5 IN SEARCH OF TEGEA: DELIMITING A GREEK POLIS BY SPATIAL ANALYSIS OF AN ARCHAEOLOGICAL FIELD SURVEY

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INTRODUCTION

The ancient city of Tegea was located in Arcadia, in the Peloponnese peninsula in Greece (Fig. 1). Tegea was one of the most important *poleis* in Antiquity. It was founded on a highland plateau surrounded by hills. Quite near, on the very same plateau, two other, Mantineia and Pallantion were also founded. The karstic nature of the plain and the poor and precarious drainage system through swallow holes had important repercussions. Fluctuating river courses and flooding must have been important factors in the topography until recent times. Flooding has been a problem in the past and some areas were waterlogged for a substantial period of time.

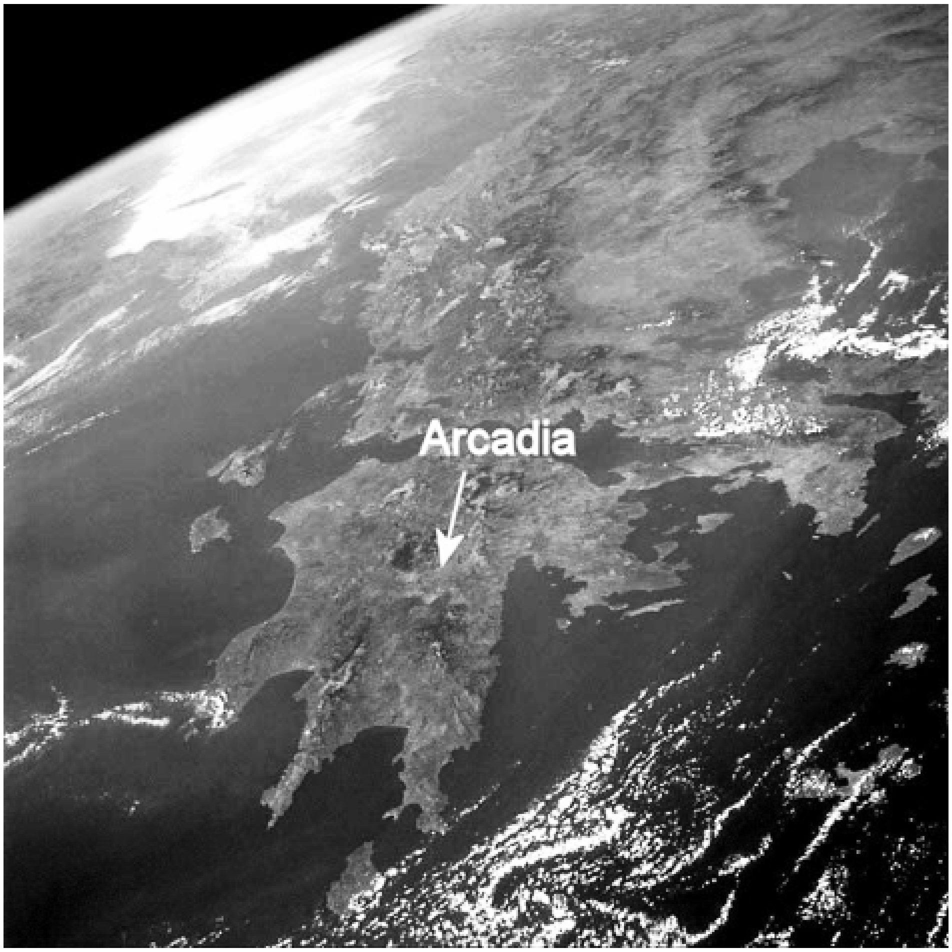

Figure 1: The investigated area lays in the surroundings of the ancient polis of Tegea, in the central part of the Peloponnese Peninsula (source: NASA).

The three cities are described in the guidebook written by the traveller Pausanias, who visited the area some time after A.D. 150 (Pausanias & Levi, 1971). According to him, Tegea as well as Mantineia were fortified, and Tegea even had the largest temple in the Peloponnesus.

Today we can see the lower courses of the elliptic city wall of Mantineia and several of the ruins dug up in 1887-88. In Tegea, we can see the podium of the temple of Athena Alea, excavated in periods from 1879 to 1994 (Østby, Luce, Nordquist, Tarditic & Voyatzis, 1994), and some remnants of the *agora*, excavated in 1990, several kilometres west of the temple area (Spyropoulos & Spyropoulos, 2000). There are no visible remnants of a city wall. The whole area that might have been the city-area is a plateau with 5 villages surrounded by intensively farmed land. When the Norwegian team finished the excavations of the sanctuary in 1994, some of the people from the team began to explore the landscape around the temple. The main goal was to delimit the extent of the ancient city of Tegea, thus facilitating further research and cultural heritage management in the area. (Ødegård, Bakke, Risan, Sollund & Stabbetorp, in prep.)

