Understanding the origin of magnetic anomalies in Monte San Vincenzo (Southern Italy) archaeological Site: susceptibility measurements, PXRD, XRF and optical analysis

M. Ciminale, D. Gallo, M. Pallara and Rocco Laviano

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Key words: Magnetic survey, Archaeological sites, Susceptibility, Magnetic minerals, X-ray and optical analysis.

Figure 1: Final result of the integrated survey in Monte San Vincenzo Site: part of the processed magnetogram ([-18, 18] nT black/white). Intense magnetic anomalies outline precisely shape and position of the buried structures. Apart from the general plan of the Neolithic village, a pattern of regularly spaced spot features is clearly identifiable. These define the layout of an ancient olive grove whose orientation is in agreement with the roman land subdivision. The white rectangle delimits signals chosen for the targeted excavation.

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information on the geometry and location of the sources of recorded remotely sensed data.

In order to understand the origin of the relevant magnetic anomalies, susceptibility measurements were also performed; the detected contrast between the filling material and the calcareous bedrock was used to create synthetic models of the archaeological sources. Theoretical and experimental data were subsequently compared.

Following this the material filling the ditches was sampled for Powder X-ray Diffraction (PXRD), X-ray Fluorescence (XRF) and optical analysis. PXRD quantitative analyses showed a variable presence of clay minerals, quartz, feldspars and calcite. Among the clay minerals, illite plus muscovite are more abundant than smectite. XRF analysis data displayed SiO\(_2\), CaO, Al\(_2\)O\(_3\), Fe\(_2\)O\(_3\) and K\(_2\)O as main oxides as in the “tout venant” samples as in the clay fraction (Φ<2μm) (tab. 1). Optical microscope observations showed many crystals of pyroxenes, amphiboles, melanite garnets, magnetite, hematite and amorphous Fe-oxide-hydroxides (Fig. 3). Furthermore microscope optical analyses indicated the presence of volcanic rock pumices and lava fragments.

All these interesting results, let us hypothesize that the provenance of the material filling the ditches, and thus its magnetic properties, can be ascribed to the nearby (55 km) Vulture volcano complex.

Eventually, since the presence of magnetic minerals in clayey materials indicates the occurrence of alluvial and col-luvial process, a spatial distribution of the igneous products could be inferred from geomorphological studies (Eramo et al., 2004; Laviano & Muntoni 2006) and therefore it could be used to analyze magnetic data recorded in other sites surveyed in the same territory.

Acknowledgements

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References


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<th>SiO(_2)</th>
<th>TiO(_2)</th>
<th>Al(_2)O(_3)</th>
<th>Fe(_2)O(_3)</th>
<th>MnO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na(_2)O</th>
<th>K(_2)O</th>
<th>P(_2)O(_5)</th>
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<td>4,22</td>
<td>0,14</td>
<td>1,60</td>
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<tr>
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<td>5,89</td>
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<td>2,48</td>
<td>0,33</td>
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Table 1: Average chemical composition of (1) “tout venant” samples and (2) clay fraction samples.

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