Settlement Patterns and Socio-Economic Differentiation in East Crete in the Final Neolithic

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Abstract

During the Late and Final Neolithic Cretan communities appear to have been affected by a series of social and material changes. At the large lowland site of Knossos these changes include the appearance of symbolic representations of houses, an increase in household storage capacity, the enclosing of formally open areas between houses and the development of new technologies (e.g. flax textiles). Such changes may be understood as reflecting a new ideology of hoarding and the emergence of a more socially and economically independent household (Tomkins forthcoming). In the wider Aegean greater household independence would explain the first appearance of different types of socio-economic specialisation or differentiation in craft (e.g. pottery, shell beads) and food production (e.g. agricultural intensification and diversification). These socio-economic changes appear to have some sort of corollary in changes in the settled landscape of the Aegean as suggested by the first appearance of sites located in agriculturally less stable landscapes (e.g. upland landscapes, small islands). Some of these are very small, probably comprising just one house (e.g. Magasa), others represent larger communities (e.g. Chalavra, Lamnoni 65). Neolithic upland sites, both on Crete and in the wider Aegean, have been interpreted by some in terms of the arrival of a pastoral economy, however others have disputed this.

In order to explore this phenomenon further, Geographical Information Systems (GIS) were employed to examine in detail the nature and function of FN settlements in a single region of Crete (site location, spatial distribution, site interaction, site clustering). The Siteia region of East Crete was selected as the pilot study area because of the large number of sites noted by past excavations and surveys.

Methodology

After an extensive search of the literature and a full study of available ceramic material, a database of 53 sites was isolated for further study. All known finds were listed per site. These sites were topographically mapped through either fieldwork with the use of DGPS techniques or digitization of survey maps. Equally important was the analysis of the environmental features of the sites through the construction of integrated databases, consisting of information extracted by topographic, geological, land use and hydrological maps of the study area. The location of streams, springs and geological and land use formations were digitized from 1:50,000 scale maps of the Geographical Service of the

Hellenic Army, the Institute of Geological and Mineral Exploration (IGME) and the Ministry of Agriculture.

Landscape analysis of FN sites was based on a 50m pixel size DEM, derived by a SPOT stereoscopic satellite image covering the whole island of Crete. Only part of this DEM was used, comprising the Siteia region of east Crete. The DEM was geo-referenced to the EGSA'87 projection system, based on the coastline of Crete, digitized by 1:50,000 scale topographic maps. Analysis of the data was carried out using ESRI ArcGIS, together with the employment of Spatial Analyst and X-Tools extension.

Cost-surface grids were computed based on a classification scheme of the slope. Slope values were divided into five classes according to the travel time ("cost") needed to cover a certain distance on a given slope. The adopted model exhibited an exponential growth form, considering a velocity range from 4 km/hour for a flat ground (0-10^0 of slope) to approximately 0.033 km/hour for a much more sloping terrain (40-76^0 of slope). In order to investigate potential clusters of sites, cost-weighted distance surfaces were created based on the above scheme. Different accumulative cost-distance surfaces were created by including all sites in each model. Twenty one small clusters defining hypothetical territorial boundaries were finally formed based on the calculation of a 20 minutes walking distance site catchment (Figure 1). Statistics of slope, altitude and proximity to water resources were calculated. Communication paths were calculated by considering the least time-consuming paths among the neighboring clusters (Figure 2). Communication routes were always initiated from and ended at the boundaries of each cluster.

Proximity of low-slope agricultural land was also estimated for the above clusters. The definition of the potential agricultural land pockets was based on the geological and land-use attributes of the region. The probable agricultural low-lands were approximated by considering the Boolean intersection of the alluvial, flysch and secondary deposits in terms of geological attributes, with the areas of lower slopes or open valleys in terms of terrain physiography, which were also characterized by their recent usage as agricultural lands with sufficient soil depth. With the exception of Pelekita, Traostalos, Petsofas and Kato Kastellos, all the other sites are located within a distance of 500m to the closest patch of potential agricultural land (Figure 3). The general distribution of sites suggests that occupation was mainly determined by the proximity of sites to agricultural land.

