Proceedings of the 4th Symposium of the Hellenic Society for Archaeometry

National Hellenic Research Foundation, Athens
28-31 May 2003

Edited by

Yorgos Facorellis
Nikos Zacharias
Kiki Polikreti

BAR International Series 1746
2008

This title published by

Archaeopress
Publishers of British Archaeological Reports
Gordon House
276 Banbury Road
Oxford OX2 7ED
England
bar@archaeopress.com
www.archaeopress.com

BAR S1746

Proceedings of the 4th Symposium of the Hellenic Society for Archaeometry. National Hellenic Research Foundation, Athens, 28-31 May 2003

ISBN 978 1 4073 0188 4

Printed in England by Synergie Basingstoke

All BAR titles are available from:

Hadrian Books Ltd
122 Banbury Road
Oxford
OX2 7BP
England
bar@hadrianbooks.co.uk

The current BAR catalogue with details of all titles in print, prices and means of payment is available free from Hadrian Books or may be downloaded from www.archaeopress.com

Between Peak and Palace. Reinterpretation of the Minoan Cultural Landscape in Space and Time

S. Soetens

Département d'Histoire de l'Art et d'Archéologie, Université catholique de Louvain,
Place B. Pascal 1, 1348 Louvain-la-Neuve, Belgium, ssoetens@yahoo.com and
Laboratory of Geophysical and Satellite Remote Sensing & Archaeo-environment, Institute for Mediterranean Studies,
Foundation of Research and Technology,
Hellas (F.O.R.T.H.), Melissinou & N. Foka 130, P.O. Box 119, Rethymno, GR- 74100, Crete, Greece,

A. Sarris

Laboratory of Geophysical and Satellite Remote Sensing & Archaeo-environment, Institute for Mediterranean Studies,
Foundation of Research and Technology,
Hellas (F.O.R.T.H.), Melissinou & N. Foka 130, P.O. Box 119, Rethymno, GR- 74100, Crete, Greece

K. Vansteenhuyse

Département d'Histoire de l'Art et d'Archéologie, Université catholique de Louvain,
Place B. Pascal 1, 1348 Louvain-la-Neuve, Belgium and
Department of Oriental Studies, Katholieke Universiteit Leuven,
Blijde Inkomststraat 21, 3000 Leuven, Belgium

Abstract: Crete is the spatial entity where the history of the Cretan Bronze Age was enacted. It is obvious that the landscape as a whole and the temporal dynamics within it contain many distinctive properties for the better understanding of its culture. One of the key parameters for capturing the dynamics of the Minoan landscape is the specific social, religious and topographic character of the Minoan peak sanctuary. In the past, it has been argued that the location of the peak sanctuaries depends on the topography of the landscape. Their position would also be determined by their relation with the court complexes.

In order to test the validity of the above argument, Differential Global Positioning System (DGPS) was employed for the accurate positioning of the relevant archaeological sites. The topographical and environmental parameters of peak sanctuaries and palaces were extracted from digitized maps and from SPOT stereoscopic satellite images. GIS (Geographical Information System) analysis was systematically applied to investigate the spatial characteristics of these sites and their spatial relations. Among other techniques, intervisibility between peak sanctuaries and other sites was simulated through viewshed analysis and line of sight. Results of the least-cost distance computed from the peak sanctuaries to the near-by environmental and archaeological features were subjected to statistical analysis in order to define the weight of importance of these features as an indication of their relevance to the location of the peak sanctuaries.

Hypothetical territories were suggested for the court complexes, through the application of the most commonly used models, namely Thiessen polygons, Cost Surface Analysis and the Xtent model. The location of peak sanctuaries within these territories suggests that they played a neutral role in the early stages of their existence. This picture evolves through time and geographical regions. The origin, acme and decline of peak sanctuaries seem to be strongly related to the political development within the island.

Περιληψη: Η Κρήτη είναι η χωρική οντότητα στην οποία πραγματοποιήθηκε η ιστορία της εποχής του χαλκού της νήσου. Προφανώς το συνολικό περιβάλλον και η χρονολογική δυναμική της νήσου περιέχουν πολλά συστατικά για την καλύτερη κατανόηση του Μινωϊκού πολιτισμού. Ο ιδιαίτερος κοινωνικός, θρησκευτικός και τοπογραφικός χαρακτήρας του Μινωικού ιερού κορυφής αποτελούν από τις σημαντικότερες παραμέτρους για την κατανόηση του Μινωικού περιβάλλοντος. Στο παρελθόν προτάθηκε ότι η τοποθεσία των ιερών κορυφής βασιζόταν στην τοπογραφία του περιβάλλοντος. Επίσης η τοποθεσία τους θα μπορούσε να είχε καθοριστεί από την σχέση τους με τα λεγόμενα 'court complexes' ή συγκροτήματα αυλής.

Διαφορικά Συστήματα Παγκόσμιου Εντοπισμού (DGPS) χρησιμοποιήθηκαν για την μέτρηση συντεταγμένων ακριβείας των σχετικών αρχαιολογικών θέσεων με στόχο την εξακρίβωση του προαναφερομένου επιχειρήματος. Τοπογραφικά και περιβαλλοντικά στοιχεία των ιερών κορυφής και των ανακτόρων αντλήθηκαν από ψηφιοποιημένους χάρτες και στερεοσκοπικές δορυφορικές εικόνες του SPOT. Τα χωρικά χαρακτηριστικά των θέσεων και των αμοιβαίων σχέσεών τους διερευνήθηκαν συστηματικά μέσω των αναλυτικών εργαλείων των Γεωγραφικών Συστημάτων Πληροφοριών (GIS). Η προσομοίωση της ορατότητας μεταξύ των ιερών και άλλων θέσεων πραγματοποιήθηκε μέσω αναλύσεων οπτικού πανοράματος (viewshed analysis) και της ευθύγραμμης οπτική επαφής (line of sight). Τα αποτελέσματα της ανάλυσης του ελαχίστου κόστους απόστασης (least-cost distance) από τα ιερά κορυφής στα εγγύτερα γεωμορφολογικά χαρακτηριστικά και αρχαιολογικά μνημεία υποβλήθηκαν σε στατιστική ανάλυση για τον καθορισμό του συντελεστή βαρύτητας αυτών ως ένδειξη προσδιορισμού της θέσης των ιερών κορυφής.

