CHEMICAL ANALYSIS OF FLOOR SAMPLES AS A TOOL FOR ARCHAEOLOGICAL PROSPECTION. COMPARISON WITH THE MAGNETIC SURVEY AND THE ARCHAEOLOGICAL EXCAVATION DATA: THE CASE STUDY OF PAVA (ITALY)

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Introduction

Phosphate analysis is one of the first techniques applied in archaeological prospection. Its utility was already clear in the middle of the XIXth century.
Phosphates are in fact related to human activity and at a major level correspond to the human presence in the landscape. At intra-site level phosphates concentrations correspond to trush pits, food preparation and consumption areas as well as stables and cemeteries.
The use of phosphate analysis as a prospection instrument it's less and less used in archaeological projects also due to the effectiveness of other techniques such as geophysics.
Nevertheless in the project of Pava directed by Campana and Felici, we decided to use a broader spectrum of techniques in order to gain as much information as possible before starting the excavation.
The aim was also to test the validity of the different techniques and establish the suitability of their use in different situations. In this case we had in fact the opportunity of comparing the results of the prospection with those obtained by an extensive excavation that can allow testing the results of each technique and their complementarity.
Among the techniques carried out there were the chemical analysis of soil samples taken from the surface. pH, phosphate and carbonate analysis were carried out in order to find patterns that could reflect the presence of human activities or cultural modifications of the soil.

Methodology

Samples from a 20 meters grid were taken every 2 meters on the surface of the site.
The presence of phosphates, carbonates and the pH values were tested in all the samples.
The chemical analyses were carried out at the Archaeometric Laboratory (LSAA) of the University of Siena using spot tests developed in Mexico by Barba, Rodriguez and Cordoba (1991). They are simple qualitative tests that can show the presence of concentrations of chemical indicators such as phosphates, carbonates and pH values.
For the phosphate analysis 0.5 g of each sample are tested with Ammonium Molybdate and Ascorbic Acid. For the carbonate analysis 0.10 g of each sample are tested with chloridric acid, while for the pH analysis a portable pH-ameter is used.
The results of the analysis are then reported on the GIS platform of the project in correspondence of the sampling grid and are interpolated using the Surfer software in order to obtain distribution maps for each chemical compound (Fig 1).
The maps obtained are then compared with the excavation data.

Results of the chemical analysis compared with archaeological excavation data

It's almost the first time that surface chemical analysis is carried out in Italy in order to check the relationship between human activities and chemical enrichment of the soil. The work has just started and we are facing the first results, but they seem to be promising.

The area analyzed until now seems to be characterized by the presence of two sub-areas: one is poor of chemical enrichment and corresponds to the interior of the church, while the other - richer - corresponds to the space around the church.
Furthermore phosphate concentrations seem be localized where burials were found digging: until now five tombs have been found but we expect others to be present.
The chemical enrichment in the south eastern part of the church corresponds to an area where the excavation revealed the presence of dark soil rich in charcoal and organic material.

A.P.

Magnetic survey and phosphate analysis: a comparison

The results of the chemical analysis of the soil were compared with those obtained with the magnetic survey that was carried out on the same areas and in the same day of the chemical sampling (Fig. 2).
As the excavation proceeded all the prospection techniques were carried out. Comparing the results of the magnetometry and of the phosphate analysis it is possible to observe that while the first one points out the limits of the church, the second indicates enrichments in the "outside" area. They may correspond to human activities carried out in outdoor spaces and to the burials that cannot be "seen" with the magnetometry. In the north part of the excavation area the possible contribute of data integration between magnetic survey and chemical analysis to the knowledge of the site is particularly clear. The interpretation of the magnetic anomaly as a wall of the church on the subsurface is enhanced by the concentration of phosphate in the outside area. The test excavation shows in the outside area the presence of burials and the correspondence between the magnetic anomaly and the wall. On the basis of test excavation and considered that the concentration of phosphate and the magnetic anomaly follow the same pattern it is possible to sustain the continuity of the cemetery outside the church (Fig.1 and 2).
The chemical concentration in the south eastern part of the church pointed out before corresponds to a positive magnetic anomaly. Nevertheless in this case the two anomalies cannot be attributed to the same archaeological feature. While the phosphates are due to the presence of organic material, the magnetic anomaly depends on the presence of a brick floor underneath. The first results of this methodology show that the different techniques are complementary and that carrying out all together could be useful for a better understanding of site.

