

# Closing the loop. Extracting more value out of archeogeophysical surveys in the Raganello Basin

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## INTRODUCTION

To make optimal use of the money, time and expertise that goes into archeogeophysical survey, geophysicists and archaeologists must ensure that their interactions are truly interdisciplinary — not multidisciplinary as is still often the case. Collaborations must start in the research design phase and continue all through the analysis, synthesis and ‘further work’ stages of a typical research program. In particular, geophysicists and archaeologists alike must learn what they can from invasive field tests (coring, topsoil stripping, test pits, full excavation) about the true character of a wide range of anomaly types. I will present the work of my own landscape archaeological research program in the basin of the Raganello river as a model for interdisciplinary work, discussing some of its successes and failures and what we should learn from them.

Groningen University’s *Rural Life in Protohistoric Italy Project* (RLP, 2010–2015) studies a selection of small protohistoric sites that were recorded in earlier systematic fieldwalking surveys in the basin of the Raganello river (northern Calabria, Italy), but the main import of the research is methodological: namely, the development of approaches for the analysis and interpretation of dispersed rural sites, as recorded in field surveys all over the Mediterranean. The research builds on geophysical experiments conducted in 2006 (van Leusen *et al.* 2014) and detailed models of how slope processes affect the preservation and visibility of archaeological sites (Feiken 2014).

The research aims to produce a scientific description of site types that are usually ignored because they are of no culture-historical interest, but by their very ubiquity are of great socio-economic significance. A second aim is to develop a fast site assessment method, useful to both researchers and managers of the archaeological heritage. The Project uses an explicit sampling framework to determine the smallest number and type of sites that must be investigated in order to derive conclusions with a sufficient degree of confidence, and employs three stages of increasingly intensive and, at the same time, selective investigation: surface survey – geophysical survey and coring – trial trenching. A GIS environment is used for field recording and project data integration.

## RESULTS

The *Rural Life Project* has conducted a substantial number of experiments to determine which geophysical mapping methods work in the specific Mediterranean geoenvironment, which types of geological and anthropogenic anomalies occur, and how the latter relate to subsurface archaeological reservoirs. The results are currently being prepared for publication

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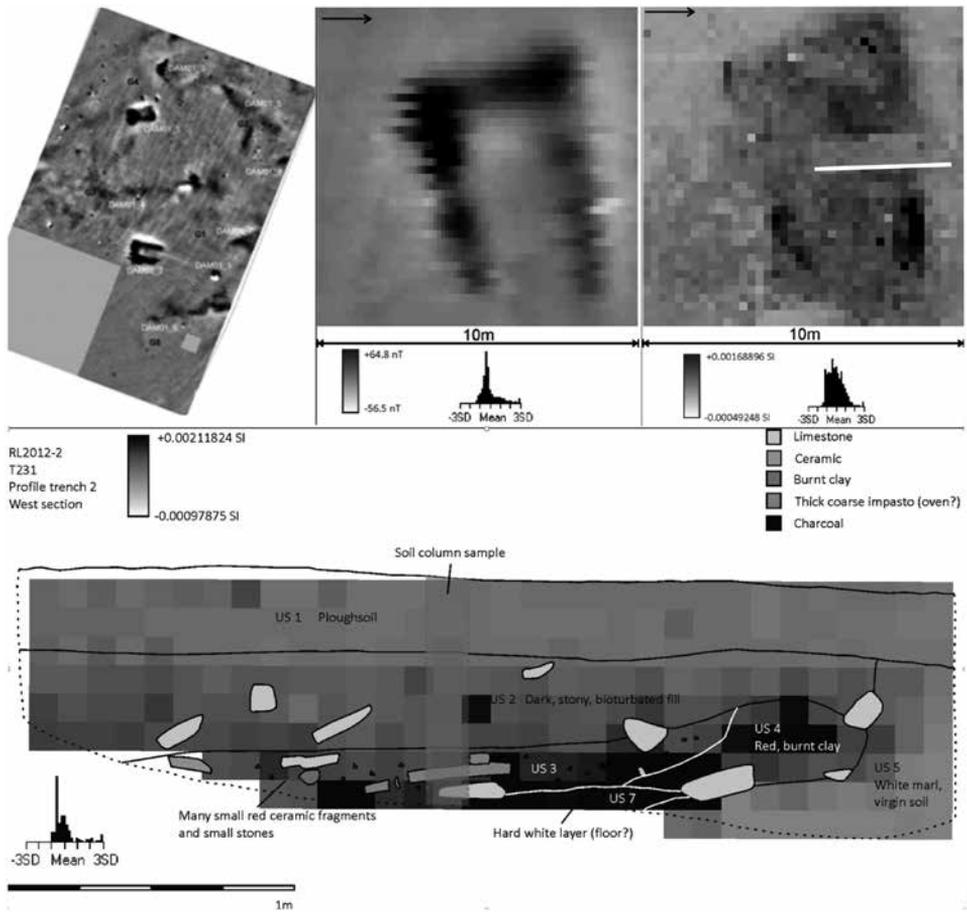


