

Geographic Information Systems and Archaeology: the case of ancient Nora (Pula-Cagliari)

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Abstract: The Punic-Roman ancient city of Nora is located on the Sardinian south-western coast, near Cagliari, the most important sardinian city, on the south coast. Latest excavations and territorial surveys of Nora (1990-2000) have proved the continuous settlement between Phoenician-Punic-Roman and Late Roman periods (VII BC-VIII AD). The need of urgent updating of archaeological, historical, environmental data, with monitoring on ancient urban decay (ancient mosaic floorings and other structures) has led to the use of the Geographical Information System in order to solve archaeological problems and to improve research on Nora. In this prospective the study and reflections on ancient city, based on interdisciplinary research between the Dipartimento di Ingegneria del Territorio and Monuments and Fine Arts Office, have begun. The research deals with several points: Cultural Heritage, Archaeological Surveys and Field research, Intra Site Applications, Scientific studies. We evaluate problems between Urban City Planning and historical-environmental resources, respectively. The identity of present territory cannot be described as inalterable substance, but it can be considered as the continuous historical stratified result of local Community mentality. The paper aims to discuss some advancements in the Nora city planning research and to propose the description of a GIS oriented system for the archaeological assets and management of the cultural heritage.

Key words: Nora, ancient urban planning, ancient roman Sardinia, archaeological Information Systems, cultural heritage.

Introduction

The Nora peninsula stretches out into the Mediterranean Sea in an unusual shape, which, nevertheless, allows to include this site among the geomorphologically characteristic sites of a number of coastal areas in Sardinia. These include the promontories of Tharros, the lagoons of Carales and Bithia, the settlements of Bosa Vetus, Olbia, and the east coast as far as Villasimius. All these settlements are characterized by the presence of coastal lagoons, promontories, and coasts with precise harbor characteristics.

These geomorphologic characteristics partially contributed to create the privileged strategic conditions that have led to the establishment and development of the city of Nora. Research on the ancient site in the form of *excavation archaeology* started in the early 1950's. This damaged the city and caused the loss of most of the stratigraphies referable to the shallower deposits, which were irremediably compromised by the tendency to privilege the search of objects and remarkable things to preserve. In the 1990s stratigraphic excavations were at last started in Nora by a number of researchers from the Universities of Genoa, Padua, Pisa, Venice and Viterbo and from the Archaeological Superintendence for the Provinces of Cagliari and Oristano. The remaining parts of the stratigraphies destroyed in the 1950's, i.e. of the Pesce period, were excavated

stratigraphically, trying to reconstruct wherever possible the missing pieces of the history of the city of Nora. Parallel with these investigations, a collaboration between the Department of Land Engineering of the University of Cagliari and the Archaeological Superintendence for the Provinces of Cagliari and Oristano was started with the aim of studying and implementing an Information System for Nora. The Scientific Project is co-ordinated by Prof. G. Deplano.

A possible reading of the forma urbis

The reconstruction of the forma urbis of Nora is at present compromised by the actual knowledge of the city as known so far, and especially because it has not been possible to reconstruct its extension completely, though excavations have proceeded quite rapidly in the past years (MELONI 1990). Therefore the reconstructive hypothesis that will be attempted here will have to be revised when the inevitable following updates will be available as a result of further investigations. Nevertheless, considering what has emerged so far, and considering the different chronologies proposed by various scholars for the best known buildings, careful reading of the residual urban texture, shows few interesting elements that could be discussed today and in the future.

While it is not our intention to enter the debated problem of the phases of the foundation of the city of Nora (BONETTO-NOVELLO 2000), it can safely be stated that its urban phase started around the VII-VI century BC, at a crucial time in the history of this part of the Mediterranean Sea, when the balance of the forces at stake, i.e. the autochthonous population and the Phoenicians, was in favour of the latter. The original role of the city is not totally clear. It certainly must have been related both to the exploitation of the land's potentialities, whose economy depended on its rich hinterland, and to overseas relations with other Mediterranean poles of interest, such as Africa, Spain, the Balearic Islands, France, and Italy. Its relationship with Cagliari, for example, which must have been an important settlement already in the VII century BC, if not earlier, as shown by studies on the via Brenta area, is not clear (AA.VV. 1992). However, the same conformation of the small peninsula of Pula conditioned the roads which characterize its layout and which became more monumental from the Empire onwards, and therefore more clearly defined. No stratigraphic surveys have been made on road works in Nora. Nevertheless, a few data can be obtained from the supporting relationship among structures such as the theatre and the baths at sea, and road portions, considering that roads are supported and therefore are posterior to the two above structures and can be dated within the III century AD.

