Making the Most of Maps: Field Survey on the Island of Kythera

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Introduction

According to local belief, the island of Kythera, off the coast of the Peloponese, was depopulated seven times. One episode with particular significance was the sacking of the Venetian settlement of Agios Demitrios (Paliochora) by the Ottoman "pirate" Barbarossa in 1537 and the subsequent removal of as many as 7,000 people from the island (the current population is 3,000). Whatever the veracity of the belief in repeated depopulation, the island landscape is characterized by shifting abandonment and reuse through time. The sacking of Paliochora probably contributed to the abandonment of a large area of marginal agricultural land in the east coast hinterland, perhaps starting with a shift from cultivation to opportunistic use and grazing, and thence to the pervasive *aspalathos* (spiny, impenetrable regrowth, which today clothes large parts of the island). The Paliochora region is by no means the only abandoned area, but its history is of particular interest owing to this documented event and historical accounts that can be tested archaeologically.

The Australian Paliochora–Kythera Project (APKAS) is a project of the Sydney University Archaeological Computing Laboratory sponsored in Greece by the Australian Archaeological Institute at Athens and carried out in cooperation with members of the Ohio State University Excavations at Isthmia. APKAS aims to reconstruct the occupation history of the northern part of the island through mapping of the cultural landscape, archaeological field survey, and historical and ethnographic enquiry. The Paliochora area acts as a case study and central focus for the survey. The first preliminary field season took place in 1999 with a team of 15 people, roughly divided into fieldwalking (8), GIS/GPS (2), pottery collection and analysis (2), and historical and ethnographic research (3). We have just commenced a second preliminary field season with a team of seven, aiming to finish the more specialized aspects of the study and finalize our methodology in preparation for future seasons with a larger team of volunteers.

From the outset, APKAS has adopted GIS and GPS as an organizing framework on which to hang all data collection. Our field lab, in a disused school made available by the local community, is equipped with an Ethernet network of three Pentium laptops, one of which acts as a file and print server as well as a primary GIS machine. The other two are used primarily for data entry, GPS download, and Internet access. A Trimble ProXL GPS receiver with a 2 Mb data logger, run from a car battery to avoid downtime in case of power failure, is used as a base station for differential GPS correction. Field data from a Trimble ProXR and two Trimble GeoExplorer GPS receivers are downloaded and corrected at the end of each day. They are used to update the GIS, allowing production of updated working maps for the field team on a daily basis, feedback on survey progress, and detailed preliminary results throughout the field season. The GIS/GPS team to field team ratio has been approximately 1:5 in our preliminary seasons, but we would expect 1:10 now that the system has been established.

A team from the Institute of Archaeology, University College London, led by Cyprian Broodbank has been carrying out an extensive fieldwalking survey immediately south of our study area since 1998 (Broodbank 1999). Their project, with a team of approximately 35 people, uses more traditional transect survey based on topographic maps, gridding of the landscape, and concentrating on surface scatters of ceramics rather than landscape features. ArcView is used to plot maps of artifact density across the landscape and within intensively sampled sites. The two projects will provide an opportunity to compare the results of these two contrasting approaches.

GIS Procedures

The field area (total 60 square km) is covered by excellent and highly detailed 1:5,000 topographic maps and monochrome aerial photographs from 1967. Since much of the area is abandoned, these maps and aerials remain quite valid despite their age (more recent aerial photographs are available but are at a smaller scale, and we have therefore used the older images on which the maps are based). In our first season we made a rough assemblage of the maps and aerials in MapInfo, rectified with RasTools, and used the Trimble ProXR GPS to map our survey plots and all landscape features encountered (walls, wells, threshing floors, etc.) onto this base. This intensive approach is, of course, quite time-consuming; we will use it only for detailed study of a few areas selected as representative of different types of landscape use.

For our second field season, we created a seamless database by scanning the maps and photos at higher resolution and using ERMapper to mosaic them and export them to GeoTIFF.

