ARCHAEOLOGICAL AND METHODOLOGICAL APPROACHES FOR THE CONSTRUCTION OF AN *INTRASITE* AND *INTERSITE* GIS OF ELAIUSSA SEBASTE (TURKEY)

Emanuela Borgia

Dipartimento di Scienze Storiche, Archeologiche, Antropologiche dell'Antichità, Università di Roma "Sapienza", P.le A. Moro 5, 00185 Roma, Italy - emanuela.borgia@uniroma1.it

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ABSTRACT:
Main purpose of this paper is exposing the theoretical and methodological approaches adopted while conceiving and constructing the GIS of Elaiussa Sebaste, a Hellenistic, Roman and Byzantine city located in south-eastern Turkey. The excavation at Elaiussa Sebaste is carried out by a research group of the Università di Roma "Sapienza" since 1995. The *intrasite* and *intersite* GIS has been developed within a wider project (Archeomedsat) funded by the Italian Ministry of University and Research. As the information is collected at two different scales, regional survey and excavation data, the GIS of Elaiussa Sebaste has been conceived in order to organize, analyze and share both these categories in the simplest and most suitable way. The aim of the GIS of Elaiussa Sebaste is firstly to manage the excavation information, to be collected into specific databases: the "Archaeological Layer" has been chosen as central element, to which all the categories of finds are connected. Through the investigation of the superposition of the layers and their chronology it will be possible to isolate the main phases of the buildings, which can be examined in their historical and chronological evolution. Spatial analysis or distributional analysis of the information on the site, such as the study of single urban areas, helps in understanding the formation process and changes of the city during its long history. Thus the elaboration of a GIS system can offer good opportunities not only for the recording and elaboration of data, but also for their reinterpretation.

INTRODUCTION

History and topography of the site

The city of Elaiussa Sebaste is located in the ancient region of Cilicia *Tracheia*, corresponding to the actual south-eastern coast of Turkey (in the district of Mersin). According to the historical and numismatic sources, it has been founded during the late Hellenistic period and enjoyed a high prosperity under the Augustan era. The first settlement was certainly located on a small promontory facing the sea, while in the Roman imperial period (2nd and 3rd centuries AD) the urban area was extended as far as the hills in the mainland (Figure 1).

Figure 1. Aerial view of Elaiussa Sebaste from south-east

As it is proved by the impressive monuments discovered during the excavation, the site was, in this period, one of the most important harbours of the Roman province of *Cilicia*. In the Early Byzantine age, after a short phase of decline during the late 3rd and the 4th centuries, a new extensive building activity occurred, accompanied by the development of manifold manufacturing activities. The site was an important Episcopal see until the first decades of the 7th century, when it was definitively abandoned, probably owing to the difficult and uncertain political situation of the region such as because of the occurring of a severe earthquake, which caused the destruction of the most part of its buildings.
On the promontory the main living quarters together with several important public buildings - bath complexes, porticoes, Byzantine palace, Byzantine basilicas - belonging to the Roman and Byzantine period were located.
The Roman monumental quarter in the mainland includes a theatre, a commercial agora, a bath building, while a huge Corinthian temple rises on the hill to the south of the city. The urban area is surrounded by three necropolises whose tombs, pertaining to different typologies, are aligned along the main ancient roads entering the city. A number of production and facility structures, such as cisterns, wells, kilns, are spread in the city and all over its hinterland, such demonstrating its high vitality during all its life.

The research and excavation project at Elaiussa Sebaste

The research and excavation project of the University of Rome "Sapienza", directed by prof. Eugenia Equini Schneider, started in 1995 upon a formal request of the Turkey Ministry of Culture and, since then, is going on annually. The archaeological area, including the living and public quarters such as the necropolis, covers an extension of about 23 hectars. During 12 years of excavation some of the main public and private buildings of Elaiussa Sebaste have been extensively excavated and carefully documented, while in other areas surface surveys have been carried out. As a consequence at present time the general layout

of the urban topography and the progressive development and growth of the city can be quite easily reconstructed (Figure 2).
Even if after a quite short period of activity, the high quantity of data hitherto resulting form the work on the field and their variety and complexity in nature and chronology made it necessary to choose computerised systems in order to facilitate the collection of information and to optimize the goals of the research. Such systems can allow both the acquisition of new information, to be coded following the new requirements, and the *ex post* reorganisation of datasets deriving from the past researches.