The case area

The area around the known remnants of Tegea has been relatively densely settled and cultivated for the last 5000 years, but modern mechanised agriculture was introduced only recently. The existence of favourable conditions for studies of vegetation history based on pollen analysis had already been evidenced by excavations (Bjune, Øverland & Krzywinski, 1997). Furthermore, we knew from the outset that the topography had changed considerably during the last 5000 years, due to interconnected processes of erosion and sedimentation. Our fieldwork consequently had a potential for illuminating the complex relationships between cultural and natural factors involved in landscape change. (Ødegård *et al.*, in prep.)

Even though the hydrological factors are of obvious importance in the history of the area, they also create considerable problems for an archaeological survey. Recent sedimentation is particularly problematical with regard to the collection of artefacts on the surface.

Earlier investigations

The site of the urban centre of ancient Tegea has, since the late 19th century, been recognised as being located in the area of Paleo Episkopí, where the remains of a theatre from the Hellenistic period are partially visible. This structure can be linked to Pausanias' description of the city, where it appears that the theatre was situated "not far from the market-place" (Pausanias & Levi, 1971: VIII, 49, [1], p. 489). The city of Tegea has so far received only little scholarly attention from archaeologists. V. Bérard made the main contributions as far back as 1892 (Bérard, 1892; 1893), and then in the context of the French interest in the archaeology of Mantineia and the Sanctuary of Athena Alea. The large-scale excavations of the sanctuary were initiated by C. Dugas (Dugas, Berchmans & Clemmensen, 1924). Bérard's work at Tegea followed closely his earlier investigations at Mantineia, and one of his main aims was to locate and date the city walls. Although then, as now, no traces of them were visible on the surface, Bérard located four possible stretches of the walls by means of trial trenches. Bérard dated all structures to the early 4th century, mainly on the evidence of analogy with the better-documented walls of Mantineia. The four trial trenches and the assumed elliptical wall circuit were documented in the form of a sketch map published in 1892 (Bérard, 1892: PL. XIII; see Fig. 2). It must be noted that Bérard himself was unsure whether the southernmost wall fragment (the capital letter D in Fig. 2) had anything to do with the three other wall fragments he uncovered (Bérard, 1892: 547).

On the basis of these four points, Bérard assumed that one could discern the course of the walls in the modern road network. Again, this assumption was mainly based on the experience from Mantineia, where it was quite evident that later road building had exploited the firm foundations of the walls.

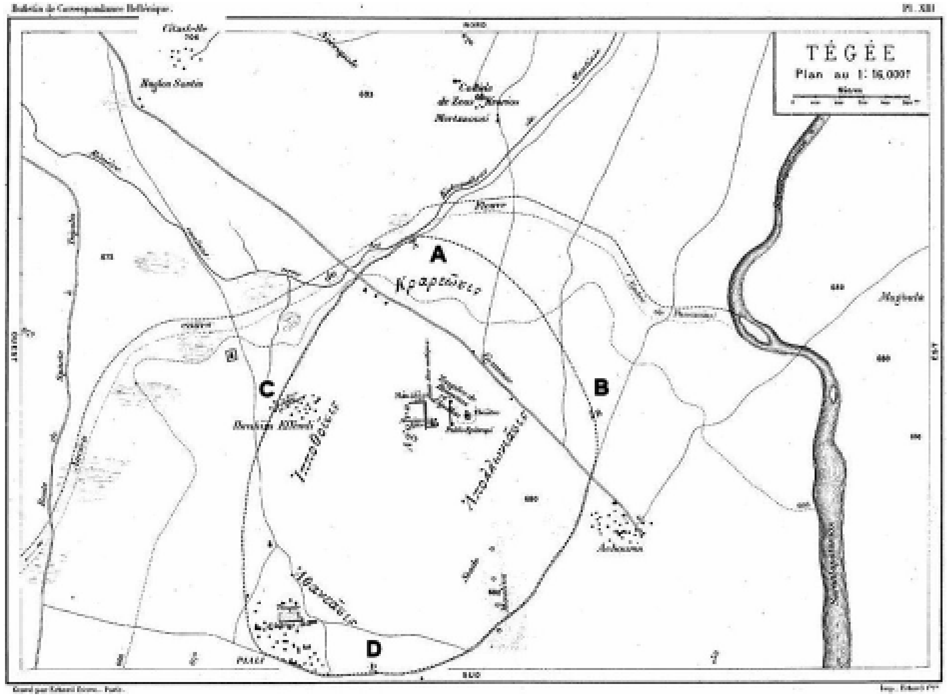

Figure 2: Bérard's (1893) map of Tegea, with his interpretation of the position of the city wall from the classic period. The letters A-D indicates the possible wall fragments found by Bérard.

Excavations conducted by the Ephorate of Antiquities of Arcadia and Laconia and directed by Th. Spyropoulos in the 1980s[1] found the remains of buildings clearly connected with the agora, such as a Hellenistic stoa. However, later rebuilding obscures the original layout, which, according to Pausanias, was of "brick-shape".

