Original Study

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Patterns of Visibility, Intervisibility and Invisibility at Bronze Age Apesokari (Crete)

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Abstract: Tholos A at Apesokari (south-central Crete, Greece) was constructed on a sloping ledge of bedrock, overlooking the Mesara Plain below. Such an inconvenient topographic setting makes Tholos A an unusual example in the corpus of Minoan circular tombs, which were more commonly built on flatter ground. The builders seem to have cared greatly about placing Tholos A precisely at this location, even at the risk of jeopardizing the stability of its circular chamber. Furthermore, due to limited space availability, the annex rooms of Tholos A had to be built at a higher level on the bedrock, resulting in an architectural configuration unparalleled in other circular tombs. This paper addresses the question of why this particular location was chosen for the construction of Tholos A. Geographical Information Systems (GIS) are used to examine the possibility that concerns related to visibility, intervisibility or invisibility may have played a role in the decision to build Tholos A at this particular spot. Five potential scenarios are formulated and tested to assess whether the tomb may have been placed with the intention of maximizing its visibility and ensuring (or, to the contrary, preventing) intervisibility with specific features in the local landscape.

Keywords: Minoan Crete, circular tombs, GIS, viewshed, landscape

1 Introduction

Viewsheds are among the most commonly performed GIS analyses in archaeological research (e.g. Wheatley, 1995; Lake & Woodman, 2003; Llobera, 2003; Llobera, Wheatley, Steele, Cox, & Parchment, 2010; Kantner & Hobgood, 2016; Gillings, 2017). Their popularity stems both from the central role played by vision in human interaction with the world, and from the analytical and exploratory potential of digital technologies. Sight is the most powerful of all senses when it comes to perceiving space and constructing a sense of place: it provides, at once, information on the size, shape, color, distance, location and spatial arrangement of objects in the landscape, both in the near and far distance (Llobera, 2007, p. 52). It comes, therefore, as no surprise that the visibility, intervisibility and visual properties of ancient sites are major foci of investigation in landscape archaeology. In this context, a significant contribution of GIS technologies lies in their ability to quantify visibility, and hence, in the opportunity they offer to compare the visual characteristics of multiple locations and thus gain insights into the way past peoples used monuments to structure the landscape (e.g. Wheatley, 1995; Llobera, 2007; Gillings, 2009, 2015, 2017; Dungan, White, Déderix, Mills, & Safi, 2018).

Computer hardware evolves at a rapid pace and recent software developments have contributed to improving the speed and efficiency of viewshed computation (e.g. Gillings, 2009; Llobera, Wheatley,

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Steele, Cox, & Parchment, 2010; Zhao, Padmanabhan, & Wang, 2013; Ferreira, Andrade, Magalhães, Franklin, & Guilherme, 2014; Dungan, White, Déderix, Mills, & Safi, 2018). By decreasing computational costs, hardware and software developments open up new possibilities for GIS practitioners to multiply viewsheds, increase the scale and resolution of analysis, and experiment with different parameters, scales and datasets. Caution is, however, required, for we may run the risk of being carried away into a mass production of viewsheds, losing touch with the archaeological focus of our research and falling into the pitfalls of technological determinism – which would turn the digital progression into an archaeological regression. Indeed, whatever the advances of computer technologies, it is crucial that the archaeological question always remains at the heart of the analyses (Gillings, 2009, 2015, 2017). For meaningful results to be obtained, GIS-based visibility analyses must be driven by archaeological research problems – rather than by technology. Moreover, if we are to generate new knowledge instead of merely building a huge but futile corpus of visibility data, the methodology must be tailored to address clear questions, and the parameters of the analysis (e.g. viewing radii, offsets) must be defined accordingly.

