

## SOME ASPECTS OF ARCHAEO-GEOPHYSICS IN ALBANIA

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### ABSTRACT

The establishment of a new development in the immediate vicinity of the ancient city of Albania is expected to cause a conflict of interests between developers and the state's archaeological service. It has also realized that by application of non-destructive geophysical techniques have got information for the underground features such as wall remains, ditches, kilns, road, etc.

This paper shows some examples of most interesting geophysical results of Buthrotos and Apollonia, two of the most important archaeological sites of Albania. High effectivity of these methods, clearly shown in different archaeological site above-mentioned, has led to excavation and detection of archaeological targets related to the outlines of geophysical anomalies.

### 1. GENERAL INFORMATION.

*Apollonia*. It was founded at the beginning of the 6<sup>th</sup> century BC (before Christ). The colonists coming from Corinth, Coreyra and perhaps from Dyrrachium too, settled close to a dwelling center inhabited previously by native people. Apollonia was linked with the sea through the river of Aaos (Vjosa) at that time flowing near the city and being navigable. In the 5<sup>th</sup> century BC it was a developed economic center extending relations with the Illyrian world and Attica, and later with Italic world as well. During the Roman Empire the city kept on still being an important economic and cultural center. The Architecture and other art branches (sculpture in particular) started to flourish in the 3<sup>d</sup> century.

*Buthrotos* is an ancient city in Epirus, located on a hill of the Ksamili peninsula close to the lake of the same name. It was a part of the kaone community and later of the Epirus state. At J. Caesar's time it turned into a roman colony and after that it followed the destiny of the Roman and Byzantine Empire; later it was possessed by Venice (1690-1797), until it was detached by Ali Pashe Tepelena. The data obtained by archaeological excavations confirm that in the 7<sup>th</sup> to 6<sup>th</sup> centuries BC. In the 5<sup>th</sup> century it appears as a genuine city being spread on the whole northern side of the hill and late, in the first half of the 3<sup>d</sup> century BC it was extended on the field, in the southern part of the hill (agora of the city, a portico, a small temple and the theater with 1500 seats). Four structures in Buthrotos belong to a later antiquity: cult, basilica of Acropolis, "three-konk" church of Vivari, baptistery and big basilica.

*The baptistery* of Buthrotos was excavated by Ugolini in 1928. He concluded that it is a building of recent ancient Roman time (4<sup>th</sup> century); in this building during 5<sup>th</sup> and 6<sup>th</sup> centuries have been constructed columns on the basement place and so it changed into a baptistery hall.

### 2. FIELD PROCEDURE AND INTERPRETATION

Some steps have been followed during the whole cycle of the geophysical investigation in Apollonia and Buthrotos: reconnaissance, survey grid setup, measurements (data acquisition), data processing and interpretation.

