The Archaeoastronomical Results of Three Bronze Age Buildings at Agia Triada, Crete

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Abstract
This is the final site report from the Uppsala archaeoastronomical project of ancient Crete. The project comprised a careful selection of the most important Bronze Age buildings from 15 archaeological excavations and 23 buildings at those excavations (Fig. 1). A list of our publications of the project can be found on our webpage (http://minoanastronomy.mikrob.com/?page_id=2), which is under construction. Such a study has not been done before. We use the standard methods of archaeoastronomy which, in short, are measuring the orientations of foundation walls and their opposite horizons, analyzing the measurements statistically, and comparing the results with digital reconstructions of the positions of celestial bodies for the time when the walls were built (Blomberg & Henriksson 2001a). We discovered that all of the buildings had orientations towards major celestial events such as sunrise or sunset at the equinoxes or the solstices, moonrise or moonset at the standstills, the heliacal rising or setting of a distinctive star, or sunrise on the first day of the twelve solar months of the Minoan calendar. The study also led to a new way of recognizing Mycenaean from Minoan buildings through their orientations (Blomberg & Henriksson 2001b). Agia Triada is one of the four sites in our project where this distinction is demonstrable.

KEYWORDS: Minoan astronomy, Minoan calendar, Minoan villa, Mycenaean megaron

POVZETEK
To je zaključno poročilo uppsalskega arheoastronomskega projekta o starodavni Kreti. Projekt je obsegal skrben izbor najpomembnejših bronastodobnih zgradb s 15 arheoloških izkopavanj, skupno 23 zgradb (slika 1). Pregled naših publikacij o projektu je na voljo na naši spletni strani v nastajanju (http://minoanastronomy.mikrob.com/?page_id=2). Takšne študije do sedaj še ni bilo. Uporabljamo standardne arheoastronomske metode, s katerimi merimo usmeritve temeljnih zidov in njihovih nasprotnih horizontov, meritve statistično analiziramo ter rezultate primerjamo z digitalnimi rekonstrukcijami položajev nebesnih teles v času izgradnje zidov (Blomberg & Henriksson 2001a). Odkrili smo, da so vse zgradbe usmerjene proti pomembnim dogodkom na nebu, kot so: Sončev vzhod ali zahod ob ena-

konočju ali solsticiju, vzhod ali zahod Lune v skrajnih legah, heliakalni vzhod ali zahod izstopajoče zvezde in Sončev vzhod na prve dneve dvanajstih solarnih mesecev minojskega koledarja. Študija je pripeljala tudi do novega načina razlikovanja mikenskih in minojskih stavb na podlagi njihove orientacije (Blomberg & Henriksson 2001b). Agia Triada je eno izmed štirih najdišč v našem projektu, kjer je to razlikovanje razvidno.

KLJUČNE BESEDE: minojska astronomija, minojski koledar, minojska vila, mikenski megaron

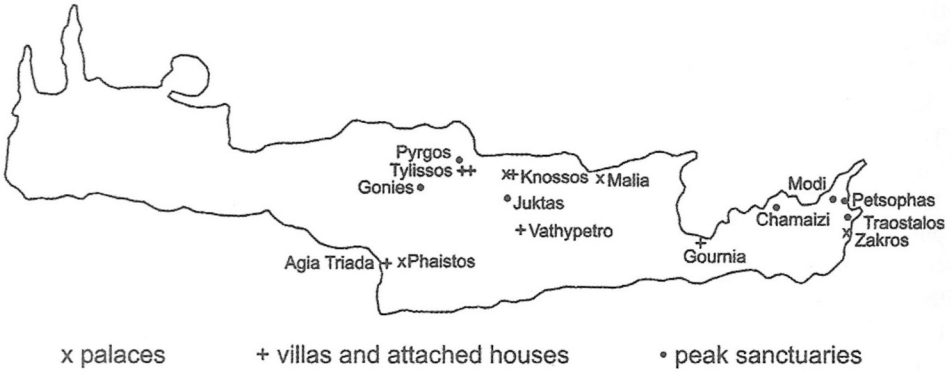

Figure 1: Map of the sites on Crete.

Introduction

Crete was settled in the seventh millennium BCE, and Agia Triada was an important settlement from at least the Final Neolithic until late in the first millennium BCE, a period of over three millennia. The site was excavated by the Italian school at Athens from 1902-1914, with supplementary studies made in the 1970s, and it is located a little over two kilometers from Phaistos, one of the four large Minoan palaces (La Rosa & Rizzo 1985).

