

GEOARCHAEOLOGY OF THE LANDSCAPES OF CLASSICAL ANTIQUITY

GÉOARCHÉOLOGIE DES PAYSAGES DE L'ANTIQUITÉ CLASSIQUE

International Colloquium Ghent

23-24 October 1998

Colloque International Gand

23-24 octobre 1998

edited by

FRANK VERMEULEN & MORGAN DE DAPPER

Leiden
Stichting BABESCH
2000

A GIS based Database to Process Roman Cadastre and Settlements

A. Rizakis,¹ A. Vassilopoulos,² N. Evelpidou,³ M. Petropoulos

Abstract: *In the modern study of Roman cadastres and settlements, it is important to systematically import and store the locations and measurements in a database that is able to reproduce not only the data, but also their geographical distribution. Moreover, it is important to link them with other data, such as chronology, date of excavation, reference, aerial photo numbers, etc.*

In this paper, we describe an easy and flexible GIS-based database model for the storage of all the data that could help scientists to work on Roman cadastres and settlements. As a pilot study, this method has been applied in the area of Patras, with a remarkable success. During fieldwork, it supported the use of GPS and the instant import of the field data to the GIS of a portable computer. In the laboratory, these data were systematically analysed and the database was updated with other secondary information on each site. In addition, other scientists using a similar GIS-based database will find it easy to communicate and exchange data.

In this paper, we used the Patras area as an example to demonstrate the contribution of modern technology in the manipulation of archaeological data relating to Roman cadastres and settlements. This is a preliminary attempt at recording archaeological data in a GIS-based database instead of a conventional one. The need for this arose from the difficulty of manipulating large amount of archaeological data for numerous sites. GIS-based databases use tools both from GIS and powerful databases, facilitating a series of tasks such as: automatic selections using various fields, data exchange among software, direct import of GPS measurements, automatic field update with values from GIS algorithms, fast and easy reproduction of custom maps and data tables, etc.

We will not expand upon the technical characteristics and benefits of these tools, since most scientists are familiar with the general principles. The main point we would like to stress is that we used the GIS 'MapInfo' in connection with the powerful external database 'Access'. This enables users to analyse their data quantitatively and spatially on a GIS platform, while, behind each map object, Access maintains a variety of information organised in fields and records. It is obvious that instead of MapInfo and Access,

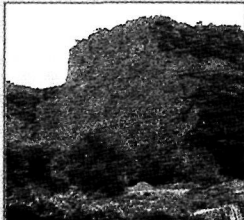
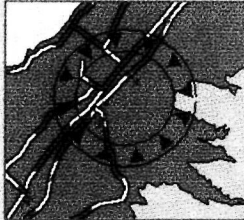
other software could have been used, as far as they could communicate through ODBC drivers or other data exchange mechanism.

Importing locations into the computer is simple in principle, but the GIS-based database permits the combined use of the portable computer and the GPS. This enables the correction of the variable error (EPE) that GPS introduces to the coordinates. The correction method was originally developed by our team at the Remote Sensing Laboratory of the Athens University. It has been successfully used many times for geological, geomorphological and environmental purposes and we applied it for archaeological purposes to all the field measurements of Patras area. A simple database is created for the site locations, in which we store the name of the site, the EPE (estimated position error) and the altitude for each measurement. These data are processed by the GIS, and cross checked manually or automatically: a) with the altitude derived from the DEM (Digital Elevation Model) that was digitised before the field work, b) with the altitude value provided by an external altimeter, c) with the boundary area formed by previous measurements of the same named site. If the new data are in conflict with the altitude information or the previous measurements of the position of the same site (using a reasonable tolerance), the point is rejected, otherwise it is imported to the GIS. At the end of the field work, the site data are grouped by name, and the correct site location is taken to be the geometric centre of all the measurements having the same site name.

The related database that was developed for the area of Patras holds all the information in one record, which can be displayed on a single screen layout. *Figure 1* shows two different records being displayed, with all the important archaeological fields. Due to lack of archaeological data, these do not represent real archaeological conditions. At the bottom of each record, we can see four image windows. The first two windows represent a general view and a GIS map of the area. The third and fourth images represent the archaeological findings. Other image fields could of course have been added as well.

The databases field structure is described in the following table:

Site No	IIV	Last Update Date	1/10/98	Geomorphological Description	
Site Type	ROMAN BRIDGE (EAST PART)			1. Alluvial deposits (5m) 2. Altitude range : 0-100m	
Site Name (Full)	ANO AHLADOKAMPOS				
Location (Wide)	AHAIA			Vegetation Type	
Location (Near)	PATRA			OLIVE TREES	
Location (Exact)	GPS No 27a			Testimony	
X_Coord	38,5654458	Y_Coord	24,5659866	GPS_epe	31
Altitud	35				
Architectural Find	NONE				
Movable Finds	FOUND BUT NOT REPORTED YET.				
Fieldwork Type	EXTENSIVE EXCAVATION				
Fieldwork Init.Da	1/1/1997	Fieldwork Duration (Day)	270	References	
Site Preservation	POOR			STRNGFIELD, V.T., LEGRAND, H.E., 1969, Relation of sea to fresh water in carbonate rocks, USA, & Cephalonia (Kephallinia), Greece, p. 387-404.	

