sidera research project on Cultural Astronomy. The twenty countries where fieldwork has been made during the dozen years of three successive projects of the same name are coloured red. Pink colour marks those countries where research has been done using high-resolution satellite images (Bolivia and Sudan). Yellow stands for countries whose data, obtained in previous campaigns by our team or by other researchers (as in the case of Algeria and Greece), have been used in analyses developed under OAS framework. The nucleus of our work has been the Mediterranean Region.

Pursuing ancient people mind, and how this was reflected in art, iconography, architecture and epigraphy, our research team promoted a scientific project in the early 2000s where cultural astronomy studies may be situated within an appropriate funding and institutional framework. This would precisely be "Orientatio ad Sidera". Since then, and on a three/four years period basis, three consecutive versions of the project have been approved and have permitted to follow up scientific objectives in five "continents" and more than twenty countries (see Figure 1). There have been lights and shadows in our work but the highlights have been inspiring and have proven beyond any doubt that sky- and landscape relationships have been more the rule that the exception in the way humans have connected to the cosmos. Let us show some examples.

2. SELECTED HIGHLIGHTS

2.1. Before writing: Göbekli Tepe

Until very recent times, the megalithic monuments in Europe, and in particular Stonehenge, were the archaeological remains earning all the credit on any potential astronomical knowledge of our earliest ancestors. However, a discovery in the steppes of southeast Anatolia has disrupted previous ideas. There, on a barren isolated hill called Göbekli Tepe a team of German and Turkish archaeologists (Schmidt, 2006) are excavating a cluster of suggestive stone monuments erected with large, megalithic pillars in the form of a T within a series of dry-stone enclosures. They started to be 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 despite of their great antiquity.

These monuments are mostly ellipsoidal in form and had megalithic accesses mostly open to the S-SE that might define a favourite orientation (see Figure 2). A few contradictory proposals have been put on the table. For example, Collins (2014) defends an orientation to the northern skies, notably to Deneb, offering certain clues for the importance of the Cygnus constellation in Prehistoric times. This would be highly dependent on the original landscape and orography of the site which is not easy to reconstruct. On the contrary, Magli (2015) defends a southern orientation centred on Sirius, the brightest star of the sky that would be visible in that region precisely in that epoch after have been out of sight for centuries due to precession.

However, what is undebatable is that between the series of monumental structures, there is one with nearly rectangular walls which were almost perfectly aligned according to the cardinal points (see Fig. 2). 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 exercises, analysing the profuse decoration of the T-pillars where we may already find atavistic 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 constellations, such as Leo, Taurus or Scorpius, that we can recognize in the skies of other evolved cultures in the region several centuries later. Interestingly, one of the pillars of the cardinally orientated hall, which was framing an altar on the eastern side of the structure, has a representation of a lion; and Leo was rising with the sun at the Spring Equinox precisely at east in the epoch of construction of this particular shrine (see Fig. 2). A moment in time when Taurus and Scorpius where marking other annual cycle milestones such as the solstices.

Unfortunately, when the data of Göbekli Tepe is analysed, a problem is faced: its singularity. There is no other preserved monument of the same culture where data can be contrasted and hence it will always be extremely difficult to further develop any hypothesis on the site relationship with skyscaping and to prove it beyond any reasonable doubt.

