INTEGRATION BETWEEN MAGNETIC SURVEYS AND ARCHAEOLOGICAL EXCAVATIONS: THE CASE STUDY OF PAVA (SIENA, CENTRAL ITALY)

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Topic: Integrated prospection methods

Key words: gradiometric survey, archaeological excavation, Pava (Italy)

Abstract

The archaeological site of Pava is located in the southern province of Siena, (municipality of San Giovanni d'Asso). The location of the area, obtained through the historical and archaeological studies of landscape, is part of the project "Archaeological Map of Siena Province", started in the 1990 with a collaboration between the Department of Archaeology of University of Siena and the Province of Siena. The researches made with the aim to asses the historical and archaeological properties of the territory of San Giovanni d'Asso, have interested a period between 2000 and 2004, with the results to locate about 260 historical-archaeological sites. Pava is one of the most important site among these.
In this area the scatter pottery allowed us to consider the site as a remarkable complex probably linked to the ancient road. The chronology of the site covered a time from the late (roman) republican-first imperial (I century b.C.-I century a.C.) till the late roman phase (till VI century a.C.) The main interesting implication for this site is contained in a document of Lombard time (714-715) where there is the mention of a *S. Pietro in Pava* parish church (today inexistent). The site has been studied analysing a set of vertical aerial photographs and making aerial surveys from 2002 to 2004, with the aim to locate buried structures. Together with these information, a large scale geophysical surveys, employing a differential magnetic method, have been carried out.

The Magnetic survey

For the specific magnetic survey, the measurements were carried out employing the GEM System Overhauser gradiometer GSM-19GW. This instrument measures the vertical gradient of the Total Magnetic Field (F) with a fixed inter-sensors vertical spacing of 1 m. During the survey the bottom sensor was used at a constant height (0.20 m) from the surface. Taking into account the depth and dimensions of the possible targets present in this site (walls and road remains), the measurements where taken at a sampling spatial interval of 0.5 *m* along S-N stretching profiles.

The full area, of about 20000 sqm in size, was subdivided into 8 squares of side 50 m, due to logistic reasons. In each square, 50 parallel profiles, spaced 1 m apart oriented in a S-N direction, were collected and the measurements were carried out continuously with a sampling time interval of 0.5 sec. According to the main interest of the archaeologists, a portion of this zone with dimensions 20×20 m, in the southern of the area, has been selected with the aim to verify, applying different experimental acquisition techniques, the correspondence between magnetic anomalies and located structures (after excavation). The different experimental acquisition techniques are based to different distance between the sensors of the gradiometer and the centre of the hypothised anomalous bodies. To apply this configuration, the measurements have been repeated, in the same area, after the removal of some portion of the ground with different thickness (10-15 cm; 20-25 cm). A total of 1600 measurements were taken in this area, for each data set. After the usual pre-elaboration techniques such as despiking, filtering and reranging (Brizzolari et al, 1992; Piro et al, 1998) the results have been represented as a coloured contour maps of the residual values of the gradient of the total magnetic field for the investigated squares, Fig.2. The analysis of these contour-maps show that this area is characterised by many dipolar anomalies in a range of -10, +75 nT m^{-1}, –45, +30 nT m^{-1} and –18, +24 nT m^{-1}. These anomalies, as it is possible to see in all portion of the investigated area, are spatially organised as a pseudolinear structures or semicircular structures.

The archeological excavation

First archaeological excavation have been made during July - August 2004. This excavation has interested the west part of the site (an area of 20×10 m) corresponding to the space where the main magnetic anomalies have been located. With the aim to check the possible source-magnetic-bodies, two small stratigraphic excavation (3×3 m in size) were made in correspondence of two clear magnetic dipoles. The Fig.3 shows the comparison between obtained magnetic anomalies and the archaeological excavation.

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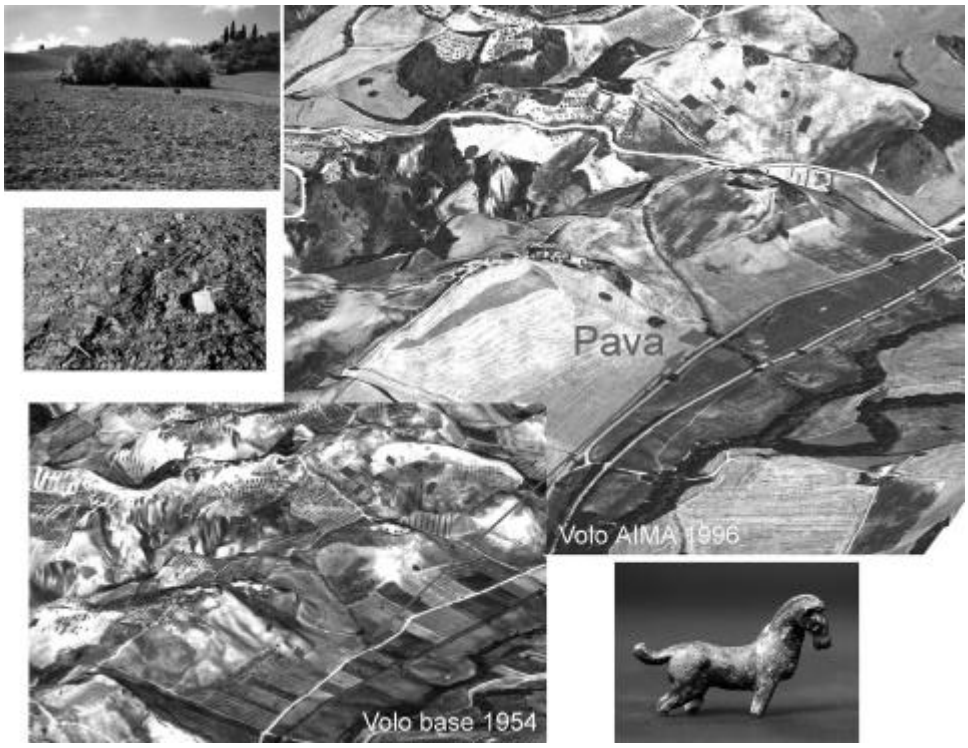

