

INTERACTION BETWEEN NATURAL DYNAMICS
AND HUMAN SETTLEMENTS IN THE TERRITORY
OF GRICIGNANO D'AVERSA (CAMPANIA PLAIN, ITALY)
FROM THE NEOLITHIC TO THE ROMAN AGE

1. INTRODUCTION

This paper examines the changing topography of a sector of the Campania Plain, where the fertile volcanic soils of Gricignano d'Aversa have sustained continuous agricultural productivity and settlement from the Neolithic to the present (LAFORGIA, DE FILIPPIS 2002; PIZZANO 2014; BOENZI in this volume). The area has been reshaped over time by natural dynamics (volcanic and alluvial) and human intervention; a notable example is the Clanio River, along the municipality's northern edge, whose course and drainage were substantially modified by seventeenth-century land-reclamation undertaken under the Spanish Viceroyalty. Our topographical and geoarchaeological reconstruction of northern Gricignano d'Aversa is grounded in the recovery and enhancement of legacy data generated by preventive excavations conducted in the late 1990s during construction of the Rome-Naples high-speed railway (TAV) (BRANCATO *et al.* 2024; cf. also FRANDI, LUDOVICI 2020). These records enable a long-term reading of human-landscape relations in the alluvial plain, where stratigraphy around the Neapolitan volcanic centres preserves evidence of settlement and land use from the Late Neolithic through the historical period (SACCOCCIO *et al.* 2013; BRANCATO *et al.* in press). Despite the plain's extreme flatness and alluvial character, intensive occupation and cultivation were possible thanks to the fertility of volcanic-ash soils and to successive waves of ancient and modern reclamation, still legible in today's landscape.

The study adopts the concept of 'deep mapping' as a framework for diachronic geo-archaeological analysis within a GIS environment (ROBERTS 2016). Rather than a static map, the deep map is a digital workspace that integrates a wide spectrum of geo-referenced sources (archaeological, historical, environmental, and topographic) allowing layered visualisation and interpretation of material geographies. In this perspective, the intended outcome is an archaeological map of the municipalities of Gricignano d'Aversa and Carinaro: a diachronic, 'deep' representation of the historical landscape of the Campania Plain that encompasses both visible surface evidence and buried deposits revealed by large public-works projects. As highlighted by DE CARO (2002), preventive archaeology and developer-funded investigations have transformed our understanding of the plain. The substantial,

