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TIBISCUM AND ITS RURAL TERRITORY IN THE ROMAN PERIOD. ARCHAEOLOGICAL LANDSCAPE INVESTIGATIONS USING NON-DESTRUCTIVE SURVEY METHODS

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Abstract. Landscape archaeology has frequently relied on traditional excavation methods putting a strain on the surroundings and causing a threat to the durability of the cultural heritage. However, with the development of modern non-destructive techniques, such as the geophysical survey or GIS methods, tackling scientific problems has become easier and much more efficient. The dependence on excavations was minimised and the costs reduced at the same time.
In 2014, the project of non-invasive survey of *Tibiscum* and its rural surroundings received a financial grant from The Ministry of Science and Higher Education of Poland. The principal investigator, Michał Pisz invited Romanian partners from the West University in Timişoara and the County Museum in Caransebeş, as well as Polish investigators to join the project. The aim of the study was to locate, examine and document Roman settlements – both known and those, which might not have yet been discovered.
The research set of methods was based on modern non-destructive techniques, such as geophysics (magnetics and earth resistance survey), aerial photography (aircraft and drones), and aerial thermography, but also traditional surface survey, including mapping of finds.
The employment of aerial thermal prospection is considered an innovative and experimental method in archaeology. The Polish-Romanian *Tibiscum* Project is going to carry out a series of experiments aiming to determine the best conditions for aerial thermal prospection and evaluate the feasibility of this method for revealing shallow buried objects. The study takes a holistic approach with research to take place during different calendar seasons, varying weather conditions and different hours of the day.

Keywords: *Tibiscum*, Non-destructive archaeology, Geophysics, Thermography, GIS, Landscape archaeology.

1. Introduction

The first systematic research of the Roman fort and settlement at *Tibiscum*-Jupa were conducted by Professor George G. Mateescu and Bishop Ioan Boroş[1] during the interwar period, at the initiative of Constantin Daicoviciu. Even if this

[1] Benea, Bona, 1994, p. 11; Timoc, 2003, p. 299.

project spread over a period of a few years and it was never finalized and published, we know from archive sources that the method used for registration of archaeological data was "the photography of situation" applied to excavations and fieldwalking, thus saving important information regarding the status of the Roman ruins for this archaeological site. A very important piece of information is represented by the image of an ancient bridge foot revealed by a great flood in 1926 in the Caransebeş–Lugoj area[2].

Systematic investigations were resumed in 1964 by the archaeologist Marius Moga with spectacular results obtained in a few years of hard work[3], event welcomed by the Romanian archaeologists. Important information was added to the domains of military history, epigraphy and ancient economy for *Tibiscum*. But, because of the poor quality printing during the communist era that offered poor quality images, the photographic records remain precious archive materials which still await an exhaustive publishing. These photographs reveal interesting information regarding the strategy and the methodology used in the archaeological research.

The 20th century aerial photography for the area of the archaeological site *Tibiscum* represented military secrecy due to the fact that 5 kilometers south of the site an important military base functioned as part of the Second Army of the Romanian state. In 2004 this military base was closed down, thus an important image could be published within a monography dedicated to the ancient civil inhabitance at *Tibiscum*-Jupa[4]. This image can be dated in the summer of 1989[5] due to a master section excavated in the area of the small *castrum* and its author is probably Colonel Liviu Groza who, during his career, was interested in promoting the ancient ruins at *Tibiscum*-Jupa.

The beginning of the 21st century brought higher standards and procedures in archaeology and obliged the *Tibiscum* research team to look up for new solutions to obtain aerial images in order to access new possibilities of archaeological investigation. A GSM antenna was mounted in the vicinity of the archaeological reservation, thus offering the first important perspective from a fixed point at a height of 30 meters together with access to Google Earth images since 2003 to create a research direction for landscape archaeology at *Tibiscum*-Jupa[6].

The analysis of these high point images also generated fake leads and the best example is the *Tibiscum* "amphitheater" where the excavations in the indicated area refuted the existence of this circular construction[7].

The necessity of high quality aerial photography coupled with high-accuracy topographical measurements was necessary in the recent decades for the strategy of systematical research in order to include within a single survey plan all areas inves-

[2] Păunescu, 2000.
[3] Tudor, 1968, p. 37.
[4] Ardeț, Ardeț, p. 21, fig. 10.
[5] Benea, 1993, p. 213-217, fig. 2 (în anexă).
[6] http://www.tibiscum.uvt.ro; Micle, 2003, p. 127-130.
[7] *Idem*, 2002, p. 87-92.

tigated via archaeological excavation, but also because the entire area of the archaeological site is larger than the archaeological reservation due to the fact that *Tabula Peuntingeriana* reveals two *Tibiscum* settlements separated by the river *Tibiscos* (nowadays Timiş)[8]. The topographical situation of the *Tibiscum* Archaeological Reservation was recently resolved through the efforts of Adrian Cîntar, who also made the necessary observations regarding the rules that the Romans used as guidelines in shaping the street lines and main roadways[9].