The two low hills of Akra and Agios Sostis are situated north of the *polis* area, as defined by Bérard. Building fragments and figurines have been found near the top of the latter, which has been interpreted as a sanctuary of Demeter and Kore, also mentioned by Pausanias (Pausanias & Levi, 1971: VIII, 53, [7], pp. 497-498). It is not entirely clear from Pausanias' account whether the sanctuary of Demeter and Kore was situated at "the high ground" which he mentions later and which he associates with Zeus Klarios (Pausanias & Levi, 1971: VIII, 53, [9], pp. 498). It is equally uncertain whether the *acropolis* was located at Agios Sostis, Akra or somewhere within the city area, which today is mainly level ground.

The survey approach

[1] The results of these excavations have not yet been properly published. A short description can be found in Spyropoulos, & Spyropoulos, 2000: 23-26.)

One practical problem associated with surveys in the Mediterranean is the sheer amount of artefacts encountered on the surface. Concentrations of artefacts can virtually litter the surface, and the density of these can be sufficiently high to create considerable practical problems. Even though a methodologically strict approach would be to devise a grid system and collect everything from each grid in separate bags, such an approach is highly unrealistic. The obvious solution to this problem, and one followed in most early surveys, is to collect everything from one field that seems to be diagnostic and leave the rest. Such an approach is appropriate if artefact concentrations, *i.e.* sites, are the main focus of the survey. If, however, the focus is on patterns of artefact density, the exclusive documentation of diagnostic pieces is unsatisfactory, particularly since artefacts from some periods tend to be more readily recognized as diagnostic than artefacts from other periods. This is especially the case with fine ware pottery from the Greek or Roman periods, which has a shiny black- or red-glazed surface. Also field walkers more often pick up the common roof-tiles, which often were black-glazed in the Archaic-Hellenistic periods. Another problem is that undecorated roof-tiles, by far the most common artefact encountered, often have no clear diagnostic features. It is obviously problematical that an archaeological project might leave the most common artefact group virtually undocumented (Ødegård *et al.*, in prep.).

The Norwegian Arcadia Survey adopted a compromise between the extremes of total collection and the exclusive collection of diagnostic pieces from sites with high concentrations. In order to document artefact density patterns, we counted every artefact, but only collected what were deemed to be diagnostic pieces. The counting procedure distinguished four different groups of artefacts: pottery, tiles, worked stone and "other". Although these groups are very generic, the advantage in the field was that even field walkers with little experience easily discerned them. (Ødegård *et al.*, in prep.)

This paper presents some of the methods used and the results arising from the Norwegian Arcadia Survey (NAS), an interdisciplinary landscape survey aimed at archaeological, palynological and geological documentation, and study of part of the territory of the ancient city of Tegea in South-eastern Arcadia on the Peloponnesus (Ødegård *et al.*, in prep.). We will concentrate on a spatial analysis of the quantitative results from the archaeological field survey.

MATERIAL AND METHODS

Field survey methods

Field surveys in Greece have employed different approaches to the task of gathering data (see for instance Alcock, 1993; Snodgrass, 1987). This survey combined some of these strategies, hopefully to get the best possible point of departure for spatial analyses and interpretation of the historic landscape of Tegea. Fieldwork was carried out from 1999 to 2002. The field workers were divided into teams, each normally consisting of 5 persons. Each team investigated one agricultural field (some abandoned, but the majority still in use) at the time. The team members were walking straight lines in parallel with 5-metre intervals while counting and collecting. The number of artefacts in the different classes were registered every 20 metres by the field-supervisor in each team. The amount of pottery and tile fragments was recorded separately. After the datasets were collected the amount of pottery fragments and tile fragments for each surveyed field were calculated. The collected material was examined immediately after the field had been surveyed, and diagnostic material was kept for cleaning and further analysis. (Ødegård *et al.*, in prep.)

Some surveys prefer mainly to investigate ploughed fields. However, this would lead to the abandonment of areas of potentially great interest only for reasons determined by modern agricultural practices. In Arcadia, a large part of the target area on the plain is under cultivation. After the grain harvest in late June/early July, the majority of these fields were either ploughed or contained stubble; consequently they had very good surface visibility. Other fields under cultivation, such as orchards or cornfields, were also fairly easy to investigate. On the hills in the target area, however, the soil cover is often very thin and used for grazing, if used at all. The vegetation consists mainly of grasses or *maquis* (mostly prickly oak, *Quercus ilex*) and the conditions for survey are far worse than on the plain. It became clear that the visibility of the ground surface had to be documented if the density of artefacts in such areas would be compared to that of ploughed fields on the plain. We decided to adopt a strategy where the surveyors judged the surface visibility as a percentage of the visibility in newly ploughed fields. This measure of visibility was registered for each 20 m along the survey lines along with the counts of artefacts. The surveyors were given a simple set of rules for estimating the visibility on this scale (Ødegård *et al.*, in prep.).