Η μοντελοποίηση των περιοχών επικράτειας (hypothetical territories) για τα συγκροτήματα αυλής πραγματοποιήθηκε με την εφαρμογή διαφορετικών διαδικασιών όπως τα πολύγωνα Thiessen, η ανάλυση επιφάνειας κόστους (Cost Surface Analysis) και το μοντέλο Xtent. Τα αποτελέσματα των ερευνών προτείνουν έναν σχετικά ουδέτερο ρόλο για τα ιερά στις αρχές της ύπαρξής τους. Η εικόνα αυτή εξελίσσεται με διαφορετικό τρόπο τόσο χρονικά όσο και ανά γεωγραφική περιοχή. Η προέλευση, η ακμή και παρακμή των ιερών κορυφής φαίνονται να σχετίζονται άμεσα με την εξέλιξη της πολιτικής ανάπτυξης στη Κρήτη.

Introduction

Before we jump into the pool of GIS spatial analysis and archaeological interpretation, a short introduction to the theme and its particular approach is in order. Cretan peak sanctuaries from the Bronze Age (c. 3000 – 1070 BC) have been the focus of attention almost since the birth of Minoan archaeology at the beginning of the 20th century AD. Nowicki (1994) defined the main features of a Minoan peak sanctuary as: positioned on a mountain top, with one or more sides formed by a cliff, the presence of pottery/figurines, and the presence of pebbles. The peak sanctuaries emerged in Early Minoan III – Middle Minoan IA, or perhaps as early as Early Minoan II where Iuktas is concerned (Karetsou 1981). Iuktas has basically survived the millennia as a sacred mountain (fig. 1). The site is still known as the tomb of Zeus and an orthodox church dedicated to the Metamorphosis, Agios Georgios, Agii Pantes and Agia Zoni is still located at the peak. Its remarkable shape, as seen from the area south - west of the mountain still triggers our imagination. Its profile, as seen from this angle, resembles a resting human head and it is right on its forehead, the human metaphor of the mountain's spirit, that the Minoan peak sanctuary is located. The major religions of the world today and our perception of mountains through the millennia show that mountains were always highly humanised. The western appreciation tends to be more competitive, in a sense that we conquer the mountain (read: 'stand on its peak'), while the oriental world has a more humble tradition in which the mountain must be respected as the abode of the immortals, the axial pillars that support the sky.

Peatfield (1983), one of the first to make a comprehensive study of the concept of the peak sanctuary, defined peak sanctuaries foremost on their topographical characteristics. He stated that *"The sanctuary should be seen from the region it served"* and *"it should 'see' that region"*. From below we see "…*the most prominent mountain*" and therefore "*the best landmark for worshippers to travel to"* (Peatfield 1983, 274-276). Intervisibility between the peak sanctuaries was understood as "*the expression of ritual unity that may have transcended political boundaries*" (Peatfield 1994, 25).

The proximity of peak sanctuaries to nearby settlements, the intervisibility of the sanctuaries and their visual quality as landmarks from both land and sea, and the diachronic changes of distribution of both Minoan 'Palaces' and the peak sanctuaries hold many clues to a better understanding of the history of the Cretan Bronze Age. The relationship of peak sanctuaries with central places of power, presumably the so-called 'Palaces', seems intensified in the Neopalatial period (c. 1640 – 1550/1425 BC), as Cherry (1978, 429-431) and Peatfield (1987) remarked a long time ago.

The classification of a site as a central place of power needs some further clarification. Instead of using the canonical

Figure 1: Iuktas from Giofyro, Iraklion

Figure 2: Iraklio from Iuktas, Knossos should be somewhere in the plain on the right

'Palaces', namely Knossos, Mallia, Phaistos, and Zakros, we opted here to present the analysis of a larger group of sites: the court complexes (Agia Triada, Kommos, Galatas, Makrygialos and Petras, including Knossos, Mallia, Phaistos and Zakros), together with some sites where a court complex can be expected or sites which can be understood as centres, based on architectural quality of structures, size of site, and presence of administrative documents (Archanes, Chania, Palaikastro, Stavromenos-Chamalevri) (Driessen et al. 2002). The identification of central places in the Protopalatial (c. 2000 – 1640 BC) period is often obscured by the Neopalatial structures constructed on top of them. The variability - central place or not central place - remains mostly unknown for the Protopalatial period. Therefore the Protopalatial dataset should be seen more as a test case. The burial sites were not included here, because we are interested in the interaction of the 'living Minoan' with his/her landscape. It is possible, however, that the tholos tombs in the Mesara (Early Minoan period) were the foregoers of the peak sanctuaries (Branigan 1998). A future analysis is being prepared to compare the relation tomb/settlement and peak sanctuary/settlement.

How 'real' is the observation that the relations between the central places and the peak sanctuaries intensified? First of all, the chronological coincidence between the construction of the first court complexes and the emergence of the nearby peak sanctuaries is not as clear as was previously assumed. The chronology of peak sanctuaries itself remains dubious, due to the limited publications and rescue character of the

excavations. A reviewed chronology dates twenty peak sanctuaries to the Protopalatial period (Soetens 2004), but the most intensively investigated sites emerged earlier. At the beginning of the Neopalatial period, most go out of use while the foundation of two new sanctuaries at the same moment, Kofinas peak (Karetsou and Rethemiotakis 1990) and Liliano Kefala (Rethemiotakis 2002: 62, 65) is rather unusual. Secondly, the common cult apparatus and presence of Linear A may indeed be present at both site types, but are not exclusive to these sites. Thirdly, the presence of iconographic representations of peak sanctuaries only found at the court complexes is a rather risky argument to argue for an exclusive relationship. The representations are extremely few and fragmentary, while some other representations from non-palatial sites may also be interpreted as peak sanctuary representations.

Investigated here is not so much the common finds and architectural characteristics of peak sanctuaries vis-à-vis central places of power, but rather their spatial interaction. Visibility and distance between the peak sanctuaries and the contemporary settlements are not so much landscape characteristics, but rather indicate the human experience of that landscape.

Data collection and organization

The sites, including the most relevant contemporary sites of the peak sanctuaries (only published material) were either visited with differential GPS receivers or they were digitized. The peak sanctuaries were all located by DGPS. Most of the survey sites were digitized, and the level of accuracy here, depends entirely on the accuracy of the published map. The archaeological data was organized in a database where all sites were related to their typology, chronology and bibliography, peak sanctuary finds, landscape characteristics of the peak sanctuaries and more (see Soetens 2004).