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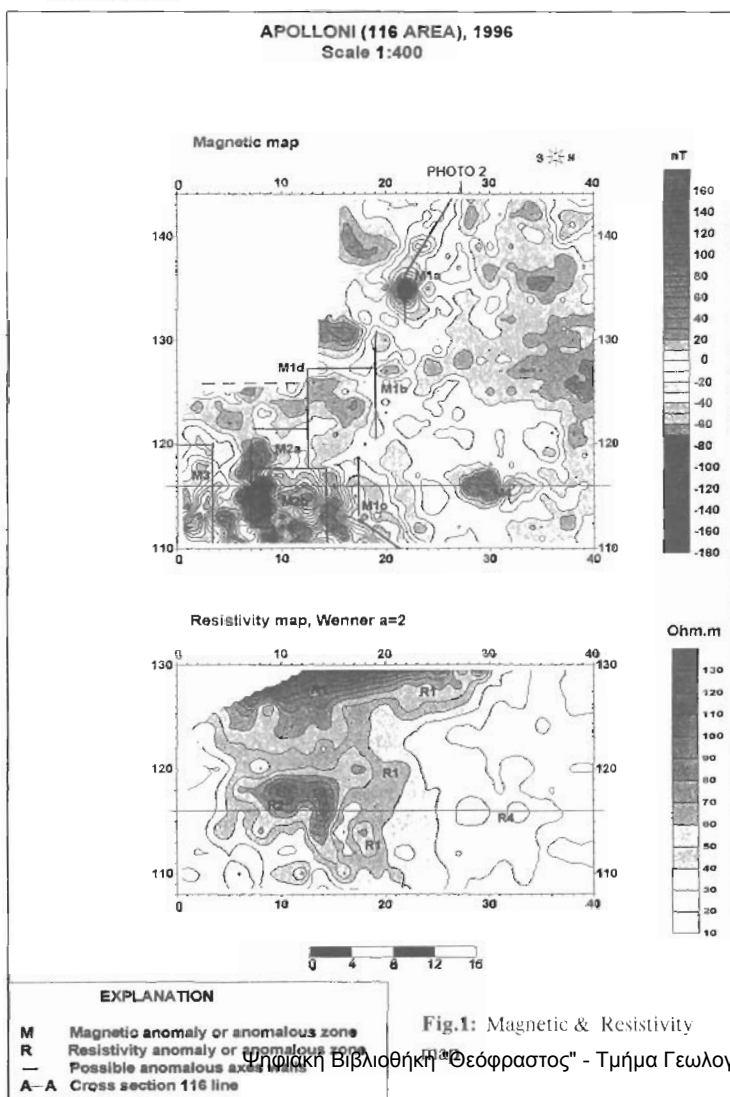
Magnetic data have been measured every 1x1 m and 2x1 m the resistivity ones every 2x1 m and rarely 4x1 m. The apparent resistivity measurement have been carried out using an electronic auto-compensatory. A proton magnetometer was used to measure the total vector of the magnetic field, with an accuracy of  $\pm 1$ nT. Before mapping usually we have carried out an experimental cycle, mostly on lines of well-known archaeological features. This cycle was achieved solutions such as: are the high sensor (0.6 m), the patterns of the magnetic anomalies for the magnetic surveys; the best electrode space was found a=2 m in Apollonia and a=1 m in Buthrotos, using a Wenner array for the resistivity.

*Processing data.* The field data (both resistivity and magnetic) were processed using special programs such as Geostatistical, Mapping Surface System and Geosoft Map software's.

### 3. DISCUSSION OF RESULTS.

**Apollonia.** The city covers an area of about 100 ha, only 10 ha have been investigated with geophysical methods. The part of the mapped area in the central part of the city treated on the paper are respectively parcels P116, P113.

**Parcel 116.** Magnetic and resistivity surveys (Fig. 1).



Several magnetic anomalies were obtained. They are related to different archaeological features exhibiting thus distinct characteristics. It is very clear that stone walls without complications, ( such as burning in antiquity) and for mixtures of bricky material cause negative magnetic anomalies like M1a, M1b, M1c and M1d. Anomalies M2a and M2b individualize target, probably, a dwelling house with positive value 160 nT, caused from burning in antiquity and/or existing buried bricky walls. This kind of anomalies is explained by remnant magnetization. Anomaly M3 outlines part of another dwelling house next to the first. Anomaly M4 is related to an individual target that does not show high resistivity contrast, resistivity being something above the background (30 ohm.m). It is similar with the anomaly of normal dipole. Probably it contours "a trash pit".

A very clear apparent resistivity anomaly is obtained. It covers the most part of the

surveyed area. Generally, all the reddish color of resistivities above 40 ohm.m, may present a prospective zone for excavations inside which can be discovered several archaeological targets. Based on the shape of the anomalies we have separated 3 targets of interest. Anomaly R1 is related to the extension of the wall (magnetic anomalies M1a, M1b, M1c and M1d) contouring its Southward turn (at 127-130 lines). Probably, near the wall, a monument may be discovered because the anomaly covers a large surface. Anomaly R2a outlines an archaeological target which includes a part of magnetic anomalies M2a and M2b. Anomaly R4 is obtained at the Northern edge of anomalies R1 and R2. This anomaly is of a lower resistivity compared with the above mentioned ones. This anomaly is accompanied related with anomaly M4.

Fig. 2 shows the results of the magnetic mapping in the area 113, where two intensive anomalies can be easily seen. The anomaly M8a should be related to a kiln. The anomaly M7 may express a too magnetic environment due to hearth or trash. The axis P3 might be related to a "pathway".

