

# A Geophysical Campaign at the Neolithic Settlement of Kandou - Kouphovounos (Cyprus).

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The geophysical mapping of the Neolithic Settlement of Kandou-Kouphovounos, in Cyprus, was conducted as part of the continuing archaeological research program in the specific area. The goals of the project included the mapping of the shallow depth architectural remains of the site in order to assess the limits of the settlement and plan the future excavations of the site. Magnetic surveying was successfully applied, together with soil resistivity prospecting. Both techniques resulted to a number of features that have been correlated to the existence of architectural features. The electromagnetic survey (EM38) encountered various problems related to the balancing of the instrument due to the extreme high temperatures, the high resistivity of the shallow bedrock and the lack of contact with the surface due to the dense vegetation islets and bedrock outcrops that were scattered in the area. The magnetic susceptibility maps, covering an area with existing architectural relics, resulted to a detail mapping of their inner details, in close correlation to the other techniques.

Subsequent excavations in the following year revealed a number of architectural features which were located by the use of geophysical prospection techniques. The geophysical maps indicate that the site extends in the north, south and west directions with no evidence of a surrounding defensive structure. Further geophysical work is planned to map the relics on the slope of the hill. The final product will consist of the superposition of the excavated regions on the geophysical maps to provide a tool for the management and preservation of the site and its environmental settings.

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## **Introduction**

A joint team of the Institute of Mediterranean Studies, the Technical University of Crete and the University of Indiana conducted a geophysical survey at the Neolithic settlement of Kandou - Kouphovounos, in Cyprus. The past few years, systematic excavations by the Archaeology Department of the University of Athens have revealed various architectural residues, such as rectangular residential units, pits, fire hearths, graves, and lithic tools. Most of the architectural features were lying on the top of the bedrock, 0.2-0.5m below the ground surface. A few test excavations in the southern part of the hill, where the settlement is spread, did not produce any finds, raising questions about the limits of the site.

Geophysical techniques were employed for dealing with problems

related to the layout of the residential units and the limits of the settlement. The grids covered a total area of 3.800m<sup>2</sup>, towards the south side of the hill. A small region to the north was also surveyed to verify the existence of architectural remains. Magnetic (vertical magnetic gradient), soil resistance (twin probe), and electromagnetic (EM38) techniques were used for prospecting the above areas. In addition, measurements of the surface magnetic susceptibility were obtained in a small region, in order to correlate them with the corresponding results of the magnetic and EM surveys. Sampling was performed at 0.5m and 1m step interval for the magnetic/electromagnetic survey and resistivity survey correspondingly. A 1m Twin probe configuration was used in the resistivity prospection of the site.

## **Discussion of Results**

The results of the geophysical survey were characterized by a general uniform trend, with the exception of a number of extreme values due to the existence of metal poles at the edges of the 20x20m archaeological grids, which were set up during the topographic survey of the region. The presence of metal fragments, bushes and outcrops of the bedrock were responsible for numerous extreme values that masked specific areas in their vicinity. Despiking techniques and bandpass filtering in the spatial domain removed the most intensive anomalies that were caused by non-archaeological features. The close registration of the geophysical maps to the records of the surface anomalies was valuable in the recognition and

removal of these anomalies, without any loss of information. Magnetic data were most satisfactory in detecting the presence of architectural features in the W and SW sides of the hill, close to the excavation trenches (B & E). Both magnetic and electromagnetic data revealed a constellation of architectural features in the northern part of the hill, approximately 30-40m away from trench A. The presence of these candidate targets was confirmed by the superposition of the soil resistance anomalies. A number of linear features in the south portion of the prospected area are probably related to variations of the bedrock's anaglyph, which could be considered as constituting a natural defensive border for the settlement to the south.

Evidence of intensive soil corrosion to the south enforces the supposition that the settlement was mainly expanded in the northern part of the hill.

In contrast, the north section of the hill appears to be more promising in relation to the existence of architectural remains. A specific region was surveyed by all methods, in order to be used as a guide in the

### **Conclusions**

The employment of geophysical prospection techniques in the surveying of Neolithic sites needs special attention, especially when dealing with a dry environment (weak signal registration), intensive soil corrosion phenomena (lack of signal distinction) and unfavorable preservation conditions. In Kantou-Kouphouvounos, the recognition of the geophysical signatures (depending on the method used) met a number of