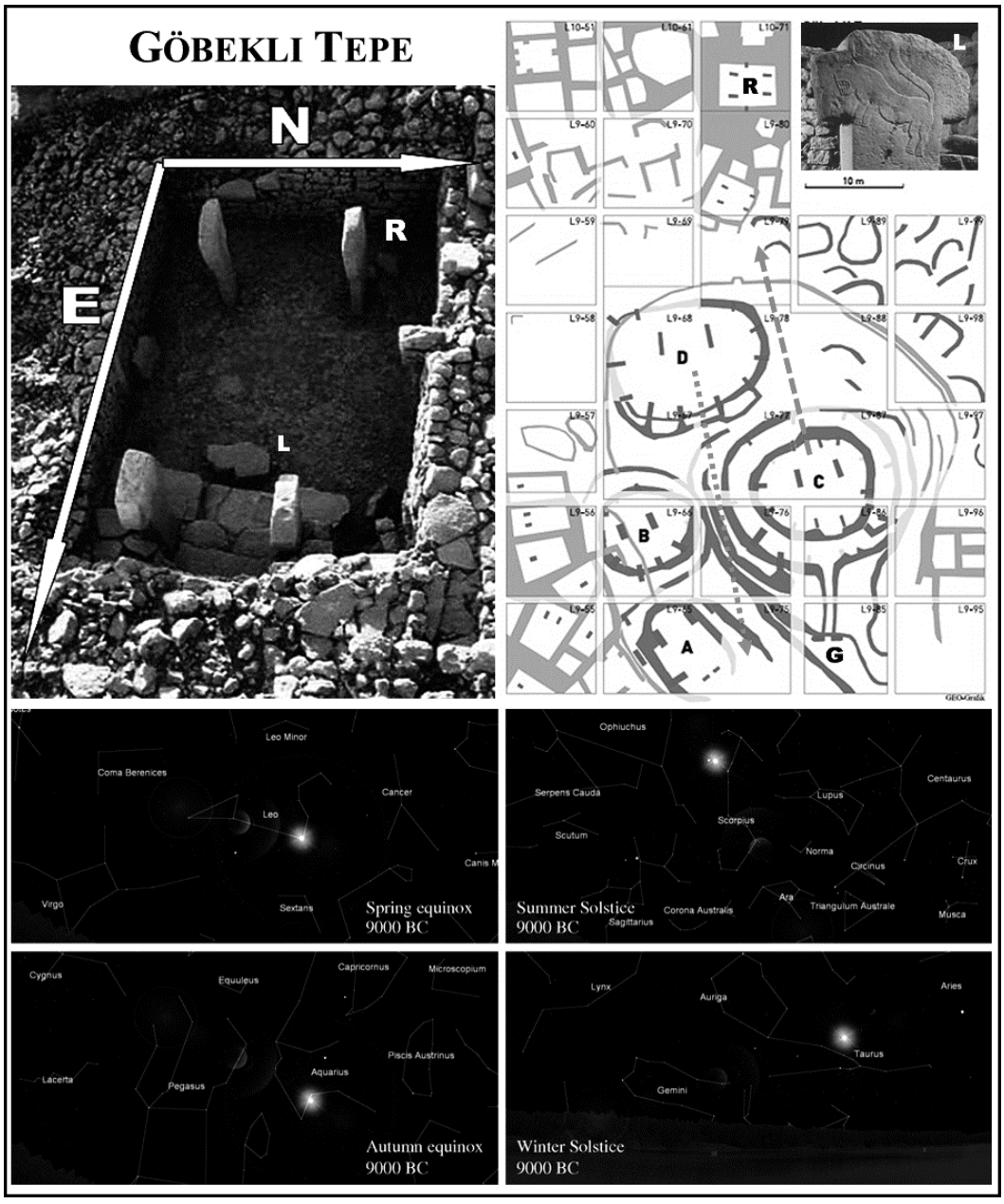

Figure 2. Composite diagram of some astronomical proposals for Göbekli Tepe. The walls of the rectangular structure (R) built c. 8500 B.C. in the upper sector of the site are perhaps the first orientated in the cardinal directions by humankind discovered so far. One of the pillars (L) was decorated with a image of a lion. Either by chance or design, the equinoctial sun was easterly rising in conjunction with our Leo in that epoch (other seasonal constellations of the epoch: Scorpius for the summer solstice and Taurus for the winter one had also his graphic counterparts in the pillar decoration on the site). The orientation of the main axes of the older larger enclosures (notably C and D) has been alternatively related to Sirius (dot-line; Magli, 2015) or to Deneb (dashed-line; Collins, 2014) See the text for more details. Diagram by the authors with images adapted from photographs by courtesy of M. Sanz de Lara and Stellarium.

