

Digital vs. historical cartography for studying archaeological sites: a case study from Corsica

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Abstract

In this paper we wish to query the meaning of the use of computer technologies to study historical cartographic documents in an archaeological project. To illustrate some of the possible applications of IT and historical cartography within the context of an archaeological project, a case study from Corsica will be presented. On-going interdisciplinary research on the site of the Roman town of *Mariana* is taken as an example for discussing problems and possibilities offered by the GIS-integration of historical maps, old site plans and early aerial photographs with new survey data and excavation evidence. Some issues about digitalization of old cadastral and topographic maps are addressed, while interpretative mapping is evaluated. The resulting hypotheses and models concerning the exact location of old “excavations” and the major topographic elements of the Roman town and its hinterland (circuit wall, gates, public centre, road network, cemeteries, land division) procure new guidelines for on-going fieldwork on the site and for the management and valorisation of the archaeological and landscape values of the ancient town area.

Introduction

A very specific form of computer mapping of archaeological features concerns the use of ancient maps and older cartographic information. Historical maps provide valuable information for archaeologists: here, archive data are accompanied by certain spatial references, even if only in the most recent and accurate cartographic production (mostly since the 17th century) the use of geodetic reference points allows the extraction of approximated coordinates. The use of spatial GIS software can supply more convenient access to maps and even allow better preservation of the originals. But, perhaps most importantly, the IT provides researchers with tools to extract more information from traditional maps than can be obtained using the paper map alone.

The topographical reliability and the fidelity to the real extent and shape of geographical elements in historical cartography present a quite variable degree of exactness, according to the geographical knowledge of the time the map was realised, the experience of the author, the availability of financial resources supplied by the commissioner, the scale and the function of the map (e.g. chorographic description or decorative use vs. practical purposes like cadastral survey or navigation necessities).

The function and the target of each map heavily influence also the level in the accuracy for rendering the topographical elements: i.e., in nautical maps highest relevance is given to the location of harbours, landing places and river mouths, while the inland topography is very approximate; on the contrary, in estate or political maps human seats appear very clearly, overwhelming the details of environmental factors. Characteristics such as the metrical scale, the use of uncommon units of measure, the approximate or not recognizable projection system, the difficulties in the identification of symbols and in the reading of texts and toponyms (sometimes due to a bad preservation of the originals) make it difficult for IT to interpret, analyse and manage this kind of sources.

Nevertheless, all these documents can find a relevant use in the reconstruction of historical landscapes and can provide very useful information about lost archaeological elements. For this purpose, together with the valuable cartography produced by different European traditions (above all, Italy and the Low Countries) since the 16th century, we could take into account a huge amount of artistic impressions of landscapes, sketches and basic plans with location of archaeological elements or persistent landmarks.

Until recently, historical maps have been inserted among traditional sources of information and their "exploitation" has been limited to an introductory comment or as an additional proof of the existence of archaeological features, mostly Roman roads and rural estate buildings. The massive introduction of GIS in archaeology and cultural heritage management offers now the possibility for a different processing of these data. The transformation of these often distorted historic maps into spatially referenced information layers to be used for the successful reconstruction and analysis of the historical landscape is now within reach.

Given the complexity, the variability and the lack of precision in most of such documents, this application comprises:

- the correction to modern topographic base (to predict the location of specific features and for interpretation purposes);
- the identification and location of control points;
- the confrontation with field data.

Such data processing can be managed perfectly through the integration in the GIS of the historical map layers with a full battery of field techniques and with the possibilities now offered by remote sensing technology. In this context, the use of historic cartographical documents can be very rewarding, but their introduction into a GIS must coincide with the application of good historical criticism.

Only a small number of archaeological projects in Europe have dealt intensively with full GIS use of historical maps, although there are a few good examples (CRUMLEY, MARQUARDT 1987¹; FLYG 1997; POIRIER 2006), and more and more specialised labs are testing processing methods, sometimes with fine results (GUERRA 2000; PEARSON, COLLIER 2002; CAMPANA 2003; SURIAN, RINALDI 2003). In most cases, maps are raster scanned into the system and patched together to create several useful georeferenced layers; less frequently, such maps are even vector digitized into the GIS; in some projects historic maps have been combined and rectified by hand, overlaid on modern cadastral maps and digitized only in a second phase.

