Agios Nikolaos

Archaeological Background

The magoula at Agios Nikolaos is located near the modern village of Kanalia, Greece. Identifying the magoula and settlement for this survey was very difficult due to several factors. The magoula itself is covered by a small pine grove and a recently restored byzantine church. Despite these modern disturbances there are indications that suggest that this site was first inhabited during the Late Neolithic Period.

Satellite Remote Sensing and Historical Aerial Photography Survey

A GeoEye-1 image from 4 May 2010 was used for satellite remote sensing at Agios Nikolaos Kanalia (Figure 1). The satellite image has an off-nadir angle of 14.0°, a ground sampling distance (GSD) of 0.50 m (panchromatic) and a 1.91 m (multispectral). In addition to the satellite imagery, an aerial photograph from 24 May 1982 with a scale of 1:30,000 was used for remote sensing (Figure 2).

Agios Nikolaos Kanalia is situated within relatively flat agricultural land. The site is surrounded on the north, east and south by the foothills of Mt. Pelion. The artificial Kanalia reservoir borders the western side. Various streams and irrigation channels pocket the terrain. There are few modern constructions apart from a scattering of farm installations. Olive tree and/or citrus tree cultivation predominates the landscape, although other low standing crops are prevalent. The other Neolithic site in the region, Kanalia 2, is approximately 1.5 km to the south. Elevation in this area range from 50–80 mean average sea level (masl) in the agricultural region. The Neolithic site is found within the complex of Agios Nikolaos church and a grove of olive trees. Land use does not appear to have changed much since the 1982 aerial photograph.

In the remote sensing data, there appears to be many surface anomalies in a 1 km radius around Agios Nikolaos Kanalia (Figures 3–4). Many of these are hydrological features from former stream beds and/or seasonal flooding (blue). However, a number of other features could be of archaeological interest (yellow). The magoula has a clearly defined circular form that is approximately 215 m in diameter (Figure 5). The church and crossroads fall within the magoula's center. The exterior limits of the circular form are easily visible in the red-greenblue (RGB) pansharp images due to tree growth, modern field boundaries and vegetation stress (particularly at the northeast). Viewed with spectral filters such as normalized difference vegetation index (NDVI), infrared over red (IR/R) and principle component analysis (PCA), the features of the magoula are even more apparent (see Figures 3 and 5). In this case, remote sensing provides fairly clear evidence for the boundaries of Agios Nikolaos Kanalia.



Figure 1. Agios Nikolaos Kanalia from a 4 May 2010 GeoEye-1 image.



Figure 2. Aerial photograph of Agios Nikolaos Kanalia from 24 May 1982.



Figure 3. Spectral filters and vegetation indices applied to the 4 May 2010 GeoEye-1 image around Agios Nikolaos Kanalia.



Figure 4. Surface anomalies from the 4 May 2010 GeoEye-1 image around Agios Nikolaos Kanalia.



Figure 5. A circular anomaly indicates the boundaries of Agios Nikolaos Kanalia: (l) PCA; (r) IR/R.

Geophysical Prospection

Ground-Penetrating Radar

The resulting ground-penetrating radar (GPR) amplitude slices obtained by the single channel NOGGIN Plus Smart Cart at the area of Agios Nikolaos, are presented in Table 1. Darker colors indicate higher amplitude values while lighter colors indicate low amplitude values. Depth slices or amplitude slice-maps were extracted using 10 cm thickness from the surface down to 2.0 m. The filters and corrections that were applied include: Trace Reposition, Repick first break (10%), Dewow, Sec2 (Atn=10dB, StrtG2.50, MaxG=430), Low-pass filter (f=50% Nyquist), High-pass filter (f=30% Nyquist).

The total area covered using GPR was 840 m^2 and consists of three survey grids that were set west and south of the byzantine church of Agios Nikolaos. The GPR grids position regarding its relationship to the boundaries of Kanalia are presented in Figure 6.

The GPR slices within the depth range of 0–70cm do not exhibit any particular information rather than noise that was caused by debris of the recent church renovation. At deeper levels, from 70 cm down to 160 cm, a group of well-defined linear anomalies are detected. These are more detailed within the range of 100–150 cm. In Figure 7a the georeferenced slice of 110–120 cm is presented while Figure 7b illustrates the overall interpretation. Figure 8 is a 3D representation of detected anomalies.





 Table 1:
 GPR amplitude slice-maps for the three grids at Agios Nikolaos showing 10 cm depth thickness.



Figure 6 : Superimposed GPR slice-map on a 1982 aerial photograph of Agios Nikolaos Kanalia, with the settlement boundaries outlined (brown).



Figure 7. Noggin GPR subsurface image where (a) is the georeferenced slice at depth 110–120 cm while b) is the interpretation of the survey results.



Figure 8: 3D GPR images of the subsurface.

GPR anomaly A1 reveals a prolonged linear anomaly (~9.0 m long) with orientation almost northwest-southeast. This feature seems to expand and connect with the anomaly designated as A2. The latter, outlines a well preserved rectilinear structure 15 m long that has at least two rooms with similar dimensions ($4.0 \times 4.0 \text{ m}$). This prolonged structure is oriented in north-south. Close to anomaly A2, a smaller group of linear and more attenuated anomalies are identified as A3. These indicate the presence of structural remains. Anomaly A4 exhibits

another prolonged linear feature with a slightly different orientation than the previous anomalies identified. Despite this, its shape suggests that it is architectural.

Soil Resistance

The resistance survey at Agios Nikolaos did not produce subtle subsurface features of the Neolithic settlement. Based on their electrical properties, high and low resistance anomalies were mapped and are concentrated at different parts of the survey grids. Unfortunately, the results do not reveal any culturally interpretable features. Overall, the GPR results provide the best geophysical dataset for detecting subsurface intact archaeological material at this site.



Figure 9. Results of the resistance survey at Agios Nikolaos. High resistance is shown in white, while low resistance values are shown in black color.

Site Bibliography

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