Site Photo	Site Map	Architectural Finds (Photo)	Movable Finds (Photo)
			

Site No	IIIX	Last Update Date	07/10/1998	Geomorphological Description	
Site Type	ROMAN SITE			1. HIGHLY ERODED SURFACE. 2. WELL DEVELOPED DRAINAGE SYSTEM / GORGES 3. HIGH SLOPES (OVER 100%) / KNICK POINTS	
Site Name (Full)	KATO AHLADOKAMPOS				
Location (Wide)	AHAIA			Vegetation Type	
Location (Near)	PATRA			VINEYARDS , OLIVE TREES	
Location (Exact)	GPS No 41			Testimony	
X_Coord	21,762201	Y_Coord	38,264301	GPS_epe	18
Altitud	60				
Architectural Find	IF ANY, NOT REPORTED YET.				
Movable Finds	NONE				
Fieldwork Type	SURFACE EXCAVATION				
Fieldwork Init.Da	2/5/1998	Fieldwork Duration (Day)	125	References	
Site Preservation	GOOD			GLANZ, T., 1965, Das Phänomen der Meermühlen von Argostolion, Eine hydraulisch - physikalische Betrachtung, Steir. Beitr. Hydrogeol., 17, 113-127.	

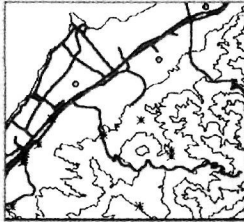
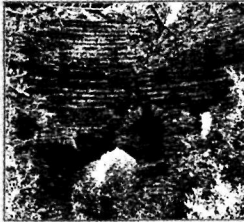
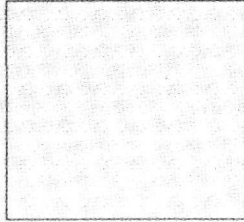
Site Photo	Site Map	Architectural Finds (Photo)	Movable Finds (Photo)
			

Fig. 1. – Two typical archeological records.

Field Name	Data Type	Description
ID	AutoNumber	Data Record ID Number
Site No	Text (5ch.)	Site Field Numbering
Site Type	Text (50 ch.)	Site Archeological Type
Site Name	Text (200 ch.)	Site Archeological Name
Location (Wide)	Text (200 ch.)	Site Location (General)
Location (Near)	Text (200 ch.)	Site Location (Approximate)
Location (Exact)	Text (200 ch.)	Site Location (Exact)
Date	Text (50 ch.)	Dating of Roman site
Archeological Finds	Text (200 ch.)	Description of Archeol. Finds)
Movable Finds	Text (200 ch.)	Description of Movable Finds
Fieldwork Type	Text (50 ch.)	Type of Field work
Fieldwork Date	Text (50 ch.)	Fieldwork's initial date
Fieldwork Duration	Number-Integer	Total number of fieldwork days
Site Preservation State	Text (200 ch.)	Site Preservation State
Geomorphology	Text (225 ch.)	Geomorphological Description
Vegetation	Text (255 ch.)	Vegetation Description
Testimony	Text (255 ch.)	Local people Testimony
References	Text (250 ch.)	References related to sites/findings
Site Map	OLE Object	Local Site Map
Site Photo	OLE Object	General Site Photo
Archeological Finds	OLE Object	Photo of Archological Finds
Movable Finds	OLE Object	Photo of Movable Finds

This table can be modified; it reflects the data we intend to classify at Patras. If the model were applied to a different area, or archaeologists provided us with more or different data types, the flexibility of the database's structure would permit fast and efficient modifications.

Apart from database and other capabilities, GIS tools provide spatial distribution analysis of the sites and in particular, the ability to select all the objects (sites) from a specific territory within the area being studied. For our example, *Figure 2* shows the relief of the Patras area coloured differently for each altitude range. On this map, we can also see the 17 points that represent the exact positions (retrieved by GPS) of archaeological sites.

Having imported all these data to the database and connected it with the GIS, we can automatically retrieve or update data in the database, while having a map window and viewing all the sites. Moreover, the user can apply complex queries to the GIS, concerning both geographical/geomorphological characteristics and database information. For example we asked the GIS to select and mark all the sites that are situated at an altitude less than x m, have age of y years, and distance from the sea less than 300 m.

To conclude, GIS and GPS technology reduce the time and effort needed to query a large database, while increasing the accuracy and the efficiency of the working team.