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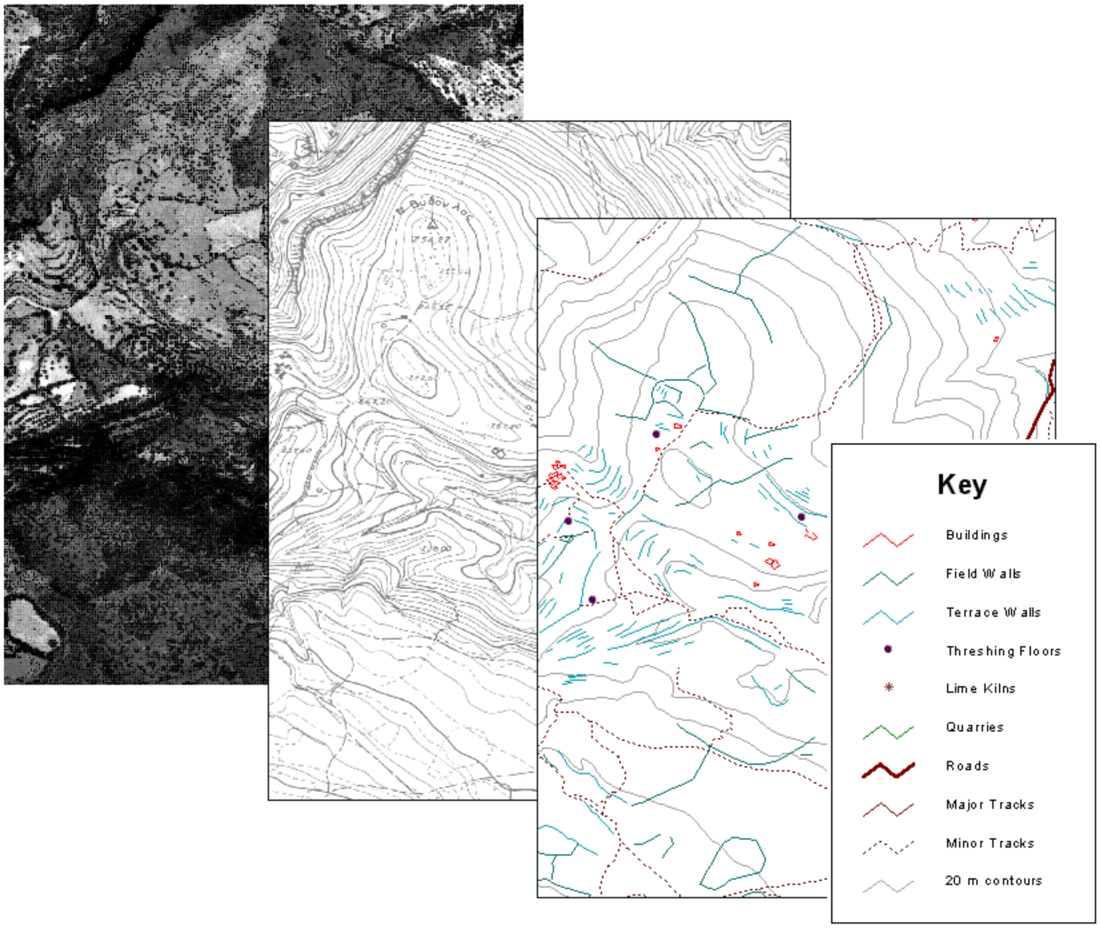
Figure 1
Aerial Photograph Mosaic (back), Topographic Map Mosaic (center), and Extracted Cultural Features and Survey Units (front)



The eight map sheets (14,000 x 9,000 pixels) were resampled to 50 percent, rotated and trimmed in a bitmap editor, then registered to geographic coordinates (latitude/longitude) by their corners. The aerials (4,500 x 4,500 pixels) were registered by selecting control points from the topographic map coverage, rectifying and mosaicking with ERMapper's mosaicking wizard.