Fig. 1. Magnetic data collected at site T231. Top left: 60 m x 90 m magnetometer survey (T231 is just below the center). Top right: magnetometer survey data over land surface and stripped surface. Bottom: magnetic susceptibility (MS) data in 10 cm grid across section in test pit, highlighting destruction layers

in a substantial volume (Armstrong and van Leusen 2015), but these are not the topic of this paper. Instead, the focus will be laid on lessons learned about the role of feedback between the project archaeologists and geophysicists, as well as between the two disciplines.

FEEDBACK BETWEEN ARCHAEOLOGISTS AND GEOPHYSICISTS IN THE RURAL LIFE PROJECT

After the pilot geophysical work conducted in 2005–6 (van Leusen, Kattenberg, Armstrong 2014), our first practical experience with geophysical mapping came in 2010, when Eastern Atlas conducted a magnetic gradiometry survey for us. Discussing these data, we were surprised:

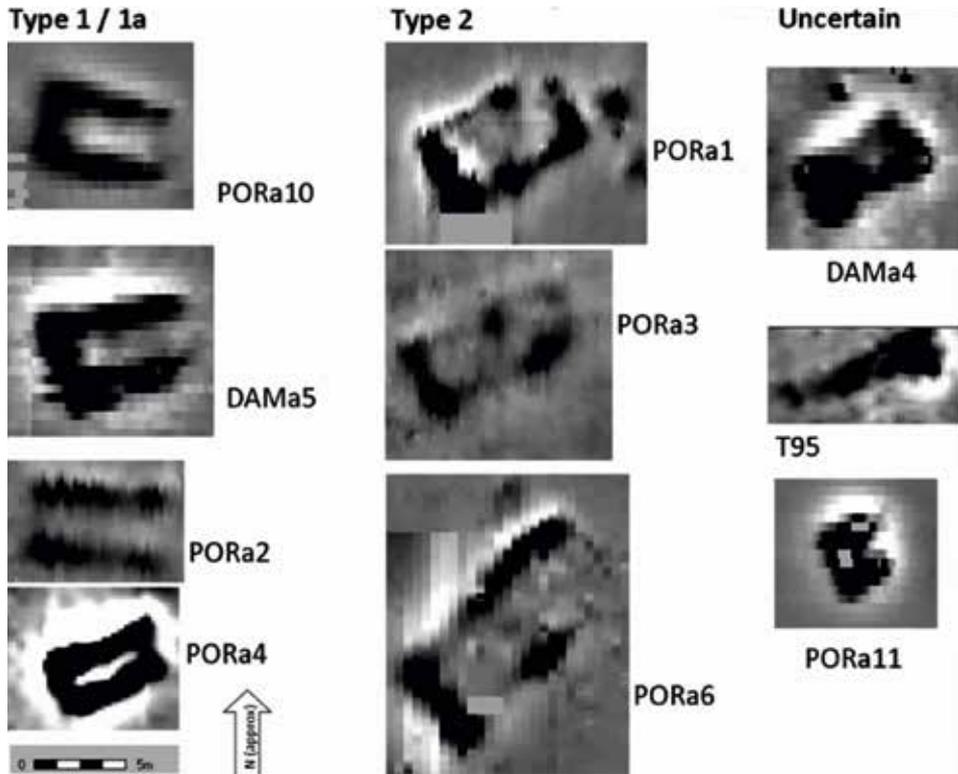


Fig. 2. Towards a 'library' of archeogeophysical anomalies. Shown here are (partial) rectangular gradiometer anomalies surveyed in the first year of the RLP, displayed at the same scale and with original orientation. Although this preliminary typology is now out of date, it shows how a new rectangular anomaly could be assigned to a type with excavated examples from the same region and geology, potentially leading to a more confident interpretation as, e.g., a Late Bronze Age house plan

- how few confident interpretations the geophysicists were willing to provide;
- how little feedback there is, during and after invasive studies of geophysical anomalies, between archaeologists and geophysicists;
- how little interest there seems to be in studying the *application* of geophysical methods to different archaeological and geological situations; geophysics is typically employed by archaeologists only to 'map' sites that have already been discovered, and innovation in archaeological geophysics centers on the technological improvement of measurement apparatus.

