

Final dissertation: Master of Science in Geotechnologies for Archaeology

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Dr. Chiara Ceccacci

"Capena Solare": From preventive archaeology to photovoltaic installations. Documentation tool and Methods
Internship at British School at Rome

This work aims to examine all the phases involved in preventive archaeology and the circumstances that require the archaeologist's intervention. It focuses on the analysis of the tools and methods used to document the archaeological context, highlighting the role of new technologies as a fundamental support to manage the complexity of the working process. Initially, the project that motivated the intervention of the company Eos Arc S.r.l with a preventive archaeology excavation is outlined, illustrating the initial phase of research and study of the context, typical of such interventions. Subsequently, the actual implementation of the archaeological investigation and the operational methods adopted during the excavation are described, with particular attention to the tools and instrumentation used on-site to initiate and conduct the excavation operation. After an analysis of the extensive excavation involving specific sectors of the project area, the use of digital tools for the documentation of the archaeological investigation is examined. This is followed by a brief presentation of the results of the extensive archaeological investigations and their initial interpretation in a historical perspective. Finally, is shown the latest intervention of the company Eos Arc S.r.l. in the design of the new photovoltaic plant "Capena Solare".

Dr. Giordano De Coste

Modelling multi-temporal soil loss through historical and contemporary remote sensing data. Possible implementations in Landscape Archaeology studies.

Internship at Koninklijk Nederlands Instituut Rome

Archaeological field survey is deemed as one of the most important practices in landscape archaeology discipline. Its aim is to quantify and collect the material culture (namely, pottery shards) scattered across the Mediterranean countryside, whose visibility and preservation are strictly related to landscape dynamics, outcome of the interplay between topography, climate and human intervention. Particularly, there is a correlation between erosion and sedimentation phenomena and artefact density recorded during field survey. On one hand, this interaction may introduce biases in the recording and historical interpretation of surface scatters. On the other hand, it might lead to the potential dissolution and degradation of the archaeological record through slopewash and weathering.

Moreover, due to industrial and mechanical development in agricultural practices, together with more recent climate changes, Italian rural landscapes dramatically changed after World War II. The consequent increased stress on the natural environment often led and still leads to a human-induced land degradation that might eventually turn into a degradation of the archaeological surface record.

The following thesis aims at discussing such an important topic for the archaeological research community by evaluating the landscape evolution of a study area located in the Tappino valley (Molise) during the last seven decades. As part of an ongoing research project conducted at the Royal Netherlands Institute in Rome (KNIR), the preliminary results here presented show the development and the methodology of a multi-temporal model of the erosion index (from the '50s to the present day) using historical and current environmental and remote sensing data.

Dr. Arianna Ferrero

Documentation and mapping of cultural and archaeological structures in coastal and shallow submerged sites in Crete using drone photogrammetry and 3D laser scanner

Internship at IMS - FORTH

This report summarizes the internship project carried out in Crete between October and December 2023. It focuses on the documentation and mapping of cultural and archaeological structures in shallow submerged and coastal sites on the island, through the use of drone photogrammetry and 3D laser scanner. The project was promoted by the University of Siena in collaboration with the Institute for Mediterranean Studies (IMS) - Foundation for Research and Technology - Hellas (FORTH) at Rethymno and in particular with the "Geophysical – Satellite Remote Sensing and Archaeoenvironment laboratory - Geosat ReSeArch Lab". Through the use of tools such as DJI Mavic 2 drone and Faro Focus 3D laser scanner and through the subsequent data processing with Agisoft Metashape, Faro scenes and Cloud Compare, it was possible to obtain new or updated documentation of the mentioned sites, useful for understanding their evolution dynamics and for their safeguard. Each project concerns structures with different chronology and function, which are extremely connected to the history and geology of the area, as well as being characterized by different datasets acquired with various tools. Drone photogrammetry has allowed to obtain information of large and submerged areas, with an excellent camera quality. The laser scanner was useful for the acquisition of metric information. Both techniques produced point clouds, 3D models, digital elevation models. The coordination of these techniques has produced good level data and with a margin of error as limited as possible for these coastal and submerged sites. We understood how much these sites are exposed to erosive agents that modify them widely over time. Also, the human action on them must not be underestimated, considering that they are often located in tourist area or they are subjected to neglect. So, the technologies used can also carry out a monitoring and safeguarding activity. A fundamental point of the project is the sharing of learned processes through the inclusion of the obtained information in a FORTH – GeoSat ReSeArch Lab Wiki, divided into general topics. It can be used by those who want to reproduce similar results or wants to approach to this type of sites for the first time. All files including original datasets can be downloaded by researchers or trainees who want to engage in them. Finally, we tried to create useful files not only for protection or monitoring, but that could be spent for other purposes such as documentation, scaled mapping and drawing.

Dr. Marco Forte

Geophysical surveys for the characterization of the archaeological contexts located in Gran Carro (VT), Rocca di Montefiascone (VT) and Paestum (SA)

Internship at INGV and Bologna University

The aim of geophysical surveys applied to archaeological contexts has undergone a fast development in the last years, progressing hand in hand with the adaptation of sophisticated and particular technologies to better define the best strategies to search a specific archaeological target. It is therefore essential not only to know how to employ the tools in relation to a specific context, but also to understand the processing of the acquired data, delving into the possibilities that next-generation software offers in terms of data interpretation for research purposes.

Not all survey contexts are easily readable (reasons range from logistical issues encountered while working in the field to the presence of underground interference sources), which is why a correct understanding of the phases regarding the preparation of a geophysical survey campaign is primarily important. This includes the choice of instrumentation to be used in the field, based on the questions posed preliminarily (closely related to the purpose of the investigations), and the selection of parameters that are useful for a correct data processing.

To sum up, this paper attempts to comprehensively illustrate the work that has been done both in the field and in the post-processing of data, in order to identify and spatially locate potential anomalies attributable to the presence of archaeological targets, through the use of different geophysical investigation techniques that are widely used in scientific circles, often in an integrated and complementary way.

Dr. Alessia Mandorlo

Ground Penetrating Radar (GPR) and Electrical Resistivity Tomography (ERT): An Integration at Vulci Archaeological and Naturalistic Park (VT) and Archaeological Area of Sodo, Cortona (AR)

Internship at Geostudi Astier s.r.l.

In archaeological contexts geophysical surveys represent an increasingly adopted tool due to the significant role they play in improving the understanding of archaeological contexts and cultural heritage. Geophysical applications are no longer considered secondary to the knowledge of buried archaeological heritage; in fact, they are essential for identifying elements that are not visible or difficult to investigate. By measuring variations in physical quantities, it is possible to reconstruct the dimensions, depth, and origin of buried structures, allowing for the interpretation of important information about archaeological landscape reconstruction. Integrating two or more geophysical methods enables a better analysis and interpretation of data. In this study two different geophysical methods were adopted: Electrical Resistivity Tomography (ERT 2D-3D) and Ground Penetrating Radar (GPR) surveys. These methods were used to explore and characterize the shallow subsurface in two Italian archaeological sites: in the area led by Prof. Maurizio Forte (Duke University) at the Archaeological Park of Vulci (VT), located near the Western Forum and south of the Decumanus, between the Great Temple and the House of the Cryptoportico, and in one barrows of the Archaeological Area of Sodo, Cortona (AR). In both study cases, the combination of ERT and GPR methods allowed for collecting a significant amount of data, which were processed in specific software and interpreted in the Quantum GIS environment. The archaeological investigations conducted in the study areas revealed anomalies associated with both natural and anthropogenic elements, contributing to an increased understanding of the shallow subsurface in both contexts.