More recently, warping techniques have been elaborated to process non-geometrical cartographies (BALLETTI 2000), and specific software has been produced to allow the "random" re-distribution of key-points featured in the old maps on the modern cartographical layers, replacing the classic procedure of *referencing-transformation* with the concept of *referencing-correspondence*, where the check-points on the ground are given the higher relevance (GUERRA 2000).

Very accurate procedures have been widely tested for geometrical transformation based on global as well as on local parameters, performing referencing processes known as rubber-sheeting (global positioning) and point or feature based warping (local positioning: BALLETTI 2000, p. 30-31), both for urban as well as rural mapping (BAIOCCHI, LELO 2005).

Still, the range of experiences and experiments has to be widely enlarged, before the "protocols" for processing historical cartography could be considered ordinary routine. Furthermore, only in very few occasions these historical map data are actively used to direct field research.

Research in the Roman town of *Mariana* (Haute-Corse, France)

By way of a case study of research undertaken by the universities of Cassino and Gent, we would like to show some of the possibilities that such an integrated work can offer for field archaeology. Here the historical and old data, mostly historical maps, old site plans and early aerial and field photographs, are integrated with data from recent field observations, aerial photography, geophysical research and excavations.

The case study is taken from an on-going international research project in and around the Roman town of *Mariana*², an ancient urban site on the east coast of Corsica. The team of Cassino and Gent is involved here in studying the ancient topography of the city in a diachronic framework.

The site of *Mariana* is part of a still mostly rural plain, inserted between the mountainous parts of the island and a coastal lagoon, immediately south of Bastia (fig. 1). Pressure on the landscape by intensive tourism is increasing and the original agricultural use of space diminishes continuously. A site such as the one of *Mariana*, with only very few remains above ground, is therefore under threat.

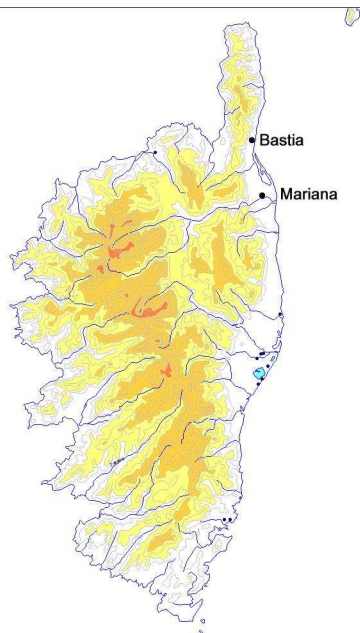


Fig. 1 - Location of the Roman town of *Mariana*.

The GIS work is mostly based on Map Info software, with a cartographic base consisting of several topographic maps of the area on regular scales, combined with very recent cadastral map data on a 1 to 2000 scale. Further layers of cartography were obtained from geological and soil maps, from historical maps and older cadastres, from existing and newly made aerial photography, and finally, from existing and new excavation data.

Our research is at the moment involved in answering three main questions. The first of these is concerned with a reconstruction of the ancient landscape around *Mariana*. It is clear from all existing observations that the dynamics of the river Golo, of the lagoon system and of the coastline in this part of Northern Corsica, are strong and have a tremendous impact on the archaeology of *Mariana*. A simple regressive cartographic study of the existing maps of the area shows how much, for instance, the river bed

has fluctuated through time. As some of the older cartography of the Département de Haute-Corse is of excellent quality, such as a 18th century map of the lower Golo area demonstrates (fig. 2), we can already learn much about river dynamics.



Fig. 2 - Carte Topographique de la Communauté de Lucciana, attached to dossier «Isle de Corse. Description générale et détaillée de la communauté de Luciana», 1785 (Archives Nationales, Paris). Scale 1/21.500.

