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Gonio (Georgia) : non-invasive surveysof the Roman Fort of Asparos - season 2012

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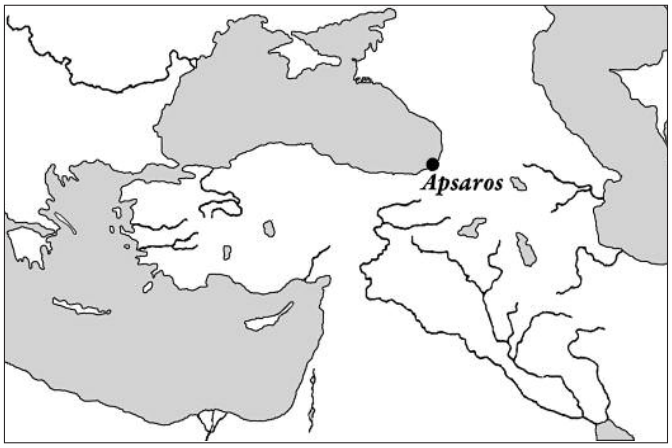
Gonio (Georgia). Non-invasive surveys of the Roman fort of *Apsaros* – 2012 Season

The non-invasive surveys of the Gonio site in Georgia done in 2012 (June 15–30) were aimed at supplementing the data and enabling a rational continuation of excavations at this site, planned by the Institute of Archaeology of the University of Warsaw. These surveys were financed by the Polish Centre of Mediterranean Archaeology, University of Warsaw (PCMA UW) and carried out by Krzysztof Misiewicz, Miron Bogacki and Wiesław Małkowski. The activities carried out as part of the research included aerial photography with the use of kite photography, topographical measurements and the magnetic method of geophysical prospecting. During the research, also a number of experiments were undertaken, aimed at developing an optimal way of integrating data from non-invasive and archaeological research.

The *Apsaros* site and its remains were described for many times.[1] Plans of the preserved fortifications and the remains uncovered during the excavations have been published. Unfortunately, they were not always free from mistakes, concerning not only the size of the fortifications, but also the number of the preserved towers or the inner area layout. Therefore, it was decided that it would be appropriate to verify the previous results. It was planned that the first stage of the project would consist in making a correct photogrammetric documentation on the basis of aerial photography sessions and land survey carried out for this purpose.

Aerial photography and topographical survey

The aim of the kite aerial photography was to document visually the areas where the geophysical survey was planned. In total, more than 900 vertical and oblique photographs were taken, of which about 100 of the best quality were chosen for further analyses. The vertical photographs were processed in a photogrammetric software along with land survey measurements and as a result, the Digital Terrain Model and the orthophotomaps (**Fig. 1**) were created. 98 photographs were processed, which made it possible to obtain high accuracy of the orthophotomaps and of the 3D model. The topographic survey indispensable for creating 3D models of the surface relief was done with the use of the GPS RTK system and conducted in three stages. At the first stage, accurate position and height measurements of the preserved fragments of the wall were carried out. The second stage consisted in levelling measurements made automatically while recording magnetic field intensity variations. At the third stage, the position of the ground control points was determined, which was necessary to make the orthophotomap and the 3D model of the site surface.



Geophysical survey

The geophysical survey was carried out with the use of a Geometrics G858 Magmapper caesium magnetometer, with two sensors in a horizontal position. In this way, measurements of the total vector of the magnetic field strength were made. The horizontal arrangement of the

[1] A. Plotke-Lüning, *Apsaros. Quellen und Geschichte*, (in:) A. Geyer (ed.), *Neue Forschungen in Apsaros (2000–2002)*, Tbilisi 2003, 7–16; E. Kakhidze, *Apsaros. A Roman Fort in Southern Georgia*, "Pontos" 3, 2003, 303–332.