Fieldwork in Greece is bedeviled by Greek map coordinates, which are relative to local datums and the Bessel ellipsoid (for the 1:5,000 series only!). We solved the problem by calculating a false position for our base station that aligns GPS latitude/longitude with map latitude/longitude (the differences in ellipsoid over the area of our survey is irrelevant) and achieve correspondence of approximately five meters (1 mm on the map) between GPS and map-scan location of unequivocal features (notably churches, threshing floors, and triangulation points). This accuracy exceeded our expectations of scans made from vintage paper maps. Similar techniques have been used by Richard Rothaus for the

Eastern Korinthia Archaeological Survey (personal communication). While we have achieved visually satisfactory matching of air photographs in the mosaic, our study area is a zone of high relief, and the offset between the actual (map/GPS) position of features and their position in the air photomosaic can be as high as 25 m. At present, this precludes direct overlay of the topographic map and air photographs for plotting of survey units, many of which fall in the 10–20-m size range. We hope to be able to reduce these errors through orthorectification before our next field season, allowing us to work with the aerial photomosaic as our primary map base. This will permit rapid and accurate delineation of survey units directly from the map base; the topographic maps do not provide sufficient detail for this, particularly in areas where features such as terrace walls are overgrown (it is also noticeable that the reliability of representation of features on the map—even those clearly visible on the aerial photos—drops off as one moves away from the modern villages).

We have also created a digital elevation model for the survey area by digitization of 20 m contours and interpolation in Vertical Mapper. Owing to the highly dissected topography, this very coarse DEM is quite adequate for creating general three-dimensional views of the survey area draped with the aerial photomosaic, topographic map coverage, geology, or survey results. However, a more detailed version will be required for analysis of site locations relative to local topography. We are building this more detailed DEM using ProVec for semiautomated contour vectorization.

Field Survey

Our survey area is intensively subdivided by stone field and terrace boundary walls, and our field survey is based on these divisions of the landscape (our plots are subdivided when they are large or the characteristics of the landscape change within such a boundary, but this is uncommon). The scanned and registered topographic map coverage shows many of these walls along with buildings, animal pens, wells, threshing floors, lime kilns, and other features of the cultural landscape.

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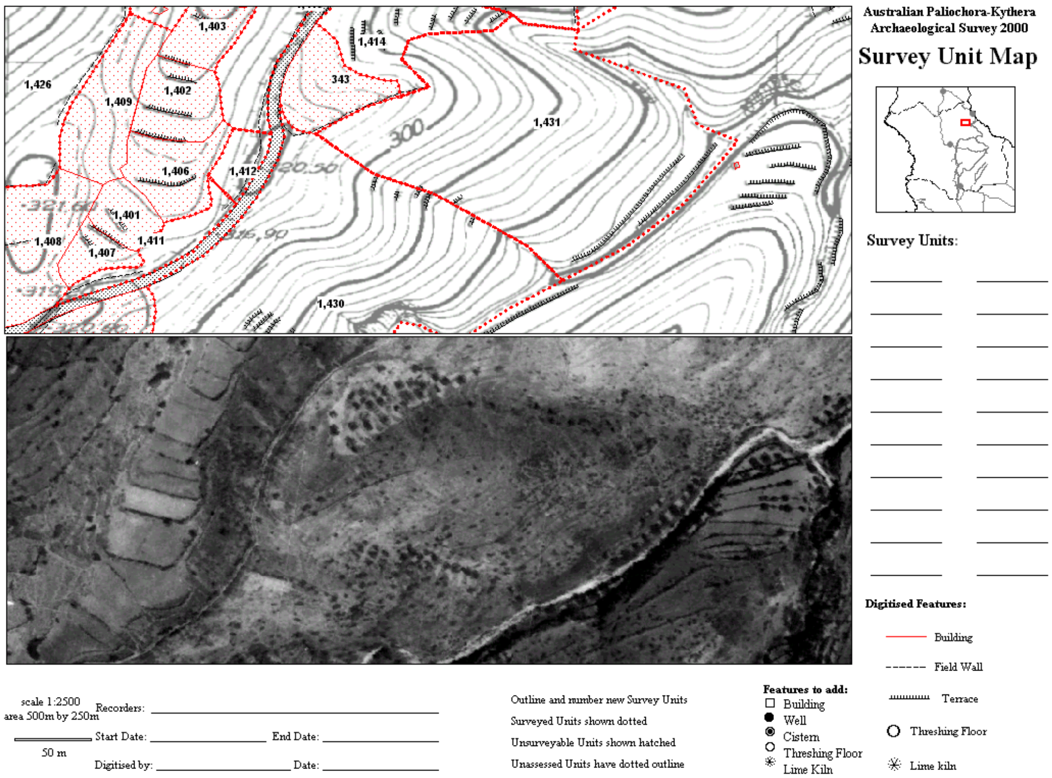
Figure 2
Survey Unit Field Map. Hatched units have zero ground visibility, stippled units have been walked, open outlines await recording.