Even the country roads along the coast namely, the Cagliari road to the east and the *Bithia* road to the west, conditioned the city layout, since they joined the city roads at certain points that can be hypothesised with some certainty (BONETTO, forthcoming) and few observations, which should be integrated with new data from road findings, have been made. In fact two stretches of paved road in an east-west direction, parallel to the access road to the archaeological site, have been found in the north-eastern part of the city. The stretches are built with andesite slabs with a 20 cm kerb, and are 3.80 m wide and 5.70 m long. The remains of a large building tangent to the road with squared blocks of yellowish sandstone *in situ*, were also found in the same area. First of all this suggests an important fact: the city extended towards north-west covering the available space of the isthmus between the small lagoon and the sea. To what extent is difficult to tell. One thing is certain: the Sant'Efisio necropolis delimited the *pars urbana* near the sea towards north-east. On the other hand, it cannot be ruled out that the settlement used to occupy without interruption the spaces available in the hinterland and along the coastline. At a certain point this road must have joined the extrarurban road system. Considering the presence of important buildings even towards north-west, i.e. at the furthest limit of the military zone, it must have joined the extrarurban road system at some other place further on. It has been seen that the foundation of the city should probably be placed in the VII-VI century BC. Of this period we can only hypothesize an early organisation of spaces and roads, of which we know next to nothing, except for the banal consideration that it must have been shaped to fit the geomorphology of the site. It is obvious that, considering the strongly conditioning nature of the morphological characteristics of the small peninsula of Nora, both the Phoenicians and the Romans must have become adapted to this peculiar situation, for which an organic settlement was only during the empire, at least from the data in our possession. It should be remembered that the

terminology *cardus* and *decumanus*, which is often used to define the main roads in a city refers to a situation that is typical of a centuriation system, and cannot be used with another meaning (BONETTO, forthcoming).

The phases of the city

Which phases can be clearly characterised in the construction of a city layout? What is the distribution of spaces and the destination of functions? Regarding the pre-Roman phases, it can safely be stated, as already said, that the city developed in the VII-VI century BC, near the upland plain later occupied by the forum. This was an area assigned to the mixed destination of dwellings and public utility services. In the late republican age, this forum area underwent extensive town-planning restructuring (NOVELLO 2000)

In the first half of the I century BC, the area was reprogrammed to receive the forum square with its imposing paving. From a town-planning point of view, the forum is eccentric with the city core, an aspect described in Vitruvius treatise when dealing with the difference between forums in harbor cities and forums in internal cities (SOMMELLA 1988).

The location of public area par excellence is maintained in the town-planning history of the city.

As regards equipped areas, that is baths, fountains, and various works, the only clarified element so far is the link between the so-called *insula A* and the west harbor. The *insula A* is characterized by a large two-storey building complex that includes *tabernae*, actually *ergastula*, and dwelling areas on the top floor (GUALANDI-RIZZITELLI 2000). The excavation of part of the hill on which the *insula A* was later built in the middle of the III century AD (RIZZITELLI 2000) was a very significant event in the town-planning. This indicates a precise decision to refunctionalise an area related to port activity. Besides this important planned operation related to *insula A*, several other smaller works for the community life were carried out. These refer to public service areas, that were continuously on the increase during the Empire and can also be defined as the "district" level based on privileged mileage and on the inevitable attraction of crossroads: this is the case of the Small Baths that were linked to the AB block, of the Baths at Sea that were linked to the harbour, of the Central Baths that were linked to east and south oriental districts of the city, and of the Eastern Baths that were linked to the eastern districts to the city and perhaps to the supposed eastern anchorage (VERDUCHI 1995) The Small Baths building, which was originally destined to serve a block along the largest western artery of the city, was transformed perhaps in the IV century AD in successive phases from a private *balneum* to a public establishment, with the addition of new parts to evolve completely a new function of the complex (COLAVITTI, forthcoming)