However, statistics can be a good approach to perform cultural astronomy studies when dealing with illiterate extinct cultures, or cultural phenomena, of the past. In this sense, the earliest unmistakable evidence of an interest in the local landscape, including the skyscape, can be found throughout the megalithic monuments of the Iberian Peninsula. This is especially true in the southwest where Neolithic settlers built a series of monuments with a very similar architectural structure − they almost are 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 early 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 (Hoskin, 2001), are pointing at sunrise − or moonrise in a naïve alternative − at a certain moment in the annual cycle. We think that this very simple pattern of orientations was undistinguishable of megalithic monument 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 extended territories (González-García and Belmonte, 2010).

2.2. *Reading the Bronze Age*

For various reasons, archaeoastronomy has not been one of the favourite disciplines of Egyptologists in the past. Hence, 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" (Belmonte and Shaltout, 2009) funded by the successive OAS Projects has contributed to the solution of this problem. In order to achieve this, the Mission measured in five years the orientation of more than 350 temples in the Valley, the Delta, the Oases and the Sinai (reaching 400 if we include satellite image data from Sudan; Belmonte, 2012). 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 Figure 3). 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 landscape, dominated by the Nile, and skyscape, dominated by the sun and the stars, combine in order to permit the establishment of Ma'at, the Cosmic Order, on Earth (Belmonte, Shaltout and Fekri, 2009).

Hieroglyph sources, such as astronomical papyri, star-clocks and celestial diagrams were scrutinized in an effort to gain as much information as possible on how astronomy and its archaeological implications could help to better understand the ancient Egyptian civilization. Within the same framework, we should also highlight the identification of a series of Egyptian stars and constellations obtained on the analysis of the Senenmut's astronomical ceiling (the oldest complete symbolic representation of Egyptian skies) and the well-known Zodiac of Dandara. The analysis drives, under very simple assumptions, to the potential identification of the stars, asterisms and constellations that populated the skies of ancient Egypt, and their use as star-clocks within the framework of a sophisticated astral eschatology (Lull and Belmonte, 2009).

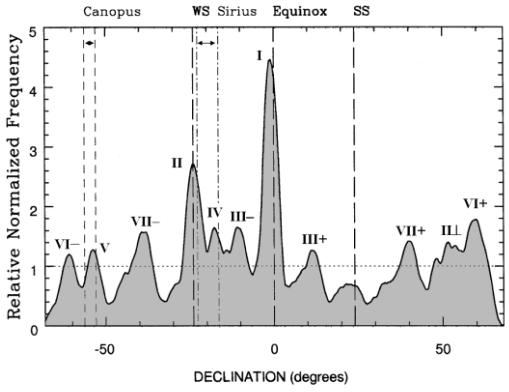

Figure 3. The seven (I to VII) families of astronomical orientations of the temples of ancient Egypt. Three of them have a solar character: eastern (I), solstitial (II) and seasonal (III). The other four (five) have a stellar character: eastern (I, in the perpendicular direction), Sothic (IV), Canopus' (V), meridian (VI) and quarter cardinal (VII). The cardinal families (I, VI and VII) would probably be related to alignments towards the constellation of Meskhetyu (the Plough, in Ursa Maior). Adapted from Belmonte and Shaltout (2009).

The last effort that our project has devoted to the ancient Egyptian civilization has dealt with the earlier steps of Egyptian monumental construction and the role astronomy played within (Belmonte and Magli, 2015). The two pyramids built during the Old Kingdom by the 4th Dynasty King Sneferu at Dahshur are usually considered as two consecutive projects: the second – that of the Red Pyramid – being generated by a presumably failure of the first, the Bent Pyramid. It has been shown that the archaeological proofs of such a scenario are far from obvious and that, on the contrary, a series of architectural, topographical, epigraphic and astronomical hints point to a unitary project probably conceived

from the very beginning in terms of the two pyramids and their annexes. Similar conclusions could be reached for other royal tombs of the 4th Dynasty, notably at Giza, Abu Rowash and Zawiyet el Aryan. The pyramids of the period all-together are thus shown to form a conceptual, sacred landscape related to the power of the King and his afterlife within the context of a sophisticated astral eschatology.