At the end of the Middle Minoan period, about 1700 BCE, which is the beginning of the high point in the Minoan culture, a large sumptuous villa was built over an earlier house. It had all of the typical features of grand houses of the time, large suites of pillared chambers, stone floors, frescoes, fine objects, and large store rooms. Many of the objects found are of the highest quality and some are unique, e.g., exquisite vases carved from serpentine. Furthermore, the largest assemblage of Linear A documents in Crete was found in the villa. These were temporary economic records jotted down on unfired clay tablets. They were baked unintentionally by the fire which destroyed the villa. Permanent written records are assumed to have been documented on perishable materials. The villa was destroyed at the end of Late Minoan I (ca. 1450 BCE), but it was not ransacked. The time of destruction was widespread in the island and coincides with a period considered by many to mark the takeover by the Mycenaeans, who were Greek. It is not known how the Mycenaeans came to power, but they seem to have been present on the island for

some time. Their original home was mainland Greece and their culture had been heavily influenced by the Minoans for centuries.

After the destruction a large megaron was built directly above the villa and a small megaron was built in the southeast corner of the site. The megaron is the most characteristic Mycenaean architectural form and the large example at Agia Triada is their most monumental structure in Crete. For the most part, the Mycenaeans only took over the Minoan buildings. The objects found in them identify their owners as Mycenaeans. The buildings from Agia Triada that are including in the Uppsala project are the Minoan villa, and the small and large megara.

We have presented our study of the small megaron at Agia Triada with two other contemporary Mycenaean buildings from other sites that have the same orientation in Blomberg & Henriksson (2005) and now present the Minoan villa and the large megaron. The orientation of the villa, especially the upper levels, is difficult to study because of the later construction of the large megaron directly over it. From our measurements we could determine the orientation of the bench room on the lower level. This and the adjoining rooms were an important part of the villa, used either for ceremonial or cultic purposes. Opposite them in the west is the sea. The long northern wall in this area is oriented to the equinoxes. Since the altitude of the terrain increases towards the east, we can conclude that the sunset alignment was intended. A wall appears to have been to the west, making it likely that the alignment was only visible from the upper rooms in this part of the villa. Additionally, there is a corridor in the lower level that has an alignment to the west peak of Mt. Ida. The large megaron built above the villa is also oriented towards the equinoxes, but likewise due to the terrain, we can conclude that a sunset alignment was intended (Fig. 2). The small megaron, which we presented earlier (Blomberg & Henriksson 2005), is oriented towards sunset at the summer solstice. This orientation is marked by the natural foresight of a hilltop in that direction.

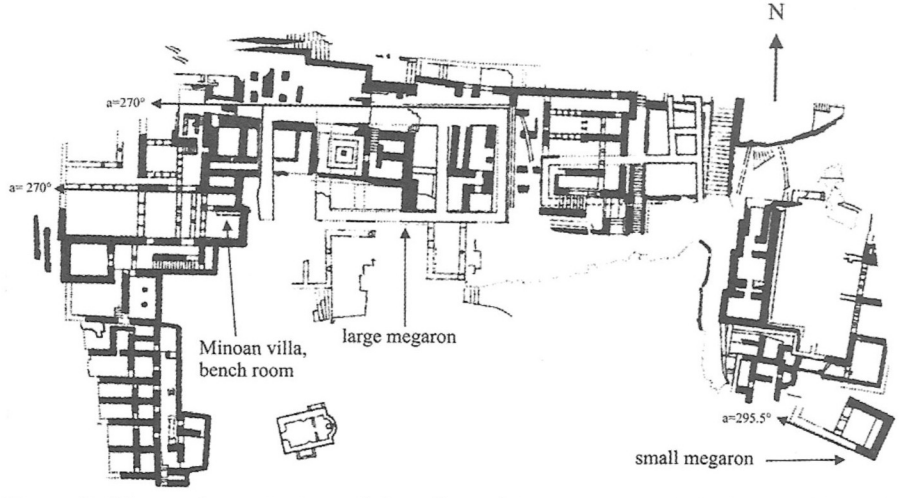

Figure 2: Plan and orientations of the villa and the megara at Agia Triada. From the Aerial atlas of ancient Crete (Myres et al 1992), with permission.