Finally, visibility analysis was approached by calculating a series of 21 viewsheds taken from an origin corresponding to the highest site within each cluster (given an additional 2m height above the actual altitude of the DEM to account for the observer's height). Traostalos, Petsofas (close to locales that later evolved to become peak sanctuaries – Figures 4 & 5) and Endichti Adravaston exhibit the highest visibility coverage (especially towards the north and east sections of the region) of all the sites, followed by the important coastal site of Kephala Petra. Traostalos seems to have a visibility access to more than 15 sites belonging to 5 different clusters. On the other hand, some coastal sites, while often enjoying only limited visibility over inland resources, appear to have been well-located to control marines resources. Examples include Kephala Petra, Fovolies, Viglia, Koufota, Karoumes, and Pelekita. This would seem to signify the importance of marine-based interactions.

General Remarks.

GIS analysis has proved to be an extremely useful way to investigate the macro-scale socio-economic relationships of FN settlements in the Siteia region of east Crete. The location of most sites and clusters seems to have been defined by their proximity to freshwater, agricultural land and/or to coastal resources. This agrees well with the frequent presence of mortars for cereal processing at these sites and suggests that they probably practiced a form of spring-fed mixed farming and not pastoralism *per se*. Furthermore, consideration of the total quantity of suitable agricultural land and gaps in the network of sites indicate several areas where undiscovered sites may exist and these frequently correspond to valleys that have not yet been subjected to intensive survey. Within well-surveyed areas site density is relatively high with generally good intervisibility between sites complimenting their close physical proximity and sharing of material resources. Further support for the importance of exchange and interaction within and between clusters is provided by petrographic study of ceramic material from a number of inland upland sites. Thus the dispersal of small sites seems to have been balanced by a form of visual integration that supported the formation of a form of dispersed community. Also important in this process were certain sites, which by their liminal location and extremely high intervisibility (often including other clusters) appear to have been special sites where communities could gather. Examples include Petsophas, Traostalos, Endichti and possibly Lamnoni 23 (Figure 7). In this way dispersed inland and coastal clusters were inter-linked to form a single network of overlapping social fields.

