Report on the Geophysical survey undertaken at Kouphovouno between 28th June and 2nd July.

Introduction:
A team comprising of two undergraduate students (Anna Moles & James Taylor) and two postgraduates (Jackie Whalen & Margarita Lianou) undertook one week of work on the Neolithic and Roman site of Kouphovouno, Sparta (Fig. 1). The Geophysical survey was undertaken by Dr Michael Boyd (report enclosed). The Ephor, Mrs Vassilogamvrou, was very welcoming and she had had the fenced area cleared of vegetation to facilitate the work. We are very grateful for her support.
We were fortunate that several nights of rain made it possible to undertake more focused work than is normally possible for the height of summer in Greece and so the results are particularly telling.

Summary of Results:
It is clear that both archaeological and non-archaeological features lie below the ground surface. The presence of the olive trees (and probably tree-pits see Figs 2 & 11) may have created some non-archaeological anomalies in the resistivity results and the metal survey pegs from the Neolithic excavations created non-archaeological anomalies in the magnetometer survey.

Possible archaeological features:
The magnetometer survey revealed an anomaly (18 x 13 m) so strongly magnetic to the west of area G (see plan) that it may represent a kiln, oven or furnace (Fig. 8). Other circular features may also represent the same kind of activity on the site. Some of the linear features may represent ancient features and they correspond with some of the resistivity results (Fig. 8 & 9).
The resistivity survey revealed N-S linear features on the east side which may be interpreted as terracing or roads (Fig 11).
Two possible collapsed architectural features were located in the north central part and the south central part of the survey area. The northern one is oriented NE-SW and may be collapsed architecture. The southern one appears to represent a square (c. 7 x 7m) architectural feature. The results of the magnetometer survey concur with these anomalies (Fig. 11).

Future work:
At this point in time the results are not as clear cut as we would have liked although we have certainly had the best results we can get from the Geophysical survey. If the project is to continue I would not plan on a large scale excavation right away but three targeted test trenches would be prudent in the areas marked on the plan.

Acknowledgments:
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Brief report on geophysical investigations at Koufovouno, Sparta, 28 June to 1 July 2010

Michael Boyd

Resistance and magnetometer surveys were carried out at the Neolithic and Roman site of Koufovouno near Sparta for four days in June and July 2010. The aim of the survey, building on previous surveys by Neil Brodie and by this author, was to investigate the area immediately west of the recent excavations of Neolithic layers, where test trenches had indicated the possibility of Roman habitation of the area.

The whole area was first surveyed using a Geoscan RM-15 resistance meter with standard survey settings (1m sample interval in six 20m grids covering 2,400m², with mobile probes 50cm apart, ideal for remains 50-100cm below the ground). Survey grids were oriented at 356° on their short north-south axis. No surveying equipment was available to record the exact position of the grid in relation to the previous excavation grid, but the southwest, southeast and northwest pegs were left in place for future reference. Because of the extreme dryness of the surface, readings had to be taken manually after checking for good contact. Light rain allowed for better working conditions on the following day, and it was decided to survey almost all of this area (2,284m²) again at 50cm sample resolution. With samples thus at four times standard density, this offered the possibility of better defining the features in the data, as well as discerning between the rather slight features that might be expected with Roman rural architecture. Meanwhile a similarly large area (2,113m²) was surveyed with the magnetometer at 50cm sample resolution. Because the area has recently been fenced, the magnetometer survey could not approach as close to the fenced boundary as the resistivity survey.

