

# Geophysical prospections support the historical identification of the archaeological site at Lake Gala, Hebros/Maritsa/Meriç delta (Turkey)

Anca Dan <sup>1\*</sup>, Ercan Erkul <sup>2\*</sup>, Simon Fischer <sup>2</sup>, Harald Stümpel <sup>2</sup>, Sait Başaran <sup>3,4</sup>, Elif Çokaman <sup>4</sup>, Luc Lapierre <sup>1</sup>, Helmut Brückner <sup>5</sup>, Wolfgang Rabbel <sup>2</sup>

1 AOROC, CNRS, ENS, University Paris Sciences & Letters, France

2 Institute of Geosciences, Kiel University, Kiel, Germany

3 Archaeology, University of Istanbul, Turkey

4 Ministry of Culture, Turkey

5 Institute for Geography, University of Cologne, Germany

\* Corresponding authors: E-mails: [anca-cristina.dan@ens.psl.eu](mailto:anca-cristina.dan@ens.psl.eu), [ercan.erkul@ifg.uni-kiel.de](mailto:ercan.erkul@ifg.uni-kiel.de)

## Abstract

Archaeological survey and combined geophysical measurements of magnetics were conducted. Geoelectrics and ground penetrating radar support the interpretation of a Roman station controlling a branch of the Via Egnatia leading to Ainos (modern Enez in Turkey). The site could be the first archaeological example of a road station in Thrace, constructed between the 1st and the 2nd century CE.

## Keywords

geophysical survey (ERT, MAG, GPR); Hebros / Meriç River; historical and archaeological identification; Roman road; Thrace

## Introduction

Between the 1st and the 2nd century CE, the Romans extended the sites and roads network of the Via Egnatia along the lower course of the Hebros. On the right bank of the river (now in Greece), the town of Doriskos was replaced by Traianopolis (Loukopoulou et al. 2005; Tsatsopoulou-Kaloudi 2015). On the left side (now in Turkey), besides the paved road leading to the city of Ainos (modern Enez), the Romans built at least one station overseeing the crossing over the Hebros and the Stentoris Lake (part of which still exists in the modern Gala Lake, cf. Gerhard 1929). We present here the first geophysical and archaeological attempt at studying the Eastern part of Via Egnatia and at identifying one of its stations in Thrace.

## Materials and methods

Roman architectural marbles up to 1 m, including fragments of architraves-friezes, a soffit decorated with a

simple panel with concave extremities, smooth shafts of columns and pilasters are visible on a promontory overhanging the SE shoreline of the Gala Lake, less than 10 km NE from Ainos (Fig. 1, Fig. 2 L1). Between the foot of the promontory and an ephemeral swamp filled with colluvial and alluvial deposits ca. 700 m to the SW (L2), parts of a Roman paved road, ca. 4 m large, emerge from the lake (Fig. 2 b, L3). The road's structure is similar with portions found before entering Ainos, but also with a segment continuing ca. 4 km further to the NNE on the shore of the Gala Lake, up the Byzantine village of Ntukenion (today Döken; Başaran 1999; Külzer 2008; Yeşil et al. 2017).

After registering the major archaeological pieces visible on the promontory (Fig. 2 c – h, L1), magnetic (MAG), electric resistivity (ERT) and georadar (GPR) measurements were conducted, in order to find out the plan and the depth of the Roman constructions (Fig. 3). For the MAG, a magnetometer array with 4 fluxgate probes (type



Fig. 1: Site location map of the investigation area on Lake Gala, Turkey (satellite image: Google Earth, Image Landsat/Copernicus).

Ferrex CON650, by Dr. Förster) was installed on a manual cart. The probes were mounted at intervals of 0.5 m, so that each parallel profile covered a 2 m width. In-line, measurements were taken every 5 cm. The ERT mapping was carried out with the RESECS-Multielectrode-System. A total of 23 electrical profiles, each of them 32 m long, were measured with the configurations Dipole-Dipole and Wenner. The distance between electrodes and parallel profiles was of 1 m. The pseudosections were inverted in 2D using the open-source software BERT (Günther and Rückler 2015). For the GPR, a single-channel instrument, SIR 4000 by GSSI, was used with a dual frequency antenna, including the main frequency bands of 300 MHz and 800 MHz. The profile spacing was 0.3 m and a scan was recorded in-line approximately every 2 cm.