The background maps were all geo-referenced to the same ΕΓΣΑ ’87 projection (the Greek Geodetic Reference System of 1987), and include a DEM (digital elevation model), based on a SPOT stereoscopic satellite image (50x50m pixel), slope, aspect and hill shade grids (through analysis of the DEM), digitized topographical, geological, land use and land capability maps (on 1:50000 scale).

Visibility

Empirically, the peak sanctuaries are far more visible from the settlement than vice versa. The court complex of Knossos can hardly be located from the Iuktas peak sanctuary (fig. 2).

Instead of viewsheds, line of sight analysis was chosen to better visualise a series of visibility networks (Soetens et al. 2002; Soetens et al. 2004). The analysis of the visibility of peak sanctuaries from central places (figs. 3 & 4) provided unexpected results: not a single peak sanctuary is visible from the central sites of Mallia, Zakros, Monastiraki, Myrtos, Kommos, Agia Triada or Gournia at any moment. In the Protopalatial period even Phaistos does not have a visible peak sanctuary. As a matter of fact, of the original canonical ‘Palaces’, only Knossos can see a peak sanctuary (Iuktas).

Even if some peak sanctuaries remain to be discovered, the number of visually unrelated sites makes us wonder whether the ‘Palace’-peak nexus is a real one. The exceptions are the peak sanctuaries Iuktas, Kofinas, and Liliano Kefala. Those are indeed visible from respectively: Knossos - Galatas, Phaistos – Protoria (if indeed a central place) and Galatas. Could this connection have been an exclusively Central Cretan phenomenon? Possibly, but the richness of the Vrysinas peak sanctuary in West Crete is highly suspicious and suggests the presence of a visible important place. The location of Stavromenos – Chamalevri seems promising. In the far East of Crete, the location of Petsofas and Prinias is clearly related to Palaikastro and Petras respectively. Palaikastro, however, has no court complex.

When these analyses were compared to the line of sights between peak sanctuaries and all sites (excluding peak sanctuaries and burial sites), only very few of the peak sanctuaries were not visible at all, and it is especially indicative that the sanctuaries with the highest visibility are those close to intensively surveyed areas. In both periods, the lack of any visible sites from peak sanctuaries seems due to a bias in the archaeological dataset.

It is important to note that the analogy of peak sanctuaries and visible settlements switches from settlements with a low profile in the Protopalatial period to important, larger sized settlements in the Neopalatial period.

The intervisibility amongst peak sanctuaries is much more intensive (figs. 5 & 6). Three networks appear, responding amazingly well to large Cretan eco-zones, which are divided basically by two main mountain chains, namely Dikti and Idi. No peak sanctuaries have been found on those mountains. The eastern and western networks are almost completely disconnected in the Neopalatial period, a gradual process, indicative of increasing hierarchy and lower connectivity (cf. Haggis 2002). The central network, however, changes more dramatically. The number of peak sanctuaries declines and their intervisibility increases. Especially the addition of Kofinas to the Neopalatial peak sanctuaries increased the connectivity and intervisibility of north and south central Crete in a visual system.

Environmental characteristics

The peak sanctuaries are almost all (87%) located in the category of phrygana or in severe vegetation, with very little human interference in the natural scenery. This

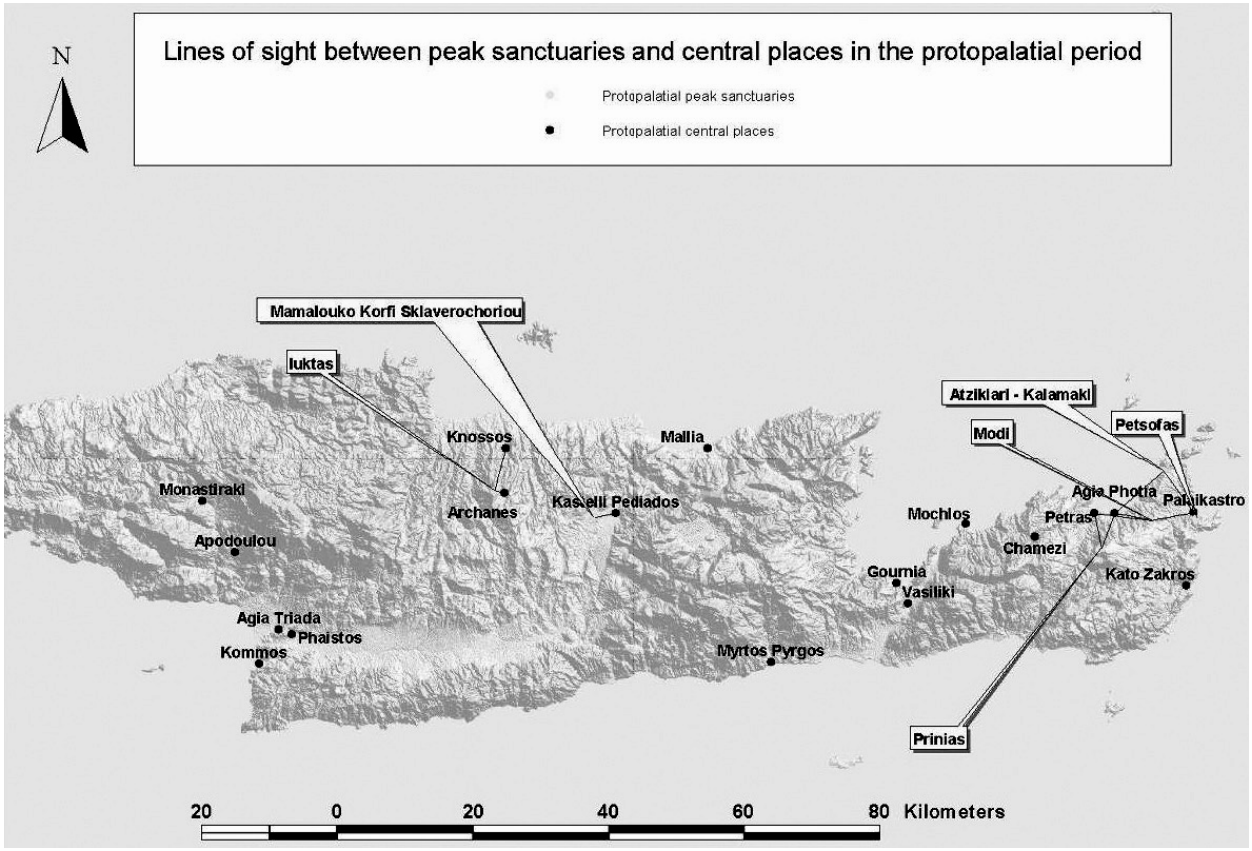

Figure 3: Lines of sight between central places and peak sanctuaries in the Protopalatial period