GIS registration methodology

GIS (Geographical Information System) was found to be the ideal tool for handling the sort of information we were gathering in the field. We digitised the investigated fields from aerial photographs on which the survey teams had marked them (see Fig. 3). This enabled the use of GIS to link the results of the survey with the spatial localisation of the fields. In order to obtain attributes to each field that were suitable for further spatial analysis the artefact counts in each field were summarised. Since the fields have different sizes, the number of artefacts by the area of the field to obtain the mean density of each artefact type for each field. Also the mean visibility of the field was calculated. This statistical information was then imported into the GIS for further spatial studies. The GIS modelling and all GIS analyses were done using ArcView (Environmental Systems Research Institute, 1996) software.

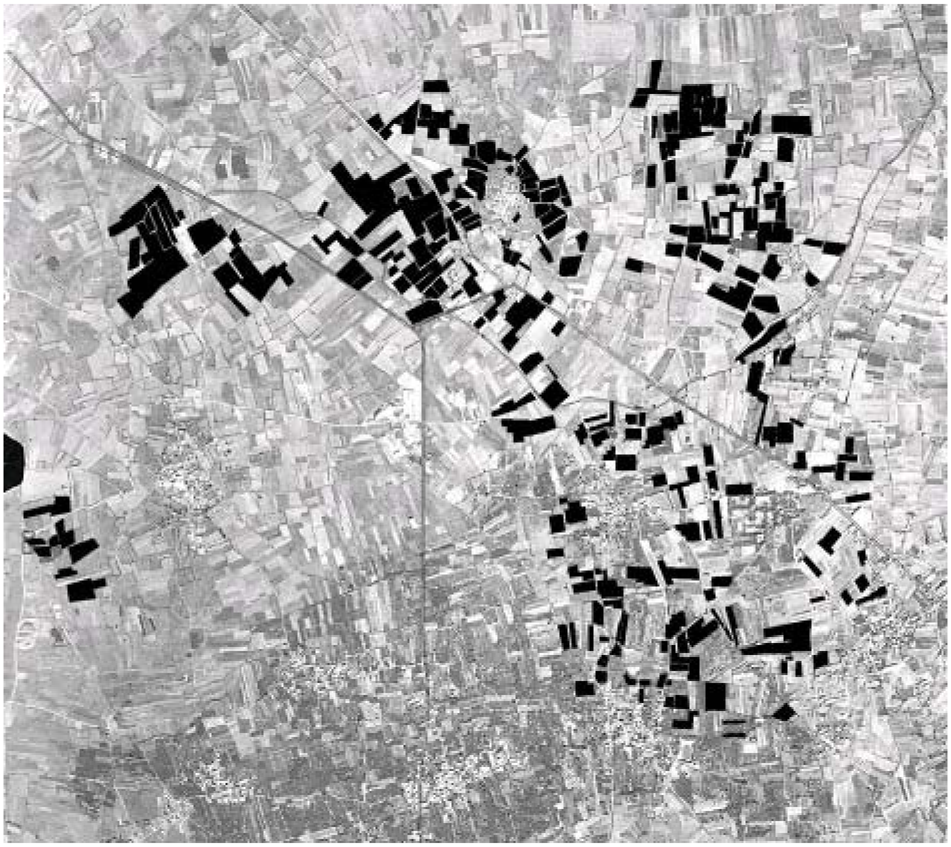

Figure 3: Aerial photograph of the investigation area, with the surveyed fields superimposed.

To simplify the visual interpretation of the spatial variation in the obtained field values, these were interpolated for the whole area. The result of the interpolation gives estimated densities also for the areas between the surveyed fields (see Fig. 4), thereby making it easier to discern spatial patterns in the artefact distribution. The interpolation algorithm chosen was IDW, Inverse Distance Weighted interpolation (Keckler, 1997). The interpolation radius was set to 400 m so that only values near the focal point influenced the estimates.

Figure 4: The survey result with respect to tile fragments. Left: observed densities of tile fragments in the fields. Right: spatially interpolated tile fragment density. Areas with the lighter shades of grey contain low-density values, while areas with the darker shades of grey contain high-density values.

RESULTS AND DISCUSSION

In total, the data set consists of 11815 observations (each of which is the registered number of the different types of artefacts along a 20 m registration line). These observations represent 355 agricultural fields, the distribution of which is shown in Fig. 3. Altogether, 20531 pottery fragments (giving a mean density of 100 fragments pr. da) and 130537 tile fragments (mean density 627 fragments pr. da) were counted.

The density of tile fragments in the investigated fields is illustrated in Fig. 4. The density of tile fragments varies from nearly zero to more than 1200 fragments per 100 m^2. Although the map may indicate three areas with high concentrations of tile fragments, any clear spatial pattern is hardly discernible, due to the high variation between neighbouring fields. As a first search for any large-scale trends in the variation of tile fragment density within the study area, the density values were spatially interpolated. This gives a new data set where every point on the map is given a value for tile density, calculated as a weighted mean of the values for the near-lying surveyed fields. The weights are determined by the inverse of the distances to each surveyed field. The fields included in the interpolation for a given point was delimited to those fields lying within a distance of 400 m from that point.

