

**Creating a Computerized Archaeological Map**  
**Through the Use of Geographic Information Systems**

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A national funded campaign has been carried out on the island of Amorgos, in Aegean Sea, as a pilot project for the application of different remote sensing techniques and the integration of them in a Geographic Information System that could be used as a tool for the management of the archaeological sites.

The micro-range module of the project included the systematic surface survey and geophysical prospection in two remote areas: a coastal Roman site and a hilly site dated to the Early Cycladic period. Both magnetic and soil resistance techniques were able to detect architectural remains of the Roman site, most of which are either covered completely by alluvium deposits, or are submerged within the sea due to the past seismic activity. Magnetic survey was also conducted at the Early Cycladic site in an effort to locate the boundaries of it and recognise residues of past habitation (shelters, tombs, etc.).

The geophysical grids were successfully registered to the aerial photographs of the wider region. Changes in land use strategies and soil erosion processes have been studied through aerial imagery belonging to different eras. Digitization of the topographic map produced the DEM of the wider region upon which the aerial and geophysical data were superimposed. Two Landsat TM images were combined to produce the satellite mosaic of the island. The DEM of the whole island became the base level upon which different records of information (satellite imagery, mosaic of aerial photographs, geological categories, etc) were draped. Modelling of the diachronic settlement of the island was

achieved by supervised classification and other statistical techniques. The final product consists of an interactive Geographic Information System which can produce a number of 2-D & 3-D thematic archaeological maps.

Issues arising from the manipulation of data belonging to different scales, the registration of images and maps to a common co-ordinate system, the restriction of the archaeological information to the published data, and other parameters related to the construction of an archaeological G.I.S. will be analysed with respect to the final goals and expected results.

The establishment of an archaeological G.I.S. dealing with the management of the archaeological sites and monuments in Mediterranean landscape requires a careful and systematic work. The availability of the cultural and environmental data is crucial in the success of such a task. Still, the underlying importance of an archaeological GIS should be stressed due to the rapidly changing environment and the development pressures on the cultural resources.

### ***Introduction***

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Micro-scale investigations through the use of geophysical prospection techniques were carried out in the north of the island, NW of the Katapola. The targets of the geophysical campaign were a coastal site, consisting of Roman/Byzantine architectural remains (Kat' Akrotiri), and a hilly settlement dated to the Early Cycladic period (Madres of Roussos). The magnetic and soil resistivity surveys were conducted in order to locate and map remnants of architectural remains. The different nature and type of the potential geophysical targets as well as the variation of their geomorphologic context imposed specific problems in the survey strategies and processing of data. The geophysical data were correlated to the results of a systematic surface survey, in order to investigate the habitation trends within the sites.

The second module of the research dealt with the macro-scale management of the archaeological sites of the island. Aerial and satellite imagery was employed to capture the geomorphologic characteristics of the island and provide the geographic context for the accurate registration of the known archaeological sites. The

digitization of topographic maps provided useful information on the altitude, slope, and aspect of the archaeological sites and became the base for the production of 2-D & 3-D thematic maps of archaeological interest.

### **Methodology & Results**

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The site of Kat' Akrotiri was surveyed by magnetic and soil resistance (Twin probe) techniques with a 1m sampling interval. The proximity of the coast to the geophysical grids influenced the resistivity readings in the direction of the sea. Shaded relief maps and directional filtering emphasized the existence of linear features, which could be correlated to the existence of coastal architectural remains. The calculation of the residuals and downward continuation reduction of the vertical magnetic gradient was used for the further enhancement of the above anomalies. Finally, traces of small wavelength anomalies are projecting away from a modern church. Together with the existence of an ancient column (*in situ*), the above features could suggest that the church is built on the top of an ancient building.

Madres of Roussos was mainly surveyed with high resolution (0.5m) magnetic techniques. Resistivity measurements were taken at specific areas of interest. The site has been leveled in order to be used for cultivation and a large pile of stones (a lot of which were probably used as the building material for the ancient structures or shelters) has been formed at the centre of the region of interest. Magnetic data were subjected to intensive processing, including edge enhancement techniques, calculation of the residuals, and downward continuation filtering. The above manipulation, together with the superposition of the surface anomalies and the results of the surface surveying, indicated a few potential targets of archaeological interest.

The aerial mosaic of the region, created by 4 aerial images of 1983 and 1988 (1:8.000 & 1:30.000 respectively), provided a general overview of the region. The photo-interpretation of aerial photos of different seasons (1945, 1983, 1988) verified the changes of the landform that have been performed in the recent years. These changes have also been accelerated by the tectonic activity of the area. Digitization of the topographic maps produced the digital elevation model of the whole island. Two Landsat TM images were used for producing

the satellite mosaic of the island. Of the two available images, only one of them (covering the lower part of the island) was cloud free, providing satisfactory visibility of the area. Convolution of the raw data with the binary form of the DEM was effective in isolating the mainland of the island. Geometric correction of the different spectral bands of the satellite imagery, as well as the archaeological data, to the Transverse Mercator System was based on the rectification of the images using the affine transformation. True color and pseudocolor maps were produced by the combination of different spectral bands. Both aerial and Landsat imagery was superimposed on the DEM providing a 3D representation of the island.