This paper aims, first and foremost, to emphasize the need for viewshed analyses to address specific and explicit research questions, and it does so by focusing on the study of one particular archaeological site: Tholos A at Apesokari (south-central Crete, Greece). Tholos A is one of the *ca.* 85 circular tombs (often also called “tholos tombs”) discovered so far in Crete (Branigan, 1970, 1993; Goodison & Guarita, 2005). Circular tombs are monumental structures used for collective burial during the Prepalatial and Protopalatial periods (*ca.* 3100–1750/1700 BCE), primarily but not exclusively in the Mesara Plain and the Asterousia Mountains (Fig. 1). The diameter of the burial chamber ranges between *ca.* 3 and 13 m, and about one third of the known circular tombs are provided with a vestibule or a complex of rectangular annex rooms used for funerary purposes, storage of paraphernalia, or ritual activities involving a small number of participants. A wider audience probably gathered outside the tombs, in open courts that were sometimes paved or enclosed by a precinct wall.

Circular tombs are among the most discussed burial structures of Bronze Age Crete (e.g. Xanthoudides, 1924; Branigan, 1970, 1993; Goodison & Guarita, 2005; Legarra Herrero, 2014), a recurring question being the size and nature of the social groups associated with such tombs. However, a shift of attention has taken place over the last 15 years, and researchers now put the emphasis on the active role played by funerary practices in the creation of social identities and relationships (Relaki, 2004; Papadatos, 2007; Legarra Herrero, 2012, 2014; Schoep, 2018) – instead of viewing tombs as passive reflections of static social units. In this context, an interest has emerged in the position occupied by circular tombs in the landscape of Prepalatial and Protopalatial Crete. Previous studies have, for instance, examined the spatial and visual connections between circular tombs and prominent locations in the landscape, settlements, and optimal corridors of movement across south-central Crete (Branigan, 1998; Relaki, 2004; Déderix, 2014, 2015, 2017). Building on the conclusions of such studies, this paper zooms in to the local scale in an attempt to gain insights into the decision-making process that guided the placement of Tholos A in the landscape of Bronze Age Apesokari. More specifically, it evaluates the possibility that concerns of visibility, intervisibility or invisibility may have participated in this process. The discussion revolves around multiple sets of viewsheds that were calculated to assess whether the location of Tholos A contributed to maximizing its visual impact and to ensuring (or, perhaps, preventing) intervisibility with defined landscape features such as nearby archaeological sites, surrounding land, and optimal paths. Ultimately, this study of visibility patterns at Apesokari offers an opportunity to touch upon the relationship between the living and the dead, social interactions, and strategies of occupation of the local landscape.

2 Bronze Age Apesokari

The village of Apesokari is located on the lower foothills of the Asterousia Mountains, along the southern edge of the Mesara Plain (Fig. 1). To the south-west of the village, three Bronze Age sites have been identified: a settlement and two circular tombs (dubbed Tholos A and Tholos B) (Fig. 2). During World War II, August Schörgendorfer (1951a, 1951b), an Austrian archaeologist and officer in the Wehrmacht, excavated Tholos A and dug a small trench in the nearby settlement. Georgia Flouda (2011, 2017, forthcoming) recently undertook to study the results of Schörgendorfer’s work at Apesokari, which still remained to be fully published. Tholos B, on the other hand, was excavated in 1963 by Kostis Davaras (1964, p. 441).

Figure 1. Spatial distribution of cemeteries of circular tombs in Crete. The location of Apesokari is indicated by the black arrow.

Figure 2. Tholos A, Tholos B and the settlement at Apesokari in their topographic context (Google Earth image; elevation exaggeration: 2).