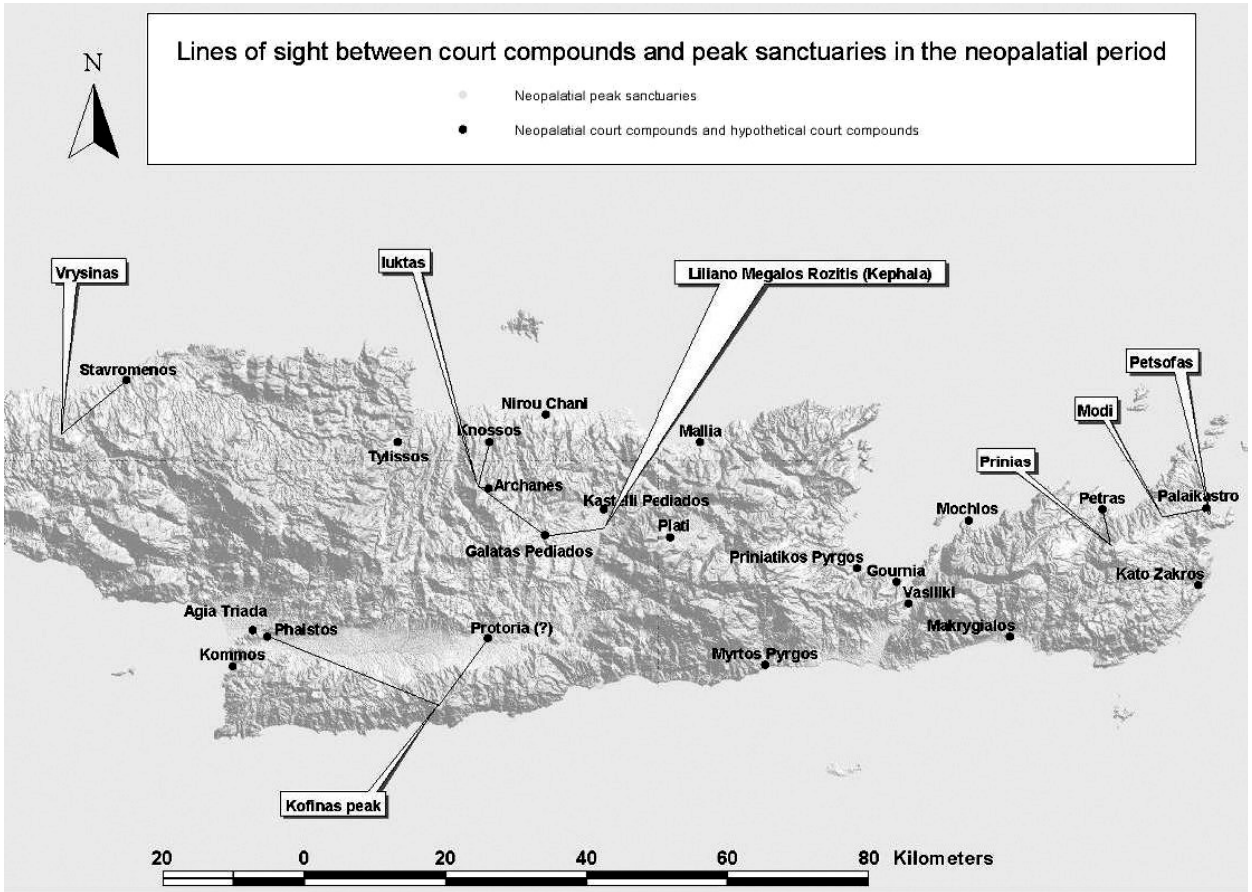

Figure 4: Lines of sight between central places and peak sanctuaries in the Neopalatial period

vegetation type forms about 42% of the entire Cretan landscape, and it excludes all agricultural land. One could define this, as has been proposed in past archaeological research as pasture land (Rutkowski 1986, 73; 1988, 75). In terms of land region, almost all are located in the broadleaved evergreen zone. Two exceptions, Karfi and Kofinas, belong respectively to the oak-cypress-maple zone, and to the Pinus bruttia-cypress zone. These three zones cover almost the entire island, except for the pseudo alpine zones and the urban zones, so these are not relevant for the peak sanctuary identification.

When we turn towards the basic geological characteristics, all peak sanctuaries belong to the sedimentary-metamorphic group of limestone and/or dolomites, a group which forms about 34% of the entire island (more specifically: hard limestone 19 sites, and one site on schist, peridotite, mixed flysch and tertiary deposits). Of the Neopalatial sanctuaries, all are on hard limestone, except Gonies Filiorimos, which can be found on a peridotite mountain. This is a remarkable feature, especially since serpentine, one of the elite materials in Minoan palatial material culture, is a peridotite mineral, which is very often used for the shaping of stone vases, stone offering tables, and seals.

When the same analysis is made for the central places (including identified court complexes and hypothetical 'palatial' sites in both the Proto- and Neopalatial period), alluvium and tertiary deposits are the main geological categories, whereas the exceptions are indeed those sites of which the identification as 'palatial' remains in doubt. As can be expected the artificial vegetation of almost all of these sites results from agricultural exploitation. It is possible that the gradual disappearance of peak sanctuaries and the emergence of the 'villas' in Late Minoan IA is an indication of an economic change of interest from a more husbandry focused society to a more agricultural landscape.

The distance of the coastline from the Neopalatial peak sanctuaries is between 295m and 14.487m, streams can be found between 832m and 17.629m away, caves between 253m and 8.125m, and springs between 73 and 3.891m. These data only become more meaningful after statistical evaluation which shows that 'normal peak sanctuaries' (those that fall within the standard deviation distance) are 5.951m ±3.863 from the coastline, 2.108m ±1.697 from a cave, 1.382m ±975 from a spring, 6.714m ±4.069 from a stream.