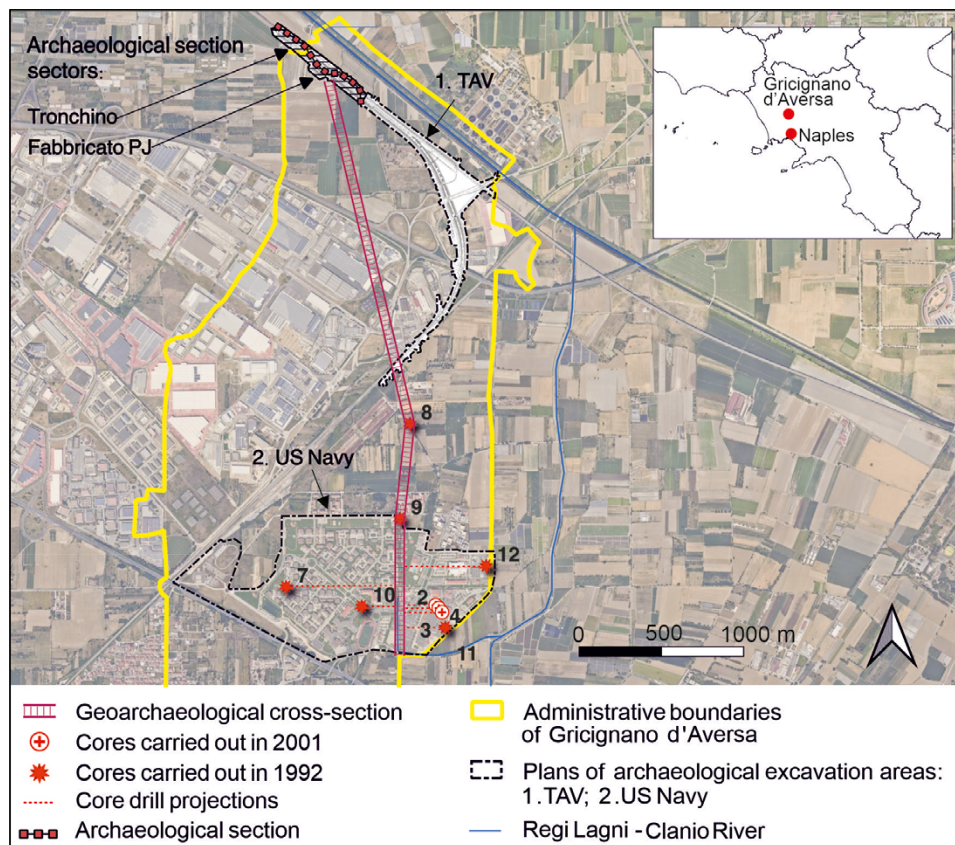


Fig. 1 – Location of the archaeological excavation areas in the Gricignano d'Aversa territory and profile of the geoaerchaeological cross-section (cartographic base: Google Satellite).

heterogeneous corpus accumulated since the 1990s – managed at the time with early GIS, vector graphics, and cartographic platforms – now constitutes a crucial body of legacy data. Its systematic integration is essential not only for research, protection, and public value, but also for addressing the geoaerchaeological visibility bias that often distorts surface-survey readings in alluvial contexts.

The following sections will contextualize the site and the environmental framework, illustrate the multidisciplinary approach adopted for the investigation, present the results and main interpretations, and finally, provide the conclusions.

R.B., E.R.E.

2. SITE LOCATION

The study area is located in the Campania Plain and is configured as a flat territory, with altitudes ranging from 34 to 17 m above sea level (Fig. 1). The area is characterized by volcanic deposits, from the volcanic centres of Somma-Vesuvius and Campi Flegrei, and by the presence of the River Clanio-Regi Lagni canalization system. In particular, the most important chronostratigraphic marker in the area is the Campanian Ignimbrite (CI, ca. 40 ka; GIACCIO *et al.* 2017), followed by the Neapolitan Yellow Tuff (NYT, 15 ka BP, DEINO *et al.* 2004; DE VIVO *et al.* 2010), and the Pomici di Avellino (ca. 3900 cal yr BP; PASSARIELLO *et al.* 2009). Historically and archaeologically, the area shows evidence of intense human activity from the Neo-Eneolithic period (PIZZANO 2014; see also BOENZI in this volume) through the Roman period (LAFORGIA, DE FILIPPIS 2002) up to the present day. Regarding the archaeological context, Gricignano d’Aversa has been subject to two main preventive archaeology projects, conducted by A. MARZOCHELLA (1998) and later by E. LAFORGIA and A. DE FILIPPIS (2002), between the mid-1990s and 2005: one for the US Navy base and the other for the aforementioned TAV works. In particular, the Tronchino and Fabbricato PJ investigated sectors are located in the northern part of the municipality of Gricignano d’Aversa (Fig. 1).

3. METHODOLOGY

Data collection was carried out through archival research conducted on several archival holdings kept at the National Archaeological Museum of Naples, which houses the archaeological and geological documentation produced during the preventive archaeology projects conducted between 1995 and 2005 in the province of Caserta. The need to recover and enhance these data, now largely inaccessible through modern software, emerged. The digitization process involved both textual and numerical data, categorized into the following types of documentation:

- scientific reports, cataloguing documentation, lists of materials;
- photographic documentation (B/W or color), slides, negatives;
- stratigraphic diagrams, drawings of archaeological materials;
- graphic documentation: phase plans, stratigraphic sections, general site plans;
- digital media: CD-ROMs and floppy disks.

For the cartographic bases, WMS services, IGM maps at different scales, LiDAR products from the Campania Region, original site plans from the excavations (retrieved from the MANN Archives), and various historical cartographic sources were used. Based on this material, digitization began along two main directions: on the one hand, the implementation of data