But ancient Egypt was not isolated. Within the framework of our project, the geographical, historical and anthropological context of a possible interest on the heavens by the ancient Hittites has also been scrutinized. Contemporaneous with the Egyptian New Kingdom, the inhabitants of the Hittite Empire produced a most sophisticated society, heir to a long Anatolian cultural tradition lasting several millennia (see section 2.1).

A review on ancient Hittite religion was performed, looking for those aspects of the cult that could be of interest to our project. These included an analysis of the solar, and other astral, divinities, the sacred space and its administrators, the calendar of festivals − i.e. Hittite sacred time − and, finally, the dead cult and related spaces and topography. This was the first serious insight dedicated to cultural astronomy studies of the Hittite civilization (González-García and Belmonte, 2011).

The importance of solar cults has been clearly emphasized and certain hints on the ancient Hittite sacred time were established with a certain degree of certitude. This was useful for a late comparison with the data provided by the archaeoastronomical research. The results showed that the analysis of a statistically significant sample of Hittite sacred structures allowed to affirm, beyond a reasonable doubt, that ancient Hittite monuments were not randomly orientated as had been previously argued. On the contrary, there were well defined patterns of orientation that could be interpreted within the context of Hittite culture and religion.

Our team was able to obtain data for nearly a hundred sacred structures erected by ancient Anatolian civilizations, such as the Hittite and the Phrygians, as a result of an extensive field prospective campaign. The analysis of the Hittite data has proven extremely fruitful. For example, our data confirm the textual evidence and have shown the relevance of solstitial and "equinoctial" orientations that could be explained within the context of ancient Hittite solar cult necessities. Indeed, Hattusha, the capital, has shown a striking and highly interesting astronomical and topographical landscape, where potential relationships between astronomical phenomena, built structures such as temples and monumental gates, and different elements of the local landscape have been illustrated.

2.3. Commemorating the past: Nemrud Dag

There are some occasions in life when one has the impression of being envisaging something unique. This was our case a few months ago when an extraordinary planetary conjunction took place in the constellation of Leo (see Figure 4). However, the most fascinating aspect of this view was that we were actually evocating a completely similar situation which happened in the sky more than 2000 years ago in the northern banks of the Euphrates River.

The Kingdom of Commagene was a small country between the upper course of the Euphrates and the mountains of Anti-Taurus in the south-east of Anatolia. Commagene played, despite her tiny size, a relevant role in the history of the Middle East during the late Hellenistic and early Roman periods as a buffer state between the powerful Seleucid (later Roman) and Parthian Empires. Antiochos I Theos (c. 69-36 B.C.) arguably was the most important of her kings, governing for more than 30 years in one of the most challenging periods of the region's history.

The world heritage site of the "hierothesion" (burial monument) of Antiochos I at Nemrud Dag certainly constitutes one of the most fascinating historical enigmas in human culture worldwide. The monument includes a stone slab with the famous lion "horoscope". On the slab, a lion with stars on his body, likely the constellation of Leo, is represented together with a crescent moon on his chest and three planets, identified in Greek as Pyroeis of Heracles, Stilbon of Apollon and Phaeton of Zeus, standing for Mars, Mercury and Jupiter, respectively (see Fig. 4). The possibility that the slab depicts a real or schematic astronomical scene or an astrological image introduced the idea of dating the monument and interpreting its nature since the earliest archaeological studies of the site. The most accepted conclusion so far had the support of Neugebauer and Van Hoessen (1959) who argued that the scene might represent a sort of horoscope for the date July 7 62 B.C. at the beginning of the reign of Antiochos I.

One of the main highlights of our work in the OAS Project has been a new approach in the analysis of the burial monument at Nemrud Dag, precisely (Belmonte and González-García, 2010), reaching different conclusions. After a visit to the monument, with on-site observations, in the summer solstice of 2009, our team proposed an alternative and more substantiated explanation which deals not only with the lion slab but also, and most important, with the orientation of the eastern and western terraces of the hierothesion and the religious tradition of the country as stressed in on the local inscriptions known as *nomos*.