## Results

On the promontory L1, the marble pieces belong to a Roman public construction (Fig. 2 c - h). The absence of vegetal decoration suggests a date before the 3rd century

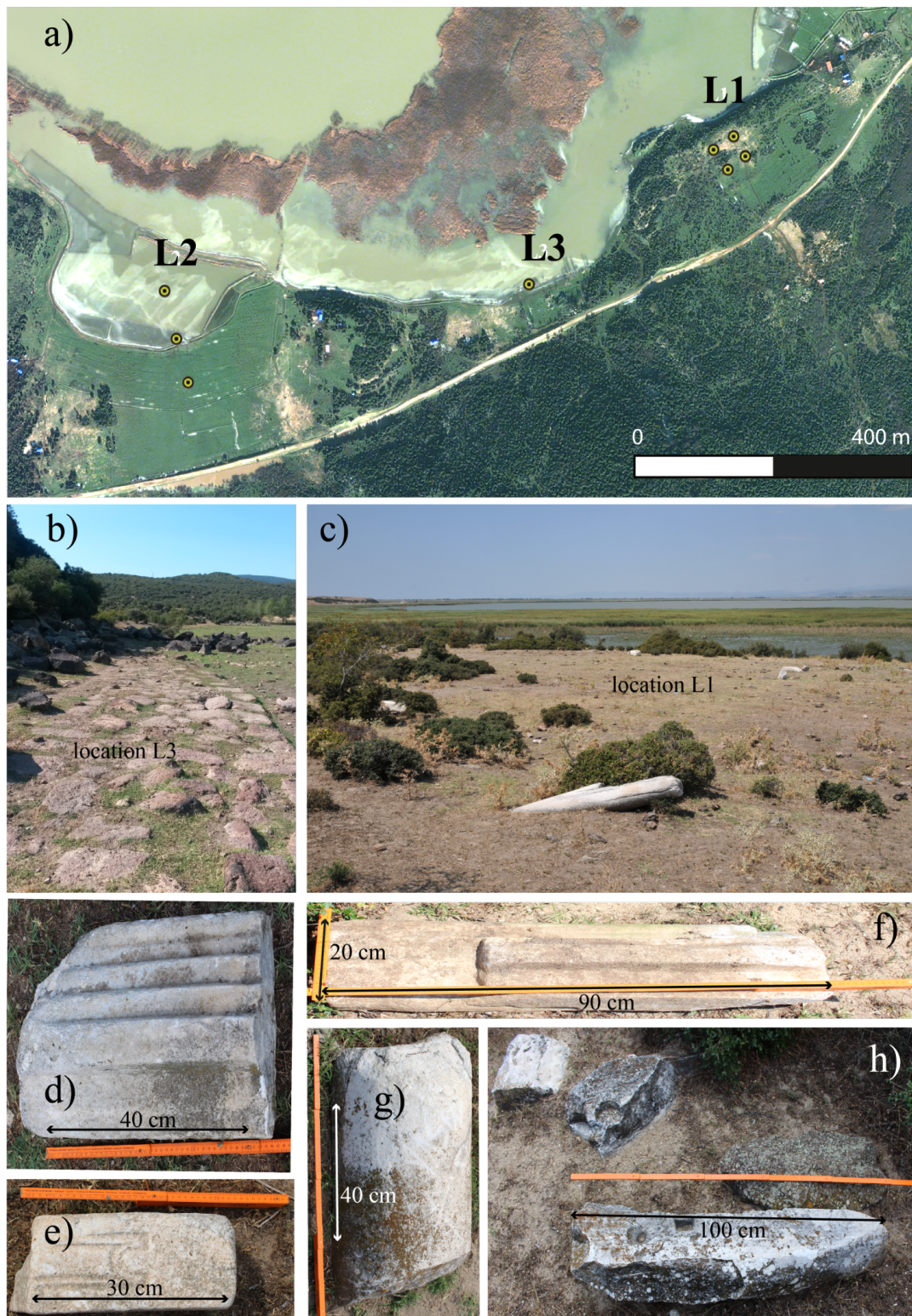
CE (the soffit in the Fig. 2e has Micrasiatic parallels in the second half of the 1st or the beginning of the 2nd century CE, cf. Wegner 1978-1980; Cavalier 2005).

