

Magnetic Gradient Horizontal Operator (MHGO) useful for detecting objects buried at shallow depth: cultural heritage (Villa degli Antonini, Rota Rio)

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Several factors were taken into consideration in order to appropriately tailor the geophysical explorations at the cultural heritage. Given the fact that each site has been neglected for a long time and in recent times used as an illegal dumping area, we thoroughly evaluated for this investigation the advantages and limitations of each specific technique, and the general conditions and history of the site.

We took into account the extension of the areas to be investigated and the need for rapid data acquisition and processing. Furthermore, the survey required instrumentation with sensitivity to small background contrasts and as little as possible affected by background noise sources.

In order to ascertain the existence and location of underground buried walls, a magnetic gradiometer survey (MAG) was planned. The map of the magnetic anomalies is not computed to reduction at the pole (RTP), but with a magnetic horizontal gradient operator (MHGO).

The magnetic horizontal gradient operator (MHGO) generates from a grid of vertical gradient a grid of steepest slopes (i.e. the magnitude of the gradient) at any point on the surface. The MHGO is reported as a number (rise over run) rather than degrees, and the direction is opposite to that of the slope. The MHGO is zero for a horizontal surface, and approaches infinity as the slope approaches the vertical.

The gradient data are especially useful for detecting objects buried at shallow depth. The map reveals some details of the anomalies of the geomagnetic field.

Magnetic anomalies due to walls are more evident than in the total intensity map, whereas anomalies due to concentrations of debris are very weak.

In this work we describe the results of an investigation obtained with magnetometry investigation for two archaeological sites: "Villa degli Antonini" (Genzano, Rome) and Rota Ria (Mugnano in Teverina, Viterbo).

Since the main goal of the investigation was to understand the nature of magnetic anomalies with cost-effective method, we have also detection and location of underground buried structures using different instruments and techniques geophysical were carried out (EMI, GPR and microgravity) and so far excavated only in a targeted sector of the area of the anomaly labeled in order to test the validity of the geophysical survey.