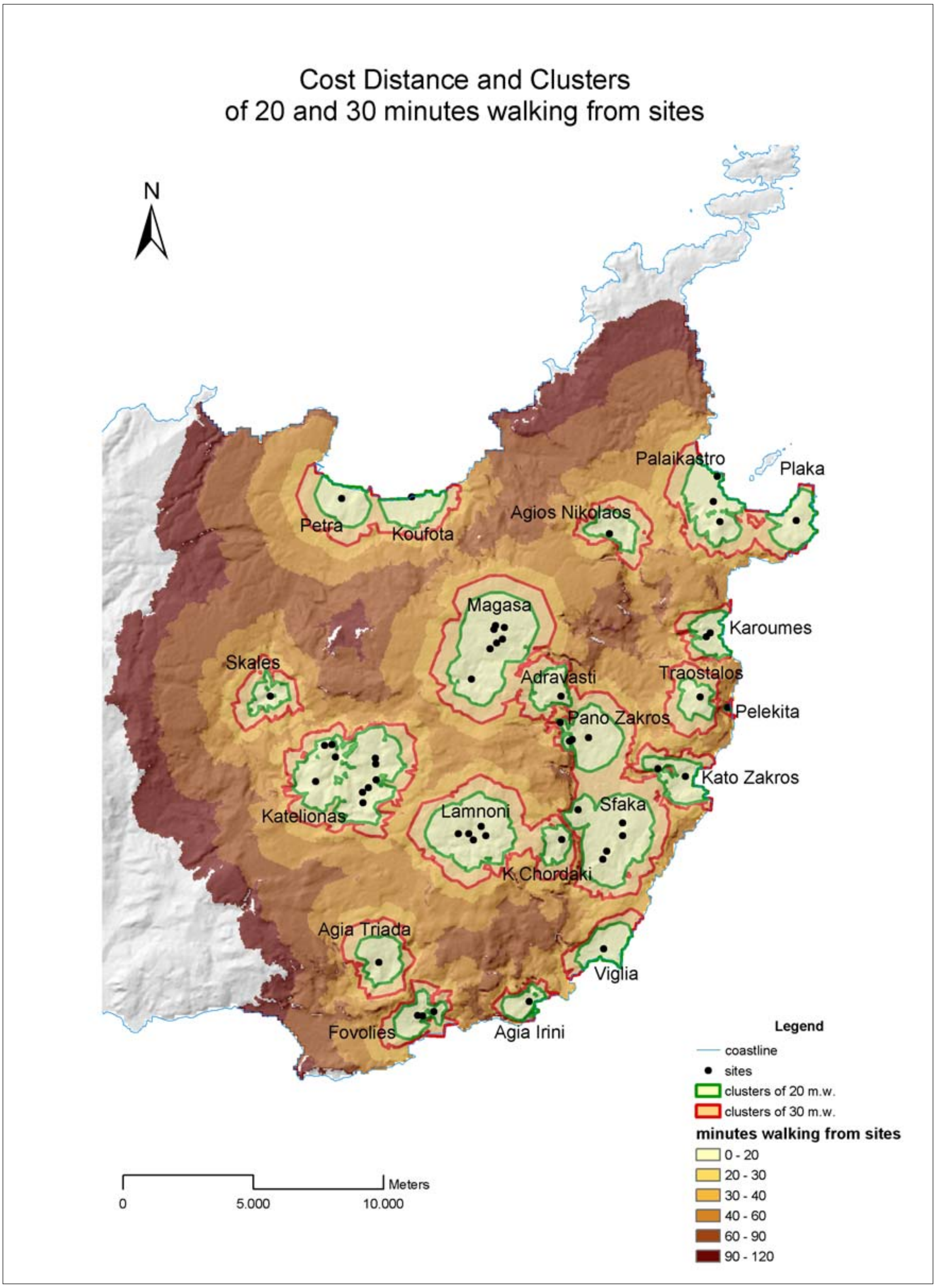

Figure 1. Twenty one small clusters defining hypothetical territorial boundaries were finally formed based on the calculation of a 20 minutes walking distance site catchment .