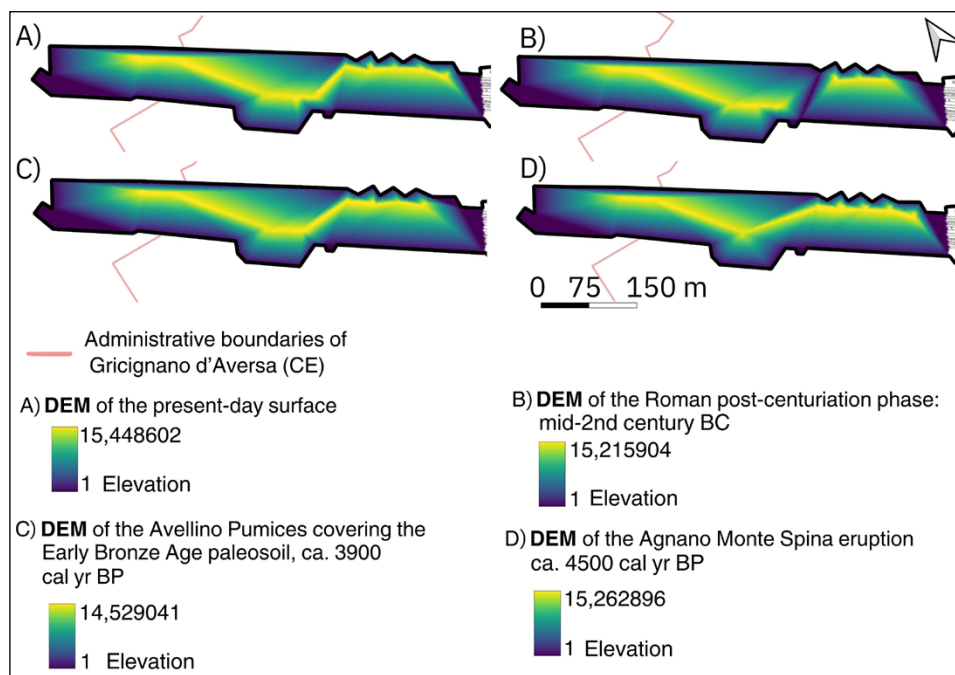


Fig. 2 – Digital Elevation Models (DEM) of the investigated archeological sectors.

in MOPR and MOSI formats within the Open Data application promoted by the Central Institute for Archaeology, i.e., the National Archaeological Geoportal, which allows the sharing and visualization of data produced from archaeological projects across Italy; on the other hand, the creation of a Territorial Information System (TIS). A central element of the latter is the stratigraphic unit sheets, associated with an average elevation and loaded into the GIS environment as georeferenced points. These data allowed for the creation of four Digital Elevation Models (DEMs) for the Tronchino and Fabbriato PJ areas (Fig. 2).

The models represent significant chronostratigraphic levels:

- the Agnano Monte Spina eruption (ca. 4500 cal yr BP; SMITH *et al.* 2011);
- the Pomici di Avellino eruption (which cover the paleosoil of the Early Bronze Age, ca. 3900 cal yr BP; PASSARIELLO *et al.* 2009);
- the Roman post-centuriation phase (mid-2nd century BC);
- the present-day surface (for a comparative principle).

A further phase of analysis was conducted in AutoCAD, with the creation of a geoarchaeological section based on the recovery in the Archive

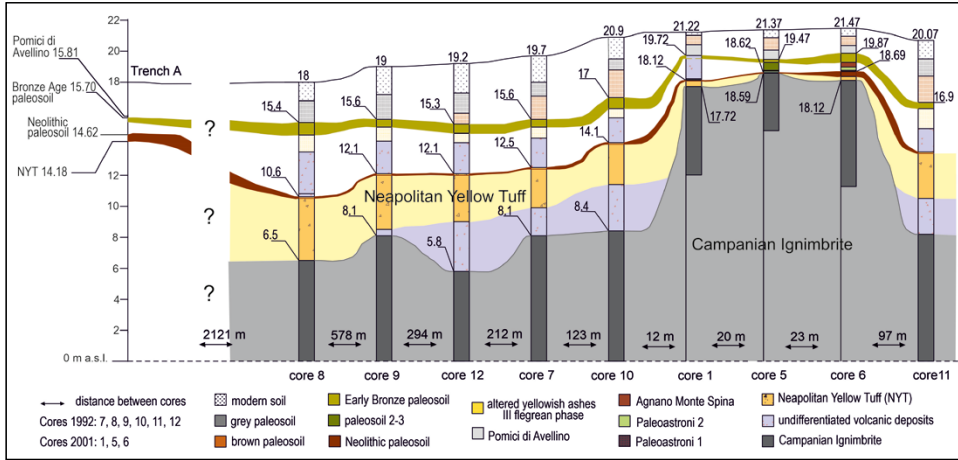


Fig. 3 – Geoarchaeological cross-section, not in scale (for location see Fig. 1).

of geological subsoil data, collected in 1992 and 2002 (Fig. 3a-b). Several core stratigraphies have been re-examined in order to identify the main chronostratigraphic levels recognized in the archaeological sections. This approach made it possible to compare the subsurface stratigraphy of the municipality (US Navy area) and the northern peripheral area (TAV area), highlighting the sectors where the lack of data would require further sampling.