However, the correlation of the two major sectors that make up the ancient *Tibiscum* within a joined plan is only possible via aerial photography, due to the abundant vegetation covering both riverbanks. This shortcoming was compensated through a research conducted by a team of young Polish scientists who are specialists in this type of non-invasive prospection. The team compared images taken with drone-mounted cameras at different times of the day during late autumn, due to the lack of vegetation.

2. The non-destructive project

The non invasive methods in archaeology have developed a lot since they had been discovered and introduced. The appearance of the computers resulted in a great progress in collecting and processing of the data. That opened new possibilities for archaeologists investigating the vast sites, which are not much known.

Such a problem concerns *Tibiscum*. The destructive influence of the Timiş river makes it disappear piece by piece during every flood. The site itself (*castrum*, *vicus* and *municipium*) has been archaeologically investigated only in a little part so far.

The employment of non-destructive techniques could be very helpful in *Tibiscum* and bring much profits as it could help to recognize the archaeological resources.

The Polish Ministry of Science and Higher Education funded the project of non-destructive archaeological survey in Crimea. The aim of this project was to examine the landscape of the rural territory (*chora*) of ancient *Chersonesos Taurica*. The research was impossible to carry out, because of the legal issues following the Russian military invasion on Ukraine and theoccupation of Crimea.

Fortunately, the established cooperation between the West University of Timişoara and University of Warsaw made a great opportunity to lead the survey in very similar conditions.

The main aim of the project is to find and investigate objects that may refer to the ancient surroundings of *Tibiscum*. This may pertain to villas, roads, cemetries, temples, or any other foundations from the Roman period. The geophysical methods such as earth resistance or geomagnetics are supposed to help with that task. Aerial pictures from the drones would be an additional documentation of the sites and moreover could help in interpretation of the geophysical data.

[8] Cîntar, 2013a, p. 591-604.
[9] *Idem*, 2013b, p. 155-159.

Furthermore, a series of methodical experiments is going to be carried out. The efficiency of aerial thermography in archaeological prospection will be tested in various conditions. Not many tests of that kind have been carried out so far, but nevertheless they bring quite promising results[10].

The project itself would last until the end of 2016 and during that time a number of six field expeditions were planned.

The first of them took place in October 2014. The main goal was to recognise the *Tibiscum* surroundings and to locate as many of previously known Roman archaeological sites as possible with use of the GPS. The other objectives were to perform the first attempt of the aerial documentation and to pick the right spot for thermal imaging experiments.

3. GPS Survey

One of the objectives of the project is to build the complementary GIS database not only for the area of the fort and *vicus*, which has been done by Adrian Cîntar[11], but also for the other sites known around *Tibiscum*. Therefore a few field trips with handheld GPS has been undertaken.

The device used for the survey was Garmin eTrex 20. It provides path tracking, recording the waypoints, registering the measurements in UTM coordinates system and exporting the data in GPX format. It does it with the maximum accuracy of *circa* 3 meter. All the sites localised during the Autumn 2014 expedition were previously known, pointed by Dr. Călin Timoc and Dr. hab. Adrian Ardeţ in the field. Hopefully, more objects will be discovered during the following investigations.

4. GIS Database

The user-friendly interface of the GPS used during the field survey, simplify processing the data in Quantum GIS software, which had been chosen for the project because of its versatility and the open-source character.

The QGIS allows to create the database containing informationsuch as maps, satellite images, aerial rectified pictures, excavation plans and drawings, GPS and geodesy measurements, thermal pictures, geophysical data and many more. All of these features have their exact coordinates, which means that they are easily trackable in the field afterwards.

The database has been built in Stereo70 coordinate system, but it is also possible to switch it easily to UTM or any other coordinate system.

Currently the database contains old Russian mapsand available satellite images, but also the GPS data and aerial pictures taken in October 2014 (Fig. 1).

More important data will be uploaded to the database gradually, nevertheless, it is possible at the moment to measure precisely the distances between all the spots marked with the GPS during the field expedition.

[10] Kiesow, 2006.
[11] Cîntar, 2013a; *Idem*, 2013b.