During the subsequent fieldwork, in which we worked with both Eastern Atlas and the geophysics team of the British School in Rome, we learned the following lessons on which this paper will focus:

- 1 Integrating archaeological and geophysical fieldwork as in the RLP requires feedback at a very basic level, regarding equipment and logistics:

- Making sure that both teams use the same measurement system, including local fixed points, for work conducted over extended periods (even across field seasons), and that field owners are fully aware what they give permission for;
  - A timely exchange of georeferenced data and interpretations, using a GIS platform, so that the field strategy can still be adapted;
  - Making sure that geophysical equipment is suitable for use by non-experts and in difficult field conditions. Once the local survey conditions are well understood, there is no reason that the data collection should not be done by trained archaeology students, if this is more convenient or cheaper. Equipment should also be sufficiently robust (e.g., no snagging cables) and user friendly (e.g., no buttons that require constant bending over) to allow efficient and effective data collection.
- 2 Stripping off the plough layer after geophysical survey, and sampling the emerging features for MS both at the surface and at regular depth intervals in cores, helps establish the precise dimensions of these features and helps understand why a particular shape and strength of anomaly was measured. Feeding back this information helps the archaeo-geophysicist reach more correct/confident interpretations of anomalies in the future.
  - 3 Stripping and further invasive study (such as in test trenches) also highlights any inconsistencies in the evidence, such as the absence of a visible feature beneath a measured anomaly, the measured MS being insufficient to explain the measured anomaly (indicated remanent magnetization), and georeferencing errors. Feedback about such inconsistencies leads to a better assessment of what is/is not achievable with specific geophysical equipment in a specific landscape context, and often points to further research avenues.
  - 4 Test pits at sites such as T231 (see Fig. 1) provide the stratigraphic information and MS data needed for the construction of forward models of selected anthropogenic and geological feature types (very much still in the pilot phase), ultimately leading to more confident interpretations of these feature types.

#### PRELIMINARY CONCLUSION

Geophysicist feedback to the archaeologist currently perforce relies on his/her own experience — not a very professional state of affairs. We need to be sure that information about similar anomalies, in similar landscapes, is available to guide geophysicists in their interpretations, and that a mechanism is developed to feed results of invasive archaeological studies of these anomalies back to the geophysicist. Some kind of ‘library’ of geophysical anomalies plus all relevant physical and archaeological data seems the best solution (Fig. 2), and I propose to apply for ERC grant funding for this. Any partners?

#### ACKNOWLEDGEMENTS

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## Archaeological and geophysical survey of Tell el-Dab<sup>a</sup>, an ancient town in the Nile Delta

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Tell el-Dab<sup>a</sup>, a site located in the eastern part of the Nile Delta in Egypt, has been known to Egyptologists since 1885 thanks to Edouard Naville's excavation. The site was investigated later by Mohamed Hamza in 1928, Labib Habachi in 1941–42 and Shehata Adam in 1951–54. The Austrian Archaeological Institute in Cairo has been investigating the site since 1966, first under the direction of Manfred Bietak (1966–2009) and now Irene Forstner-Müller (since 2009).

The site can be identified with Avaris, capital of the Hyksos in the Second Intermediate Period (15th Dynasty,) and with the southern part of Piramesse, the Delta residence of the Ramesses. By the middle of the second millennium BC, Avaris was not only the capital of the Hyksos rulers, but also one of the largest and most important cities in Egypt and the Ancient Near East. It occupied around 260 ha and had an estimated population of between 29,000 and 34,500 persons. Its strategic position on the route out of Egypt to the east gave it the status of a hub and gateway between the Nile Valley proper and the Mediterranean and the Ancient Near East.

The town was founded on now buried sand mounds (*geziras*) on the southeastern bank of the ancient Pelusiac branch of the Nile. The *geziras* were preferred for settlement for they remained unflooded during annual Nile inundations. At present the whole area is cultivated and remains of ancient settlement mounds survive in only a few places. From the late 1980s to the beginning of the 1990s, the ancient landscape of Tell el-Dab<sup>a</sup>/Qantir was reconstructed over an area of 12 km<sup>2</sup>, based on about 800 core drillings (Dorner 1994). His map of the reconstructed historical landscape with the old Pelusiac branch, the river system and turtlebacks sets the framework for all prospective work in Tell el-Dab<sup>a</sup>.

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