Tholos B at Apesokari was initially built in Early Minoan (EM) I (*ca.* 3100–2650 BCE, see Manning, 2010, p. 23), and gradually enlarged through the construction of annex rooms during the late Prepalatial (*ca.* 2200–1925/1900 BCE) and the Protopalatial periods (*ca.* 1925/1900–1750/1700 BCE) (Vavouranakis, 2012, 2016). Its open court continued to be used for ceremonial purposes in the Neopalatial period (*ca.* 1750/1700–1470/1460 BCE), but no burials were made in the tomb after Middle Minoan (MM) II (*ca.* 1875/1850–1750/1700 BCE). Tholos A (Fig. 3) was constructed *ca.* 200 m to the west of Tholos B, at least five centuries later than Tholos B: the circular chamber and the rectangular complex of annex rooms were built in EM III (*ca.* 2200–2100/2050 BCE) (Schörgendorfer, 1951a; Flouda, 2014, forthcoming). Burial depositions continued in Tholos A until MM IIB, while subsequently, in MM III, only the forecourt remained in use for occasional ritual activities (*ca.* 1750/1700–1700/1675 BCE). Tholos A and Tholos B were hence simultaneously used for burial during EM III–MM II, a period of *ca.* 500 years.

Figure 3. Plan of Tholos A at Apesokari (Schörgendorfer, 1951, pl. 16; reproduced by permission).

The settlement located to the south of the tombs, higher up on the hill, is poorly known since only one building has been partly excavated. Flouda's (forthcoming) recent examination of the pottery collected by Schörgendorfer (1951b) suggests that the settlement may have been founded in EM III. This makes it tempting to link the construction of Tholos A with the foundation of the settlement. It is, however, impossible to demonstrate that the inhabitants of the settlement were buried in Tholos A in EM III–MM II – although this is likely. Nor can we exclude the existence of another nearby settlement contributing to the burial community of Tholos A. The connection between the settlement and Tholos B is even less clear, since the tomb was established long before the settlement was founded. The ambiguous relation between the two tombs and the settlement at Apesokari is actually consistent with the broader picture of Prepalatial south-central Crete, where settlement pattern and tomb distribution correlate poorly. Indeed, only in some instances does the evidence support the association between a given circular tomb and a specific settlement (Relaki, 2004; Déderix, 2014). In several cases, multiple hamlets and farmsteads (probably not contemporaneous, as underlined by Relaki (2004, p. 179)) may have buried their dead in the same circular tomb or in several circular tombs clustered in the same cemetery (e.g. Blackman & Branigan, 1977; Vasilakis & Branigan, 2010, pp. 26–27), while in others, one settlement may have been associated with two distinct burial grounds (e.g.

Blackman & Branigan, 1975, p. 33). Where Apesokari is concerned, we must therefore acknowledge the possibility that additional habitation and burial sites still await discovery and these may fundamentally alter our understanding of local patterns of occupation. Only an intensive survey can start to answer this question. At this stage, however, examining the issue of visibility provides an opportunity to tackle the nature of the relations between Tholos A, Tholos B, the settlement, and the surrounding landscape.

3 Matters of Visibility and the Settings of Tholos A

Tholos A at Apesokari is located on a bedrock ledge that slopes down towards the west (Figs 4–5) and overlooks the Mesara Plain below. Due to this inconvenient choice of location, Tholos A stands out in the corpus of Minoan circular tombs, as flatter terrain was usually favored for their construction. In addition, since space on the ledge was limited, the rectangular annexes of Tholos A at Apesokari had to be built at a higher level on the sloping bedrock (Fig. 6). This resulted in a configuration that has no parallel in other cemeteries of circular tombs in Prepalatial and Protopalatial Crete. Other nearby locations would have been much more suitable to accommodate Tholos A, but the builders appear to have intentionally and specifically chosen to place the tomb on this particular spot – and this even at the risk of endangering the long-term stability of the circular chamber. The topographic peculiarities of Tholos A raise questions as to the reason(s) that triggered such an odd choice of location in the late Prepalatial landscape of Apesokari. To address such questions, five different hypotheses are formulated and tested to assess whether visibility may have influenced the location of Tholos A. These five hypotheses concern the visual impact of Tholos A, as well as visual connections with Tholos B, the settlement, surrounding parcels of land, and optimal paths.