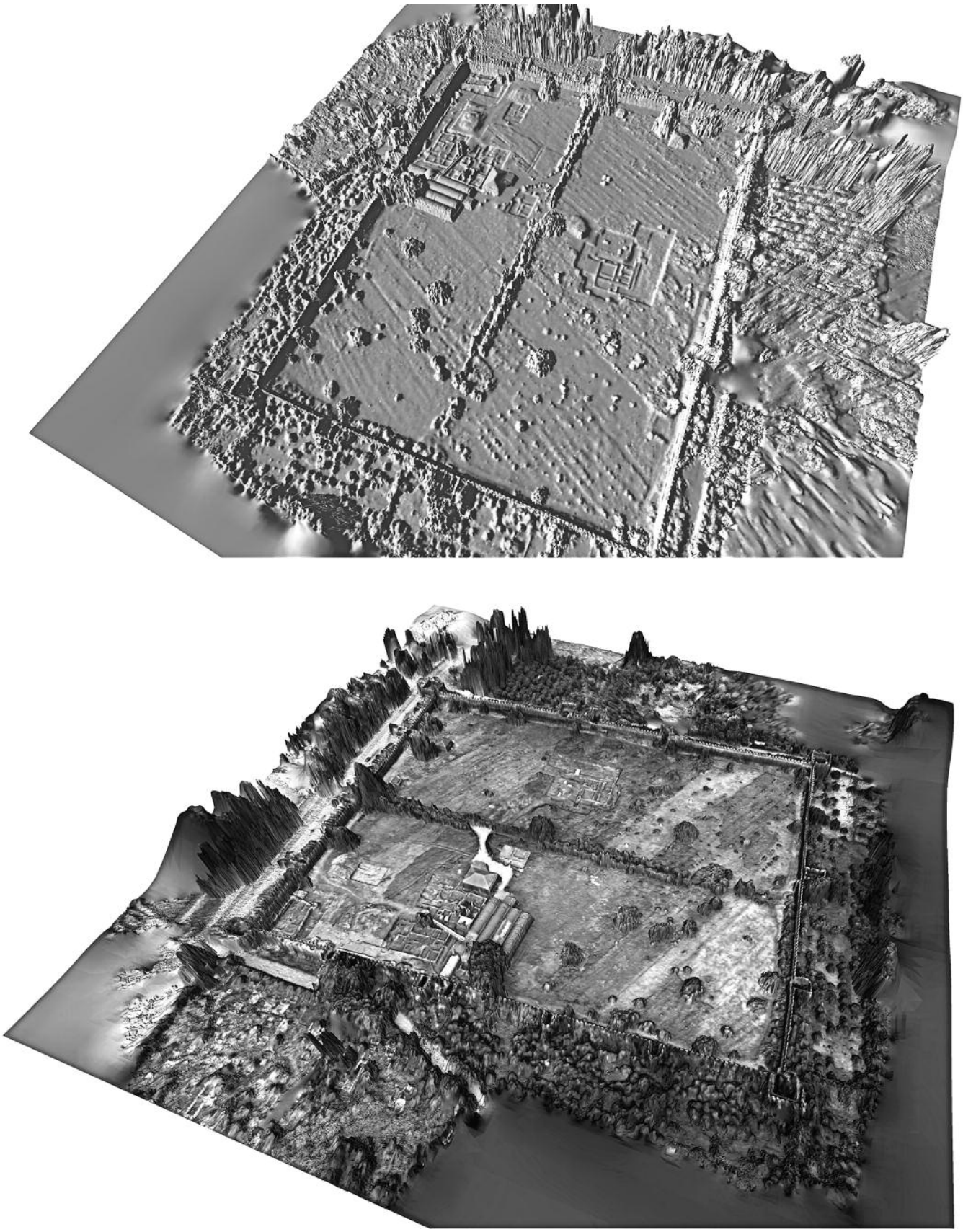


Fig. 1. Gonio. Digital Terrain Model and ortophotomap of the site (M. Bogacki, W. Małkowski).
Ryc. 1. Gonio. Numeryczny model terenu i ortofotomapa stanowiska.

Fig. 2. Gonio. Magnetic map of the site (K. Misiewicz).
Ryc. 2. Gonio. Mapa rozkładu wartości natężenia pola magnetycznego.

sensors made it possible to determine, at the same time, the value of the pseudo-gradient of the horizontal component – on the basis of the observation of the difference between the recorded values of the magnetic field strength, measured simultaneously by the two sensors set 0.5 m apart. The sampling rate was set at 0.1 seconds.