The Baths at Sea are located beside an important crossroad between an east-west axis and a north-south axis. At this point the east-west road proceeded in this direction, but it can no longer be determined today because the area has been buried by bradyseism, which characterized this stretch of coast. The

works were carried out in the imperial Age but before the construction of the *insula A*, therefore in the II century AD (TRONCHETTI 1984)

Sacred areas represent a separate problem in the urban context of the city. Little is known about them, because, except for the area located on the Coltellazzo promontory, they have never been investigated with the stratigraphic method. The most important buildings are located on the top of the two promontories that characterize the Nora area: i.e. the Coltellazzo sanctuary and the sacred area of Aesculapius-Eshmun. A threephase chronology, can only be proposed for the Coltellazzo area: an establishment phase in the VI century BC, a Carthaginian phase in the IV-III century BC, and a function restructuring or maintenance phase in the Roman republican period (OGGIANO, forthcoming). Other important sacred buildings must have gravitated around the forum, as the one hypothesized in the north-eastern part, where archaeological excavations are currently in progress.

The history of the settlement of Nora partly changes in the post-classical period. Few nuclei of the settlement certainly survive from the imperial Age in different forms, such as the western nucleus where a certain continuity of life planning has been observed with the continuation of building activity, the reutilisation of materials and techniques, the abandonment of structures, and the filling up with earth of a few areas (COLAVITTI.-TRONCHETTI 2000; BEJOR 2000).

Some of the main roads, such as G-H, are maintained efficiently, suggesting that the area or part of it was to receive some kind of new connotation in the general equilibrium of the site, which still escapes from our attention. Next to maintenance and the transformation of the city layout, was the phenomenon of Christianisation of the urban space, which was also felt in Nora, where it established itself and developed rapidly. The material signs of this period seem to be relegated externally with the creation of a pole around the church of Sant'Efisia, which partly re-utilizes a sepulchral pre-Christian area.

The construction of an information system for the city

First of all, why should we build an Information System for Nora? The simplest answer to this question is: to be able to manage the archaeological information on the city and its territory, by relating and comparing it to non-archaeological themes, such as the geomorphology of the site, the geopedology, the economic data of the Pula area and other themes, with the aim of revealing and enhancing an enormous heritage so intimately related to the problems of the Mediterranean space. Furthermore, with a Geographic Information System, different types of users can be brought together, such as the University, the Archaeological Superintendence, and the Local Authorities. Each of them could use can use the information according to his competence, in order to communicate such pressing themes as the infrastructures to be built in real times in touristic-cultural areas. Once this premise has been accepted, the priorities to build the entire system need to be established. The growing to update the historical, archaeological, and environmental data must proceed hand in hand with a continuous monitoring of the

degradation problems on the site and of the efficiency of the established methods of protection and restoration. Therefore the decision to use the information tool, which is opened in new fields of application, comes from the prospect of solving many problems related to the complexity of the archaeological site, in order to establish a correct relationship between the processes of land use planning and its historical-environmental resources. To build an archive of the ancient city would be in itself an action of great importance in planning any future event, even in the field of activity of archaeological excavation. It has been stated that since Geographic Information Systems have not been created for archaeology, they are structured on blocks of data that are strictly related to geographic and environmental variables, which the archaeologist is incapable of adapting to his research (LOCK-STANCIC 1995).

This could be true if we don't consider that a GIS is the expression in space of an archive of data.

Therefore the **Information System** for Nora, is structured on an **Archive** of data, which shows all the necessary and useful information, aimed first of all to describe first of all the archaeological level.

This information is easily interfaced with other information levels that we consider functional in explaining the greatest possible number of elements. To this purpose, we have studied a few descriptive records of the archaeological level that make up the first phase of implementation of the entire system. The architecture of the system includes a GIS platform, a management system of relational databases, and a hypertext. Thanks to the hypertext the information can be structured without having to carry out a close examination of the vast field of spatial analysis that is the heritage of more expert figures who would still have to converse with other users. The records (1-2-3) show the main categories of spatial data and attributes that make up the system, and which can be used to carry out interrogations and analyses.