The viewshed analyses were carried out in ArcGIS 10.3, using a 5 m-resolution Digital Elevation Model (DEM) of south-central Crete (courtesy of the National Cadaster & Mapping Agency S.A.) or, where a wider coverage was required, a 20 m-resolution DEM of the entire island (courtesy of I.M.S.-FORTH).

Figure 4. The circular chamber of Tholos A, built on a ledge of bedrock that slopes down towards the west (Flouda, 2011, pl. XXXVa; reproduced by permission).

Figure 5. The floor and the doorway of the circular chamber of Tholos A, seen from the west. Note the rising level of the bedrock towards the east, where the annex rooms (not visible on the photograph) are located.

Figure 6. The annex rooms of Tholos A, seen from the east. The circular chamber is located to the west, at a lower level of the bedrock.

3.1 Hypothesis 1 – Tholos A Had to be Visually Prominent in Its Local Landscape

Circular tombs are monumental buildings and it is therefore unlikely that they were meant *not* to be seen. However, from a landscape perspective, an interesting question is whether advantage was taken of topography to maximize the tombs' visibility. In other words: Were circular tombs placed in locations that naturally afforded high visibility, in order to intensify their visual impact? A methodology designed to address this question has been proposed and described in detail elsewhere (Dédérrix, 2015). It involved calculating local total viewsheds (Fig. 7) to characterize the visibility of tomb locations relative to their local landscape, with the aim of assessing whether highly visible settings were favored for tomb construction. The methodology assumes that circular tombs were built within a reasonable distance from the associated settlement(s), so that the potential locations for a given tomb were limited to a relatively restricted geographical area – hence the focus on the local (rather than the global) landscape, which was defined as a 500 m-radius buffer zone around each tomb. In this way, the visibility of a tomb's settings is compared to the visibility of the DEM cells contained within a 500 m buffer around the tomb in question (Fig. 7a).

Figure 7. Local total viewshed of Tholos A at Apesokari: a) study area and maximum viewing radius; b) local total viewshed classified into deciles.

To model the local total viewshed of Tholos A at Apesokari, it was decided to focus on the short- and middle-distance view, as objects in the far distance tend to lose clarity and blend into their background (Higuchi, 1988; Ogburn, 2006). Ogburn (2006) has shown that the middle-distance view extends until the object looked at occupies a visual arc of 3' – that is, up to a distance corresponding to 1050 times the object's size. Defining the maximum viewing radius of circular tombs hence implies first an estimation of their original height; this requires some educated guesswork given that none of them is preserved intact and their roofing technique remains debated (Girella, Marini, & Palmieri, 2015). Tholos A at Apesokari is one of the circular tombs for which the reconstruction of a stone vault seems plausible (Pelon, 1976, pp. 55–63, 1994, pp. 173–183). Therefore, assuming that Tholos A was covered by a stone vault and drawing on architectural parallels with the traditional shepherd huts (“mitata”) of the Cretan mountains (Xanthoudides, 1924, p. 135; Warren, 1973, 2007; Branigan, 1993, 1994) and specifically on the two mitata published by Warren (1973)

and Branigan (1994), the original height of Tholos A can be estimated to have been *ca.* nine tenths of its inner diameter (4.85 m) – that is, *ca.* 4.4 m high (Déderix, 2015, p. 528). Based on this 4.4 m height estimate and on Ogburn's (2006) index, the limit of the middle-distance view of Tholos A at Apesokari was set at 5060 m. The height of Tholos A was not inputted in the model in the form of a feature offset, since the aim was to assess the visual potential of the tomb's location rather than the visual impact of the tomb itself. On the other hand, given that the local total viewshed was concerned with the visibility of the tomb's location ("view to"), a 1.5 m landscape offset was added to account for the position of the eyes of an average-sized Minoan adult (McGeorge, 1988; Triantaphyllou, 2012) moving across the region.

In summary, the local total viewshed of Tholos A at Apesokari was generated based on the following parameters:

- Study area: 500 m-radius buffer zone around the tomb.
- Maximum viewing radius: 5060 m.
- Landscape offset: 1.5 m.
- Feature offset: 0 m.