MAGNETIC MAP (113 AREA) OF APOLLONI, 1994

Fig. 2

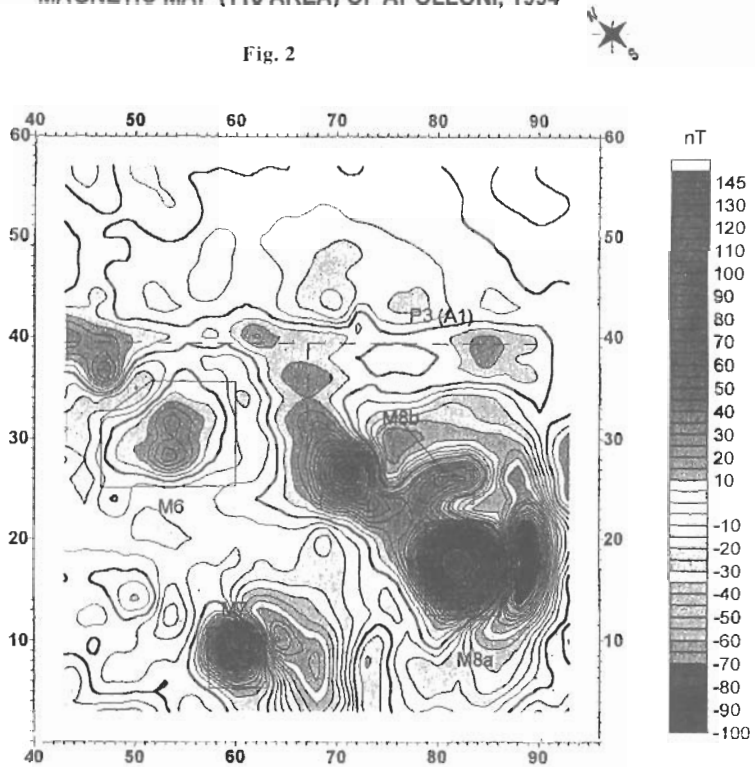


Fig. 2

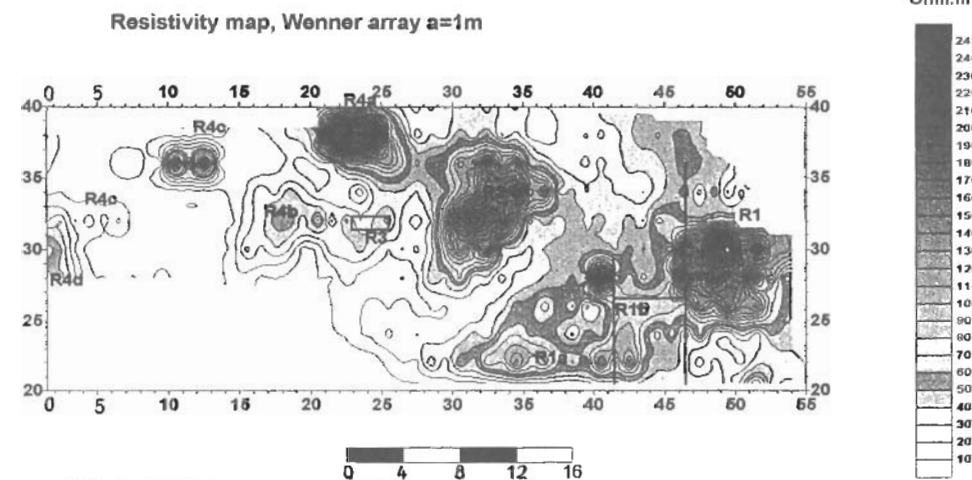
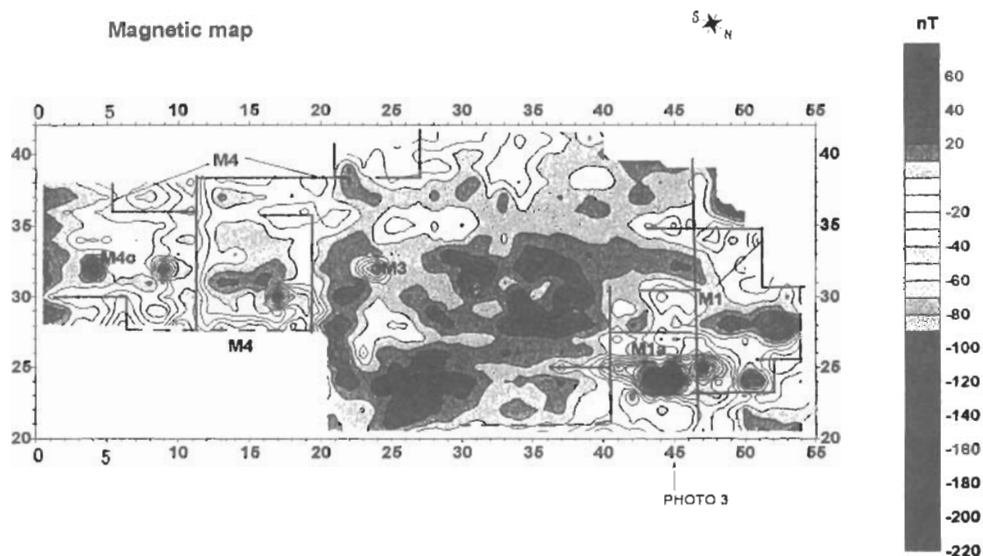