Territorial modelling

On the diachronic changes of the general distribution of central places, only hypothetical comments can be made, because the Protopalatial central places are mostly hypothetical (see comments in Data Collection and Organization). At the end of the Protopalatial period, when most of the peak sanctuaries have been abandoned, the sites of Apodoulou, Monastiraki (Rethymnon prefecture) and Chamezi (close to Siteia) were also abandoned, while we can observe the growth and/or emergence of a number of other sites: Gournia, Mochlos, Makrygialos, Plati (Lasithi plain), Galatas and possibly Protoria. At the very final phase of the peak sanctuaries, in Late Minoan IA, the 'villas' emerge. Although the archaeological data are incomplete, it seems that the regional differences in settlement patterns are bigger than the temporal differences. This means that the settlement pattern is more closely dependent on its environment than on the temporal dynamics of human interaction. The relation between peak sanctuaries and central places must therefore first be studied on a regional scale. We have attempted to model these regional territories based on the list of presumed central places and the list of known peak sanctuaries. Five methods have been tested: Nearest neighbour analysis, Cost distance, Thiessen polygons, Euclidean distance and the Xtent model.

Nearest neighbour analysis from peak sanctuaries to settlements

The Nearest neighbour analysis looks for the closest neighbour of a given site. Most obvious and important here is that Iuktas is closer to Archanes than to Knossos. Every archaeologist acknowledges this but the relationship Knossos – Iuktas is often so overemphasized that we tend to forget that a very important settlement is right at the foot of Iuktas. Iuktas remains the closest peak sanctuary for Knossos. As confirmed by the line of sight analysis, Pyrgos is closest to Tylissos, Gonies Filiorimos to Sklavokambos and Modi to the archaeologically rich but not well investigated area of Magasa. An even more promising research concept would be to relate a cluster of settlements to each of the peak sanctuaries and not simply one presumed central place. One peak sanctuary probably served a cluster of settlements rather than one particular site.

The East Cretan area is highly interlinked, and West Crete shows a bias in the available data, as can be understood from the long distances in this area. Here, statistical analysis would locate the closest central places of power at a distance of 7.353m ±4.417 from the peak sanctuaries. The closest settlements are located at an average of only half the distance or 3.215m ±2.411 in the Neopalatial period and 4.750m ±4.256 in the Protopalatial period from the peak sanctuaries.

Nearest neighbour analysis between peak sanctuaries

The thicker density of East Cretan sanctuaries shows a regional divergence, where sanctuaries are between three and seven km apart, a situation similar to the cluster of Keria, Pyrgos and Filiorimos in the valley between Tylissos and Anogeia. In Central Crete the distances are much larger, between twelve and over thirty km apart.