As a result of these parameter choices, the question tackled by means of the local total viewshed can be formulated as follows: In comparison with its 500 m-radius neighborhood, did the location of Tholos A at Apesokari appear visually prominent to an individual walking within the area from where the tomb could potentially be seen at the middle distance?

Once the total viewshed was generated, it was reclassified into 10 deciles, each covering 10 % of the 500 m-radius study area. Fig. 7b illustrates the result: class 1 corresponds with the least visible portions of the local landscape, and class 10 with the most visible. Statistical tests of significance have shown that the circular tombs of Prepalatial and Protopalatial Crete tend to be built in settings affording high visibility within their local landscape (Déderix, 2015). This is indeed the case of Tholos A at Apesokari, as the tomb's location falls within visibility class 9 (Fig. 7b). However, Tholos A would have seen its visual impact increased even further had it been built *ca.* 50 m to the east, in visibility class 10. Overall, the local total viewshed suggests that Tholos A at Apesokari was positioned in a visually prominent setting, but visual prominence alone does not explain why the tomb was built precisely on the sloping ledge of bedrock. One or several other criteria must have triggered the construction of Tholos A at this specific location rather than just a little bit further east.

3.2 Hypothesis 2 – Tholos A Visually Connected the Living and the Dead

As mentioned above, the relationship between settlement pattern and burial communities in south-central Crete is poorly understood. It cannot, therefore, be assumed by default that the deceased buried in a circular tomb lived in the nearest known settlement – let alone that the nearest known settlement was the one and only place of habitation of the community buried in the tomb. This said, it appears that circular tombs are often intervisible with surrounding farmsteads and hamlets (Branigan, 1998; Déderix, 2014, pp. 209–210). The visual link may have been deliberate, contributing to demonstrating and strengthening the connections between the living and the dead.

At Apesokari, the nearest settlement – dated to the late Prepalatial and Protopalatial periods (Flouda, forthcoming) – is located *ca.* 200 m to the south of Tholos A, higher up on the hill (Fig. 2). Tholos A is not intervisible with the building excavated by Schörgendorfer (1951b) to the south of the large rock outcrops that dominate the area. However, it is believed that the settlement extended towards the west and the north (Flouda, forthcoming). To address the question of the visual relationship (or the lack thereof) between Tholos A and the settlement, two distinct models were produced to examine the visibility of Tholos A and the visibility from the settlement, respectively.

Figure 8a shows a cumulative viewshed describing the visual impact of Tholos A as seen from its surroundings ("view to"). It was produced by summing 45 binary viewsheds generated from a single viewpoint placed in the circular chamber of Tholos A, with the feature offset being incrementally raised from 0 m to 4.4 m (increment interval: 0.1 m) (Kantner & Hobgood, 2016, pp. 1310–1311). A landscape offset

of 1.5 m was set to account for the size of an individual travelling in the area and looking towards the tomb. This cumulative viewshed shows how much of Tholos A would have been seen from which particular location in the landscape. In this way, it reveals whether an individual standing at a given location would have been able to perceive the entire building (red cells in Fig. 8a), its upper half (yellow cells), or only its very top, assuming again that the tomb was 4.4 m high (green cells). According to the cumulative viewshed, Tholos A was visible only from the northern and northwestern edges of the settlement. To reinforce this impression, the analysis was repeated, this time increasing the feature offset to 6 m. Similar results were obtained, which leads to the conclusion that Tholos A was barely visible from the settlement – even if it was higher than 4.4 m as estimated above. Actually, even the older Tholos B had stronger visual connections with the settlement, being visible from its entire northeastern sector (Fig. 8b).

Figure 8. Cumulative viewshed of Tholos A (a) and Tholos B (b) at Apesokari. Areas of high visibility (in red) are those from where the entire tomb was visible, whereas areas of low visibility (in green) were intervisible only with the top of the tomb. The models assume an original height of 4.4 m for Tholos A and 5.1 m for Tholos B – based on a theoretical ratio of 0.9 between the inner diameter of the tombs and their estimated height.