The result of the interpolation for tile density is given in Fig. 4. As can be seen, the interpolated values, giving estimates for the total area, increase the possibility to interpret the results. A large area with high densities is found in the southeastern part, in the surrounding of the villages Palea Episkopi, Nea Episkopi, Alea and Stadio. Two smaller areas are also clearly visible; one in the surroundings of Agios Sostis and one north of Akra. The spatial pattern obtained from pottery fragments (not shown) also becomes more evident after interpolation.

However, the patterns obtained from these simple visual analyses are clearly dependent also on the ground surface visibility, which varies profoundly between the fields. It is therefore necessary to calibrate the density values with respect to this factor to obtain a more realistic picture of the spatial variation. Simple scatter plots of tile resp. pottery density *vs*. the visibility values are shown in the two upper diagrams in Fig. 5. For both types of artefacts there is, as should be expected, a clear tendency of higher density scores with improved visibility, but the relationships are not linear. For further modelling we therefore log-transformed the values along each of the scatter gram axes to obtain the relationships shown in the two lower diagrams in Fig. 5.

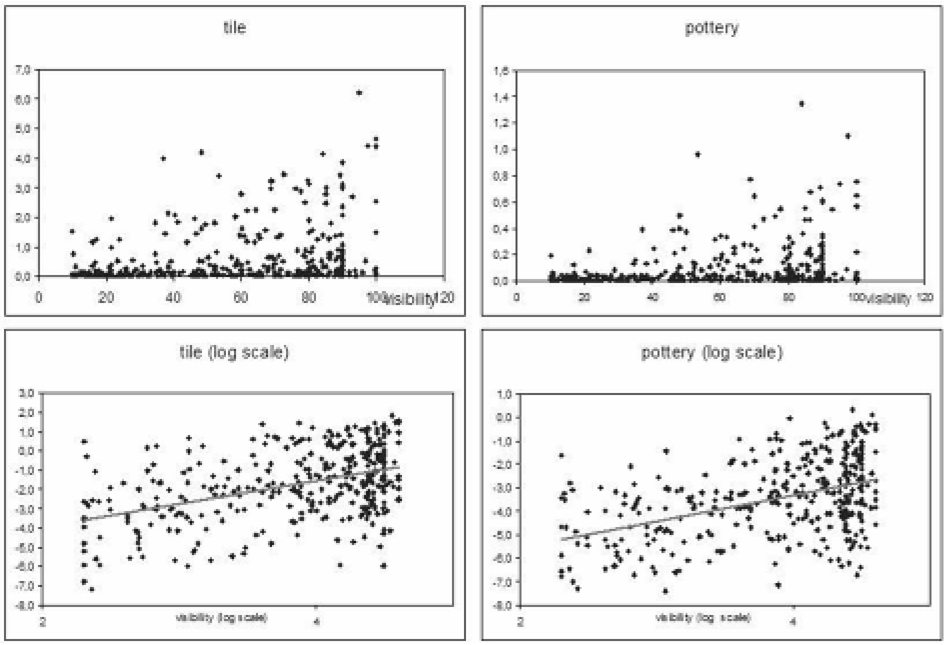

Figure 5: The relation between the density of tile respectively pottery fragment density and the visibility of the ground surface. The two uppermost diagrams are scatter plots between fragment density and visibility on an arithmetic scale. In the two lowermost diagrams both axes are transformed to a logarithmic scale, and with the regression lines superimposed.

For both tile and pottery fragment density, the linear correlation to visibility is highly statistically significant when the values are scored on a log-scale. This enables the use of linear regression (the regression lines are superimposed in Fig. 5) as a tool for eliminating the effect of visibility variation from the data set. In the subsequent analysis we have used the regression residual values (the logarithm of the original value minus the value expected with this degree of visibility according to the linear regression).

An example of the effect of this model is shown in Fig 6. The two maps concentrate on a small area north of Akra. At the time of the survey, only a few of the fields were newly ploughed while the others had a rather high vegetation cover. Therefore, only a few of the fields gave high scores with respect to tile density (Fig.6, left). When the values were recalculated according to the regression model, it became clear that also some of the other fields' had a high tile density, considering the poor visibility of these fields. Therefore, the peak in tile density within this small area became much clearer.