The geophysical measurements (Fig. 3) revealed rests of the foundations, parallel with the terrace overhanging the road: in the NW part of the magnetic survey, 9 m long linear anomalies in a rectangular pattern could correspond to load-bearing walls. To the S, anomalies are concentrated in two rectangular areas (rooms?) with an extension of ca. 9 m x 10 m and ca. 5 m x 6 m. Electrical resistivities up to 500 Ohmm are observed here at depths between 20 cm and 50 cm, while in the surrounding area they are below 50 Ohmm. Linear reflection patterns are observed in the GPR time slice that correlate with the MAG and ERT anomaly patterns.

## Discussion

The monumental complex, to which belong the marbles and maybe the 9 m long linear anomalies, was built in the early Roman imperial period. The pattern and orientation





**Fig. 2:** a) The locations of the promontory of the identified station (L1), the ephemeral swamp (L2) and the Roman road (L3), on a satellite image of the sites (Pléiades © CNES (2022), Distribution AIRBUS DS). b) the Roman road L3 in front of the ephemeral swamp L2, view towards W. c) the archaeological site L1, view towards NW. d) Roman marble fragments of an architrave, e) soffit, f) door frame, c) and g) column, h) threshold and other blocs from L1.

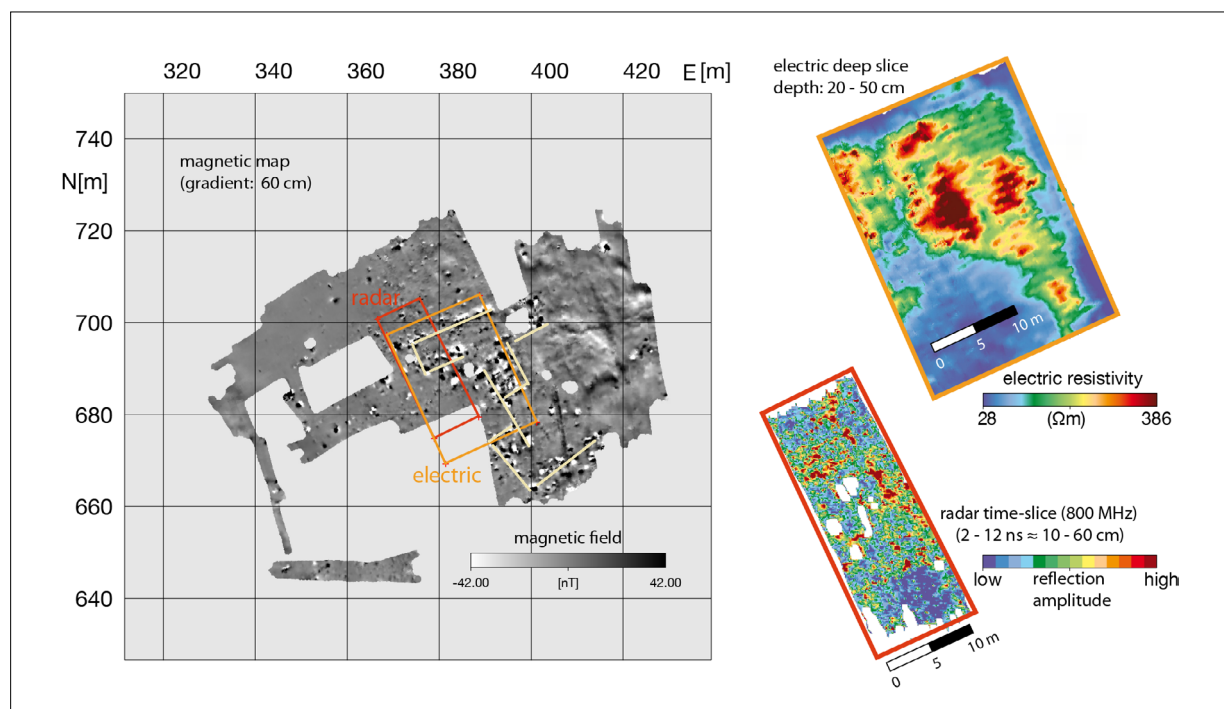


Fig. 3: Results of magnetics, electrics and georadar at the site location L1.