The topographic map coverage is used as a base for digitization allowing us to generate A4 (11.7" x 8.25") field maps (Figure 2) on demand for any area, showing vector features overlaid on the topographic map base accompanied by the aerial photograph of the area. These maps are used in the field to delimit survey plots that are described on accompanying *pro forma* record sheets (Figure 3a).

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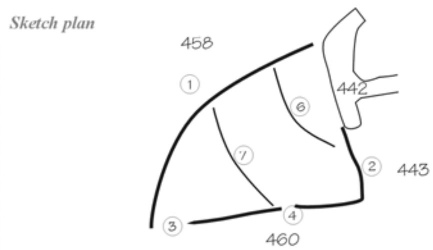
Figure 3a
Field Survey Record Sheet

Survey Unit Date: 27APR99 Recorders: AJW, IJ **Unit #** 459

Survey Zone (e.g. North of Paliochora): Aroniadika GPS: Boundary [✓] Features [✓]

Sketch plan



Nature of delimitation e.g. hillside, field boundaries, terrace group, vegetation	Field defined by walls between road & church
Landscape position	Plateau | ridgetop | hillside | lower slope | valley bottom
Slope (of landscape)	0% 2% 5% 10% 20% 30% >=40%
Vegetation type	Cultivated | Heath | Scrub | Grass/meadow | Weeds | Pine/Eucalypt | None
Dominant vegetation height	none | <=ankle | <=knee high | <=waist high | <=head high | >head high
Surface visibility %	0 5 10 25 50 75 90 100%
Surface/soil characteristics	soil | rocky soil | rock with soil patches | gravel lag | scree | graded | Unknown
Visual background (noise)	Low | Med | High | V High | Unknown
Dominant current use (circle one or more)	cultivation | grazing | olive | vine | other fruit trees | habitation | industry | institutional | transport | abandoned | not in obvious use
Olives (specific location)	none | rows along terrace wall | rows along terrace | rows along slope/flat | individual/ scattered Count: ____

Unit Notes [✓] **Other plans:** Aroniadika 459/460; AK, 28APR99

Character of unit *Historical interpretation* *Current use (details)*	A number of rocky outcrops but unit is predominantly rocky soil

Ground Survey Groundwalkers: AK, CC, GMS, CR

Date: 28APR99 Start time: 1:40 End time: 1:45 People x time = 20 min Spacing: 4 m

	bod	ftr				
Roof tile	4		Roof slate/schist	3	Building materials	
Pithoi	0		Slag		Vehicles	
Undecorated	15	3	Lithics		Machinery	
Slip	3	1	Glass		Manufactured items	1
Glazed			Grinding stones		Recent dump	
China						

Artefact Notes

Character of scatter *Dating/period* *Specific types* *Further study?*	Manufactured item: plastic bottle

APKAS: Australian Paliochora-Kythera Archaeological Survey 1999 *Data Digitised by:* CR