A second cumulative viewshed (Fig. 9) was then generated to explore the weak visual connections between Tholos A and the settlement within their wider landscape context. The focus was on the view from the settlement. Binary viewsheds calculated from 150 viewpoints spread across the settlement were summed, so that the resulting cumulative viewshed highlights which portions of the landscape are the most visible from the settlement. A viewer offset of 1.5 m was added to the viewpoints so that the cumulative viewshed addressed the visual experience of an individual standing on ground level (rather than on rooftops, for instance) in the settlement. The model shows that the settlement at Apesokari offers poor visibility towards the northwest, which supports the conclusion that Tholos A was *not* positioned with the aim of visually connecting the dead buried in the tomb and the inhabitants of the settlement. Hypothesis 2 can thus be ruled out.

Figure 9. Cumulative viewshed (“view from”) calculated from 150 viewpoints distributed in the settlement.

3.3 Hypothesis 3 – Tholos A was Intervisible with Tholos B

In their current state of preservation, Tholos A and Tholos B at Apesokari are not visible from each other. GIS offer the opportunity to test past intervisibility by taking the estimated original height of the tombs into account. As the cumulative viewshed shows, a 4.4 m high Tholos A would have been invisible to a 1.5 m tall viewer moving around Tholos B (Fig. 8a); and conversely, if Tholos B was 5.1 m high, it was not visible from the surroundings of Tholos A (Fig. 8b). Above ground level (AGL) analyses suggest that Tholos A would have to have been at least 6 m in height in order for its top to be visible from Tholos B, whereas Tholos B would have needed an impossible height of almost 18 m to be seen from Tholos A. It can, therefore, safely be concluded that the two circular tombs of Apesokari were not visible from each other. Again, however, they would have been fully intervisible if Tholos A had been placed *ca.* 50 m to the east. It is therefore evident that the choice of location of Tholos A was not guided by an intention to ensure intervisibility with the existing Tholos B.

3.4 Hypothesis 4 – Tholos A Avoided Intervisibility with Tholos B

The complete absence of intervisibility between the two circular tombs at Apesokari justifies reversing the question and asking whether Tholos A may have been positioned so as to avoid intervisibility with Tholos B. It is a fact that the two tombs are not only concealed from each other (Fig. 8), but that their viewsheds likewise overlap very little in the near distance (Fig. 10). The areas visible from Tholos A and Tholos B (“view from”), respectively, coincide only to the north, starting at a distance of *ca.* 450 m from the tombs (Fig. 10a). Conversely, assuming that Tholos A and Tholos B were 4.4 m and 5.1 m high, an individual moving in the area

would have been able to catch a glimpse of both tombs simultaneously (“view to”) only when approaching from the north (up to a distance of ca. 350 m from the tombs) or when walking on the low ridge between the tombs (Fig. 10b). This ridge obstructs the view and as a consequence the two tombs are visually associated with distinct portions of the local landscape: Tholos B is intervisible with the hill itself, whereas Tholos A overlooks the valley to the west. Had Tholos A been built ca. 50 m to the east, on the ridge, the visual pattern at Apesokari would have been dramatically different (Fig. 11). In such a case, Tholos A would have been located within visibility class 10 of the local total viewshed (see Hypothesis 1), Tholos A and Tholos B would have been intervisible (see Hypothesis 3), and the viewsheds of the two tombs would have overlapped considerably while leaving a large blank area to the west (Fig. 11). In terms of visibility patterns, placing Tholos A on the ledge of bedrock on the western slope of the hill therefore had two major effects:

- Tholos A visually controlled the valley below – which would not have been the case if the tomb had been built only 50 m further east; and
- Tholos A and Tholos B were each associated with their own visual niche in the near distance.