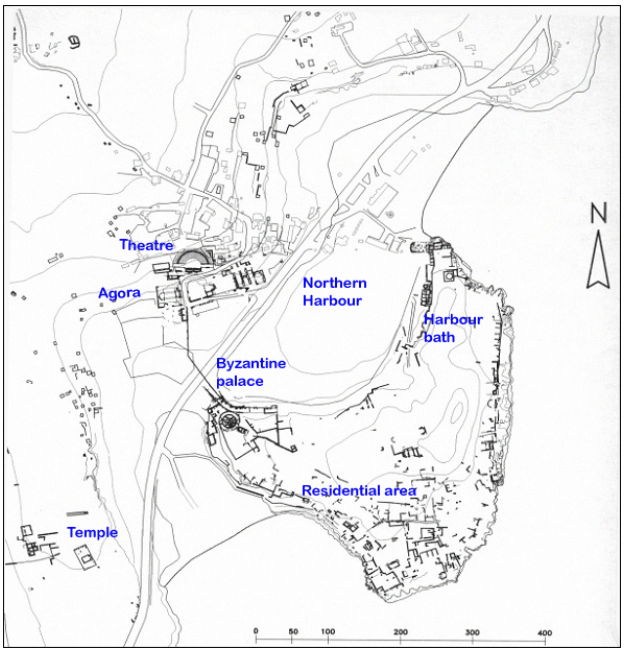

Figure 2. General plan of Elaiussa Sebaste

THE GIS PROJECT

The main purpose of this paper is to expose and analyse the theoretical and methodological approaches to which we made reference while conceiving and constructing the GIS, without taking into account the technological solutions which had to be elaborated by the concerned specialists.
The *intrasite* and *intersite* GIS project of Elaiussa Sebaste is being developed within a major research project (Archeomedsat), funded by the Italian Ministry of University and Research, particularly with the cooperation of the Dipartimento di Scienze Storiche, Archeologiche, Antropologiche dell'Antichità of the Università di Roma "Sapienza", and the Dipartimento di Ingegneria del Territorio, dell'Ambiente e delle Geotecnologie of the Politecnico di Torino.
As archaeological data is collected at two different scales, topographic survey and excavation information, the GIS project of Elaiussa Sebaste has been conceived in order to organize, analyze and share both these categories in the simplest and most manageable way. Construction of archaeological GIS data has taken place, until now, almost entirely at the scale of excavation and archaeological spatial records, which is the priority for the ongoing research on the field. Nevertheless the project aims at applying such infrastructure also to survey data collected in the urban area as well as in the territory surrounding the city.

Construction of the databases

The aim of the *intrasite* GIS project of Elaiussa Sebaste is firstly to manage the manifold data coming from the activities on the field as well as from the post-excavation researches. This rich and complex information had to be organised and collected into databases, expressly created *ex novo* during the last two years. In fact it is quite generally accepted that different archaeological sites, because of their peculiarities, must be provided of purposely made databases, which respond to requirements strictly depending on the characteristics of the sites and on the nature of the researches being carried out. This is the reason why, even if aware that the methodological approach chosen at Elaiussa Sebaste is common to many other archaeological excavations, some of which already using computerised databases, we decided to build new individual folders which could better agree with the necessities of our research; in this way the investigation methodologies and the usual procedure for data collection adopted since more than ten years has been preserved.
Archaeological information is currently recorded into detailed folders each of which contains a single category of findings, such as pottery, glass, coins, metal objects, architectural elements, inscriptions, anthropological remains, bones. The computer databases pertaining to the single categories as well as those of the archaeological layers to which the finds are referred have been created using Microsoft Access, through the transformation into digital form of the paper records, regularly used on the field since 1995.
This was a quite hard task, because of the necessity of summarising, as much as possible, all sets of data in predetermined terms or sentences. The aim was that of simplifying and standardize the single records, without losing however the complexity of the information and its internal relationships. On this respect we had to state that archaeology can not do without text and memo entries, where the written information fundamental for the specialists, even if perhaps not usable for queries or other kinds of computerised operations, can be collected.
Thus the construction of useful and functional databases required a long work of formalisation and elaboration of data and primarily regarded the creation of scientific vocabularies for the single items (Figure 3). The selected keywords can allow the sharing and connecting of data coming from different databases and permit queries and merging of more complex information.

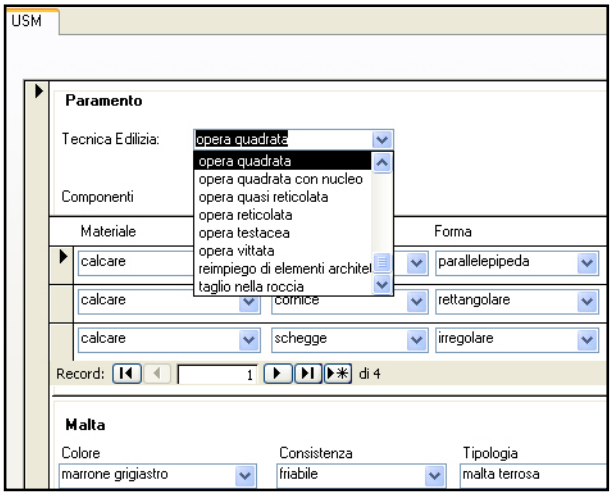

Figure 3. Example of a closed vocabulary concerning the building techniques

In order to assure the uniformity of terms, fundamental for queries and further researches, such vocabularies have been conceived as closed. However, due to the particular evolving character of archaeology, they needed to be at the same time expandable whenever necessary: therefore a special editing has been created through which new words and definitions may be added or integrated, but only by authorised users, who must check the real necessity of such an operation and guarantee its safe execution (Figure 4).