AJW/IJ 25/4/99 *Date:* 28APR99

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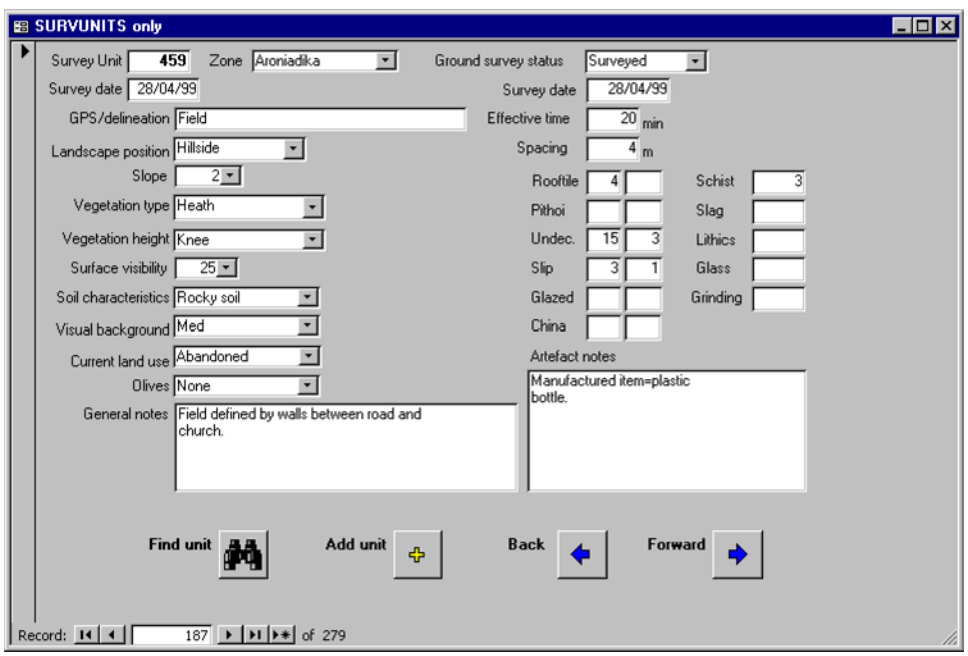
The fieldwalking team covers each survey plot at a regular spacing (nominally five meters) and counts all archaeological material observed, as well as recording ground surface visibility, modern debris, structures, and other characteristics of the landscape. To avoid collection of large amounts of material with attendant analysis and storage problems, we use a system devised by Professor Timothy Gregory (Ohio State University) for the Eastern Korinthia Archaeological Survey. Each fieldwalker collects one example of each type of archaeological material encountered in each survey unit. So, for example, if the fieldwalker encounters three ceramic sherds with different fabric, glaze, shape, or thickness they will collect all three, but if they encounter 30 sherds that are similar, they will only collect one.

As each unit is completed, the collected material is analyzed on the spot by a ceramic specialist to identify and record the chronotypes (i.e., sherds and other objects representative of datable periods) and range of forms and fabrics present in the unit, and most of the material is then returned to the unit. Only a very small sample of material is retained such as objects that are especially diagnostic, which require further identification, or are particularly unusual. This tells us about the distribution of activities on the landscape from different historical periods without the necessity for comprehensive collection.

Figure 3b
Survey Database Form



At the end of each day, survey plot and feature descriptions, including counts of material observed and descriptions of material collected, are entered in a Microsoft Access database joined to the GIS (Figure 3b). The developing picture of the archaeological landscape is used to direct further survey. While we are still at the preliminary stage of