Figure 10. (a) View from Tholos A and Tholos B at Apesokari; (b) view of Tholos A and Tholos B at Apesokari, assuming the two tombs were 4.4 m and 5.1 m high, respectively.

Visibility is one of the means by which control over the landscape can be achieved (Llobera, 2003; Sevenant & Antrop, 2007; Winter-Livneh, Svoray, & Gilead, 2012), and archaeological and ethnographical literature abounds with examples of communities using formal cemeteries to claim lineal descent from the dead and thereby uphold territorial rights (Saxe, 1970; Goldstein, 1981; Glazier, 1984; Chapman, 1995; Winter-Livneh, Svoray, & Gilead, 2012). The location, visibility and monumentality of burial sites can thus contribute to demonstrating and strengthening the rights of the living over particular land parcels, especially in periods of territorial pressure. In the context of Prepalatial Crete, John Bintliff (1977, pp. 635–636; see also Blackman & Branigan, 1977) demonstrated the existence of a strong correlation between the location of circular tombs and patches of arable land in the Agiopharango valley. Such a spatial pattern may suggest that, in this marginal region of south-central Crete, the tombs served to mark specific land holdings and in this way link the associated communities to the parcels they exploited (Bintliff, 1977, p. 636).

Figure 11. View of Tholos B (feature height: 5.1 m) and the viewpoint located 50 m to the east of Tholos A (feature height: 4.4 m). This map simulates the visual structure of the landscape if Tholos A had been built 50 m to the east, on the low ridge of the hill, in topographic settings more suitable for accommodating such a building.

Following this line of thought, two possible scenarios could be envisioned to explain why Tholos A was constructed at this particular spot at Apesokari, centuries after Tholos B: the decision may have been made within a context of either competition or, on the contrary, collaboration between the burial communities associated with the two tombs. On the one hand, Tholos A and Tholos B may have been used by distinct groups competing with each other and using their monumental tomb to visually delineate their respective territory and affirm their ancestral rights to occupy it. It is relevant, in this respect, that the late Prepalatial period (EM III–MM IA) was characterized by demographic growth, pressure on land resources, and, as a result, competitive strategies of landscape exploitation (Manning, 1994, pp. 234–236; Haggis, 1999; Relaki, 2009; Legarra Herrero, 2012). But, on the other hand, Tholos A and Tholos B may also have belonged to the same community, which would have expanded its visual control over the surroundings by building a second tomb. In such a case, the need for additional parcels of land may have arisen due to local population growth, perhaps following an episode of settlement nucleation as has been suggested elsewhere in late Prepalatial Crete (e.g. Manning, 1994, pp. 234–236; Haggis, 1999, p. 67; Vasilakis & Branigan, 2010, p. 267). This second scenario resembles that suggested for the Chalcolithic Southern Levant, where off-site cemeteries appear to have been located so as to increase the size of the viewshed from settlements and thereby claim rights over a larger territory during a period characterized by demographic growth and agricultural intensification (Winter-Livneh, Svoray, & Gilead, 2012). In the case of Apesokari, both scenarios seem equally plausible based on existing evidence; only more comprehensive data on the evolution of local habitation pattern will enable us to favor one over the other.

3.5 Hypothesis 5 – Tholos A was Intervisible with Local and Regional Communication Networks

The location of Tholos A at Apesokari resulted in the tomb being intervisible with the area to the west, which may have been intended by the associated community to enforce territorial rights by means of visual control. Another hypothesis, however, is also worth investigating: Tholos A may have been positioned so as to be visually connected to networks of movement. Due to its location, Tholos A overlooks a modern asphalt road that leads southwards through the Asterousia Mountains, connecting the Mesara Plain with the south coast of the island. A hierarchical communication network modeled on the distribution of circular

tombs in south-central Crete (Dédérrix, 2017) has shown that an optimal path crosses the area in a north-south direction, passing below Tholos A and leading up to the settlement, before continuing through the Asterousia Mountains (Figs 12–13). Tholos A is intervisible with this optimal path (Fig. 13), which would not have been the case if the tomb had been built *ca.* 50 m to the east (see Fig. 11).