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References

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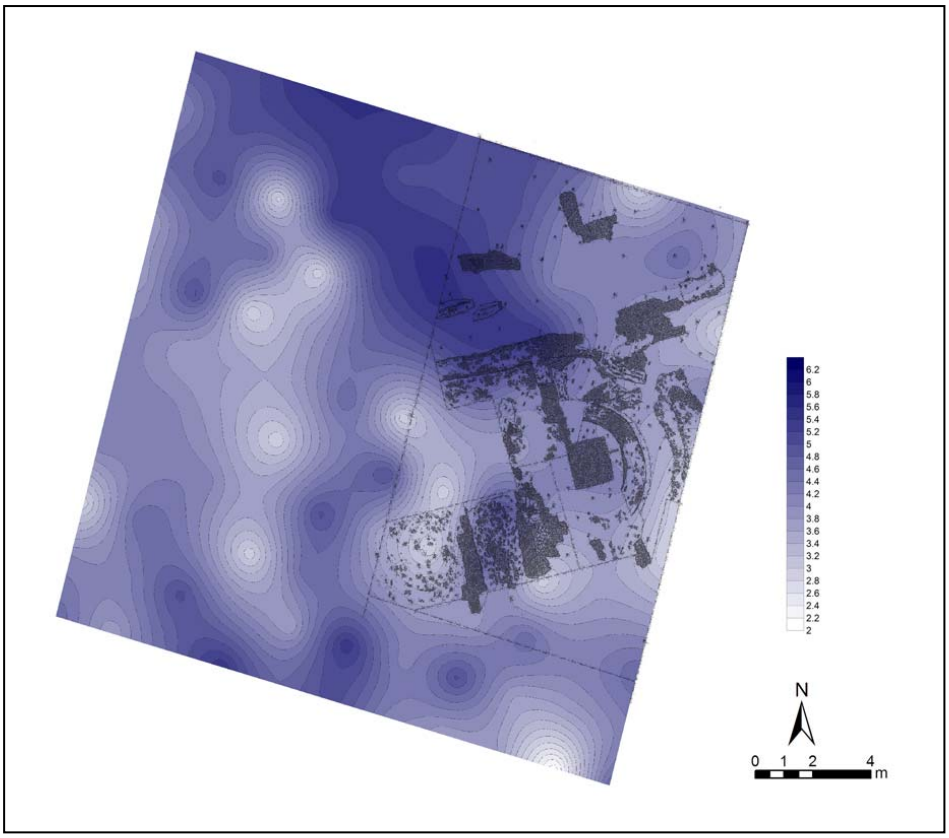

Fig. 1 – Phosphate analysis

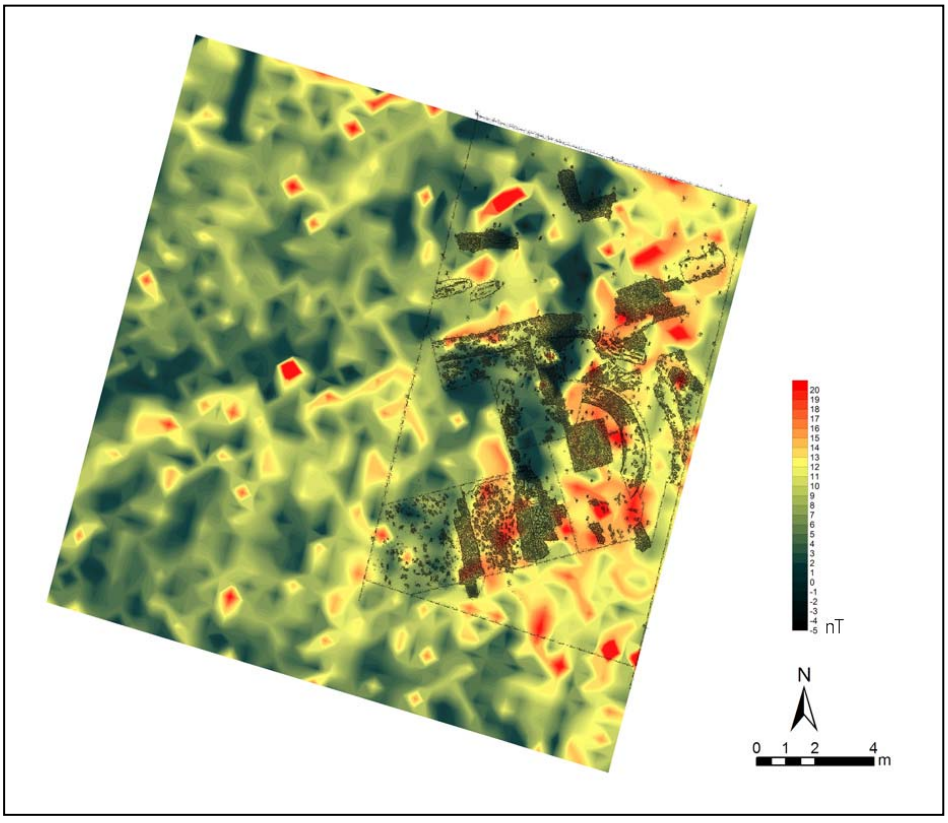

Fig. 2 – Magnetic survey