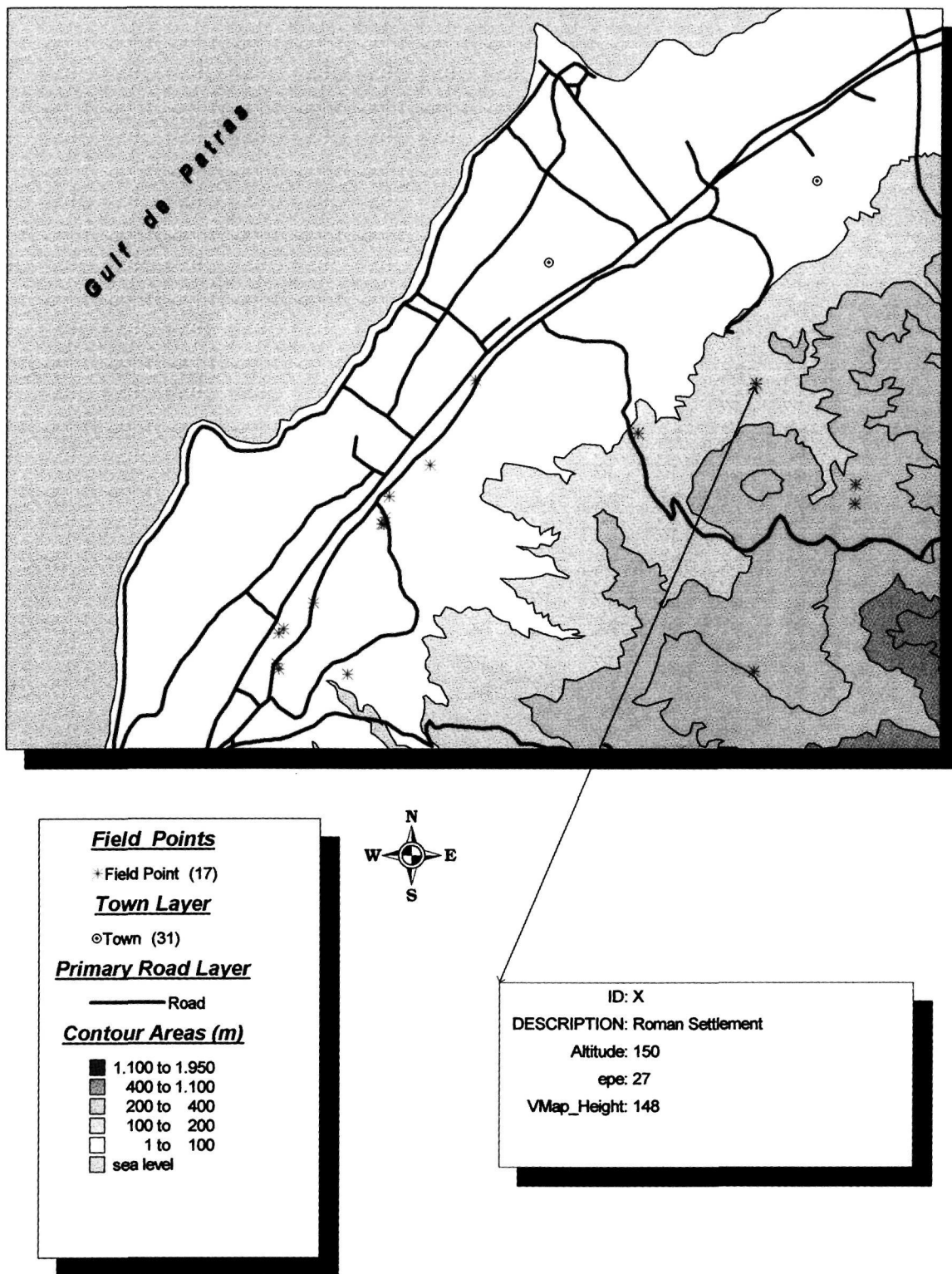


Fig. 2. – GIS-map of the Patra area.

BIBLIOGRAPHY

- Evelpidou, N., Vassilopoulos, A., 1997. *Modern techniques in Geosciences: A. Geographical Information Systems, B. Global Positioning System*, Writings of subject "Geography & Environment" Master, Athens Univ., Geology Dept., p. 51
- Evelpidou, N., 1997. *Geological and Geomorphological observations on Paros island, using GIS and Remote sensing methods*, University of Geology, Athens, p.181.
- Evelpidou, N., Vassilopoulos, A. Vaiopoulos, D., 1997. Development of GIS Methodology, for the study of land-use at Paxi island, *Proceedings of 1st International Congress "Space Applications and Environment" of Hellenic Astronautical Association*.
- Gournellos, Th., Vassilopoulos, A., Evelpidou, N., 1997. Development of a GIS-based methodology to analyze geological, geomorphological and environmental data of the island of Zakynthos, Engineering Geology and the Environment, *Proceedings of the International Environmental Congress, organized by the Greek National Group of IAEG, Athens-Greece*.
- Vassilopoulos, A., Evelpidou, N., 1994. *The Geographical Information Systems and their applications in Earth Sciences*, University of Geology, Athens, p. 87.
- Vassilopoulos, A., Evelpidou, N., Vaiopoulos, D., 1997. *Evaluating average % relief slopes at Sifnos island, using GIS, Proceedings of 1st International Congress "Space Applications and Environment" of Hellenic Astronautical Association*.