Record 1 (fig. 1)

Localisation (town-underwater land)

Conditions: Visible-non visible

Protection: Restricted-restored-not restored-not specified

Record 2 (fig.2)

Modality of recovery (from excavation -other)

Object characteristics: Immovable-free area-additional information

Record 3 (fig. 3):

Architectural complex (Fragmentary Planimetric Unit)

Functional interpretation

Chronology

Existing documentation

Literature references

The principal aim of GIS oriented system for archaeological assets is to draw up the documentary evidence from the beginning of the strathigraphic research in Nora. This fact represents a further steps to site management and perhaps to think ways for further research within urban ancient planning

and contemporary environmental Nora-Pula planning. Also monitoring the dilapidated state of ancient buildings and the studing of projects and schemes where we can research on management policy can be included in the same project. Finally the whole project will provide for Nora and Pula complete thematic maps, for example on the ancient building technologies and on the preservation of buildings and environment.

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Figures

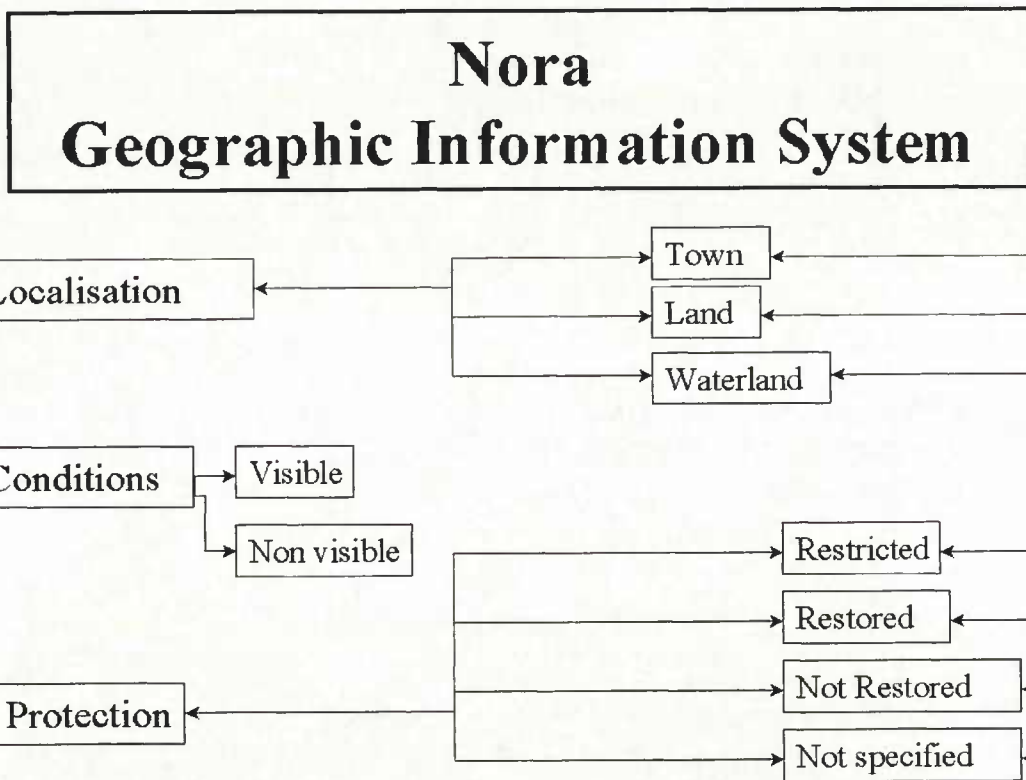


Figure 1.