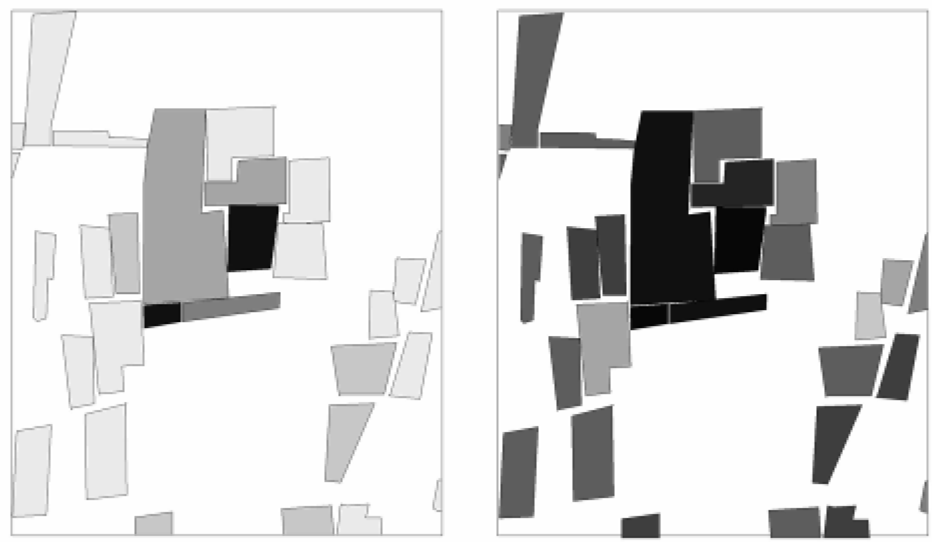

Figure 6: Close-ups of the area north of Akra, with respect to the tile density in the investigated fields. Left: The original observations of tile density. Right: The values obtained after the tile density values were corrected for variation in visibility. Greyscale code as in Fig. 4. For further explanations, see text.

The site represented in Fig. 6 lies at a commanding position overlooking the northern part of the plain which was controlled by Tegea in Antiquity. The majority of diagnostic artefacts can be dated to the Roman period. Given its dating, the sheer size of the concentration and its location in a productive environment, the site's interpretation as a Roman villa seems plausible. The quantity of roof tiles is also high relative to the pottery density within the same area. This supports the interpretation, since a collapsed roof would be the first archaeological feature to be disturbed by ploughing.

The new estimates for relative density of pottery and tile (adjusted for visibility) were then interpolated spatially in the same manner as explained for the original values above. The results are shown in Figs. 7 (tile) and 8 (pottery). The elimination of the sampling "noise" caused by variation in visibility is highly reduced, and the spatial patterns have become much clearer, and probably also more realistic.

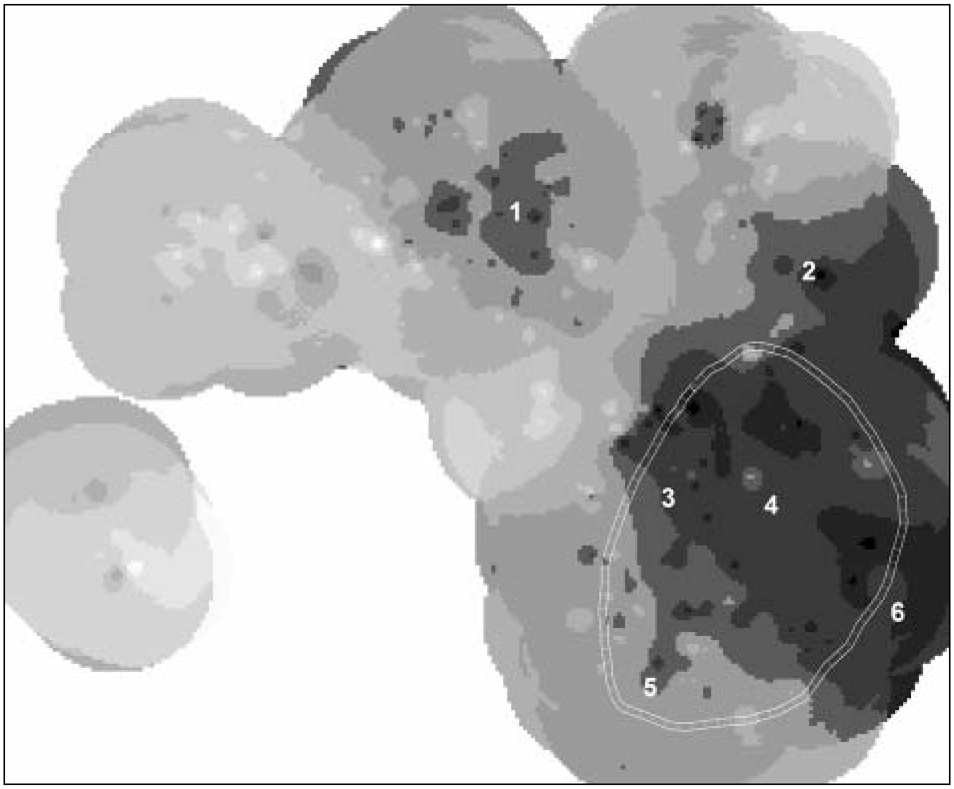

Figure 7: Interpolated tile density values adjusted for visibility. For further explanation, see text. Greyscale code as in Fig. 4. The city wall position, as interpreted by Bérard (1893), is superimposed. Numbers represent the location of current villages mentioned in the text – 1: Agios Sostis, 2: Akra, 3: Nea Episkopi, 4: Palea Episkopi, 5: Alea, 6: Stadio.

As mentioned above, earlier studies on Tegea have located the political centre and the sanctuary of Athena Alea. Since the intensive survey covered the presumed extent of the ancient city as well as the immediate hinterland, we are now in a position to obtain more results on such issues as the delimitation of the city, the function of different parts of the city and the chronology of the urban settlement.