Our main results can be summarized as follows. On the one hand, the five cyclopean statues of the eastern terrace would have been facing sunrise followed by the rising (obscured by the solar glare) of their celestial manifestations (the planets) in the constellation Leo on July 23 49 B.C., commemorating Antiochos' ascent to the throne as explicitly mentioned in the inscriptions on site (*nomos*). On the other hand, a few months later, their equivalents of the western terrace would have been facing sunset on December 23 49 B.C. in commemoration of the king's birthday. Consequently, according to our proposal, the main elements of the eastern and western terraces of the hierothesion should have been deliberately aligned to sunrise of Loios 11 and sunset of Audnayios 16 (the two festival dates mentioned in the *nomos*), respectively, in the year 49 B.C. The lion's horoscope could consequently be assigned a new date to July 12 49 B.C. (see Fig. 4).

The conclusion of our team was that Antiochos' monument reflected the situation of the skies at exclusive moments of the year 49 B.C. as confirmed by the local monumental inscription. This represents a paradigmatic change to well established theories on the interpretation of Nemrud Dag. It is indeed appealing that we could commemorate this fact with a completely similar phenomenology twenty centuries later at dawn on October 9 2015.

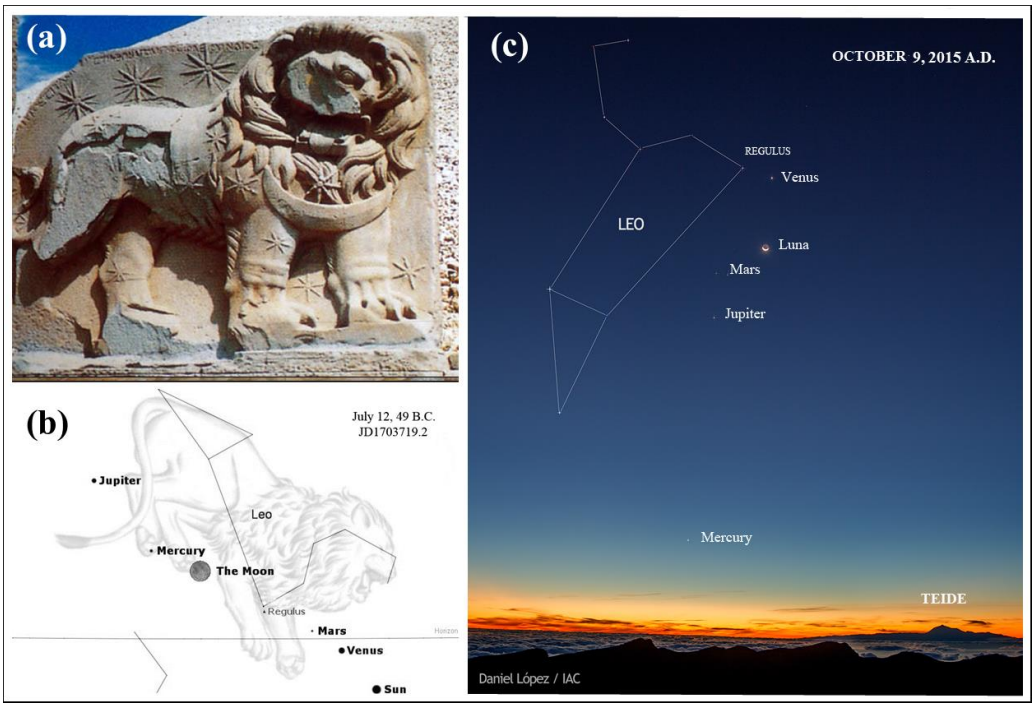

Figure 4. The famous "Lion Slab" at the eastern terrace of Nemrud Dag (a), and the corresponding astronomical diagram, corresponding to Leo's setting after sunset for July 12 49 B.C. in the Gregorian proleptic calendar. This date has suggestive connections with those yielded by the orientation of the main architectural elements of the hierothesion and the inscriptions on site. This kind of splendid celestial planet conjunction with such an important constellation as Leo are seldom repeated in the sky as the one that the authors could enjoy above Tenerife in October 9 2015 from the summit of La Palma, in the Canary Islands (c). Diagram by the authors, adapted from Belmonte and González-García (2010) and from a sky image by courtesy of Daniel López.