4. RESULTS AND DISCUSSION

4.1 The shaping of the landscape

From the comparison of the DEMs for the Tronchino and Fabbriato PJ areas (Fig. 2) and the geoarchaeological stratigraphic reconstruction (Fig. 3), several significant observations emerged.

First, the formation of stratigraphic units in the area is mainly attributable to volcanic events, interspersed with phases of quiescence during which paleosoils developed, most of which were anthropized. The most significant eruptive events include the Campanian Ignimbrite (around 39,000 years ago), the Neapolitan Yellow Tuff (around 15,000 years ago), the Agnaro Monte Spina eruption (around 4500 years ago), and the Pomici di Avellino (around 3900 years ago). The morphology of volcanic layers and paleosoils is strongly conditioned by the earliest eruption attested in the area, the Campanian Ignimbrite, which was deposited with considerable thickness across the entire Campania Plain during the last glacial period.

Subsequently, erosive processes shaped a varied alluvial landscape with hills and low-lying areas, showing greater differences in altitudes in older periods, which became less evident in more recent phases. Indeed, the erosion of heights and the progressive filling of lows, with both volcanic and colluvial-alluvial deposits, have led to a levelling of the area, which today appears almost flat. The TAV area is located at a lower elevation, around 18 m asl, compared to the U.S. Navy area, which is situated on a slight elevation, around 21 m a.s.l. This difference, slightly higher in ancient times, led to enhanced erosion on the hills. As a consequence, the stratigraphic levels (both volcanic and anthropic) in the US Navy area are thinner compared to those in the TAV area, where the stratigraphic thickness is greater (Fig. 3).

4.2 Settlement choices

From the comparison of anthropized paleosoils and archaeological traces found in the TAV area, and the sections cited before (Figs. 2, 3), some significant geoarchaeological and topographical observations emerge. The area shows sporadic settlement from the Final Neolithic period, with a more stable presence during the Late Neo-Eneolithic and Early Eneolithic. This is hypothesized based on the widespread presence of post-holes throughout the area, interpreted as remains of structures for housing or animal enclosures. The Early Bronze Age also shows evidence of frequentation, though with some inconsistencies compared to the general framework. While evidence of the Early Bronze Age in the TAV area is limited, numerous traces of an agrarian landscape dating back to this same period are documented in the US Navy area, as evidenced by the work of A. Marzocchella and A. Vanzetti. This discrepancy raised questions about the factors influencing the settlement choices of the communities of that time, especially considering that both areas were frequented during the Neo-Eneolithic period. One possible explanation emerges from the topography and hydrology of the region.

The Clanio River, which influenced the area's settlement choices, represents a significant ecological resource for those who inhabited the region. The proximity of the river during the Eneolithic period favoured settlements close to the waterway. Later, during the Bronze Age, the same river forced settlements to move to more elevated land to avoid flooding. This trend changed again during the Roman period, when the application of drainage techniques, such as canalization (Fig. 4) and embankments, allowed the establishment of settlements along the riverbanks. In fact, 21 canalization features were identified in the Tronchino and Fabbriato PJ areas, associated with traces of ploughing, as they share the same north-south orientation as the *decumani*. This designates a landscape fully consistent with the organization of the *ager Campanus* (between the 2nd and 1st centuries BC), which provides a *terminus post quem* for its realization.