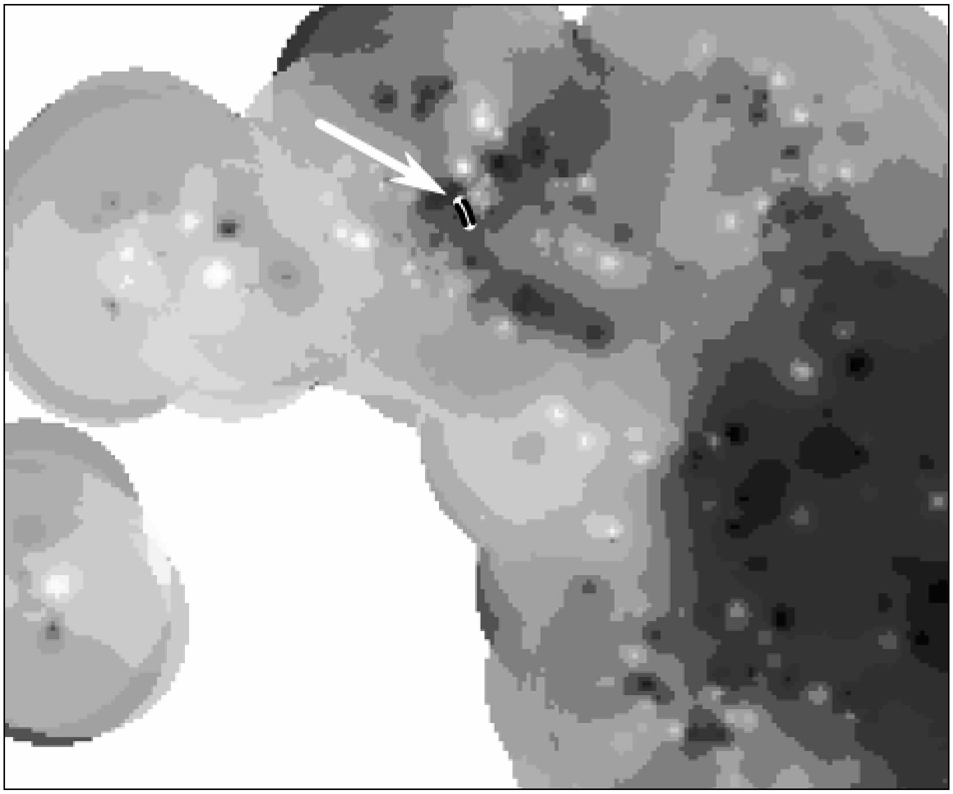

Figure 8: Interpolated pottery density values adjusted for visibility. For further explanation, see text. Greyscale code as in Fig. 4. The arrow points to an observed remnant of an ancient road.

As Figs. 7 and 8 show, we have established a concentration of pottery and tile in the area where one might expect the city to be located. We have georeferenced the map made by Bérard (1892, see Fig. 2) to modern maps using the warping procedures in ArcView (ESRI 1996). The obtained position of the hypothesised city wall is superimposed on Fig. 7 for comparison with the spatial pattern obtained for tile density. There is a clear relation between the large area of high pottery density and Bérard’s positioning of the *polis*, but the pottery data may indicate a somewhat larger extent of the city, and the high density area is somewhat skewed towards the northeast. Thus the doubts that Bérard himself had regarding the southernmost wall fragment as part of the city wall arise anew. Could the reason for the mismatch between Bérard’s interpolated line and the interpolated high tile density in respect to pottery area be that the city wall never extended as far as Bérard thought? To draw an elliptical shape based on four wall fragment sites, as Bérard did, must under any circumstances be regarded more like an educated guess than a well-founded hypothesis. However, displacement of the artefacts due to flooding and agricultural activity must be expected to have blurred the artefact density pattern. In addition, most of the tile cannot be dated. Since the area has been populated continuously since Antiquity, a significant part of the observed tile fragments must be assumed to have been deposited more recently. The spatial resolution in this type of analysis is rather coarse; thus further studies and research should be performed in order to increase the spatial accuracy of the analysis.

In spite of this, the postulated position of the city is clearly recognised. Further confirmation of the validity of the predicted urban boundary came during the field season of 2002, when the vegetation cover was low. Several polygonal stone blocks were discovered along the presumed urban boundary (the capital letter A in Fig. 2). We also found earth mounds which we interpreted as the excavation debris left by Bérard.

Our spatial predictions, as seen in Figs. 7 and 8, were combined with cadastre maps and given to the regional cultural heritage management. The Ephorate of Lakonia and Arcadia opened a trench during the processing of a building application in 2003. The maps of the Tegea area were then used as reference. The planned building project was situated within the predicted boundaries of the city. The trench dug by the ephorate uncovered foundations of several ancient buildings (Fig. 9), as well as pottery and artefacts from 500 B.C.