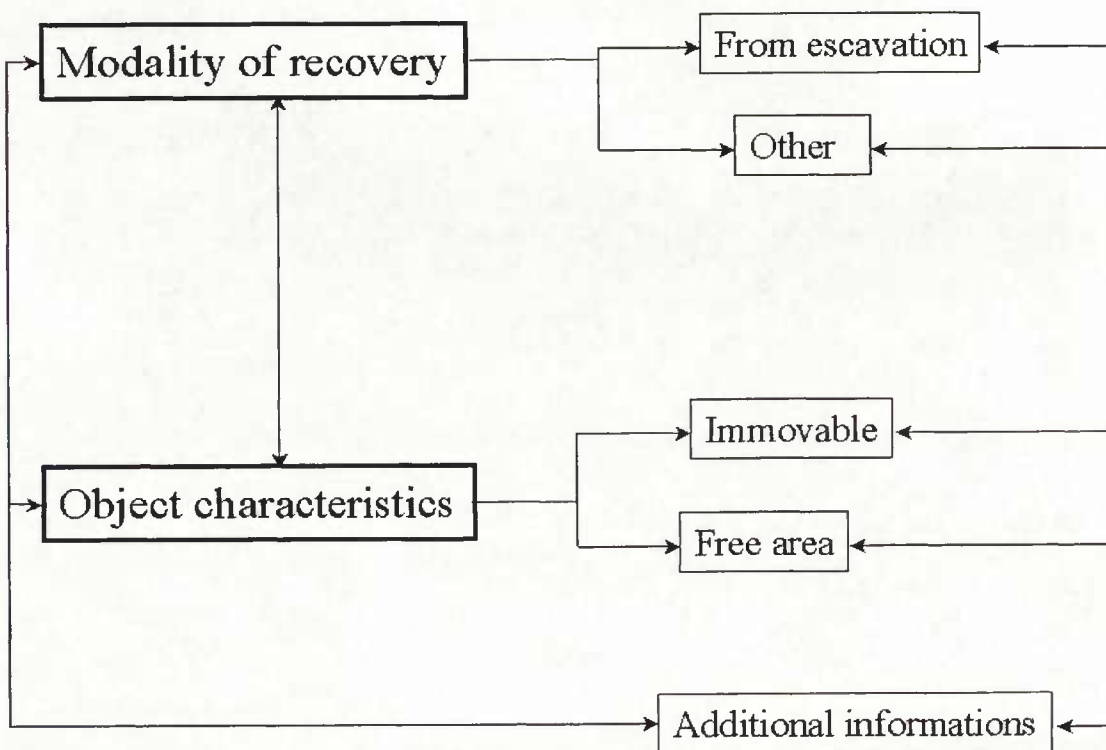


Figure 2.