The processing of the results of the measurement of the total vector of magnetic field intensity variations and the variations of the pseudo-gradient of the horizontal component produced two maps presenting the distribution of anomalies caused by features buried in layers underneath the ground surface. The measurements made it possible to calculate the values of the pseudo-gradient of the horizontal component of the total vector of magnetic field intensity within the range between -100 and +100 nT/m. The rather considerable dynamics of the anomalies is mainly due to the variations at places where there are contemporary metal structures supporting the rows of plants or constructed at the site as elements of the museum exhibition. They cause strong dipole-dipole anomalies with increases and decreases of the pseudo-gradient of the horizontal component of the vector of Earth's magnetic field intensity. A more distinctive arrangement of anomalies resulting from the buried archaeological remains in question was obtained when recording the distribution of the value of the total vector of magnetic field intensity (**Fig. 2**). In these results, linear structures caused by ground surface irregularities are also visible, but narrow linear anomalies at places where there are foundations of the old buildings of the fortress are much more clear.

When attempting to interpret the obtained results, it is necessary to take into consideration the fact that this is a multi-layered site with the earliest preserved remains of architecture dated to the 1st c. BC, and the latest to the Ottoman period. Although the repeatedly rebuilt interior of the fortress preserved its military character, it was adjusted to current needs. The original structures may have lasted relatively long, but they did not always have the same function. The redevelopment involved also erecting new buildings on the earlier foundations, expansion of rooms, changes of their layout and function. On the pattern of the recorded geophysical anomalies, it is visible when the preserved foundations of later buildings occur on traffic routes and when the layout of the preserved rooms is too complex to determine unambiguously the size of the remains that cause the recorded anomalies.