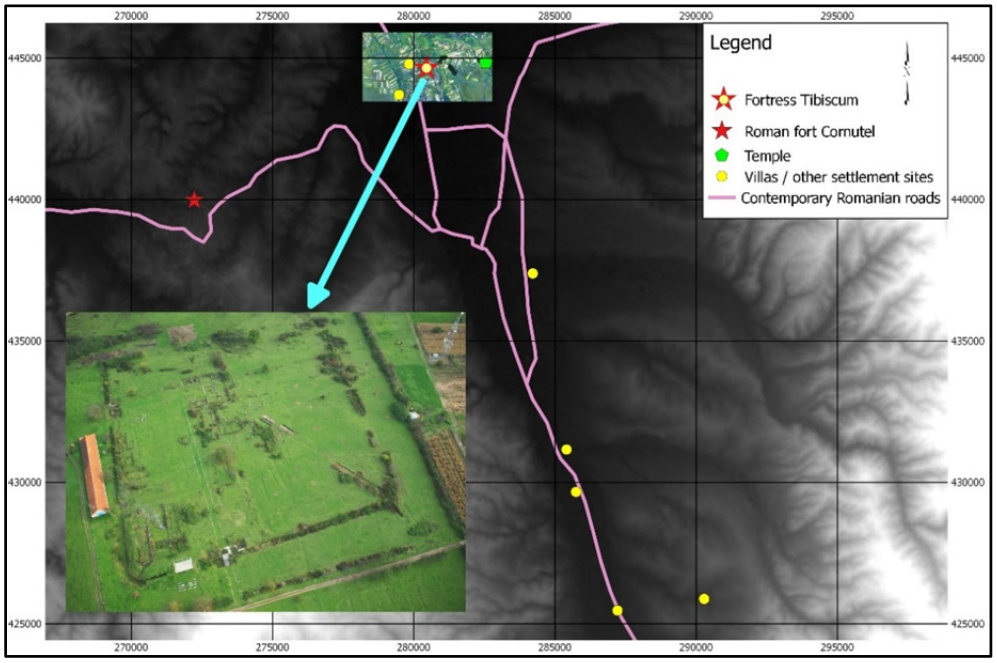

Fig. 1. The map of the sites localized with the GPS during the October 2014 expedition, prepared with Quantum GIS software.

5. UAV photography

The project assumes taking a series of aerial photographies of all marked and accessible Roman archaeological sites around *Tibiscum*. The first attempts has been taken during Autumn 2014 expedition (Fig. 2). The area *intra muros* of the fort has been documented. The total amount of 26 georeferencing points has been measured with Total Station, which allows to orthorectify the images and put them into the GIS database. The *vicus* area has been photographed as well, but due to the crop vegetation (not harvested corn) it has been decided not to make the georeferencing during this expedition, but to leave it for spring, when there will be no vegetation.

The same decisions were made for all the other sites. The area of *municipium* was heavily overgrown with weeds, and *villas* tracked with the GPS during the field survey were placed under the corn fields. In spring they are supposed to be fully accessible.

Fig. 2. The evening aerial photography session made with the drone.

6. Aerial thermography

A series of the experiments on implementing the aerial thermography will be carried out. Some scientists have already experimented with the temperature measurements on the surface of the surveyed area[12], which brought some promising results. On the other hand, some archaeologists made some attempts to use the thermal cameras in aerial prospection. The best results with investigating the Roman villas came from Germany, where Ulrich Kiesow performed the thermal imaging from the paraglider. Many great results have been published on his website[13] and in a paper[14].

Hopefully, our efforts in *Tibiscum* will bring some new information about the methodology of thermal prospecting.

7. Conclusions and perspectives

The first field expedition to *Tibiscum* brought a set of important information and rational results. The tasks carried out were an important first step for keeping the documentation and results of future actions together in the common coordinates system. With the help of Adrian Cîntar it was possible to merge the results of his previous work done in *Tibiscum*[15] with new surveys and the upcoming data from the future.

[12] for example, Křivánek, 2013.
[13] www.archaeoflug.de.
[14] Kiesow, 2005.
[15] Cîntar, 2013a; *Idem*, 2013b.

Tibiscum itself seems to be a good site for this type of investigations. Probably all of the planned actions can be performed there, including geophysical survey, fieldwalking, aerial photographical documentation and thermography experiments.

Geophysical survey results depend on many various environmental factors. At this moment, we can state that it is possible to carry out the measurements, but it is not sure, whether they will bring any positive result. Earth resistance results depend on the contrasts between the resistivity of investigated objects and its surroundings[16]. In *Tibiscum*, theoretically, this condition is fulfilled. On the other hand, geomagnetics could bring a good result only if we deal with magnetic objects and non-magnetic surrounding or inversly[17].

One of the most urgent tasks to do should be the topographical documentation of the Roman fortlet in Cornuţel[18]. This object has been heavily damaged by the treasure hunters. The fortlet is situated in a rough terrain, and it is impossible to document it with the aerial pictures, due to the forest that overgrows it. Nevertheless, the height measurements with Total Station should be carried out. If it is possible, the topographical survey would be supplemented with a geophysical measurements.

In addition to the above, the fieldwalking survey is considered to be carried out. That would probably bring some information about the sites that have not yet been discovered.

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[16] Schmidt, 2013.
[17] Aspinall *et alii*, 2011.
[18] Lungu, Hurdezu, Timoc, 2001.

Fig. 3. The team of 2014 Autumn expedition (from left): Wiktor Rutkowski, Dr. Calin Timoc, Dr. Agnieszka Tomas, Michał Pisz and Jacek Balcerzak.

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