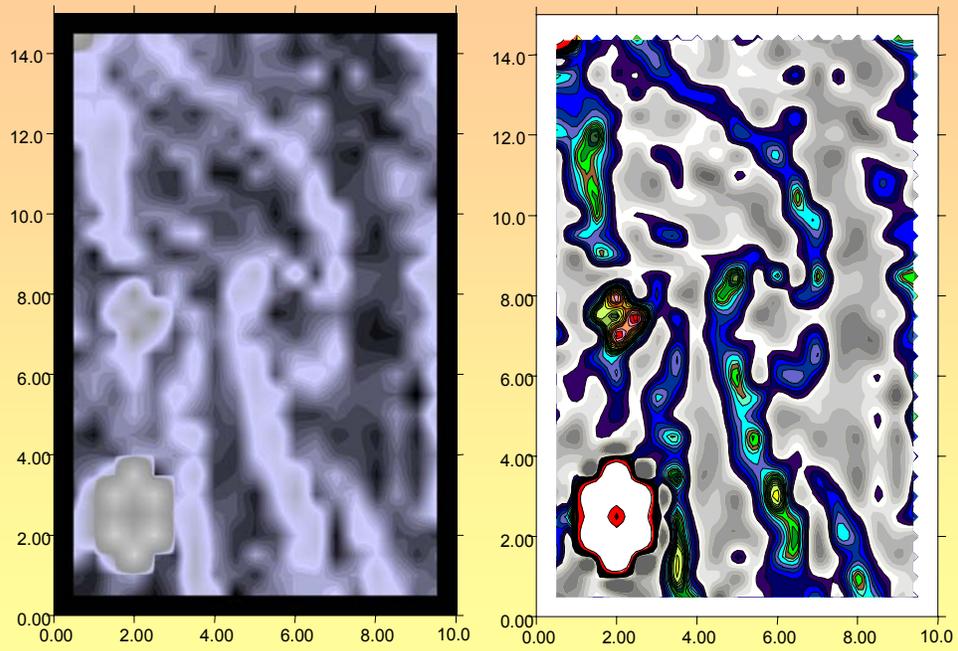
interpretation process. The internal details of architectural remains are evident in all data sets. Soil resistivity was especially successful in outlining differences that were caused by the existence of wall structures and/or corridors. Similar results were produced by the electromagnetic survey, contrary to the corresponding ones in the southern portion of the site.

difficulties due to the rough geomorphology, the frequency of thick vegetation, the outcrops of the bedrock, the lack of sufficient thickness of soil, and the size and nature of the potential targets (some of which were even engraved into the bedrock). The parallel prospection of the site by different techniques and intensive filtering of the data were critical in the enhancement of the features and the interpretation of them.

### **References**

- E. Mantzourani**, "Εκθεση Αποτελεσμάτων της Ανασκαφής στην Θέση Καντού-Κουφόβουνος", *Επιστημονική Επετηρίδα του Τμήματος Αρχαιοτήτων Κύπρου*, 1994.
- A. Sarris**, "Geophysical Surveying in Greek Archaeological Research: Retrospect & Future Plans", *Proceedings of the International Symposium on "Science & Archaeology: A Multidisciplinary Approach to Studying the Past"*, Harvard University, Boston, U.S.A., 14-16 October 1994 (*in press*, 1998).
- A. Sarris**, " Geophysical Issues in Archaeological Research: Paradigms, Uncertainties & Inferencies", *Symposium on Remote Sensing in Archaeology*, Boston , U.S.A., 16-19 April 1998.