The new GIS map in fig. 3, made by overlay of map data from several moments during the last 220 years, already show this fluctuation of the stream (CORSI et AL. forthcoming). On-going geomorphologic research by a team from the Maison Ginouvès in Paris, can now use these data for augerings and other field work, in order to obtain a map of the detailed river situation in Roman times (ROBLIN-JOUVE et AL. forthcoming).

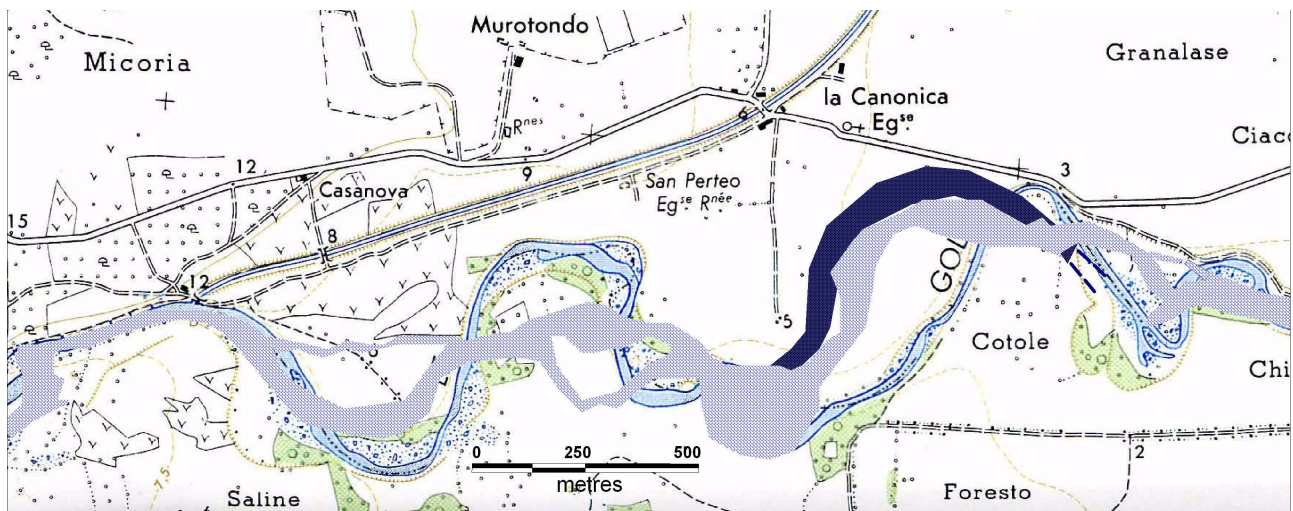


Fig. 3 - Reconstruction of the Golo river bed based on the historical maps. Cadastral maps of 1845 (light blue) and 1937 (dark blue) (C. Corsi).

The same kind of approach is possible for the reconstruction of the ancient coastline. Here the geomorphologic reconstructions based on historical map data, combined with our on-going fieldwork and aerial photography, will soon lead to comparable GIS mapping (fig. 4). Indications for the location of a possible Roman harbour site near the ancient mouth of the river are being investigated (fig. 5).