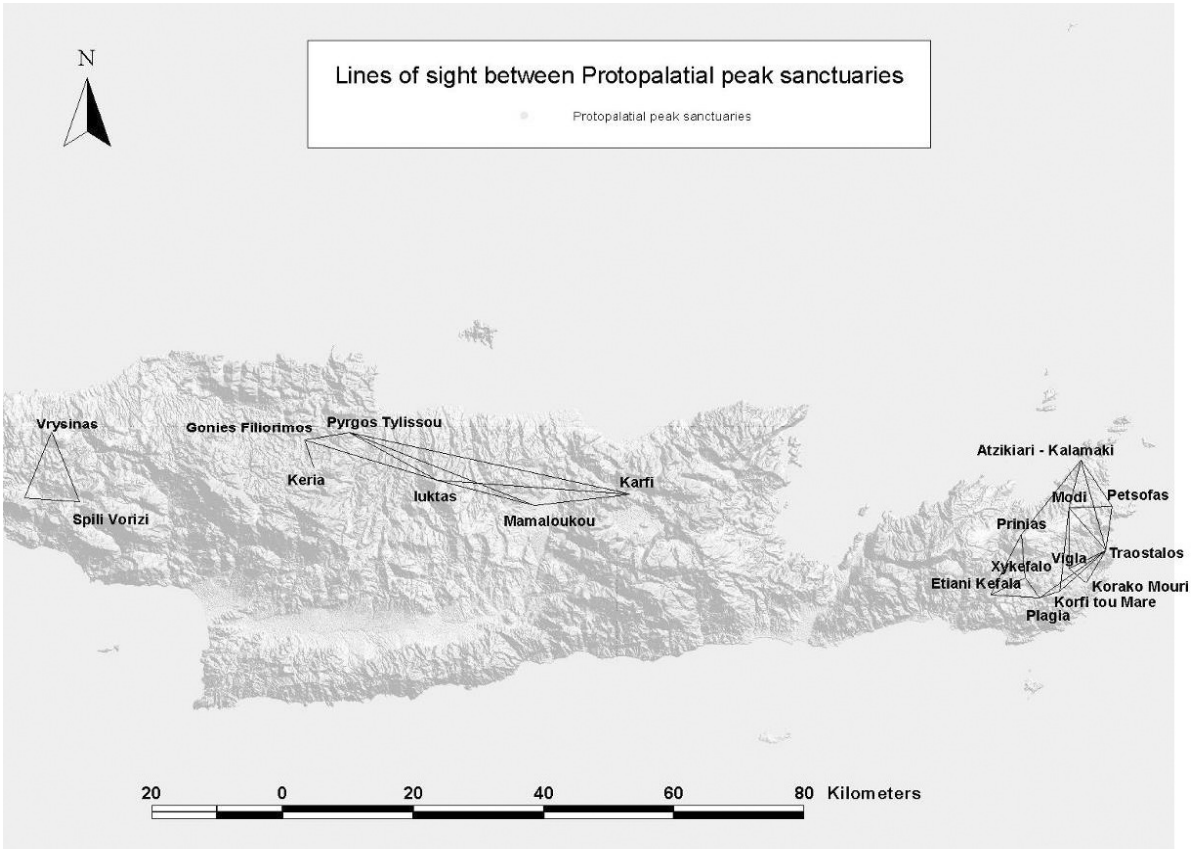

Figure 5: Lines of sight between the Protopalatial peak sanctuaries

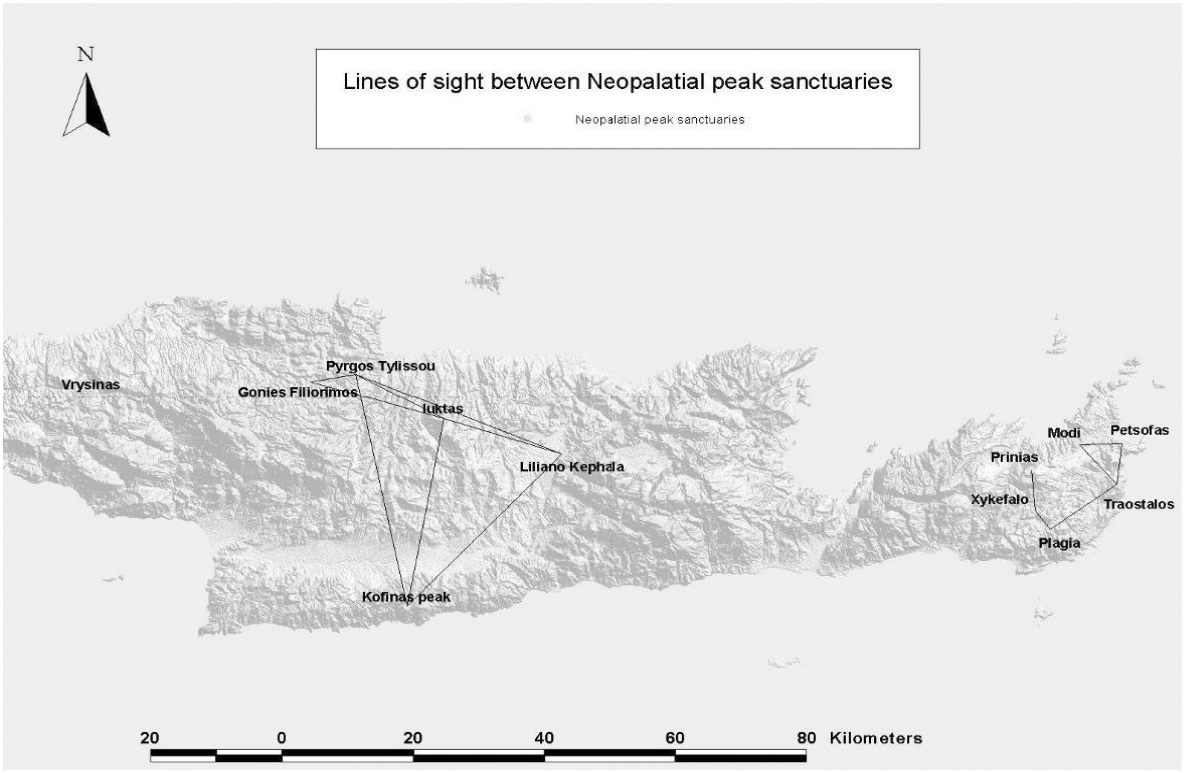

Figure 6: Lines of sight between the Neopalatial peak sanctuaries

The sanctuaries in the Rethymnon area are between eight and eleven km apart. These differences have already been interpreted as related to the different topographical and political trajectories of these areas.

The averages for the whole of Crete show that peak sanctuaries are located 8.870m ±7.003 from each other. In general, near larger valleys, one encounters fewer and higher peak sanctuaries.

Cost distance analysis

The cost distance territory is a model based on economic values. It shows how much energy is spent by crossing the landscape from any given point. This is presented graphically by irregular bands each representing one hour of walking (buffer zones). For the Protopalatial period (fig. 7), it is remarkable that within the two-hour buffer zone of some central places, we can find only half the number of peak sanctuaries. Exactly the same group of sanctuaries lies within the one-hour buffer zone of all settlements. Within the two-hour buffer zone of all Protopalatial settlements, we can find 16 out of 20 of the peak sanctuaries. The exceptions are Vrysinas, Keria, Filiorimos and Pyrgos which is probably the result of a bias in the archaeological dataset.

For the Neopalatial period (fig. 8), almost all peak sanctuaries are within 1 ½ hour walking from all settlements, and it is important to note that here we encounter sites such as: Azokeramos, Palaikastro, Achladia, Zou, Kastelli Pediados, Archanes, Tylissos, Sklavokambos, and Zominthos. This means that the peak sanctuaries in the Neopalatial period were indeed closer to the larger and more important sites.

Thiessen polygons and Euclidean distance

Thiessen polygons and Euclidean distance are basically simplified versions of the Cost distance analysis, and were added for comparative reasons but are not presented in this paper.

Xtent model

The Xtent model, originally developed by Renfrew and Level (1984), presupposes that the (political) influence a site exercises is dependent on its size and the distance to other sites of the same hierarchical level. As such, a sphere of influence can be created, presented graphically as a cone. Applied to the list of central places, one observes that the link Knossos – Iuktas is reinstalled. This model is the only one that can support the concept of Knossian hegemony during the Neopalatial period (Vansteenhuyse 2004).

Conclusion

The synchronism of the peak sanctuaries with the construction of the central places is no longer a certainty, and neither is the coexistence of all peak sanctuaries in the Protopalatial period. This fact alone suggests a dynamic political, economic and religious power game, although these modern concepts were probably not clearly distinguishable in Bronze Age Crete. It has further been shown that some older hypotheses on the relationship of peak sanctuaries with 'Palaces'/court complexes need further consideration.

Analysis of the visibility has shown that the peak sanctuaries are the most important landmarks in the landscape, and not so much the court complexes or the settlements. Many important court complexes (e.g. Mallia and Kato Zakros) do not have one visible peak sanctuary. In the Protopalatial period peak sanctuaries are mainly visible from the 'rural' settlements. In the Neopalatial period the more important settlements have better visibility to the peak sanctuaries, but there are still few court complexes with such visibility. Peak sanctuaries that are totally invisible are located within archaeologically poorly investigated areas.

Modern land use and basic geological formations seem to distinguish peak sanctuaries clearly from central places of power. Past observations were confirmed: peak sanctuaries are part of the pasture land, while court complexes and alike are mainly located in areas with good farming possibilities. While the visitor could be rich or poor, from close by or further way, the relation of the type of site to the resources of the land surrounding it in human terms seems clear.

The Cost distance analysis between peak sanctuaries and settlements shows a divergent pattern in largely three zones (West, Central and East Crete), very similar to the visibility networks, with the same empty regions near the Dikti and Idi mountain chains. The changes in the number of peak sanctuaries from the Proto- to the Neopalatial period are not impressive, but specific cases, such as the late chronology for Kofinas excluding Phaistos of the Protopalatial peak sanctuary landscape, require a different interpretation of the Minoan cultural landscape. In the Neopalatial period, peak sanctuaries tend to be situated closer to more 'important' sites.