Now that we have measured the orientations of all of the buildings in our project we can point to consistent alignments to major celestial events arranged by both the Minoans and the Mycenaeans (Table 1). These events are sunrise and sunset at the equinoxes and the solstices, moonrise and moonset at the major standstills and the heliacal risings and settings of bright stars. Seven of the 18 Minoan buildings are oriented either towards sunrise or sunset at the equinoxes, six towards sunrise at the winter or summer solstice, and one towards moonrise at the southern major standstill. Five of the remaining six Minoan buildings are oriented towards sunrise or sunset on the first day of one of the eight solar months not marked by the equinoxes or solstices. The sixth remaining building, Traostalos, has orientations only towards the heliacal rising and setting of Arcturus. Several of the buildings have more than one orientation: The peak sanctuary on Petsophas has four, the palace at Phaistos and the villa at Vathypetro have three and the peak sanctuaries at Chamaizi, Pyrgos and Traostalos have two. All of the five Mycenaean buildings are oriented towards the west, either towards sunset at the equinoxes or sunset at the summer solstice.

Table 1: Orientations of the buildings in the Uppsala archaeoastronomical project.

Site	Orientation	Foresight
Agia Triada, villa	sunset equinoxes	
LMIII megaron	"	
LMII megaron	sunset summer solstice	natural
Chamaizi, peak sanctuary?	sunrise winter solstice	artificial
	heliacal setting of Arcturus	artificial
Gournia, MM IA house	sunrise one month before and after equinoxes	
LM I house	"	
LM III house	sunset winter solstice	artificial
Juktas, peak sanctuary	sunrise equinoxes	natural
Knossos, palace	sunrise equinoxes	artificial
south-east house	"	artificial
Malia, palace	sunrise one month before and after equinoxes	natural
LM II megaron	sunset summer solstice	
Modi, peak sanctuary	sunrise two months before and after equinoxes	
Petsophas, peak sanctuary	sunrise summer solstice	natural
	sunset equinoxes	natural
	heliacal rising of Arcturus	
	heliacal setting of Arcturus	
Phaistos, palace	sunrise equinoxes	
	sunset equinoxes	natural
	heliacal rising and setting of Canopus	natural
Philioremos, peak sanctuary	sunrise summer solstice	natural
Pyrgos, peak sanctuary	sunrise summer solstice	
	heliacal setting of Arcturus	natural
Traostalos, peak sanctuary	heliacal rising of Arcturus	
	heliacal setting of Arcturus	natural
Tylissos, villa A	sunrise summer solstice	artificial
Tylissos, villa C	sunrise one month before and after solstices	artificial
	sunrise one month before and after equinoxes	artificial
Vathypetro, villa	sunrise equinoxes	artificial
	sunrise one month before and after equinoxes	artificial
	sunrise winter solstice	artificial
tripartite shrine	sunset summer solstice	artificial
Zakros, palace	moon southern major standstill	natural

The palace at Knossos and the peak sanctuary on nearby Juktas also had orientations to mark the eleven days after the autumn equinox and these were emphasized by foresights. This indicates that the Minoans had used a lunisolar calendar that began in connection with the autumn equinox. There was also a calendar regulator at the palace at Knossos that kept track of the solar cycle making it easy to know when to add an extra day every four years. This regulator might mean that the Minoans also had a solar calendar. It is probable that the Minoans regularly related their important buildings and shrines to celestial phenomena, since the orientations are repeated and foresights are used at more than two-thirds of them. All but two, the palace at Zakros and the peak sanctuary on Traostalos, were oriented to the beginning of a month in the solar calendar (Table 2). The former was oriented towards moonrise at the major standstill, an event which could have had significance in calendar; the latter had orientations to the bright star Arcturus.

Table 2: Orientations of Minoan buildings to the beginning of a solar month.

Site	Months
Petsophas, Phaistos, Knossos (2), Juktas, Vathypetro, Agia Triada	first (autumn equinox)
Malia, Vathypetro	second
Modi	third
Chamaizi, Vathypetro	fourth (winter solstice)
Modi	fifth
Malia, Vathypetro	sixth
Petsophas, Phaistos, Knossos (2), Juktas, Vathypetro, Agia Triada	seventh (spring equinox)
Gournia (2), Tylissos Villas A and C	eighth
Tylissos Villa A	ninth
Philioremos, Petsophas, Pyrgos, Tylissos Villa A	tenth (summer solstice)
Tylissos Villa A	eleventh
Gournia (2), Tylissos Villas A and C	twelfth

We have further evidence of the existence of a solar calendar by the orientations of seven of the Minoan buildings to the first days of the months that were not marked by the equinoxes or solstices. One of the buildings was the important palace at Malia, and its orientation was marked by a natural foresight (Fig. 3). This alignment marked the start of the second and sixth months, if the year began at the autumn equinox. One orientation of the villa at Vathypetro was also to the beginning of the same two months and it was also marked by a foresight (Blomberg, & Henriksson 2005).