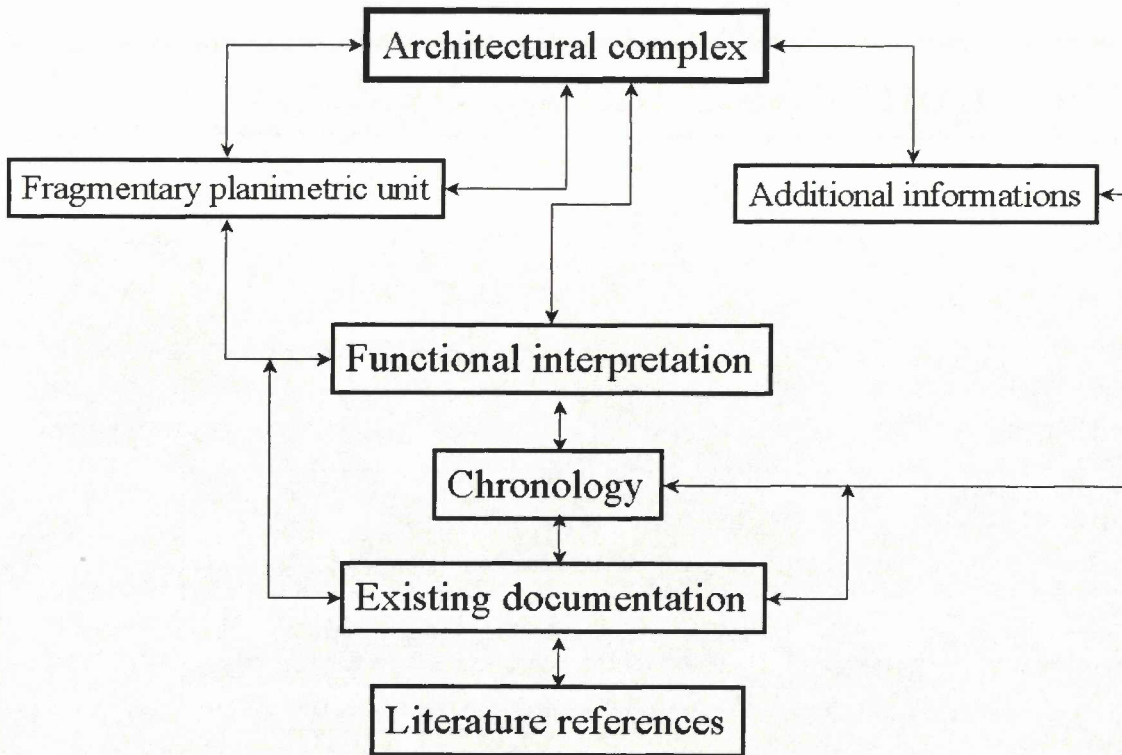
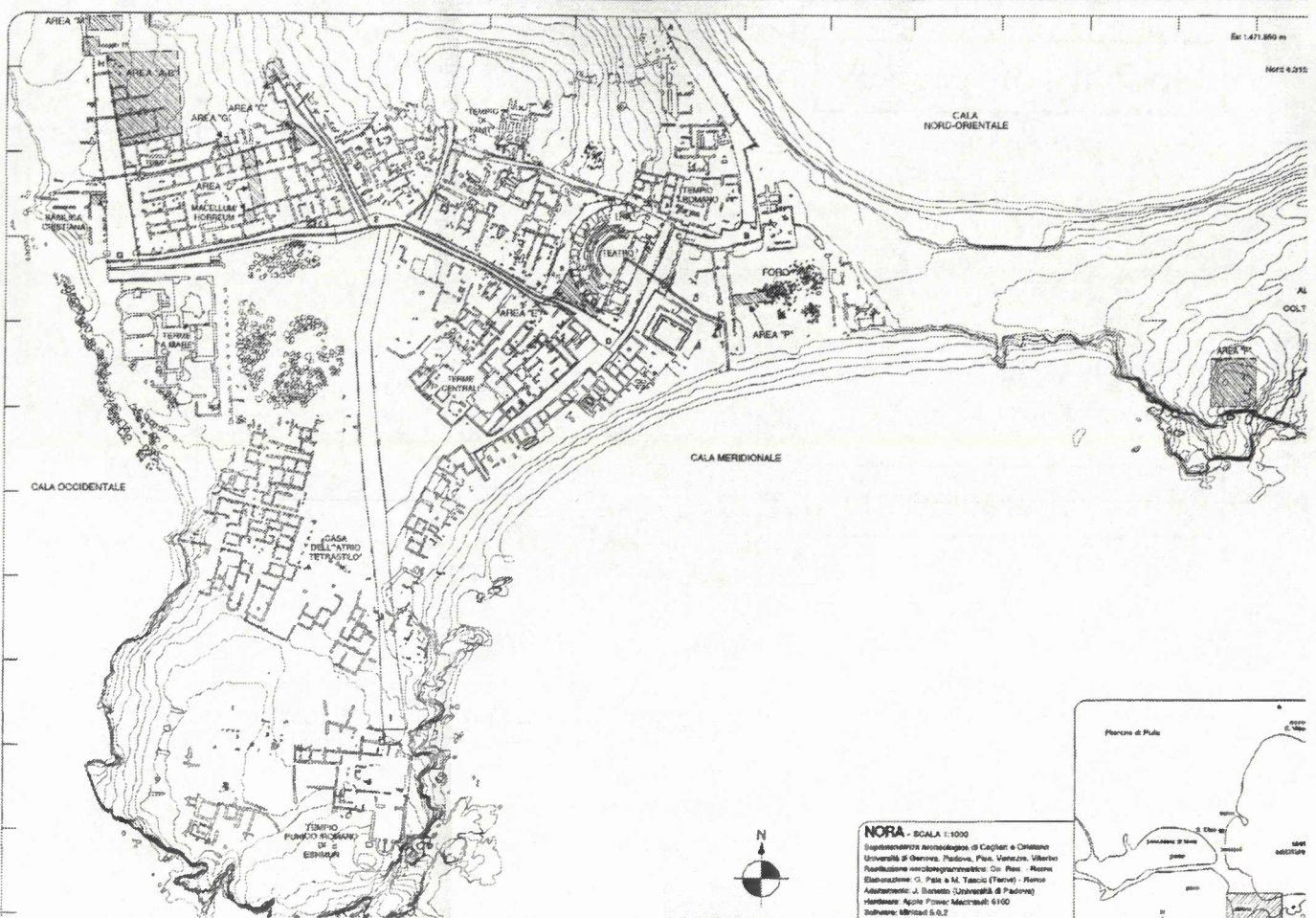


Figure 3.



Map 1.