Territories, in terms of catchment areas based on Cost distance analysis, for the central places of power and for all sites, not only confirm the assumptions of a divergent spatial pattern, they also reinforce the idea that peak sanctuaries have closer connections to sites that have no court complexes. East and West Cretan settlement patterns loose connectivity with the peak sanctuaries, except maybe for the major sites, while in Central Crete the opposite trend can be observed, with a tendency towards hierarchy. The hegemony of Knossos on a large part of the island cannot be supported by any model, except for the Xtent model. The ideological powers of memory, the ancestry of the site of Knossos and of its focal point from the central

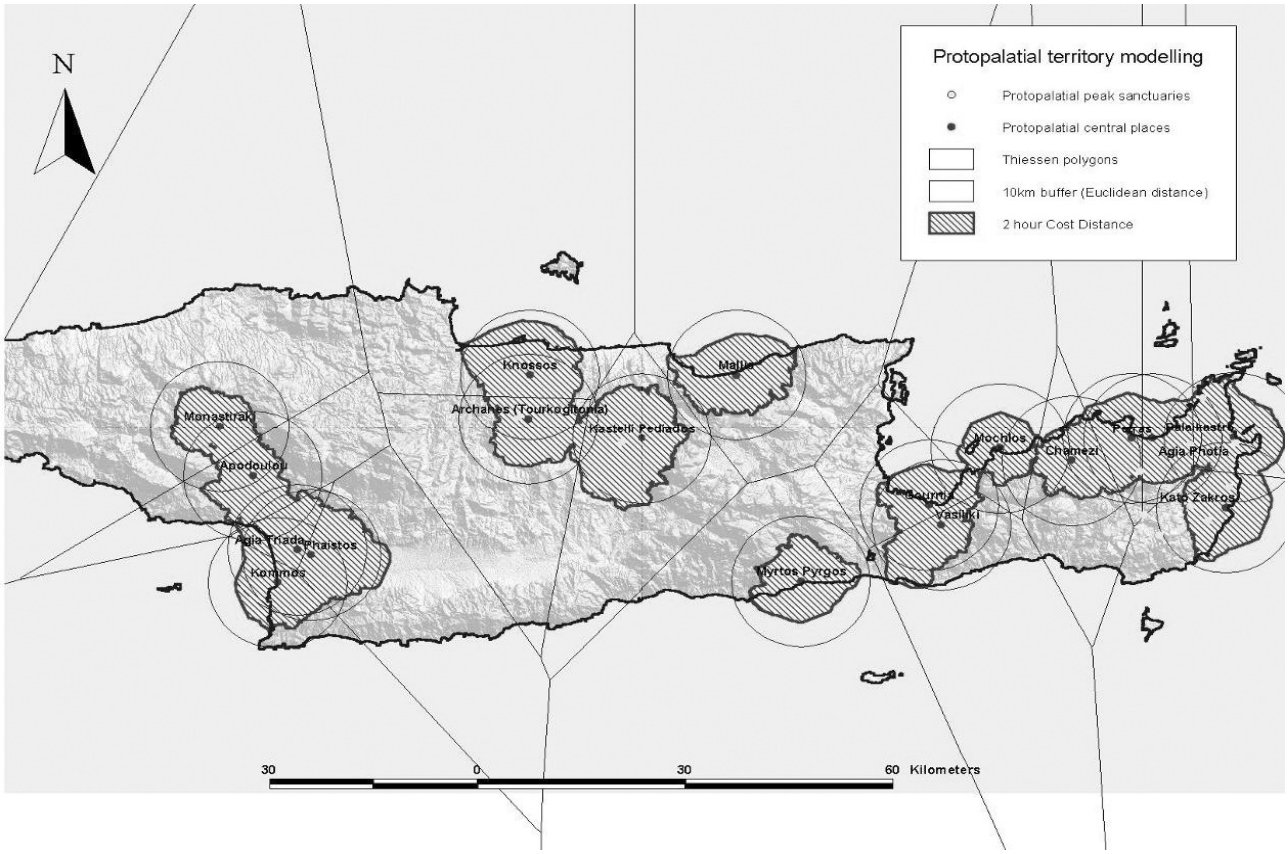

Figure 7: Modelling of Protopalatial territories, and overlay with peak sanctuaries: Cost Distance, Thiessen polygons, Euclidean distance buffers

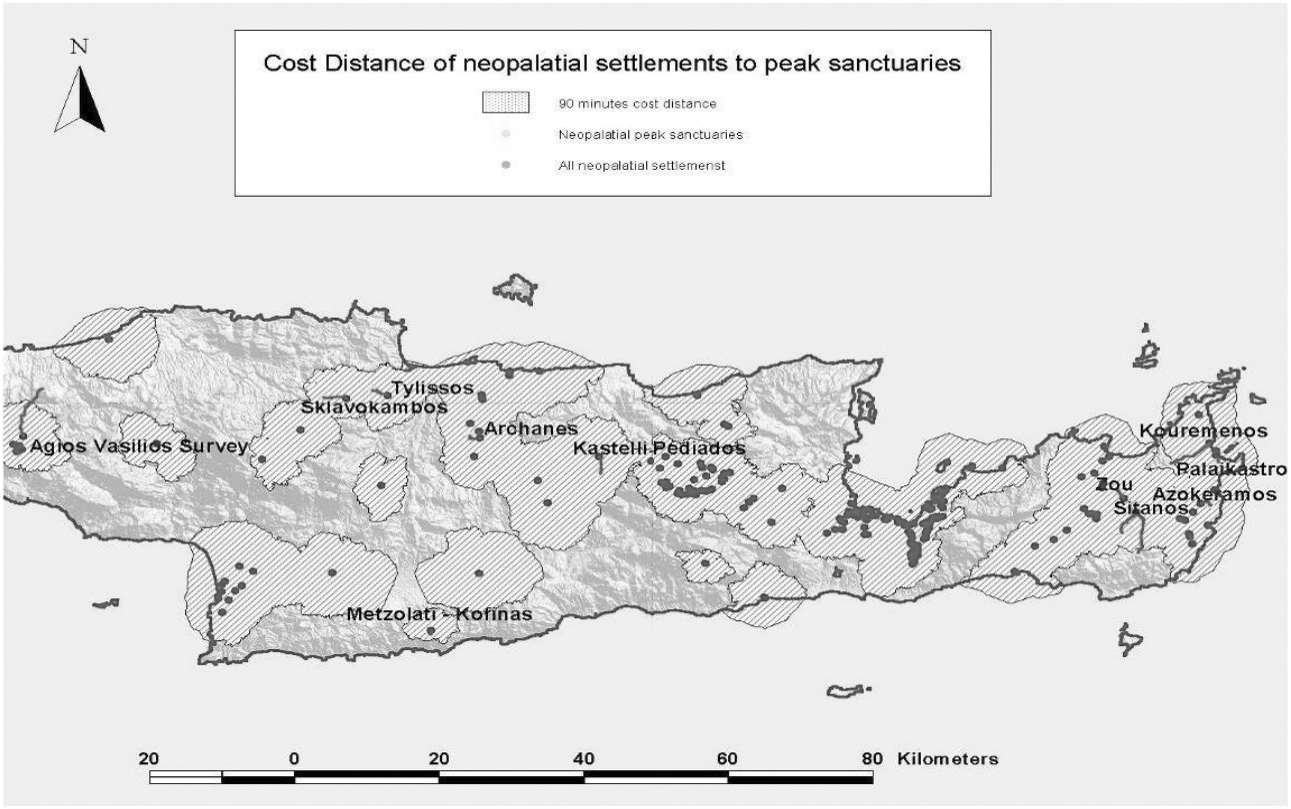

Figure 8: Modelling of Neopalatial territories, and overlay with peak sanctuaries: Cost Distance