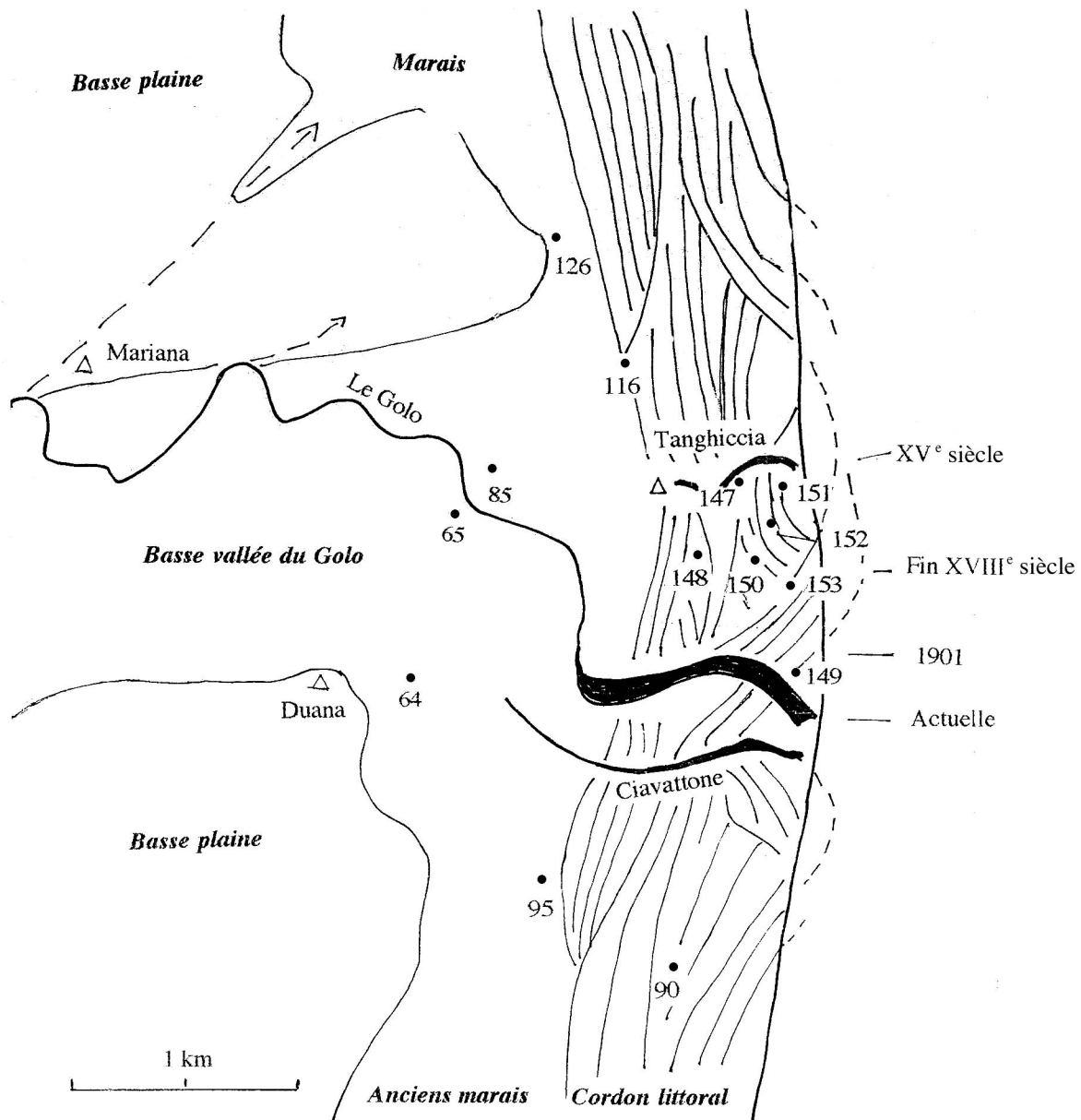


Fig. 4 - Reconstruction of the evolution of the ancient coastline and the river mouth (A. Roblin-Jouve, Maison Ginouvès)



Fig. 5 - Aerial view of the former mouth of the river Golo (so called 'Tanghiccia') (F. Vermeulen)

The second question is more specific and concerns the precise location and especially the extent of the Roman town. Although ruins of the Roman city remained long indicators for the location of *Mariana*, as we can still see on these two historic maps, kept in the archives of Paris, the representations of the town area are not very useful for modern archaeological eyes. The positioning of the town site near the Golo river and somewhat inland from the 18th century coastline, and maybe the suggestion of a town wall, are the only reliable data from such general maps (figs. 6-7).



Fig. 6 - L'Isle de Corse, T. Conrad Lotter - Augsburg 1738, scale 1/315.000 (Paris, Archives National). Detail of the localisation of *Mariana*.



Fig. 7 - Carte Militaire de l'Isle de Corse, 1768, scale 1/165.000 (Paris, Archives National). Figurative representation of *Mariana*.