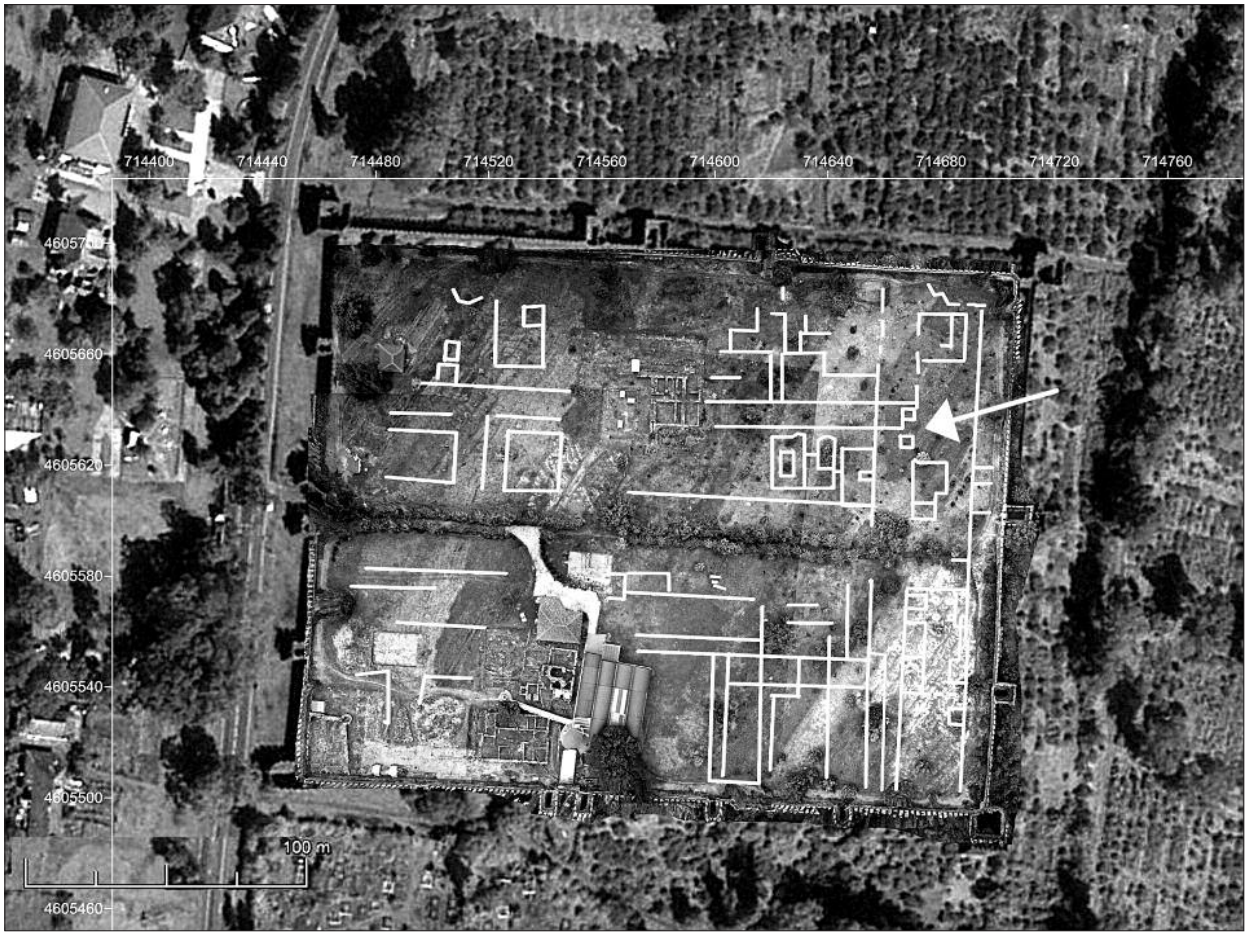


Fig. 3. Interpretation of the results of magnetic survey (K. Misiewicz).
Ryc. 3. Mapa interpretacyjna rezultatów prospekcji magnetycznej.

The final stage of interpretation of the results of geophysical measurements is a map combining all the data we obtained – the location of the remains uncovered during the excavations, 3D models of the relief of the site surface, orthophotomaps and aerial photographs, as well as the results of the geophysical survey. This map, linked to the unified system of geographical coordinates (UTM zone 37 T, **Fig. 3**) enables above all a rational plan of further excavation activity at this site. It seems that in the beginning one should carry out test excavations in crucial places, where it is possible to obtain data concerning the stratigraphic arrangements and dating of the preserved archaeological remains. This data will enable more detailed interpretations of the results of the prospecting with the use of non-invasive methods, and it will make it possible to plan the location of open area excavations rationally as well.

Two places in the eastern part of the surveyed field are selected to verification by archaeological trial pits in the first stage of excavations. The first, with coordinates 4605630 N, 714660 E (see **Fig. 3**) should explain if two squares of magnetic anomalies could be caused by the remains of fortifications (a gate?) from the first period of existence of the stronghold. Sounding in this place should also get a picture of archaeological features above and under the layer of the possible street traced here in the second period of existence of the fortress. The second trial pit, located on the opposite side of the street, where a corner of some large building complex is visible on the magnetic map, should give the information on the state of preservation of possible architectural remains and on the thickness of archaeological layers inside the buildings. Experience gained in both these trenches should be useful for planning exploration of chosen buildings, by large scale excavation.

Translated by Joanna Dżdża and Grzegorz Żabiński

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Gonio (Gruzja). Nieinwazyjne badania rzymskiego fortu *Apsaros* w sezonie 2012

Nieinwazyjne badania twierdzy *Apsaros*, wykonane w dniach 15–30 czerwca 2012 roku, miały na celu uzyskanie informacji pozwalających na odpowiednie przygotowanie dalszych pracy badawczych (wskazanie lokalizacji wykopów) na tym stanowisku, zaplanowanych przez Centrum Archeologii Śródziemnomorskiej UW. W ramach podjętych działań wykonano zdjęcia z powietrza, pomiary topograficzne i rozpoznanie geofizyczne z zastosowaniem metody magnetycznej. Pozyskane dane opracowano w postaci ortofotomap, trójwymiarowych modeli rozkładu rejestrowanych wartości parametrów fizycznych gruntu, kolorowych i czarno-białych map zmian wartości wektora całkowitego natężenia pola magnetycznego i wartości pseudogradientu jego składowej poziomej Hz. Umieszczenie danych w ujednoliconym systemie koordynat geograficznych (UTM strefa 37 T) pozwala na lokalizację wydzielonych anomalii geofizycznych w terenie i zaplanowanie koniecznych sondaży wykopaliskowych w miejscach prawdopodobnego występowania pozostałości zabudowy wewnątrz twierdzy.