NOTES

- ¹ CNRS, Athens-Greece.
- ² Remote sensing laboratory, Geology Dept., Athens University-Greece.
- ³ Remote sensing laboratory, Geology Dept., Athens University-Greece.

Introduction	1
Ch. De Jaeger, M. De Dapper, B.-M. De Vliegheer, R. Goossens et alii , Geo-archaeological Mapping using Very High Resolution and Stereoscopic Satellite Imagery (Russian TK-350) Integrated in a GIS. A Case Study for the Wadi Mujib Area near Lahun (Jordan).	7
M. Clavel-Lévêque, A. Vassilopoulos, N. Evelpidou & G. Tirologos , An Example from Béziers to Demonstrate a GIS-based Methodology on Selecting Possible Roman Cadastre Grids.	15
C. Di Celma, P. Farabollini & U. Moscatelli , Landscape, Settlement and Roman Cadastres in the Lower Sangro Valley (Italy).	23
P. Attema & J. Delvigne , Settlement Dynamics and Alluvial Sedimentation in the Pontine Region, Central Italy; a Complex Relationship.	35
J. Bintliff , Landscape Change in Classical Greece: A Review.	49
Ph. Boissinot , Les vignobles antiques du Midi de la France.	71
R. Fanti , Geomorphological Hazard in the Tharros Archaeological Area (Western Sardinia, Italy).	85
E. Fouache, Ch. Müller, Y. Gorlov, V. Gaïbov & A. Porotov , Geoarchaeological Study of the Taman Peninsula and the Kouban Delta (Black Sea, Sea of Azov, Russia).	97
Ph. Leveau , Dynamiques environnementales et dynamiques sociales sur le territoire d'Arles antique.	105
J. A. Lopez-Saenz, M. Heijmans, Ph. Leveau, M. Provansal, H. Bruneton & D. Sistach , Géo-archéologie d'un site urbain. Un égout romain à Arles (France méridionale).	119
S. Melis , Variations des lignes de rivage aux environs de la ville antique de <i>Nora</i> (Sardaigne, SO – Italie) d'après les données géoarchéologiques.	127
U. Pappalardo & F. Russo , Geomorphological and Archaeological Evidence of the Ground Movements (Bradyseisms) in the Phlegraean Fields (Naples, Italy).	137
J.L. Peña, M.T. Echeverría, A. Julián & J. Chueca , Processus d'accumulation et d'incision pendant l'Antiquité Classique dans la vallée de la Huerva (Bassin de l'Ebre, Espagne).	151
A. Rizakis, A. Vassilopoulos, N. Evelpidou & M. Petropoulos , A GIS Database to Process Roman Cadastre and Settlements.	161
F.-J. Sánchez-Palencia, L.C. Pérez & A. Orejas , Geomorphology and Archaeology in the Las Médulas Archaeological Zone (ZAM) (Léon, Spain). Evaluation of Wastes and Gold Production.	167
Z. Stančič, T. Veljanovski & T. Podobnikar , Understanding Roman Settlement Patterns through Multivariate Statistics and Predictive Modelling.	179
A. De Wulf, T. Van Herck, M. De Dapper & B.M. De Vliegheer , GPS Surveying Techniques in Archaeology: Topographical Survey of the Thorikos Region (Greece).	189

A. De Wulf, T. Van Herck, M. De Dapper & B.M. De Vlieghe , Analysis of the Efficiency in Archaeology of GPS Satellite Surveying versus Classical Surveying using Totalstations: Applications in the Thorikos Region and on the Pyrgari (Greece).	197
G. Leroux , Paysages et habitats antiques en Armorique orientale: l' exemple des bassins de la Seiche (Ille-et-Vilaine) et de l'Oudon (Mayenne).	209
F. Vermeulen, B. Hageman & T. Wiedemann , Photo-interprétation, cartographie et analyse dans le cadre d'un SIG des systèmes spatiaux anciens. L'archéologie des routes et parcellaires en Gaule Belgique septentrionale.	219



PEETERS

PEETERS - BONDGENOTENLAAN 153 - B-3000 LEUVEN