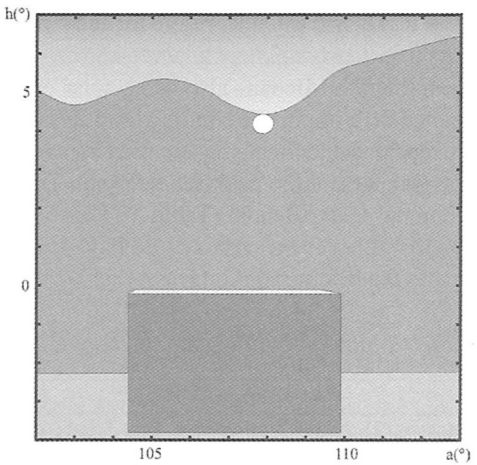

Figure 3: Orientation from the central shrine at Malia over the altar in the center of the central court to sunrise on the 22nd of October, one month after the autumn equinox and before the spring equinox.

For the palace at Phaistos, the emerging appearance of Canopus in the south seems to have resulted in the realignment of the new palace and the central court (Fig. 4, dark shaded areas). The star became visible behind the mountain in the south from the hill just west of the palace ca. 2080 BCE and its heliacal rising occurred three days before the autumn equinox (Fig. 5A). A new orientation of the central court was chosen towards the peak of the mountain in the south. The star would not have been visible from the central court while the palace was in use (Fig. 5B), but it would have been common knowledge to the Minoans that it rose behind the mountain just before the autumn equinox (Blomberg & Henriksson 2007).

Figure 4: Plan of the palace at Phaistos. From Myers et al 1992, with permission.

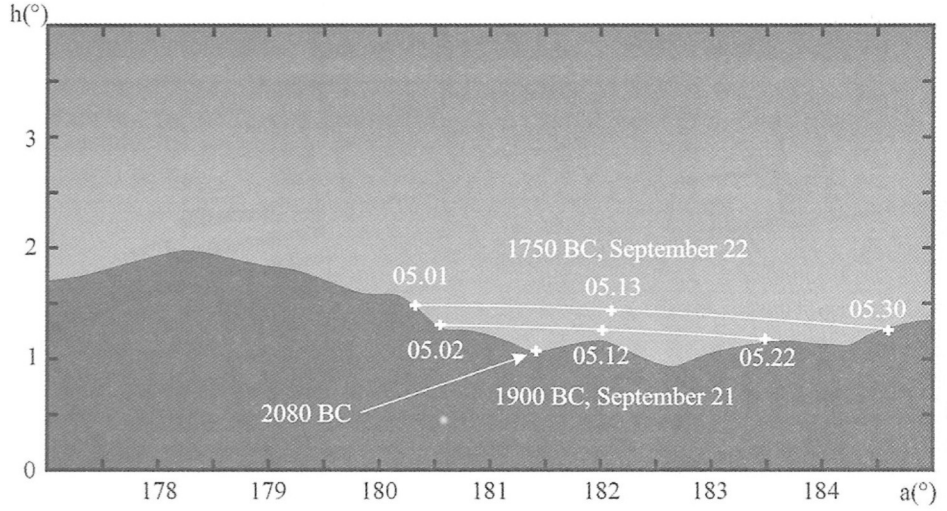

Figure 5A: After ca. 2080 BCE, Canopus would have risen and set behind the mountain south of the central court of the palace at Phaistos. It would have been seen for a few minutes only from the hill west of the palace.