Figure 4. Editing for the integration of the closed vocabularies

The first purpose was to use such computerised forms daily during the excavation activities and in the post excavation strategies on the site, so that greater speed and accuracy in the search will be granted. The real-time GIS data acquisition process - typing, scanning and digitalizing - has been partially experimented with good results at Elaiussa Sebaste during the last excavation campaigns of 2005 and 2006, but of course it should be improved in order to allow a faster acquisition and a wider sharing of the information.

The *intrasite* GIS

At Elaiussa Sebaste, like in several other archaeological sites, the central element chosen for the GIS is the “archaeological layer” database (Figure 5).

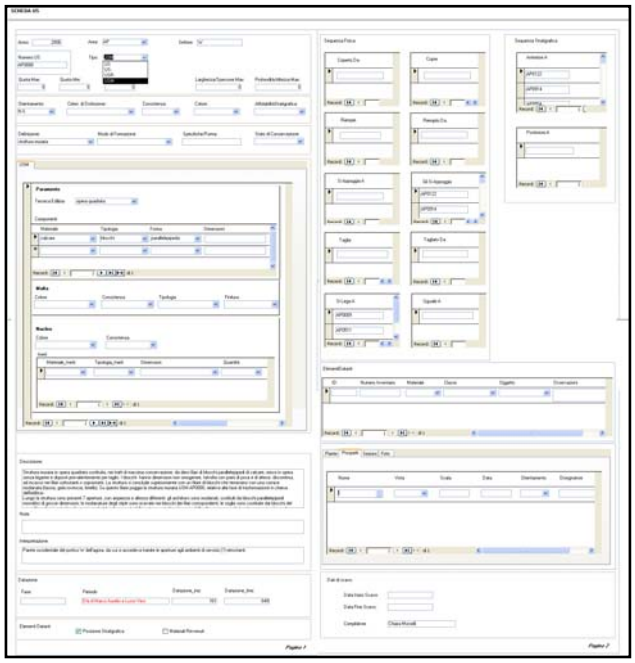

Figure 5. The database of archaeological layers

Within the same framework four different types of layers, enjoying of specific characteristics, have been isolated, that is to say the soil layers, the built structures, the floors and coating layers and the negative ones. To this central element all the categories of finds are to be connected. Concerning the materials found inside the layers we decided to realize a general concise database suitable to manage easily all the categories, together with more specific databases containing the whole necessary information exploitable by the specialists.
With reference to the chronology, which is one of the principal topics in order to interpret and understand an archaeological context, a composed system has been adopted: the starting and final dates of any single item, expressed as numbers, have been automatically connected to the historical periods to which they pertain so as to facilitate the elaboration of phases and immediate comprehension of the diachronic development of a structure (Figure 6).

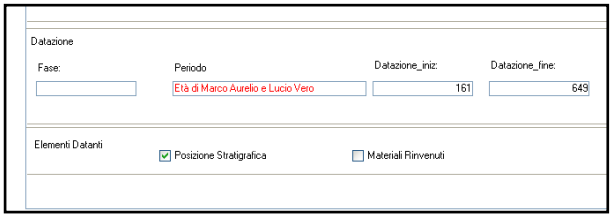

Figure 6. Composed system for stating the chronology

Starting from this point a sort of "tree shaped structure" (Figure 7) has been created, where, through their chronological distribution, the layers and the pertaining materials can be organised into phases, each of which may be related to a single building. The buildings themselves must be considered as part of specific urban districts, having peculiar functions and characteristics, which are clearly delineable on the general plan of the city, to which the databases of any item hitherto considered may be linked.
Through the analysis of the superposition of the layers and their chronology it is possible to isolate the main phases of the excavated buildings, monuments, infrastructures which can be easily displayed, quantified and queried thanks to the digital archive. In such a way the GIS has a big potentiality not only for the collection of information but also for the interpretation of the ancient levels, directly connected to the plans and sections, organised according to the different phases and periods.
The goal of this first section of the GIS is to define the main characteristics and functions of the building units, analyzed in their historical and chronological evolution. Spatial analysis or distributional analysis of the information on the site, such as the analysis of single urban areas having specific functions, helps in understanding the formation process and the changes occurred in the city during its long history. It is worth to be noted that, even if not all the monuments and architectural remains of Elaiussa Sebaste have been actually extensively excavated, they can be included since now in the general area of the GIS; moreover the system is suitable to incorporate at any time additional information coming from new researches, whenever those buildings will be thoroughly dug and studied.