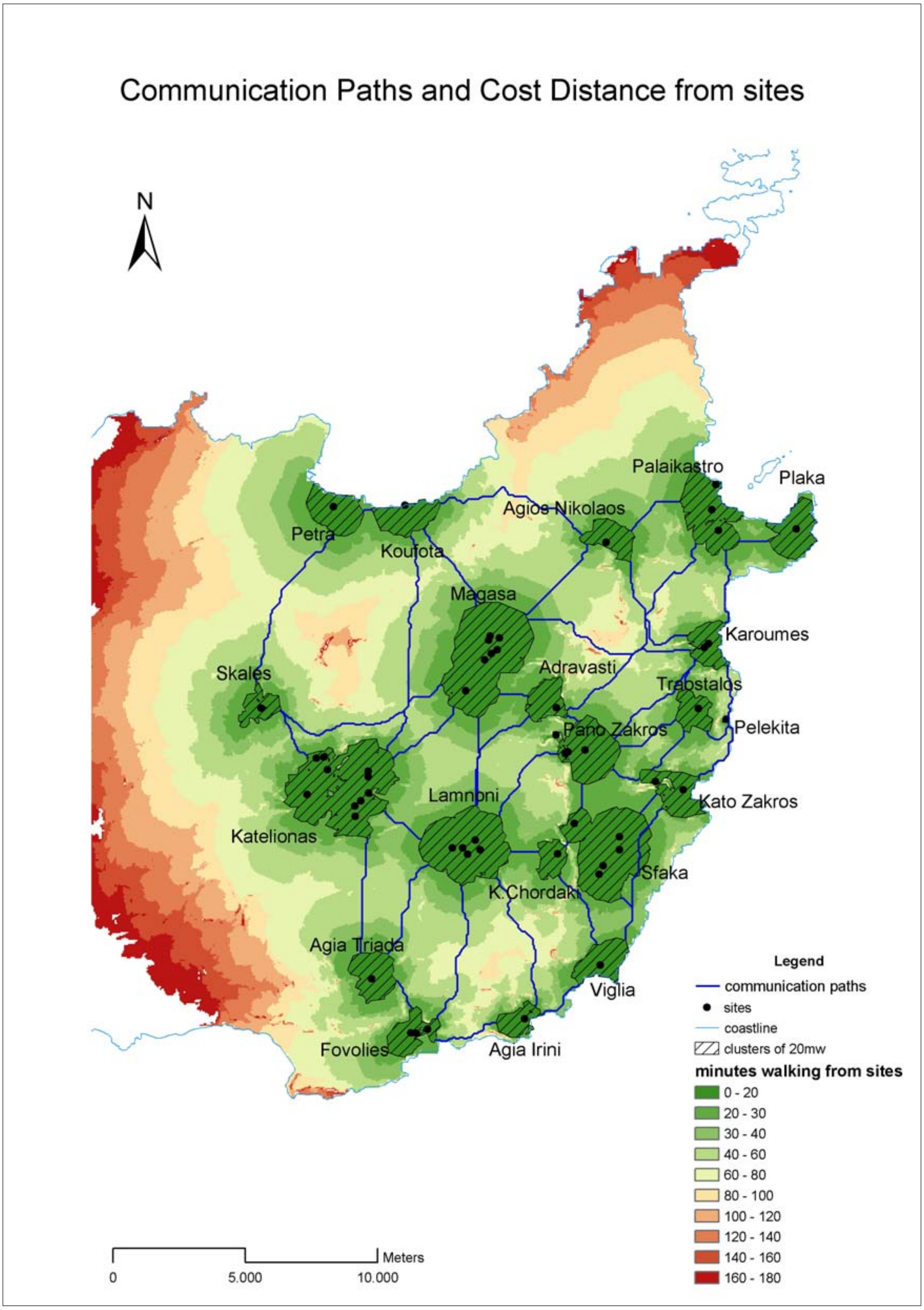

Figure 2. Communication paths were calculated by considering the least time-consuming paths among the neighboring clusters.

