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Topographical research in the canabae of Brigetio in 2014

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Abstract

The present article introduces a recently started project which aims at studying the topography of the canabae and legionary fortress of Brigetio using non-destructive methods such as aerial photography and different geophysical surveys. After a brief summary of earlier research, the methods and results of the topographical work carried out in 2014 will be discussed below.

Introduction

Although systematic excavations in Brigetio have been started in 1992, providing important results concerning the civil town, large scale comprehensive topographical research on the whole territory of the Roman town has been carrying out only since 2013. The main objective of this recently started project is to study the topography of the *canabae* and legionary fortress of Brigetio *(Fig. 1)* using non-destructive methods such as aerial photography and geophysical survey, however, we use these methods in connection with our research in the civil town as well.

Recent results of the aerial photography in Brigetio with the history of research were published in 2013,[1] therefore only the previous geophysical surveys should be briefly summarized here. The first magnetometer measurements were made by S. Puszta in 1996 at the territory of the civil town (Szőny-Vásártér). Despite a lot of difficulties caused by the urban environment, a north-south road and some traces of the Roman buildings could be identified,

1 Rupnik – Czajlik 2013.

which were confirmed by the later excavations.[2] Geophysical surveys have continued after a long break in 2013 at the same site, where traces of further buildings and some deep structures (cellars?) were identified by ground-penetrating radar. Another combined geophysical survey was made south of the *canabae*, in the vicinity of the so-called "Szőny-Füzitői-csatorna", where we tried to find – unsuccessfully for the time being – traces of the main north-south road leading out from the legionary fortress.

After these previous results, we have started in 2014 the systematic geophysical prospection of the *canabae* of Brigetio combining magnetic and GPR surveys with aerial photography *(Fig. 2)*.

Methods

Topographical survey in Brigetio and its surroundings can be made under various field circumstances. The application possibilities of remote sensing methods in the interior zone of Szőny and the neighbouring industrial areas are limited, since the Hungarian-Slovakian state border and the minimum flying altitude of 300 metres should be taken into consideration during aerial photography. Ground penetrating survey is chiefly limited by the modern built environment, while magnetometer measurements are also interfered by electronic and industrial background noise. Accessibility of the outskirts area is also diverse: the smaller ploughlands in the territory of the *canabae* can be surveyed only periodically, while south of the ancient town our research is facilitated by easily approachable large-sized plots.

Considering the above-mentioned circumstances, we used the following technical equipment during the surveys in 2014:

- Aerial photography: Cessna 152 airplane, Nikon D300 camera and Nikkor 24–70 ED lens with direct GPS data recording. The analyzed images were assembled by means of high resolution orthophotos and geodetically measured, well-identifiable landmarks. Due to the above mentioned limiting circumstances, a DJI Phantom 2 drone with GoPro Hero 3 camera was also used for low-altitude aerial photography.
- Magnetometer measurements: GEM Systems GSM-19 Overhauser magnetometer (base station and mobile instruments, with sampling intervals of 0.5 sec) in horizontal variometer arrangement with a Trimble GeoXH dual-frequency GPS, with external geodetic antenna. Due to the dual-sensor arrangement, the point density inside lines was approximately 0,5 m with a line distance of 0,75 m. Noise was extracted from the raw measurement data using various mathematical filtering methods (base correction, dynamic range compression, reduction-to-pole, downward continuation of potential field data, band filtering, optimal smoothing filtering, etc.).
- Ground penetrating radar survey: Geophysical Survey Systems SIR 2000 ground penetrating radar with 150, 300 and 900 MHz antennas, point density inside lines was 0,04 m with a line distance of 0,5 m. The cleaning and processing of data, as well as the production of data cubes and time slices were accomplished using internally developed software based on Fractal technology.

2 Dobosi 2014.

Results

The main aim of the first survey in 2014, which was a magnetometer prospection between 25th February and 7th March, was the further examination of the street-plan of the *canabae* discovered earlier by aerial photography. Another objective was to carry out measurements in a parcel south of the above-mentioned territory, where remote sensing was hitherto unsuccessful. The prospection of ca. 4,3 hectares confirmed several presumed elements of the street-plan, showing anomalies indicating massive stone buildings *(Fig. 3)*, while at the southern part of the prospected territory ditches with the same orientation were found, providing very important data on the settlement structure of this part of the *canabae (Fig. 4)*.