Fig. 1 – Location of the archaeological site of Pava.

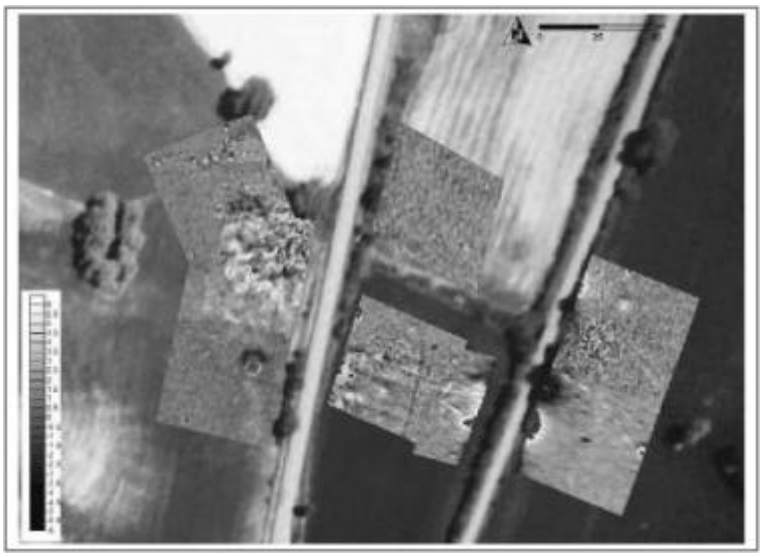

Fig. 2 – Contour map of the residual values of the gradient of the Total Magnetic Field.

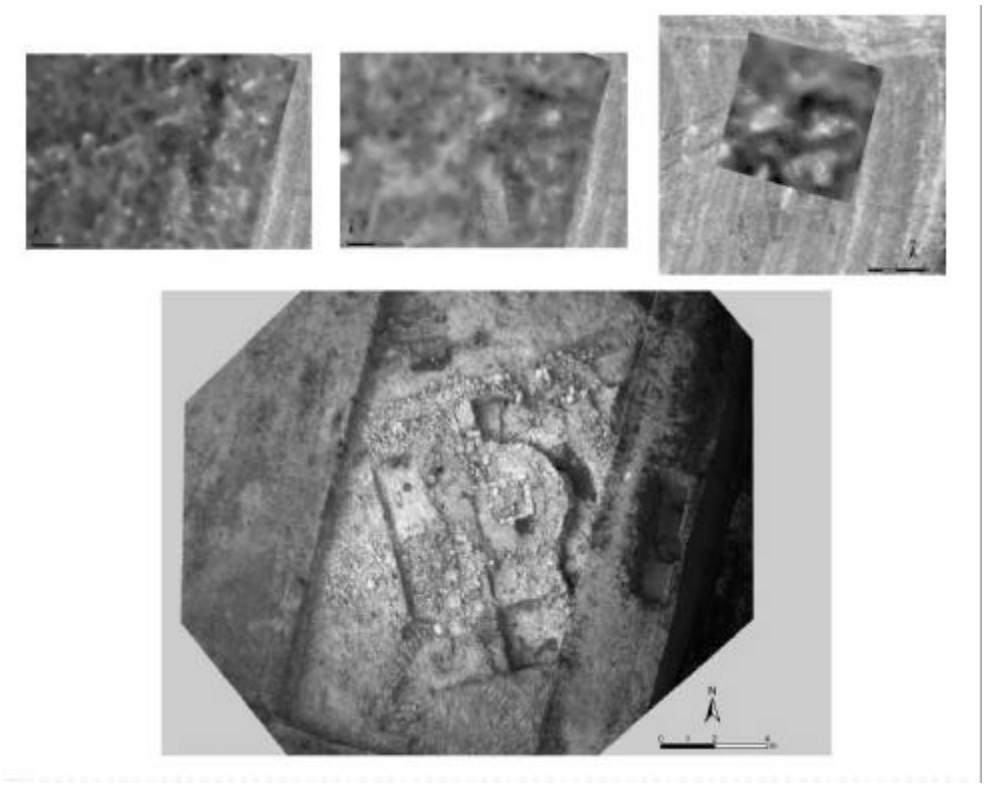

Fig. 3 – Comparison between magnetic anomalies and aechaeological excavation.