Photo 1.

Ψηφιακή Βιβλιοθήκη "Θεόφραστος" - Τμήμα Γεωλογίας, Α.Π.Θ.

### 3K AREA OF BUTHROTOS, 1995

Scale 1:400

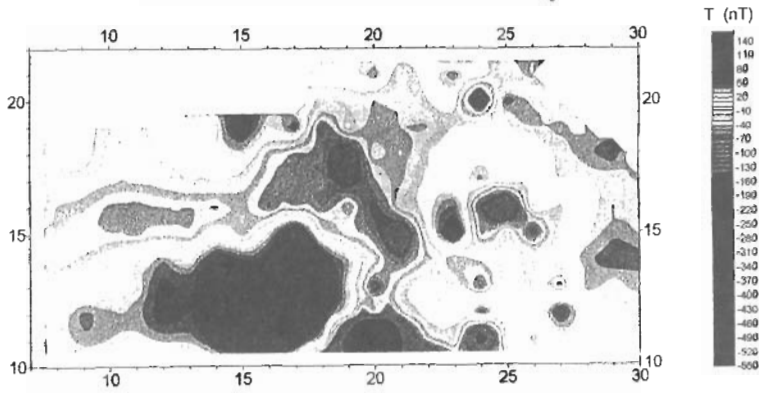


**EXPLANATION**

- M** magnetic anomaly or anomalous zone
- R** Resistivity anomaly or anomalous zone
- The axes walls after digging
- Possible anomalous axes walls