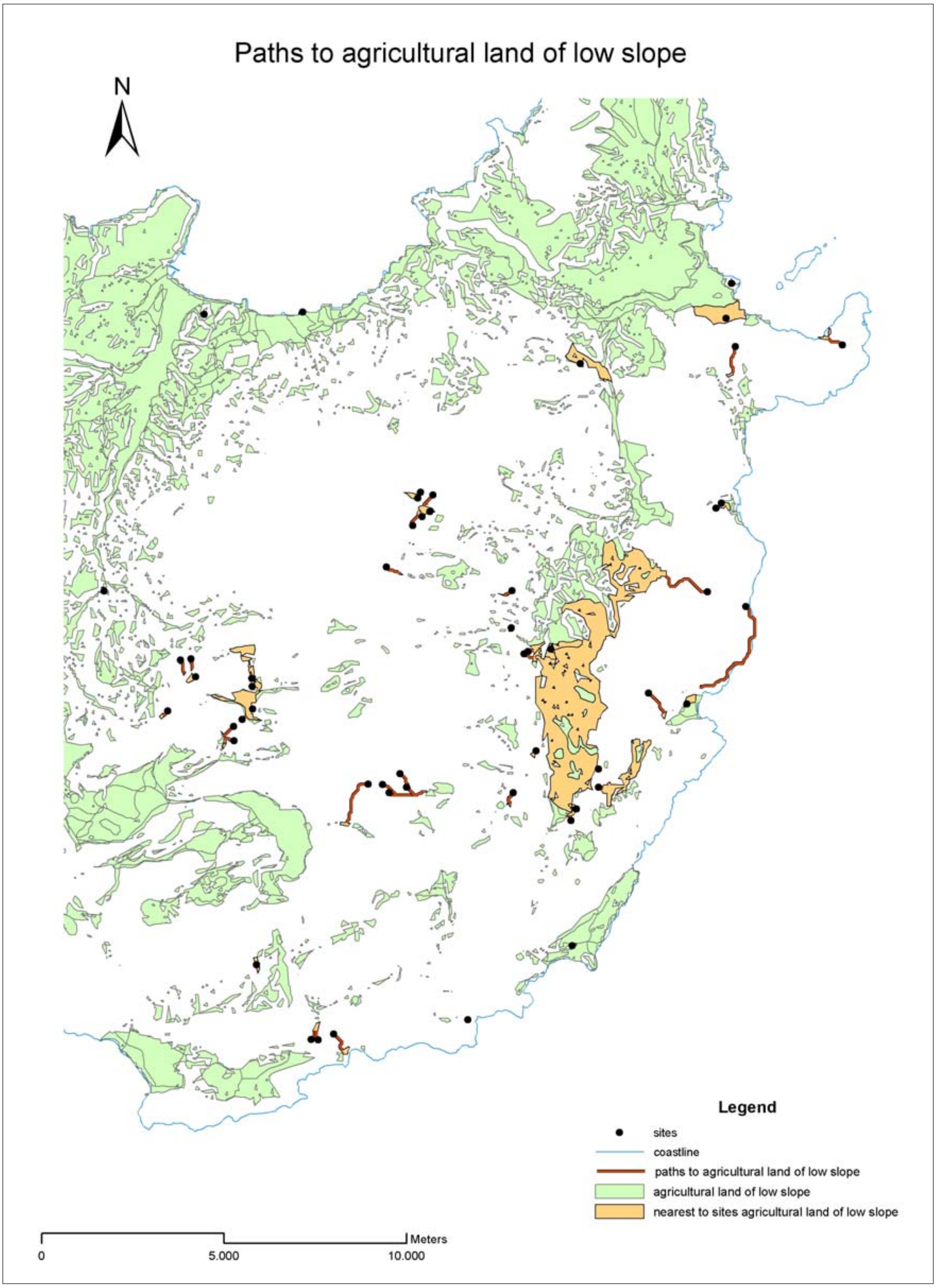

Figure 3. The general distribution of sites suggests that occupation was mainly determined by the proximity of sites to agricultural land. With the exception of Pelekita, Traostalos, Petsofas and Kato Kastellos, all the other sites are located within a distance of 500m to the closest patch of potential agricultural land.