Of much more importance, in a landscape almost void of upstanding remains, are two landmarks connected with the Late Antique and early medieval history of the site. One is the suggestive Romanesque church of La Canonica, which can be identified as the heir of a late antique 'intra-mural' church of the local bishop. The other is a comparable limestone church dedicated to San Parteo, and now to be interpreted as a the replacement of an original 'extra-mural' funerary sanctuary. Apart from the location of these churches, respectively inside and just outside the presumed ancient walls of the city, we are helped by two further topographical elements. These are two Roman cemetery areas, partly excavated in the 1950s, which should indicate, according to Roman legislation, areas outside the town. With the help of these data a general location of the city was established by Moracchini-Mazel almost half a century ago (MORACCHINI-MAZEL 1971, 1974).

(C.C.)

The "Cadastre de Napoléon"

To obtain much more precision for this location of the city, we chose to bring a series of excellent historical maps into our analysis. Most convenient are the mid 19th century maps of the so-called 'Cadastre de Napoléon' (fig. 8)³. Napoleon Bonaparte, in fact, took the decision, in 1807, to start the big enterprise of realising a new mapping and registration of the properties in the whole of the empire. A committee of 10 members was already at work in January 1808, and the measurement activities proceeded hectically until

1813. Then, after the fall of Napoleon, the “cadastre parcellaire” was restarted in 1818 but the operations went on slowly until 1821, when the responsibility of its realisation were delegated to the individual Départements. In 1850, the activities were officially closed, the Cantal being the last Département where the registration and the topographical measurements were completed, even if in several districts the mapping of landed property was achieved only later (among them, Corsica definitively completed in 1889).

The maps were produced in two copies: the one preserved in Corsica is very easily accessible at the “Archive Départemental de Haute-Corse” in Bastia. The digitized database where all the original sheets have been stored as images can unfortunately supply only printed copies, so that a third passage with scanner is unavoidable to store the raster version into the GIS.



Fig. 8 - Cadastre de Napoléon 1845/47 (Archive Départemental de Haute-Corse, Bastia). Detail of the sheet “Lucciana” C1.

Geo-referencing these map sheets and making good use of the landmarks la Canonica and San Parteo, as well as other reliable spatial points such as crossroads, made it possible to digitally extract all elements of this ancient cadastre and re-position them within the topographic framework of today (fig. 9), using the

coordinate system based on WGS 84. In this case, this procedure proved to be the fastest and most efficient, given the large scale of the cadastral maps, the good geometric distribution of those spatial key-points (they must be well distributed in the sheet, to avoid deformations) and the high reliability of the geodetic reference base of this cadastral operation, even if some errors are expected to occur (LILLESAND, KIEFER 1994).

Further research will achieve the vectorization of all the elements, polygons and lines, represented on the historical cadastre, to perform a perfect overlap with the brand new AutoCAD-made cadastre available now for the territory of the municipality of Lucciana.