Fig. 3

MAGNETIC MAP OF BAPTISTER, 1995  
Scale 1:200



TOPOGRAPHIC PLAN OF BAPTISTER

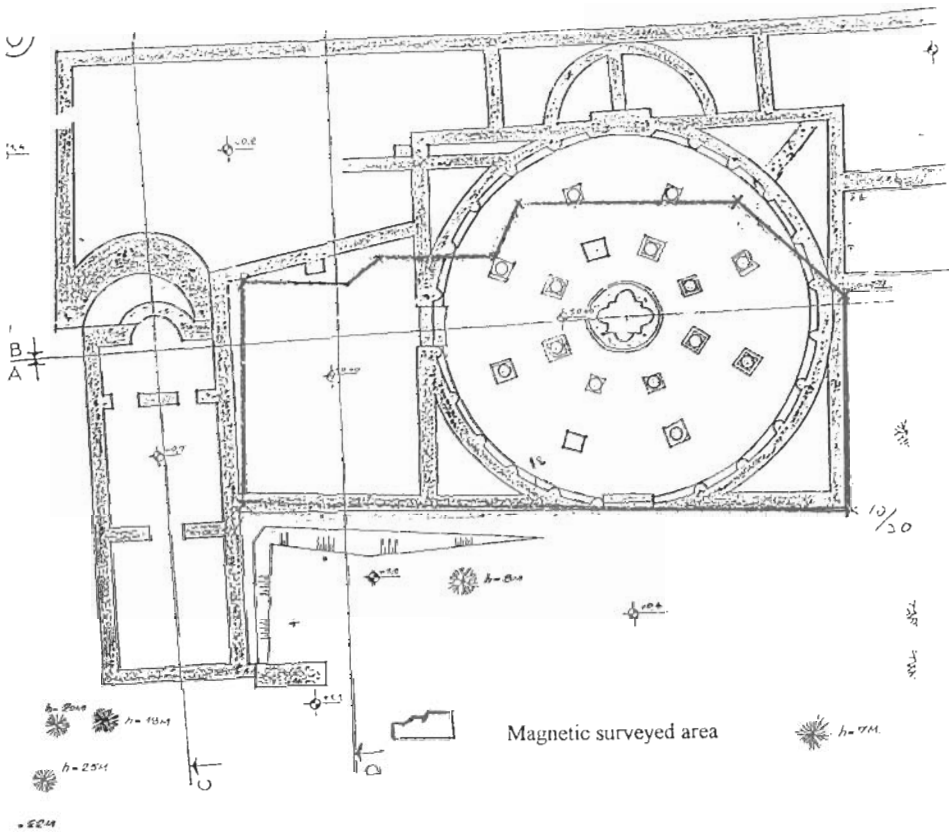


Fig. 4

Ψηφιακή Βιβλιοθήκη "Θεόφραστος" - Τμήμα Γεωλογίας, Α.Π.Θ.

**Buthrotos.** The geophysical investigation of this area will be described with two examples of the surveys carried out in 1995. In this part of Buthrotos is present the Roman culture (nymphs, gymnasium building etc.) and recent antiquity (Baptistry, 3 Konk etc).

**First object, 3K** We present the resistivity and magnetic maps (Fig.3).

Both surveys could outline fragments of walls and houses located on plan and covered by the present deluvial overburden. The red line axes represent the walls already discovered (Photo 1), the blue negative ones representing anomalous magnetic axes related to possible walls. Several magnetic anomalies were obtained. They are related to different archaeological features, maybe two separate houses, anomalous M1 zone and anomalous M4 zone respectively. Positive anomaly M2 with values 20-40 nT located on the area of low resistivity values (20-40 omm) may reflect the soils, which in antiquity period have not been the object of digging, but related to the upper part of the overburden which is more magnetic than the lower one.

Both maps show:1) The group of the anomalies M1,R1 outline a house. The group of the corresponding magnetic anomalies M1 has been assessed taking into consideration the axes of negative elongated anomalies with contours -10 to -30 nT, respond the respective resistivity R1 are contoured with the value more 50 ohm.m. The intensive negative anomaly M1a is located about Pr. 24 Pk. 45. Is due to an iron object being removed after excavations. 2) The anomaly R2 is related to a stone pile gathered during the cleaning procedure in the archaeological site. 3) The anomaly R3 delineates a small object and corresponds to the anomaly M3 being recommended for excavations. 4) The group of anomalies M4, R4 outline another house. The group of the corresponding magnetic anomalies M4 has been assessed taking into consideration the axes of negative elongated values with contours -10 to -40 nT. The anomalies R4b,R4c and R4d outline small wall fragments fixed clear from the magnetic survey (anomaly M4). The reduction of the anomalies dimensions R4b, R4c and R4d is due to the masking effect related to the presence of the salty underground waters at shallow depth (1 m to the present surface). 5) The anomaly R4e delineates a small object and corresponds to the anomaly M4e being recommended for excavations. This small target located inside anomalous zone M4 may be related to a trash pit.

**Baptistry** The idea to search in this target came out after a discussion about setting of this paleochristian structure built on the ruins of Roman constructions and about the possibility of an evaluation of the circulating water in the baptistry basin. Geophysical evaluation using only magnetic surveys is conditioned by the available techniques. Fig.4 shows the map of magnetic surveys carried out within the Baptistry monument on the existing mosaic, covering almost main halls. Large elongated negative magnetic anomalies are exhibited in this map. The rest of the map expresses the positive anomalies related to the existing mixed walls (stony and bricky rows). a- The anomalies express foundation remnants of the Roman Time and in such a case the positive anomaly reflects the monument walls characterized by the remnant magnetism. b- Negative anomalies can help to delineate the irrigation system of water circulation under the mosaic, which from the archaeological point of view should have been constructed with marble plates (elements). Concerning positive anomalies is valid the same argument mentioned above.

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