Since conventional aerial photography is suitable for exploration of relatively large areas, our research was not limited to Brigetio and its adjacent areas, but extended to the Ács – Almásfüzitő – Tata triangle, considering the presumed Roman aqueduct between Tata and Brigetio. During the first survey (13th March) soil marks of linear features were recorded, which can be mainly identified as roads, however, ditches found earlier by magnetometer measurements were also confirmed analysing the photos *(Fig. 4)*. Although the best suitable period for identifying cropmarks is early summer, our second survey (18th June) resulted in a few, hardly detectable information due to the unusually abundant rainfall. Despite of the circumstances rather good results were obtained, due to the roughly same sowing-time of the cereals on the small parcels around the "Szőny-Füzitői-csatorna" and between Újszőny and the oil refinery. Thus, our previous information on the legionary fortress and some parts of the *canabae*, based mainly on negative cropmarks, was now considerably augmented by positive cropmarks. Among others, a lower built-up density of the southern part of the *canabae* can be presumed particularly with semi-subterranean structures besides a few stone buildings.

The aim of the ground penetrating radar survey (15th July) was to find an area suitable for later archaeological excavations in that part of the *canabae*, where our earlier research indicated stone-built structures. After the evaluation of the data, the most interesting results were a T-junction north from the area measured earlier by magnetometer, and the northwestern part of the GPR survey area, where two or three coherent stone buildings were identified *(Fig. 3)*.

The northernmost part of the canabae was also surveyed in 2014, in the frame of an excavation project preceding the construction of the flood-protection dam between Komárom and Almásfüzitő.[3] Due to the alteration of the original plans the site was saved from being destroyed by the construction work, however, the top layers of soil had been already removed from an area of approximately 7000 m². Low-altitude aerial photographic survey was carried out in this territory, where several massive stone buildings could be identified *(Fig. 5)*.

The most important conclusions which can be drawn from the results of the research in 2014 is that quick and detailed survey of relatively large areas can be achieved by appropiate organization and continuous evaluation of the recorded data. Using different methods as control or supplemental application demonstrated that topographical research in other zones of the ancient Brigetio can also be accelerated and the background of later fieldwalking and excavations can be established.

3 See the short report on the excavation of the newly discovered Roman bath in the present volume: Bartus – Borhy – Delbó – Számadó 2014.

Acknowledgements

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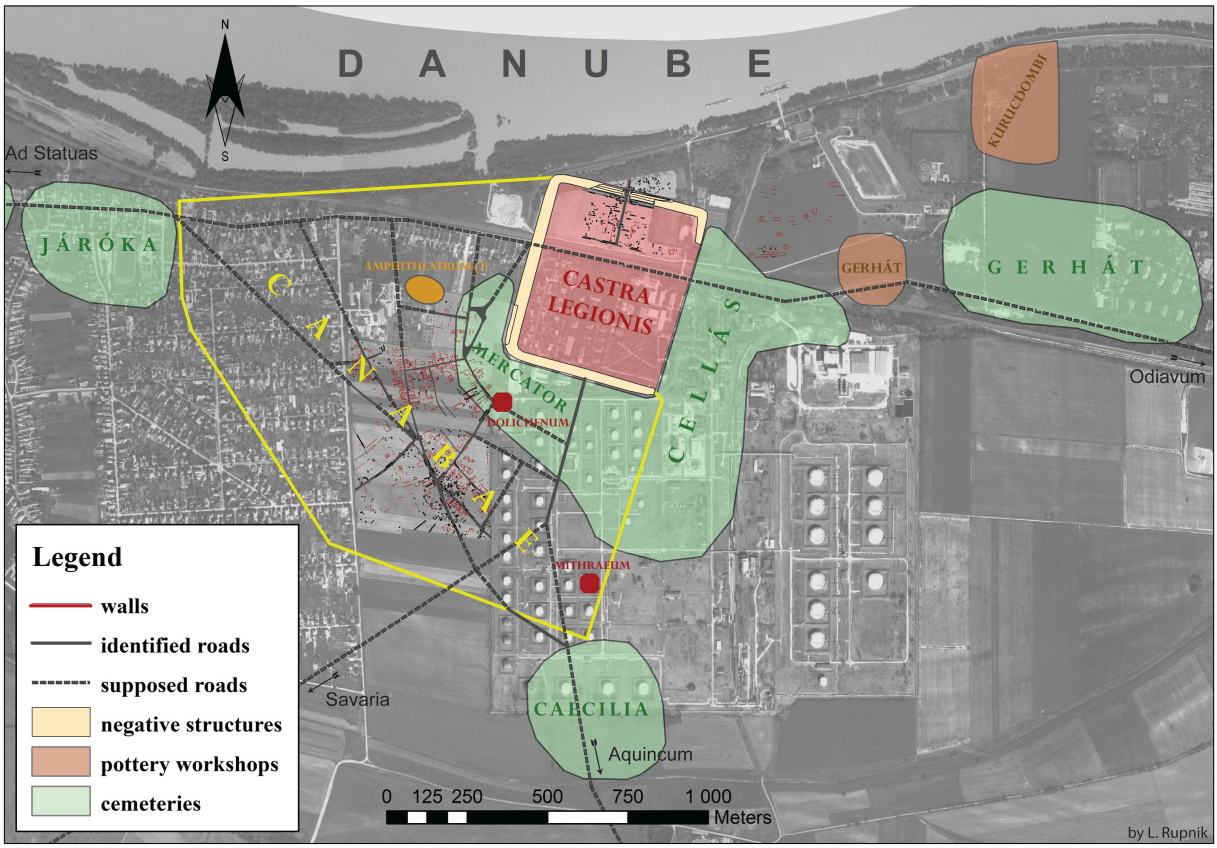