Figure 9: House foundation from the ancient city uncovered in 2003 by the local cultural heritage management in the vicinity of the village Palea Episkopi.

Regarding the peaks of both tile and pottery density around the village Agios Sostis, there are several interesting aspects. The site is situated on the top of a hill interpreted by Bérard as the acropolis of Tegea. During the field survey a high concentration of figurines were found in connection to this site, indicating a ritual use of the site. In addition, it should be noted that there is a linear structure with high pottery density from Agios Sostis towards the southeast (cfr. Fig. 8), *i. e.*, towards the ancient city. From this we hypothesised that this pottery concentration was due to an ancient road. During fieldwork in 2003, we inspected this area with respect to this hypothesis, and we discovered remnants of an ancient road in the position shown by the arrow in Fig. 8, clearly enforcing the likelihood of this interpretation. This exemplifies another encouraging aspect of our statistical models, in that the peri-urban landscape that we have investigated so far, and which has been virtually neglected in earlier discussions of Tegea, is at last making its presence felt.

CONCLUSION

This paper shows that the combination of surface field surveys and the application of spatial analyses that can be performed by GIS software give valuable results regarding historical landscapes. It also demonstrates that the variation in vegetation cover, which is a common problem when carrying out surface surveys, can be overcome by taking the varying degree of surface visibility into account.

The field survey was motivated by the question of the delimitation of an ancient *polis* of Tegea, and other known sites in the landscape, like the sanctuary dedicated to Demeter and Kore at Agios Sostis. The spatial patterns obtained from density of tile fragments give clear indications to this, and it also strongly suggests that the original delimitation of the *polis* given by Bérard (1892, 1893) is somewhat exaggerated towards the south (cf. Fig. 7). Further investigations regarding Tegea should include a re-examination of the structures that Bérard (1892; 1893) interpreted as parts of the city walls (especially the structure marked D in Fig. 2). The density patterns also give clear indications where excavations have the largest potential to discover remnants of the city wall.

The methods used have also resulted in the discovery of patterns besides the position of the *polis*. The ancient road leading towards the northwest from the *polis* was not acknowledged before the spatial analysis of pottery fragment density was performed (cf. Fig. 8). In addition, the interpretation of a site with high density of tile fragments (Figs. 4, 6) as the site of a *villa rustica* from the Roman period was strongly enforced by the analysis.

Tegea represents one of the most important centres of its time in the Peloponnese. With respect to management, the obtained results should clearly be taken into account in area planning. Areas with high concentrations of artefacts are more likely to contain archaeologically interesting structures than the remaining landscape, and therefore caution should be taken with respect to development in such sites. Furthermore, the information obtained has a potential for giving the public an increased appreciation of the cultural heritage in the area.

The mere fact that the density of artefacts is so high (more than 700 fragments/da, when pottery and tile fragments are combined) may be a surprise, and lead to an increased awareness of the scientific and recreational values of the Tegean landscape.

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REFERENCES

Alcock, S. E. (1993). *Graecia capta: the landscapes of Roman Greece*. Cambridge: Cambridge University Press.

Bérard, V. (1892). Tégée et la Tégéatide. *Bulletin de correspondance hellénique, 16*, 529-549.

Bérard, V. (1893). Tégée et la Tégéatide. *Bulletin de correspondance hellénique, 17*, 1-24.

Bjune, A., Øverland, A., & Krzywinski, K. (1997). *Palynological investigations of the Athena Alea Temple in Tegea, Greece. Report from a preliminary study of a profile north of the Sanctuary*. Bergen: Botanical institute, University of Bergen.

Dugas, C., Berchmans, J., & Clemmensen, M. (1924). *Le Sanctuaire d´Aléa Athène a Tégée au IV Siècle*. Paris: P. Geuthner.

Environmental Systems Research Institute. (1996). *ArcView GIS: the geographic information system for everyone: using ArcView*. Redlands, California: Environmental Systems Research Institute.

Keckler, D. (1997). *Surfer for windows: version 6 user's guide*. Golden, Colorado: Golden Software.

Ødegård, K., Bakke, J., Risan, T., Sollund, M., & Stabbetorp, O. (in preparation). *The Norwegian Arcadia Survey 1999-2001, Some Remarks on Survey Methodology*.

Østby, E., Luce, J.-M., Nordquist, G. C., Tarditic, C., & Voyatzis, M. E. (1994). The sanctuary of Athena Alea at Tegea: First preliminary report (1990-1992). In S. I. Athen (Ed.), *Opuscula Atheniensia: annual of the Swedish Institute at Athens. 4.º, 43* (Vol. XX, pp. 89-141). Jonsered - Stockholm: Svenska Institutet i Athen.

Pausanias, & Levi, P. (1971). *Guide to Greece* (P. Levi, Trans. 2nd ed.). Harmondsworth: Penguin.

Snodgrass, A. M. (1987). *An archaeology of Greece: the present state and future scope of a discipline*. Berkeley: University of California Press.

Spyropoulos, T., & Spyropoulos, G. (2000). Αρχαια Αρκαδια.