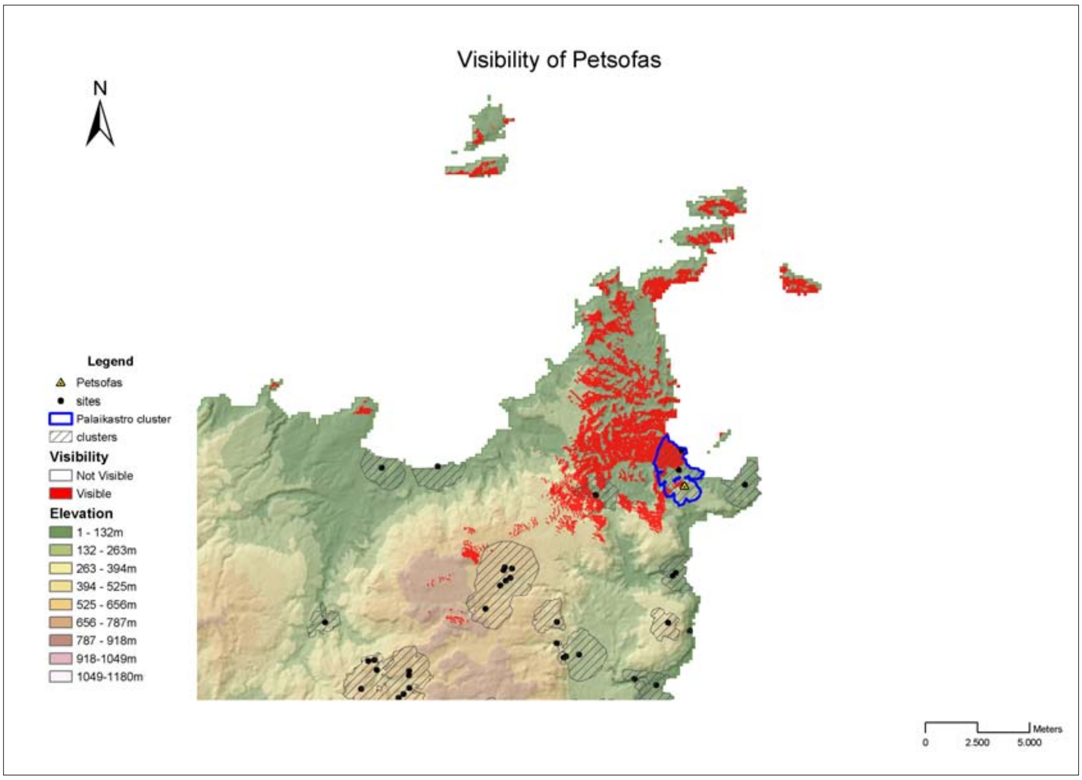

Figure 4 (above) shows the result of the viewshed analysis from the peak of Petsofas, compared to the actual visibility of the site (**Figure 5**, below).

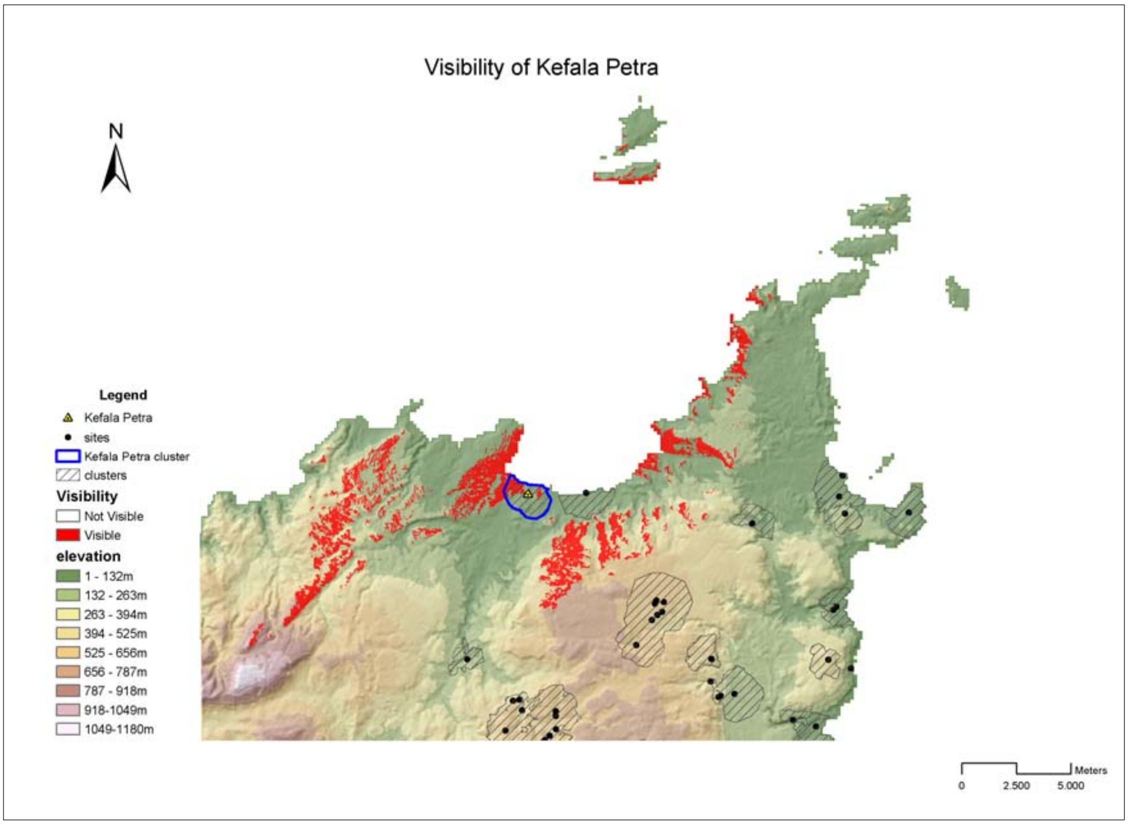

Figure 6. Some coastal sites, such as Kephala Petra, seem to enjoy limited visibility over the inland resources, but have an obvious control to marine resources.

Figure 7. Sites as Lamnoni 23 seem to have played a crucial factor in the integrity of Final Neolithic communities.