The digitized archaeological and geological data were correlated to the satellite images in an effort to recognize the spectral signatures of the archaeological sites. Supervised classification techniques have been applied to identify areas of specific archaeological interest. A number of thematic maps were produced, regarding the archaeological sites of different era and "risk" areas of similar interest.

## **Results**

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Indications of architectural remnants have been provided by geophysical techniques. Natural and anthropogenic changes of the landform impose specific limitations in the survey of archaeological sites and the interpretation of geophysical anomalies.

The superposition of aerial and geophysical data is problematic when dealing with the survey of small archaeological sites. The importance of aerial photography can be stressed in areas containing a number of surface remnants. The spectral signature of archaeological sites can be confidently recognized only when dealing with sufficiently large areas with similar environmental characteristics. The variability of the environmental parameters on the one hand and the limited availability of archaeological information on the other, imposed certain restrictions on the modelling of the settlement patterns of the island. Supervised classification of the spectral signatures of archaeological sites has been relatively satisfactory in the correct registration of the known archaeological sites (taking into account the degree of accuracy of the location of the sites, due to the absence of GPS data). Still, the corresponding thematic maps have probably

overestimated the areas of archaeological interest. At the same time, the accelerated environmental and cultural pressures indicate the need for an archaeological G.I.S. that can be continuously refined and used as a tool in the development process of the island.

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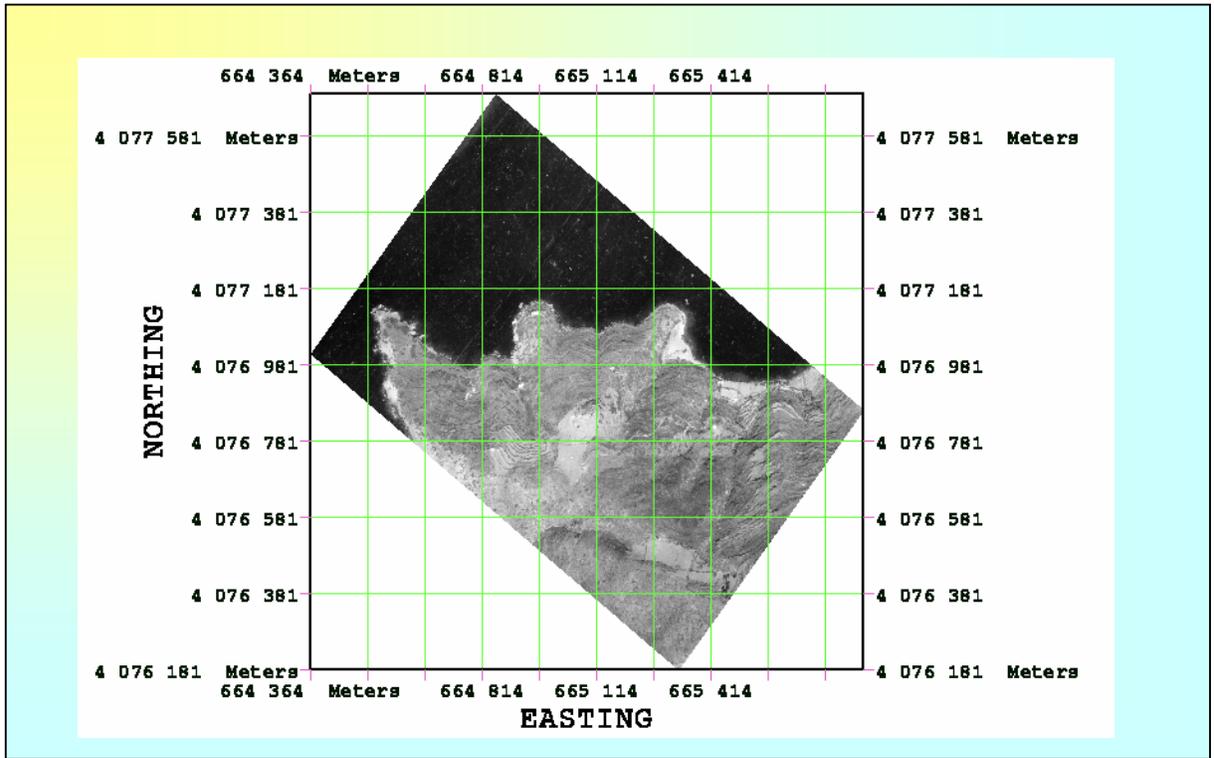
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**SURFACE SURVEY - CONCENTRATION OF SHERDS (KAT'AKROTIRI, AMORGOS)**