Fig. 1. The topography of the canabae and the legionary fortress.

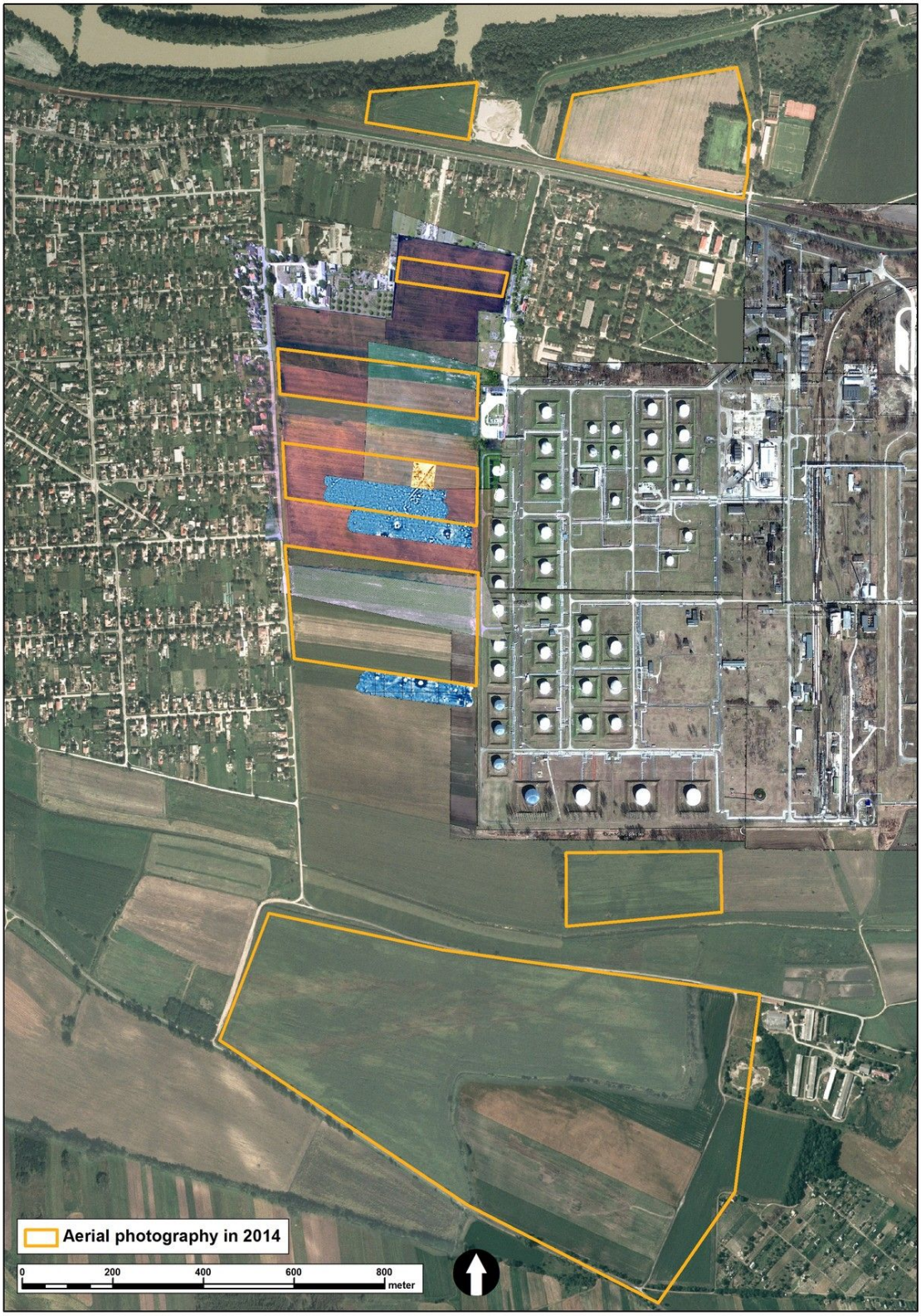

Fig. 2. Remote sensing topographical work in the area of the canabae.

Fig. 3. Remote sensing topographical work at the northern part of the canabae. Magnetometer measurements (blue), GPR survey and aerial photography (brown).