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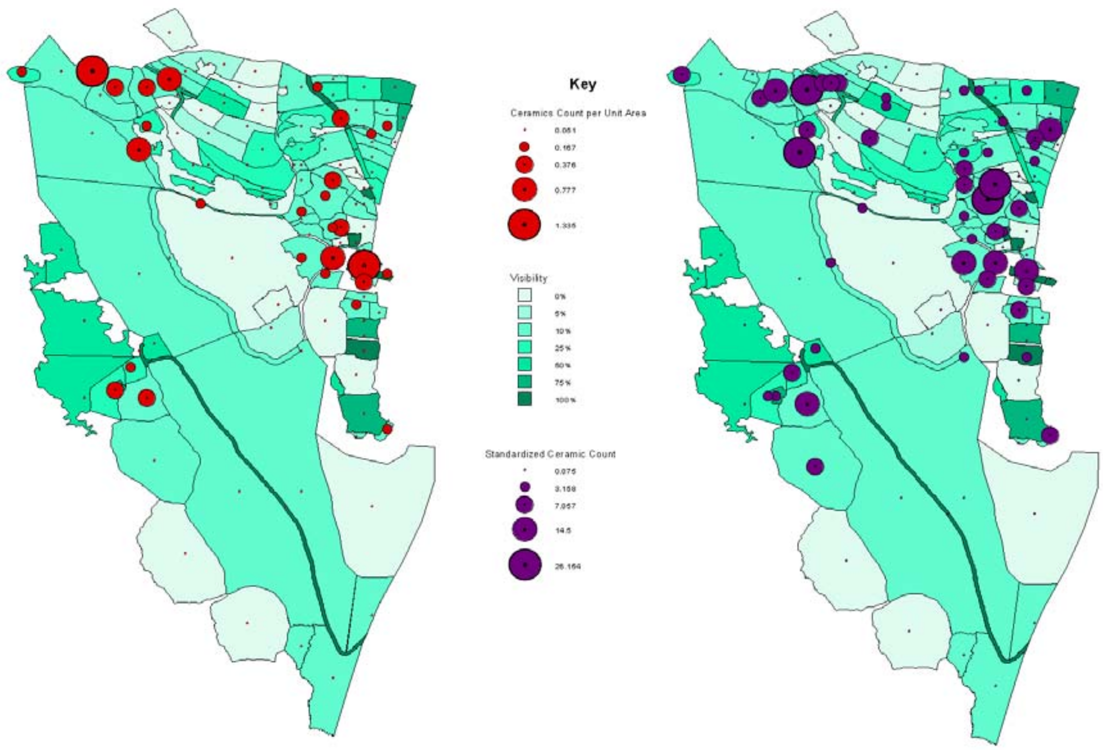
survey and have not therefore put much effort into developing overall analyses of the data, we have developed a few simple analytical plots to assist with exploration of the data collected. Figure 4 shows the effect of standardizing raw pottery counts by survey time and surface visibility to provide a better picture of relative pottery density. We prefer standardization by survey time rather than survey unit area, as it tends to compensate for the degree of enthusiasm or lassitude of the survey team, whether occasioned by weather, the aggressiveness of the vegetation, or the previous night's excesses. The details of our argument are beyond the scope of this report.

Figure 4
Field system west of Aroniadika village. Pottery Counts by Area (left) and Standardized by Surface Visibility and Survey Time (right).



Churches and Population Records

Our survey area contains a large number of churches (more than one church per square kilometers) scattered throughout the landscape, dating back as far as the 6th century. Churches not associated with a modern village may indicate abandoned settlements or powerful private estates. Timothy Gregory is recording descriptive information for all churches in the survey area and entering it into the database, allowing us to map their distribution at any selected period.

Census records from the Venetian period list individuals by age, family affiliations, and parish. Students at Ohio State University have entered all 18th century Venetian census records for our area (more than 21,000) into the database. Through his study of the churches, Professor Gregory has been able to identify the location of all the parish churches used in these records (24), allowing us to reconstruct the population distribution and changes of distribution through the 18th century. We are aiming to extend this baseline to earlier less comprehensive census records to get a better handle on population distribution changes since the sacking of Paliochora.

Oral History

Interviews with local residents, many of them elderly, have been carried out by Lita Diacopoulos, a Kytherian member of the project team. These interviews have generated a great deal of anecdotal information on the spatial use of the landscape; the processes of abandonment and reuse of the landscape; and the affiliations between villages, churches, and people. These records help us to place our archaeological work in context without, however, providing us with an analogy for the past. The information has been entered in a database but not yet integrated with the main project database.

Conclusion

Although we have only just started the project, adoption of a GIS database approach as an integral part of APKAS has paid substantial dividends in data organization, production of working documents for field use, and rapid production of preliminary results at the end of our field season. The adoption of GIS has certainly necessitated a significant investment of time and expertise and the availability of substantial equipment from the Archaeological Computing Laboratory. While this level of equipment and expertise may not be available to all projects, obtaining these facilities should be a high priority for any substantial field project.

It is worth noting that the availability of GIS has influenced not only our procedures but our whole approach to the survey. The ability to easily capture and manipulate map data and associated attributes has encouraged us to take a flexible map-based approach. As a result, we can make greater use of existing resources (topographic maps and aerial photographs), and we record cultural features and data within culturally defined survey plots (requiring mapping and mathematical standardization) rather than using a more conventional grid-based approach that would, of course, yield more directly comparable data values.

As the project progresses, the integrated database generated from our fieldwork will form an integral part of the results of the project (most probably accessible across the Internet), allowing scholars to reassess our results, compare them with other surveys, or carry the analysis further. We hope that it will form a model for detailed archaeological landscape analysis through GIS.

Acknowledgements

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