court toward Iuktas remain intriguing. If we do not take into account the sizes of the court complexes, as does the Xtent model, but apply Nearest neighbour analysis and Cost distance analysis to these central places, the results tend to verify the loose relation between peak sanctuaries and court complexes. The different results between Cost distance analysis and the Xtent model should not surprise or disappoint us. While the territories or spheres of influence of most central places tended to be regionally focused, the ideological influence exerted from, for example, Knossos – Iuktas may be more difficult to grasp archaeologically.

Acknowledgments

The authors would like to thank the Institute of Aegean Prehistory for their continued support of this project. K. Vansteenhuyse would also like to thank the Fonds National de Recherche Scientifique (B) for a travel grant. This poster is the combined effort of two individual research projects: 'Building a cultural landscape model of Minoan peak sanctuaries through a GIS approach' and 'The Archaeology of Political Organisation. Conceptual and Methodological Issues and the Case of Late Minoan IA Crete', and forms part of the wider framework project 'A Topography of Power. Studies on the Political Structures of Minoan Crete' based at the Université Catholique de Louvain. (http://www.fltr.ucl.ac.be/FLTR/ARKE /Arka/accueil/fsr.html)

References

Branigan, K., 1998, The Nearness of You: Proximity and Distance in Early Minoan Funerary Landscapes, in *Cemetery and Society in the Aegean Bronze Age* (ed. K. Branigan), 13-26, Sheffield University Press: Sheffield.

Cherry, J., 1978, Generalisation and the archaeology of state, in *Social organisation and settlement* (eds. D. Green, C. Haselgrove & M. Springs), 411-437 (*BAR International Series* 47) BAR Press: Oxford.

Driessen, J., Schoep, I. & Laffineur, R. (eds), 2002, *Monuments of Minos. Rethinking the Minoan Palaces. Proceedings of the International Workshop "Crete of the hundred Palaces?" held at the Université Catholique de Louvain, Louvain-la-Neuve, 14-15 December 2001* (*Aegaeum* 23), Ulg-PASP, Liège–Austin.

Haggis, D.C., 2002, Integration and Complexity in the Late Pre-Palatial Period. A View from the Countryside in Eastern Crete, in *Labyrinth Revisited. Rethinking Minoan Archaeology,* (ed. Hamilakis), 120-142, Oxbow Books: Oxford.

Karetsou, A., 1981, The Peak Sanctuary of Mt. Juktas, in *Sanctuaries and Cults in the Aegean Bronze Age* (eds. R. Hägg & N. Marinatos), 137-153 (*Skrifter Utgivna av Svenska Institutet I Athen* 4, XXVIII), Paul Aströms Förlag: Stockholm.

Karetsou, A. & Rethemiotakis, G. 1990. *ΑΔ* **45**: 429-430.

Nowicki, K., 1994, Some Remarks on the Pre- and Protopalatial Peak Sanctuaries in Crete, *Aegean Archaeology,* **1**, 31-48.

Peatfield, A. A. D., 1983, The Topography of Minoan Peak Sanctuaries, *Annual of the British School of Archaeology,* **78**, 274-276.

Peatfield, A., Palace and Peak: The Political and Religious Relationship between Palaces and Peak Sanctuaries, in *The Function of the Minoan Palace, Proceedings of the Fourth International Symposium at the Swedish Institute in Athens,* (eds. R. Hägg & N. Marinatos), *10-16 June, 1984*, (*Skrifter Utgivna Av Svenska Institutet I Athen*, 4, XXXV), Paul Aströms Forlag: Stockholm, 89-93.

Peatfield, A. A. D., 1994, After the 'Big Bang' – What? Or Minoan Symbols and Shrines beyond Palatial Collapse, in *Placing the Gods, Sanctuaries and Sacred Space in Greece,* (eds. S. E. Alcock & R. Osborne), 19-36. Oxford University Press: Oxford.

Rethemiotakis, G., 2002, Evidence on Social and Economic Changes at Galatas and Pediada in the New-Palace Period, in *Monuments of Minos. Rethinking the Minoan Palaces. Proceedings of the International Workshop "Crete of the hundred Palaces ?"* (eds. J. Driessen, I. Schoep & R. Laffineur), *Université Catholique de Louvain, Louvain-la-Neuve, 14-15 December 2001* (*Aegaeum* 23), Ulg-PASP, Liège–Austin, 55-70.

Renfrew, C. & Level, E.V., 1984, Exploring Dominance: Predicting Polities from Centres, in *Approaches to Social Archaeology*, (ed. C. Renfrew), 54-78, Edinburgh University Press: Edinburgh.

Rutkowski, B., 1986, *The Cult Places of The Aegean*, Yale University, New Haven (Conn.) & London.

Rutkowski, B. 1988, Minoan Peak Sanctuaries: The Topography and Architecture, in *Aegaeum* (ed. R. Laffineur), **2, 71-100.** Ulg-PASP, Liège-Austin.

Soetens, S. 2004, *Minoan Peak Sanctuaries. Building a Cultural Landscape using GIS.* Unpublished doctoral dissertation, Université catholique de Louvain, Louvain-la-Neuve.

Soetens S., Driessen J, Sarris A. & Topouzi S., 2002, The Minoan Peak Sanctuary Landscape through a GIS approach, *Archeologia e Calcolatori,* **13**, 161-170.

Soetens S., Sarris A. & Topouzi S., 2004, Peak Sanctuaries in the Minoan Cultural Landscape. *Proceedings of the 9th International Congress of Cretan Studies*.

Vansteenhuyse, K., 2004, *The Archaeology of Political Organisation. Conceptual and Methodological Issues and the Case of Late Minoan IA Crete,* Unpublished doctoral dissertation, Université catholique de Louvain, Louvain-la-Neuve.