2.4. *Present and future*

The Arabian Peninsula is for obvious reasons one of the last virgin territories for cultural astronomy studies in the Middle East. However, its relevance as a cultural crossroad at the frontier of the Fertile Crescent can hardly be discussed. This is for example the case of the Haffit and Umm an Nar cultures that dominated the northeast of the Arabian Peninsula during the Chalcolithic and the Early Bronze Age (Third Millennium BC), in the so-called land of Magan (present day Oman and the Emirates). In a field campaign in January 2012 several ancient EBA necropoleis of the region were visited and (when possible) measured in an attempt to shed some light on the orientation customs of these ancient populations. The sample, of c. 70 monuments, consists of two different types of tombs: earlier (c. 3000 BC) dry-stone cairns of the so-called Haffit type and later (c. 2500 BC) megalithic structures of the so-called Umm an-Nar type. This was the first systematic archaeoastronomical approach ever conducted in this area of the Arabian Peninsula (Belmonte and González-García, 2014). However, the work is uncompleted and there still are several options for the future. For example,

an area we did not visit in our campaign was the Eastern Hajjar Range in Oman where, as archaeology proves, the research can still offer interesting surprises (see Figure 5).

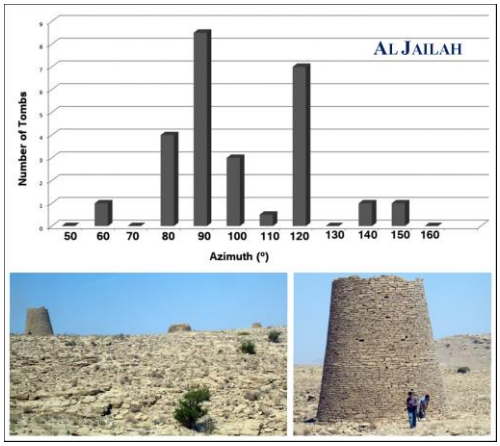

Figure 5. Orientation histogram and images of the monumental cyclopean tombs of Al Jailah in the Eastern Hajjar Mountains of Oman. It was obtained using the archaeological data collected by Yule and Weisgerber (1998). The two most significant peaks may correspond to equinoctial and winter solstice alignments. Images by courtesy of Jorge Notivoli.

The other extreme of the Arabian Peninsula was dominated at the term of the era by the powerful Nabataeans. This Arab lineage people built several monuments in Petra and elsewhere displaying a decoration with a preference for astronomical motifs, possibly as a reflection of their religion. Due to the lack of direct written accounts and the scarcity of inscriptions we do not have a clear knowledge on the precise nature of such believes and how these reflected on the calendar or the religious timekeeping system of this ancient society. A statistical analysis of the orientation of their sacred monuments (Belmonte, González-García and Polcaro, 2013b) demonstrated that astronomical orientations were often part of an elaborated plan and possibly a trace of the astral nature of Nabataean religion. Petra and other monuments in the ancient Nabataean kingdom have proven to be marvellous laboratories of the interaction between landscape features and astronomical events showing impressive hierophanies on particular monuments related to cultic times and festivals. Our work has demonstrated that the sky was a substantial element on Nabataean religion and revealed new evidence for cultic worship centred on the celestial sphere in this fascinating region of the Mediterranean contour (for further details see e.g. Polcaro et al. 2013 and González-García, Belmonte and Polcaro, 2016, in this same volume).

The most recent effort of the OAS project has been the one devoted to the study of the pattern of orientations within the ancient Roman world, notably in the Iberian Peninsula (González-García, Rodríguez-Antón and Belmonte, 2014). This is the nucleus of the first PhD Thesis undertaken within the project and that is being done by Andrea Rodríguez-Antón under the supervision of the first two authors (see also Rodríguez-Antón, Belmonte and González-García, 2016, this volume). The research includes the in depth analysis of certain substantial Roman sites. A good example is Cartagena, the ancient Punic Qart Hadašt, or Roman Carthago-Nova. Archaeological excavations have manifested the existence of ritual, urban and topographical elements that could be analysed from the perspective of cultural astronomy.