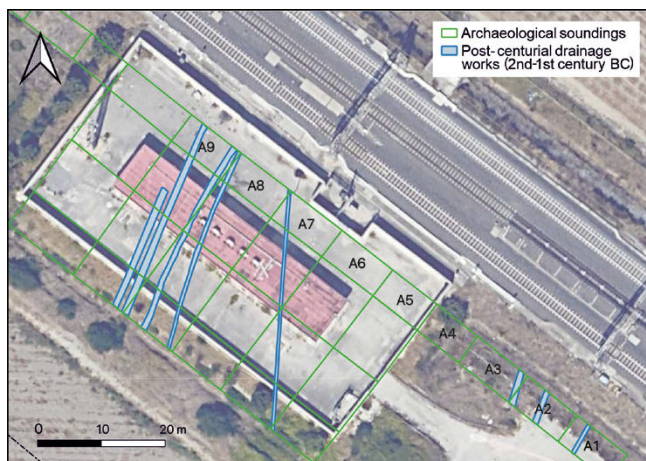


Fig. 4 – Post centennial drainage works. Focus on Fabbricato PJ (cartographic base: Google Satellite).

5. CONCLUSIONS AND RESEARCH PERSPECTIVES

In conclusion, the territory of Gricignano d’Aversa reveals a profound and ongoing dialectic between humans and the environment, marked by eruptive events that have shaped its morphology and constitute the main character of the landscape, alternating with phases of settlement recovery and habitation. Future research perspectives focus on the need to deepen our understanding of the underground layers, particularly regarding the role of the Clanio River, whose presence before the flood control works has so far been poorly documented by historical and archaeological sources. Currently, the evidence of alluvial deposits is limited to two archaeological surveys in the T.A.V. area and is insufficient for a comprehensive reconstruction of the ancient river landscape, despite the undeniable historical and environmental importance of the Clanio River.

To fill this gap, it will be crucial to continue the research through a multidisciplinary approach that primarily involves new geological investigations. These would help better define the subsurface stratigraphy, identify ancient alluvial levels, and understand the geomorphological processes that have shaped the area over time. Such analyses could be conducted from new surveys at strategic points, particularly in areas that, according to the reconstructed geoarchaeological section, are currently lacking subsoil data for approximately one kilometre. In addition to new core drilling, another way to enhance the available knowledge is through the systematic consultation of municipal archives, where technical documentation related

to public or private construction works might be found. In many cases, building or infrastructure interventions include geotechnical surveys of the subsurface. If appropriately retrieved, analysed, and georeferenced, these could significantly enrich the stratigraphic framework and contribute to the paleoenvironmental reconstruction, while also reducing the costs and impact of new direct investigations.

At the same time, the new surveys would offer the opportunity for palynological analysis, should fine alluvial or peat layers be intercepted, which may have preserved pollen useful for paleoenvironmental reconstruction. Palynological studies would indeed allow for an integration of knowledge about the ancient environment, providing valuable information on vegetation, climate, and the impact of human activities over time. This approach, based on the integration of legacy data with new data from targeted core drilling, and ultimately, laboratory analysis, represents a promising direction for deepening our understanding of the ancient landscape of Gricignano d'Aversa and the complex relationship between human communities and the environment.

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Acknowledgements

The project 'In.Res.Agri – Investigating Resilient Roman Agricultural Landscapes in Southern Italy. An Integrated and Open IT Approach to Modelling Centuriation through Archaeology, Remotely Sensed Data, Palynology and Ancient Texts' was funded by the European Union – NextGenerationEU – Piano Nazionale di Ripresa e Resilienza (PNRR) – Missione 4 'Istruzione e Ricerca' – Componente C2 – Investimento 1.1, 'Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale' (PRIN) – Project Code: 2022SMJCHX, CUP: B53D23001910006.

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ABSTRACT

This study aims to reconstruct the long-term interactions between humans and the environment in the northern sector of Gricignano d'Aversa (CE), using historical data inte-

grated into a Geographic Information System (GIS). Legacy data from the Archaeological Museum of Naples were digitized as part of a project involving the National Geoportal and the development of a Territorial Information System (TIS). The latter is primarily based on the elevations of stratigraphic units, georeferenced in QGIS. The soil elevation data were obtained from both archaeological and geological surveys. These data sets allowed the development of a geoarchaeological section, created with AutoCAD, as well as Digital Elevation Models (DEMs) generated with QGIS. The results show that the site's geomorphology was mainly shaped by volcanic events, first the Campanian Ignimbrite eruption (39,000 years ago), which had a strong impact on settlement patterns. Topographical variations resulting from these events played a key role in settlement choices. Moreover, the proximity to the Clanio River influenced settlement choices, with communities preferring areas far from the river to avoid flooding. This trend changed by the Roman period, when drainage techniques, evidenced by canalizations, allowed settlement closer to the river.