Because it was clearly visible from this natural corridor of movement, Tholos A may have functioned as a waypoint along communication networks at the local and regional scale (see e.g. Wheatley, García Sanjuán, Murrieta Flores, & Márquez Pérez, 2010). The tomb may actually have helped guiding movement towards the settlement located higher up on the hill – provided that Tholos A was indeed associated with this settlement. This would imply that when travelers arrived from the Mesara Plain, they would first encounter the dead members of the community before reaching the living – a practice for which there are plenty of cross-cultural parallels. From a chronological perspective, the potential visual link between Tholos A and networks of movement is of particular interest given that some other circular tombs built in EM III–MM IA (e.g. Miamou, Sopata Kouse, Agios Kyrillos) also demonstrate strong spatial relations with optimal paths (Dédérrix, 2017), and material evidence testifies to an intensification of regional and interregional interactions during the late Prepalatial period (e.g. Schoep, 2006; Sbonias, 2010, 2012; Anderson, 2016).

Figure 12. Hierarchical communication network of Prepalatial and Protopalatial Crete – calculated based on the distribution of circular tombs. The location of Apesokari is indicated by the black arrow.

Figure 13. Optimal paths at Apesokari in relation to the viewshed of Tholos A – assuming a height of 4.4 m for Tholos A.

4 Discussion and Conclusion

The results of the viewshed analyses suggest that Tholos A at Apesokari was highly visible in its local landscape, but high visibility alone does not suffice to explain the location of the tomb on a sloping ledge of bedrock on the west side of the hill. The analyses have also revealed that Tholos A was not placed to be intervisible with Tholos B or (one of) its potential contributing settlement. If the location of Tholos A on the bedrock ledge was indeed guided by visibility concerns, the reason seems to have been to ensure intervisibility with the area located to the west – a portion of the local landscape that would have been out of view if Tholos A had been built a few dozen meters east, in topographic settings more suitable for accommodating such a tomb. Intervisibility between Tholos A and the area to the west could have been intended to strengthen territorial claims by overlooking the parcels of land of interest, or to increase the visual impact of Tholos A as seen from an optimal path leading up the hill, to the settlement and across the Asterousia Mountains. Both interpretations find resonance in the context of EM III–MM IA Crete, as the late Prepalatial period was characterized by demographic growth and increased pressure on land resources – which could explain why the community of Tholos A may have felt the need to conspicuously demonstrate territorial rights – as well as by an intensification of regional and interregional interactions – which explain a growing interest in communication networks. Actually, the two interpretations are not mutually exclusive: Tholos A could have functioned as a waypoint along local and regional pathways while, at the same time, enforcing territorial claims by means of visual control.

This paper was intended as a variation on the theme of visibility. Far from pursuing ambitious goals of technological innovation, big datasets and large-scale processes, it focused modestly on a single tomb and its local landscape. In doing so, it aimed to stress the necessity for GIS-based analyses to address clear (and clearly stated) archaeological questions. In this particular case, the question was: “Why was Tholos A built in such an odd topographic setting?” To assess whether visibility may have played a role in

the process of decision that guided the location of the tomb, this archaeological question was broken down into five hypotheses, which were tested by means of multiple sets of viewshed analyses, each of them being specifically designed to address a particular hypothesis – e.g. “view from” or “view to” the tomb, with or without taking into account the size of the tomb. By repeating visibility analyses in relation to a single archaeological site, this paper intended to illustrate that the visual structure of the landscape can never be comprehended by a single viewshed. The game is almost endless, and it can be meaningful only if it is led by specific archaeological questions.

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Abbreviations

AGL analyses: Above ground level analyses.

DEM: Digital Elevation Model.

EM: Early Minoan.

GIS: Geographic information systems.

MM: Middle Minoan.

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