revealed by geophysics cannot correspond to a temple, but to buildings that overlooked the bay and the road – a branch of the Via Egnatia relating Ainos to Kypsela and, by ferry, to Doriskos/Traianopolis-Pheres. The road looks similar with the one on the right bank of the river, dated by a milestone from Pheres in the reign of Nero. Therefore, this station at Gala Lake could be one of the praetoria et tabernae constructed in 61-62 CE by Nero’s governor of Thrace, Titus Iulius Vstus (Christol 1998; Leveau 2016). However, judging only by the shape of the blocks, without any pottery found on the promontory, one cannot exclude a date until the 2nd century CE, when Traianopolis was founded across the Hebros’ mouths. Several blocks were later reused in a domestic context, to which could be associated also 2 empty tombs. The site was abandoned during Antiquity (no signs of Christianization have been found).

### Conclusion

The MAG, GPR and ERT measures on the promontory, correlated with the interpretation of the architectural remains, recommends the identification of the archaeological site at Gala Lake with a monumental station on a *via militaris*, part of Via Egnatia’s network. If so, this could

be the first site that confirms the epigraphic information about the construction of monumental stations in Thrace, under the early Roman Empire. The place is promising for further geo-bio-archaeological research, and must be protected, due to its natural and cultural heritage.

### Acknowledgments

We like to thank Şahan Kırçın, director of the Edirne Museum, for extensive support during the field measurements. The project was funded by the CNRS, through the project LEGECARTAS – LECTures GEOarchéologiques des CARTes AncienneS (2017-2019), and by the French Ministry of Foreign Affairs – Mission Archéologique d’Ainos (2020-present).

### References

Başaran S. Zum Straßennetz um Ainos. In Scherrer P, Täuber H, Thür H. (eds). *Steine und Wege. Festschrift für Dieter Knibbe zum 65. Geburtstag*. Wien: Österreichisches Archäologisches Institut; 1999. p. 343-348.

Cavalier L. *L’architecture romaine d’Asie Mineure: Les monuments de Xanthos et leur ornementation*. Pessac: Ausonius Éditions; 2005.



- Christol M. De la Thrace et de la Sardaigne au territoire de la cité de Vienne, deux chevaliers romains au service de Rome: Titus Iulius Iustus et Titus Iulius Pollio. *Latomus. Société d'Études Latines de Bruxelles*. 1998; 57: 792-815.
- Gerhard GA. Stentor. *Paulys Realencyclopädie der classischen Altertumswissenschaft* II.6. Stuttgart: J.B. Metzlersche Verlagsbuchhandlung. 1929; col. 2336-9.
- Günther T., Rücker C. *Boundless Electrical Resistivity Tomography BERT 2—the user tutorial*. 2015.
- Külzer A. *Tabula Imperii Byzantini* 12. Wien: Verl. der Österreichischen Akademie der Wissenschaften. 2008.
- Leveau P. *Praetoria et tabernae en Gaule: contribution à l'identification des établissements de bord de route*. *Gallia* 2016; 73.1:29-38. doi: [10.4000/gallia.449](https://doi.org/10.4000/gallia.449)
- Loukopoulou L, Parissaki MA, Psoma S, Zournatzi A. *Inscriptiones antiquae partis Thraciae quae ad ora maris Aegaei sita est (praefecturae Wanthos, Rhodopes et Hebri)*. Athenis-Paris: De Boccard. 2005.
- Tsatsopoulou-Kaloudi P. *Via Egnatia. History and the route through Thrace*. Athens: Archaeological Receipts Fund. 2015.
- Wegner M. *Soffitten von Ephesos und Asia Minor. Jahreshefte des Österreichischen Archäologischen Institutes in Wien*. 1978-1980; 52: 91-107.
- Yeşil A, Uzun A, Başaran S, Aksu A. *Enez. Its Natural, Cultural, and Touristic Beauties*. Istanbul: Ege Yayınları. 2017.

---

## Open Access

This paper is published under the Creative Commons Attribution 4.0 International license (<https://creativecommons.org/licenses/by/4.0/deed.en>). Please note that individual, appropriately marked parts of the paper may be excluded from the license mentioned or may be subject to other copyright conditions. If such third party material is not under the Creative Commons license, any copying, editing or public reproduction is only permitted with the prior consent of the respective copyright owner or on the basis of relevant legal authorization regulations.