The graphic documentation

All the graphic data and drawings - plans, sections prospects - are currently elaborated in digital form using AutoCAD so that the exact and measured spatial position of any single element - structures, layers, objects - is precisely recorded. In such way

the original layout of the archaeological context before and after excavation may be virtually reconstructed and the understanding of the subsequent events occurred can be facilitated.

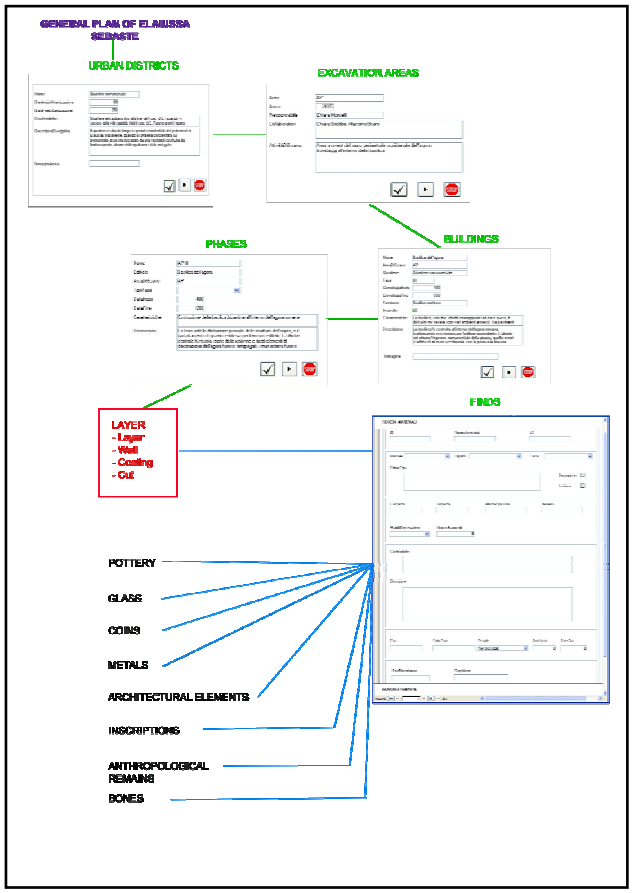

Figure 7. The general scheme of the *intrasite* GIS

The agora having been chosen as case study, the interface plan of the actual state of the building has been drawn, defining all the isolated conceptual entities - such as walls, pavements, architectural elements - pertaining to the different phases and corresponding to the application domain. For each of these aspects the corresponding visualizations have been selected (Fig. 8).

Figure 8. Plan of the area of the agora, showing the different phases of life

3D reconstructions

The previously described process is preliminary to the elaboration of 2D and 3D reconstruction models on the base of the precise archaeological data collected on site and recorded in the GIS. Until today 2D reconstructions have been elaborated only for a few case study areas, which have been thoroughly excavated and studied, such as the Harbour Baths and the theatre.
A 3d virtual reconstruction of a case study monument, the ancient agora, is under construction on the base of the precise archaeological data collected on site and recorded in the GIS. This monument is significant and particularly suitable for testing the system because of its important changes of shape and function in the three different phases of its life: a large private villa with mosaic pavements has been transformed into a Roman agora; inside this public building a Byzantine basilica has been built, later abandoned and partially reused for other purposes. The potential of using 3D reconstruction models is revealing important scientific implications and is improving the understanding of the archaeological context, so that its applications should be progressively extended to the whole urban area.

The *intersite* GIS

Areal data, which is more commonly used in archaeological GIS, has been focused on the region and the landscape surrounding Elaiussa Sebaste and helps to interpret this archaeological site in its context and setting. Surveys, topographic maps and satellite images have clearly demonstrated that the mainland of Elaiussa Sebaste was intensively settled during the Roman and Byzantine period, when little cities, villages, farms and monasteries grew and developed at a large scale. This *intersite* GIS will be able to manage the information collected during the surveys in the region surrounding the city, carried out by teams of various researchers (archaeologists, architects, geologists, topographers), in order to obtain a multidisciplinary output. The low resolution and the scarce details of the existing topographic maps have compromised the quality of the final results of the previous surface researches. The production of new topographic and archaeological maps of the area will allow for the creation of a more complete and reliable GIS.

CONCLUSIONS

The GIS such elaborated, even if yet to be tested at a large scale, revealed good possibilities to be used not only for collecting and storing data but also in order to elaborate new archaeological interpretations and scientific reconstructions. In this respect the high potentialities of such an information system are suitable for a wider management of excavation data so that they can provide methods systems for enhancing and developing the fruition of archaeological sites.

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