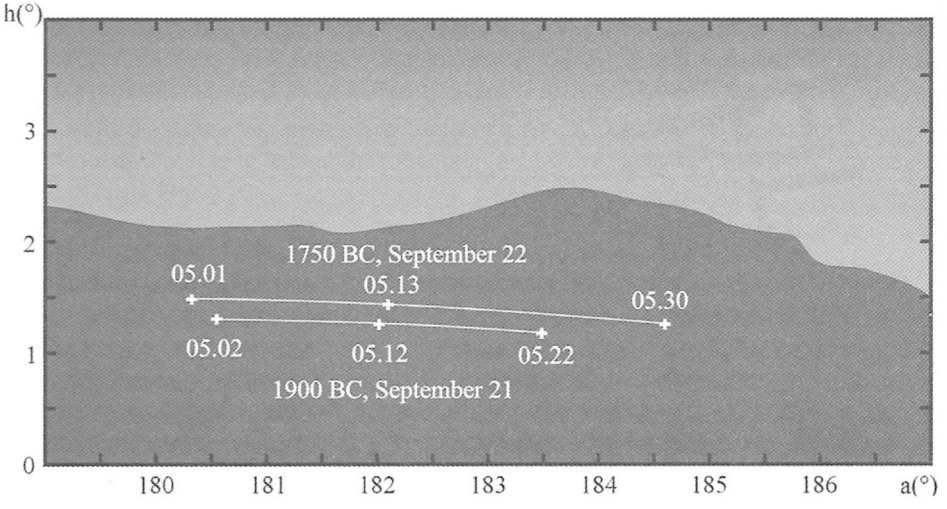

Figure 5B: Canopus would have remained above the horizon for less than half an hour, but would not have been visible from the palace itself.

This fact of the reorientation of a major monument to a new bright star stresses the importance of the meaning of celestial phenomena for the Minoans. They were much more than practical signs to mark the passing of the year and the progression of the seasons. They had extraordinary symbolic meaning that was essential for Minoan religion. Michael Hoskin reported an extreme reaction linked to the symbolic meaning of alignments at the sanctuary of Son Mas in Mallorca at about the same time. When the last star of the Southern Cross disappeared from sight due to precession, the site was abandoned (Hoskin 2001: 50f).

In Minoan Crete, each month probably was important for the places that marked the first day of that month, most likely celebrating a key event in local and national religious traditions such as an important event in the life of a divinity or hero, or times for sacred celebrations. Each place probably had its part to play in the wider context of Minoan cosmology and could have shared in a common responsibility for marking the vital annual events of human life, such as the rituals for rulers and priests, times for honoring the gods and goddesses, for sowing and harvesting, for sailing, and for national religious celebrations. All of these are echoed in later Mycenaean and Greek myths and rituals. We may take these as evidence that the second goal of our project, the influence of Minoan astronomy on Mycenaean and Greek culture was in some measure realized.

Acknowledgements

For their generous financial support we thank the following organizations: the Swedish Council for Research in the Humanities and Social Sciences, the Gunvor and Josef Anér Foundation, the Axel and Margaret Ax:son Johnson Foundation, the Magn. Bergvall Foundation and the Helge Ax:son Johnson Foundation. We also thank the Greek Archaeological Service for permission to study the sites in Crete and the personnel at the Swedish Institute at Athens for their help in many ways. We are indebted to Peter Blomberg for publishing the small finds from the peak sanctuaries.

References

Blomberg, M., & G. Henriksson. 2001a. Archaeoastronomy: new trends in the field, with methods and results from studies in Minoan Crete. *Journal of Radioanalytical and Nuclear Chemistry* 247: 609-619.

Blomberg, M., & G. Henriksson. 2001b. Differences in Minoan and Mycenaean orientations in Crete. In: C. Ruggles, F. Prendergast & T. Ray (eds.), *Astronomy, Cosmology and Landscape*. Proceedings of the SEAC 98 meeting, Dublin, Ireland, September 1998. Bognor Regis: Ocarina Books, pp. 72-91.

Blomberg, M., & G. Henriksson. 2005. Orientations of the late Bronze Age villa complex at Vathypetro in Crete. *Mediterranean Archaeology & Archaeometry* 5 (1): 51-61.

Blomberg, M., & G. Henriksson. 2007. Orientations of the Minoan palace at Phaistos in Crete. In: *Ancient watching of cosmic space and observation of astronomical phenomena, 6-10 April, 2006, Rhodes, Greece* (Proceedings of the international conference on archaeoastronomy, SEAC 14th 2006). *Mediterranean Archaeology and Archaeometry* 6 (3), 185-192.

Hoskin, M. 2001. *Tombs, temples and their orientations: a new perspective on Mediterranean prehistory*. Bognor Regis: Ocarina Books.

La Rosa, V., & M. A. Rizzo (eds). 1985. *Ancient Crete. A hundred years of Italian Archaeology (1884-1984)*. Roma: De Luca Editore.

Myers, J. W., E. E. Myers & G. Cadogan (eds). 1992. *The Aerial Atlas of Ancient Crete*, London: Thames and Hudson.