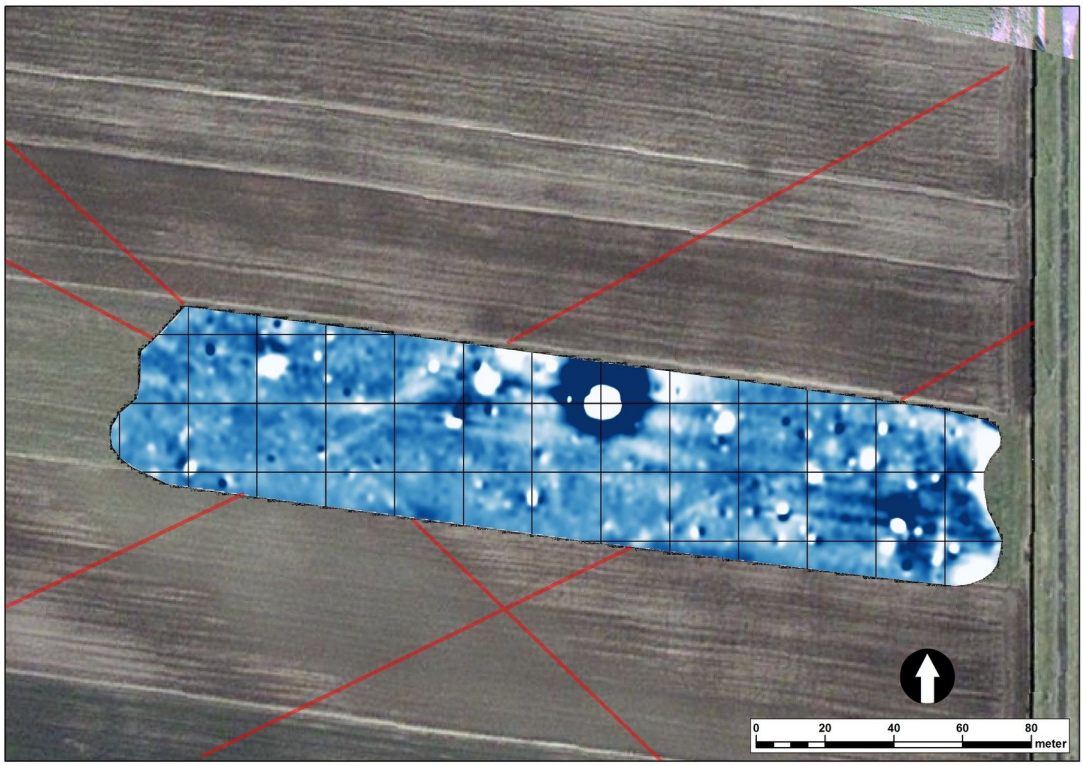

Fig. 4. Magnetometer survey at the southern part of the so-called "Pannonia-dűlő". Linear structures parallel with the street-plan of the *canabae* are visible.

Fig. 5. Traces of stone buildings at the site Szőny-Dunapart.
The photo was taken of the unexcavated area after the removal of the top soil (Photo: Zs. Varga).