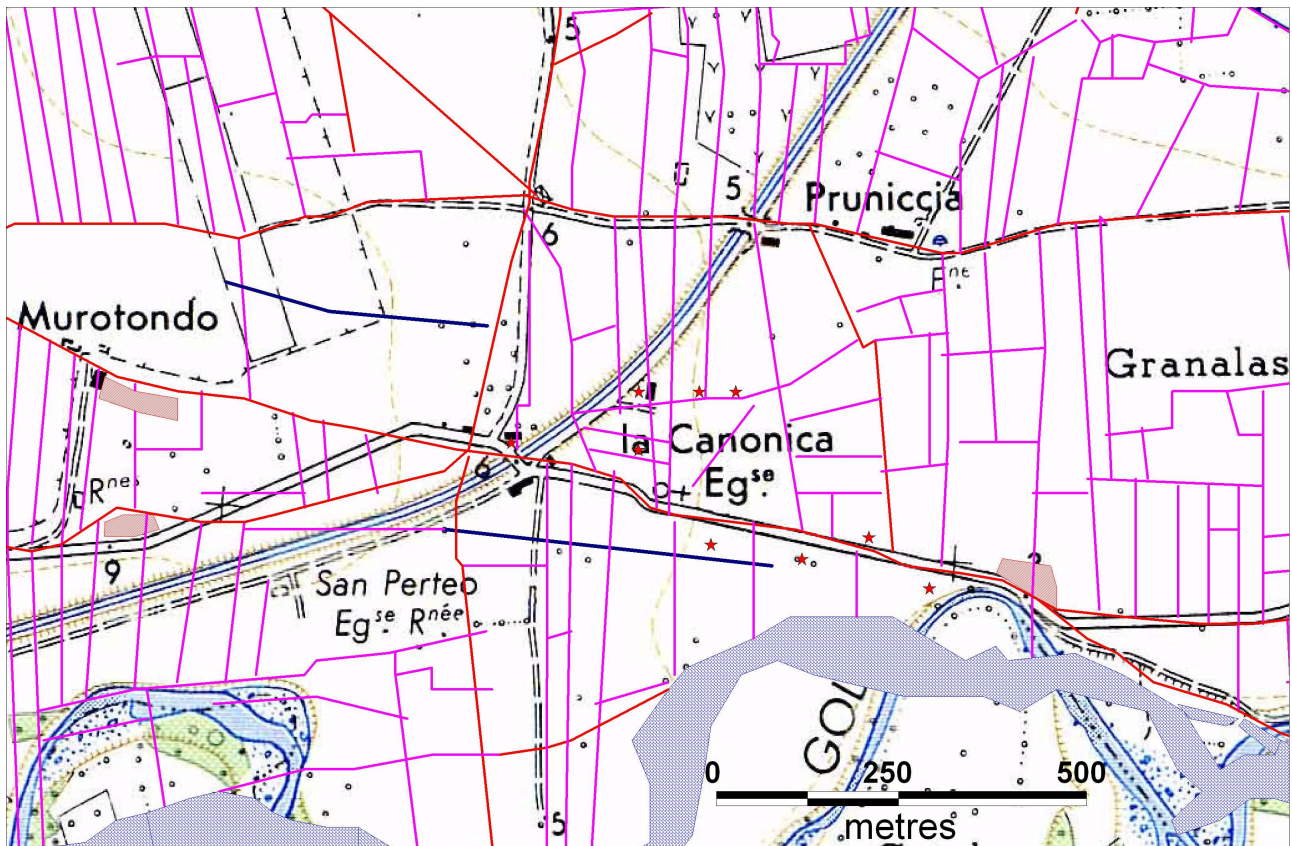


Fig. 9 - The elements from the "Cadastre de Napoléon" are overlaid on the modern topographical map (IGN Feuille 4349 OT – Vescovato): in red are indicated the most persistent landmarks (roads, channels), in violet are the land divisions.

Aerial photography, archive research, geophysical prospecting and field activities

Further historical analysis, filtering and correction work, using overlays with topographic maps and orthophotos, presented an image base of essential linear marks to further confront with other available data⁴. It was presumed that some of the lines in that mid-19th century landscape had relevance for the study of the ancient medieval and even Roman situation, as is often the case with this remarkable document in France.

Especially the confrontation with our analysis of the excellent historical aerial photographs of this region, now archived at the Institut Géographique National in Paris, seemed meaningful. Several now 'fossil' lines in the landscape were identified and framed in their proper context in this way (fig. 10). In fact, full comprehension and evaluation of the traces of aerial photography is possible thanks to the comparison with ancient cadastres, where they can be connected to old land division or roads (fig. 11).



Fig. 10 - Vertical aerial photography (IGN, NP 11 1937, n. 30), with traces of the wall circuit of the Roman town.



Fig. 11 - The overlapping of the elements from the "Cadastré de Napoléon" on the vertical aerial photography (IGN, flight 19719, 1958, n. 83) shows how persistent the delimitations of the Roman town of Mariana have been as landmarks through time.

Field control of such a linear indication on the northern side, lead to the identification of a small remnant of the Roman circuit wall, now partly hidden by vegetation (fig. 12). Confrontation of such traces with rediscovered photographs of the 1930s lead to a positive identification as the remains of the Roman town wall, now almost completely vanished on ground level.