EM38 SOIL CONDUCTIVITY



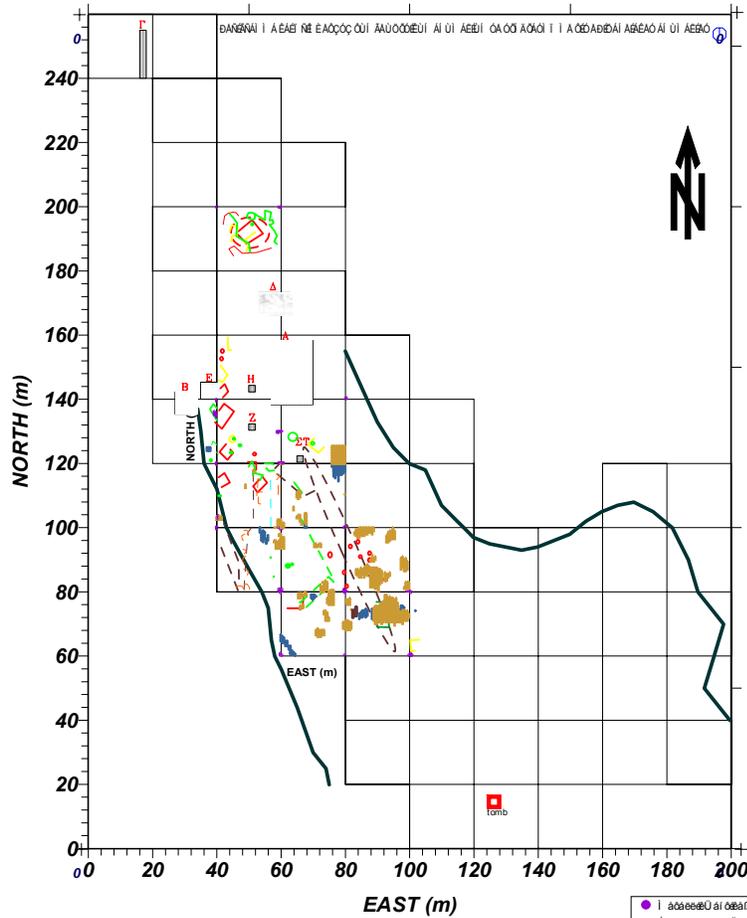


*Details of the Magnetic Survey*



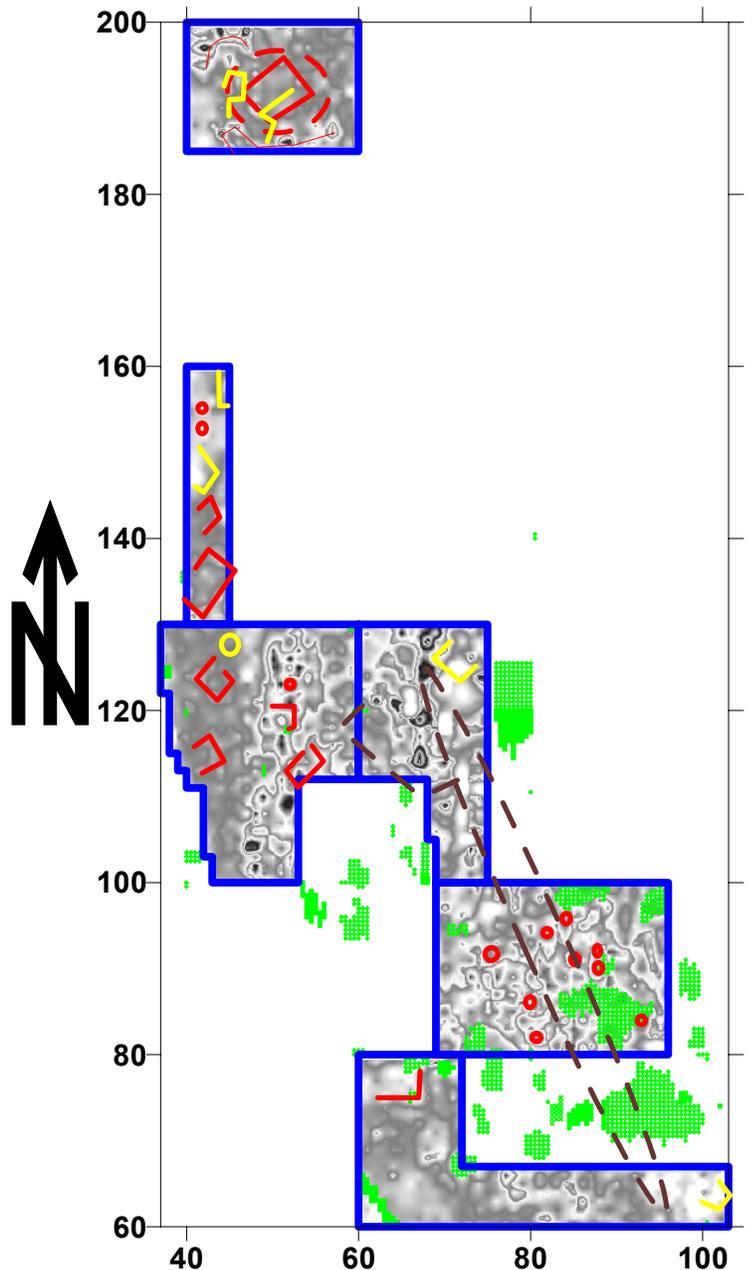
*Details of the Electromagnetic Survey*

ΕΚΤΕΛΕΣΗ ΤΩΝ ΕΡΓΩΝ ΑΝΑΚΑΤΑΣΤΑΣΗΣ ΤΗΣ ΟΔΟΥ ΕΛΛΗΝΙΚΗΣ ΣΤΗΝ ΑΡΧΑΙΑ ΑΓΙΑ ΣΟΦΙΑ, 1996  
 Η ΟΔΟΣ ΤΩΝ ΑΡΧΑΙΩΝ ΟΔΩΝ - ΠΛΑΤΕΙΑ ΑΝΑΚΑΤΑΣΤΑΣΗΣ ΤΗΣ ΟΔΟΥ



- Τείχος/στάση
- ▲ Ερείκη/στάση - αετωτικό
- ◆ Ανεπίσημο γαστρονόμιο
- Αίθουσα





**SOIL RESISTANCE DATA & PROBABLE SUBSURFACE TARGETS**

GEOPHYSICAL PROSPECTION PROGRAMME: KANTOU - KOUFOVOUNOS (PHASE I, 1996)  
INSTITUTE OF MEDITERRANEAN STUDIES (FORTH) - UNIVERSITY OF ATHENS