Therefore, in October 2013, an interdisciplinary team of astronomers and archaeologists conducted a field campaign of the main topographic and archaeological landmarks of the Punic and Roman periods of the city. Methodologically, a basic guide criterion was established for each particular element, measuring its corresponding azimuth(s). The data demonstrated the relevance, within the ancient city, of a series of orientations towards sunrise and sunset at the summer solstice, whose significance could be fully integrated within the context of the Punic ritual (González García et al., 2015). This skyscaping was merged and reinterpreted in the framework of the subsequent Roman appropriation of the city landscape, including their successive urban and architectural programs, particularly that of the period of Augustus, when certain astronomical orientations could serve to strengthen the image of Rome and the *Princeps* as restorers of peace and guarantees of a new order based in cosmological elements. There are plans to repeat similar approaches in other ancient Roman cities.

3. CONCLUSION

In our opinion, the OAS Project has made a substantial and essential contribution to the advance of cultural astronomy research in the Mediterranean region and elsewhere in the last decade. This is reflected in the recently published "Handbook of Archaeoastronomy and Ethnoastronomy" (Ruggles, 2015), where the participation of members of the project (and immediate collaborators) has been notable, contributing with a total of 17 essays. Additionally, the IP of the OAS project was one of the seven Section Editors of what hopefully will become a reference volume in our discipline.

OAS is a living project! Progressing, growing and in permanent reenovation (an IVth extension to 2019 has just been approved). We now expect that it will become an important partner in the promotion and development of the Astronomy and World Heritage initiative (Ruggles and Cotte, 2010).

ACKNOWLEDGEMENTS

Substantial parts of the fieldwork and data interpretation during these dozen years of hard work were carried out with the help of a series of persons whose collaboration was fundamental for the success of the project. We would like to especially acknowledge astronomers Lourdes Costa-Ferrer and Giulio Magli, anthropologist Margarita Sanz de Lara, Egyptologists José Lull, Miguel Ángel Molinero and Magdi Fekri, and archaeologists María Antonia Perera and Marco García Quintela for their ongoing permanent support. This work is partially financed under the framework of the projects AYA2011-66787-P ''Orientatio ad Sidera IV'' of the Spanish MINECO (and earlier versions of the same project), and P310793 ''Arqueoastronomía'' of the IAC. ACGG is a Ramon y Cajal Fellow of the Spanish MINECO.

REFERENCES

Belmonte, J.A. (2012) *Pirámides, templos y estrellas: astronomía y arqueología en el Egipto antiguo*, Barcelona, Crítica.

Belmonte, J.A. and Shaltout M. (eds.) (2009) *In Search of Cosmic Order: selected essays on Egyptian Archaeoastronomy*, Cairo, Supreme Council of Antiquities Press.

Belmonte, J.A., Shaltout, M. and Fekri, M. (2009) Astronomy, landscape and symbolism: a study of the orientation of ancient Egyptian temples. In *In Search of Cosmic Order: selected essays on Egyptian Archaeoastronomy*, J.A. Belmonte and M. Shaltout (eds.), Cairo, Supreme Council of Antiquities Press, 213-285.

Belmonte, J.A., and Gonzalez Garcia, C. (2010) Antiochos's hierothesion at Nemrud Dag revisited: adjusting the date in the light of astronomical evidence, *Journal for the History of Astronomy*, Vol. 41, 469-481.

Belmonte, J.A., González García, A.C. and Polcaro, A. (2013a) On the orientation of megalithic monuments of the Transjordan Plateau: new clues for an astronomical interpretation, *Journal for the History of Astronomy,* Vol. 44, 429-455.

Belmonte, J.A., González García, A.C. and Polcaro A. (2013b) Unveiling Petra: astronomy and landscape in the Nabataean lands, *Nexus Network Journal,* Vol. 15, 497-502.