Features of archaeological and non-archaeological origin are present in the survey results. In the magnetometer data both strong and weak features are present. Certain of the strong features are owed to surface metal (mainly earlier excavation pegs that could not be removed). These are marked on the interpretation. Other strong features (+/- 30nT to 60nT) do not seem to result from surface factors. Most apparent is an area of about 18m x 13m to the west of trench G, where the disturbance appears it would continue south of the magnetometer survey area (see arrow on Fig. ). The disturbance is strongest in the southwest corner of this rectangular area, where measurements exceed 100nT. This is exceedingly strong and the suspicion must be that metal must be responsible; however, the feature does not exhibit the standard appearance of an iron spike (as the adjacent trench spikes do); but instead appears to form a well-defined rectangular area 6m x 3.5m. If architectural it is conceivable it could be a kiln, oven or furnace; or just possibly a concentration of magnetic architectural material close to the surface (brick, tile or burned mud brick). Another
strong magnetic feature is located at the northwest corner of the survey area, where a linear feature can be detected over 16m, joining with an amorphous magnetic feature at its eastern end (see arrow on Fig.). Other strong magnetic features are roughly circular in shape, and if not due to buried iron, may be burned or furnace features. Roughly in the centre of the magnetic survey, a series of weak linear features running at about 50° with others perpendicular are not aligned with the axis of cultivation and may therefore represent ancient anthropogenic features. These coincide with some of the resistance features described below and may relate to buried architecture.

The eastern side of the resistance survey is dominated by weak north-south features apparent for the entire width of the survey area. If unrelated to the recent excavations, these might be terracing features, or possibly pathways/roads. Two main areas of resistance anomalies are apparent. In the north-central part of the survey a large area (maximum 33m x 18m) is dominated by raised resistance readings ca 50-60Ω against a background of ca 35-50Ω. The main orientation is northeast-southwest (50°) (see arrow on Fig.). Major and minor magnetic linear features in this area also agree with this orientation. It is impossible to discern any clear ground plan in the resistance readings here but it is possible that these raised readings are caused by collapsed architectural features. The second main resistance area is immediately to the south, in the south-central zone of the survey. Here the strongest feature (up to 60Ω) is formed of a wide north-south anomaly (10m long and 3m wide) with an attached rectangular area to the east making a squared feature 7m x 7m (see arrow on Fig.). This feature could be architectural and the apparently very wide walls might be a result of the collapse of the feature. This feature coincides with the very strong magnetic feature described above and could be a built furnace or kiln feature. It is also conceivable that a strong brick foundation might cause this sort of anomaly. To the north of this feature is a broad area of raised readings similar to that described further north, measuring 20m x 7m. Within this on the west side a dogleg feature can be recognised running at approximately 25° – 125° – 40°, and just to the east a north-south feature is on the same line as the west wall of the strong square feature to the south. Either of these features could be architectural. Throughout the resistance data circular high resistance features are caused by the presence of olives which dehydrate the ground immediately surrounding themselves.

Overall, although no features can easily be interpreted as offering a clear architectural plan, the combination of the weak magnetic anomalies with the resistance data in the centre of the survey area suggests constructions in the vicinity. Furthermore, the strongest magnetic and resistance anomalies coincide to suggest a possible built feature. The recognition of Roman architectural layers in parts of the excavations make these interpretations more plausible.
Fig 1. Topographic Plan showing location of site and geophysics

Fig 2. Area of possible tree pits in West of fenced area (from south)
Fig. 3 Kouphovouno Plan Location of possible trial trench (2 x 5m) in the west of the site for 2012 (Marked by blue rectangle (after Cavanagh, Mee & Renard)

Fig. 4 Location of possible trial trenches (2 x 5m) in the east of the site for 2012 (Marked by blue rectangles)
Fig. 5 Image of location of anomalies and possible trial trenches in east (southern section) of site

Fig. 6 Image of location of anomalies and possible trial trench in east (northern section) of site
Fig. 7 Image of location of anomalies and possible trial trench in west of site

Fig. 8 Magnetometry results with features outlines in red. Arrows locate the features discussed above.
Fig. 9 Magnetometry results overlaid on resistivity results with features outlines in red.

Fig. 10 Magnetometry results and location of Neolithic trenches
Fig. 11 Resistivity Results including image with outline features in red. Arrows locate the features discussed above. Note location of trenches E & F.