Belmonte, J.A. and González García A.C. (2014) On the orientation of Early Bronze Age tombs in ancient Magan. *Mediterranean Archaeology and Archaeometry*, Vol. 14, 233-246.

Belmonte, J. A. and Magli, G. (2015) Astronomy, architecture, and symbolism: the global project of Sneferu at Dahshur, *Journal for the History of Astronomy*, Vol. 46, 173– 205.

Collins, A. (2014) *Göbekli Tepe: Genesis of the Gods*, Rochester, Bear & Co.

González Garcia, C. and Belmonte, J.A. (2010) Statistical analysis of megalithic tomb orientations in the Iberian Peninsula, *Journal for the History of Astronomy*, Vol. 41, 225-238.

González Garcia, A.C. and Belmonte, J.A. (2011) Thinking Hattusha: astronomy and landscape in the Hittite lands, *Journal for the History of Astronomy*, Vol. 42, 461-494.

González García, A.C. and Belmonte, J.A. (2014) Sacred architecture orientation across the Mediterranean: a comparative statistical analysis. *Mediterranean Archaeology and Archaeometry*, Vol. 14, 95-113.

González García, A.C.; Rodríguez Antón, A. and Belmonte J.A. (2014) On the orientation of Roman cities in Hispania: preliminary results. *Mediterranean Archaeology and Archaeometry*, Vol. 14 (2014), 3, 107-119.

González García, A.C. and Belmonte, J.A. (2015) The Orientation of Pre-Romanesque Churches in the Iberian Peninsula *Nexus Network Journal*, Vol. 17, 353-377.

González-García, A. C., Noguera Celdrán, J. M., Belmonte Avilés, J. A., Rodríguez Antón, A., Ruiz Valderas, E., Madrid Balanza, M. J., Zamora, E. and Bonnet Casciaro, J. (2015) Orientatio ad sidera: astronomy and landscape in Qart Hadašt/Carthago Nova, *Zephyrus*, Vol. 75, 139-160.

González-Garcia, A.C., Belmonte, J.A. and Polcaro, A. (2016) A diachronic analysis of orientation of sacred precincts across Jordan, *Mediterranean Archaeology and Archaeometry*, this volume.

Hoskin, M. (2001) *Temples, tombs and their orientations*, Bognor Regis, Ocarina Books.

Lull, J. and Belmonte, J.A. (2009) The constellations of ancient Egypt, In *In Search of Cosmic Order: selected essays on Egyptian Archaeoastronomy*, J.A. Belmonte and M. Shaltout (eds.), Cairo, Supreme Council of Antiquities Press, 155-195.

Magli, G. (2015) Sirius and the project of the megalithic enclosures at Göbekli Tepe, *Nexus Network Journal*, in press. http://link.springer.com/article/10.1007%2Fs00004-015-0277-1

Neugebauer, O. and Van Hoessen, H.B. (1959) Greek Horoscopes, *American Philosophic Soc. Memories* Vol. 48, 14-16.

Polcaro, A., González-Garcia, A.C. and Belmonte, J.A. (2013) The orientation of the Bronze Age Temple of Pella, Jordan: the dying god Baal and the Rituals of the Summer Solstice, *Anthropological Notebooks*, Vol. 19, 481-492.

Rodríguez-Antón, A., Belmonte J.A. and González García, A.C. (2016) Romans in Near East: Orientation of Roman settlements in modern Jordan , *Mediterranean Archaeology and Archaeometry*, this volume.

Ruggles, C.L (ed.) (2015) *Handbook of Archaeoastronomy and Ethnoastronomy*, Heidelberg, Springer.

Ruggles, C.L.N. and Cotte, M. (eds.) (2010), *Heritage sites of astronomy and archaeoastronomy in the context of the UNESCO World Heritage Convention*, Paris, ICOMOS.

Schmidt, K. (2006) *Sie bauten die Ersten Temple*, Munich, Verlag C.H. Beck.

Yule, P. and Weisgerber, G. (1998) Prehistoric Tower Tombs at Shir/Jaylah, Sultanate of Oman, *Beiträge zur allgemeinen und vergleichenden Archäologie*, Vol. 18, 183-241.