

Urszula Bugaj\*, Goce Naumov\*\*, Maciej Trzeciecki\*\*\*,  
Małgorzata Chwiej, Marcin Przybyła, Piotr Szczepanik, Michał Podsiadło

## ARCHAEOLOGICAL, GEOPHYSICAL AND TOPOGRAPHIC SURVEY OF THE NEOLITHIC TELLS IN PELAGONIA

### ABSTRACT

Bugaj U., Naumov G., Trzeciecki M., Chwiej M., Przybyła M., Szczepanik P. and Podsiadło M. 2014. Archaeological, Geophysical and Topographic Survey of The Neolithic Tells in Pelagonia. *Sprawozdania Archeologiczne* 66, 221–239.

Pelagonia — a large valley in the southern part of Macedonia — is one of the most important settlement centers in this part of the Balkans with a concentration of approximately 80 Neolithic tells, so far very poorly recognized. In 2013 the archaeological reconnaissance, the magnetic and topographic prospection have been carried out, with focus on the Central Pelagonia — the Mogila, Trn, Karamani and Dobromiri villages. Survey aimed at mapping, documenting and magnetic prospection of the sites selected by the following criteria: accessibility for surveying, visible land form suitable for Digital Elevation Modeling and state of archaeological research. The magnetic prospection gave a quick insight into the tells' organizational patterns. Together with precise positioning within RTK mode and Digital Elevation Models (DEM) it made a framework for the future presentation and processing of research results. The 2013 survey revealed the first images of the Neolithic tells in Macedonia. The enclosures surrounding the settlement e.g. in Dobromiri, although already known for the Balkans, have not been noted so far at the Neolithic or Chalcolithic sites in Macedonia.

Key words: Pelagonia, Middle Neolithic, Late Neolithic, tell sites, geomagnetic survey, DEM, anthropomorphic figurines, house models

Received: 07.04.2014; Revised: 14.06.2014; Accepted: 21.07.2014

\* Institute of Archaeology and Ethnology, Polish Academy of Sciences, Al. Solidarności 05; 00-140 Warsaw, Poland; bugaj.urszula@gmail.com

\*\* Euro-Balkan University, Skopje, Republic of Macedonia

\*\*\* Institute of Archaeology and Ethnology, Polish Academy of Sciences, Al. Solidarności 05; 00-140 Warsaw, Poland

## INTRODUCTION

Pelagonia is the largest valley in the Republic of Macedonia. Surrounded by the Baba, Busheva, Dautica, Babuna, Nidje, Selechka and Nereshka Mountains, the valley provides ideal prerequisites for human habitation (Fig. 1). The natural conditions of Pelagonia with enough rainfall and fertile soil capable to absorb and hold the water both from rain and snow melting in the surrounding mountains add to requirements of place for inhabitation. The fruitful landscape stimulated the establishing of the first agricultural communities, prehistoric villages, Classical cities, Medieval fortresses and modern urban centers. Several exceptionally significant Neolithic, Chalcolithic, Bronze and Iron Ages settlements and necropolises (such as those at Porodin, Mogila, Shuplevec, Crnobuki, Karamani and Beranci) were founded just there. In the early Classical period Stybera, Ceramie, and Pelagonia were established, as well as Heraclea Lyncestis, which was later one of the most important episcopal centers in the Roman province Macedonia Prima. When speaking of the Middle Ages one must mention the fortresses at Markovi Kuli, Debrešte, Zivojno and Zovic. Pelagonia retained its importance even today with one of the largest cities in the Republic of Macedonia – Bitola and Prilep (Mikulčić 1966; Babić 1977; Todorovski 2002; Mikulčić 2007).

Although there are no confirmed Paleolithic and Mesolithic sites in Pelagonia, hundreds of prehistoric settlements dated to the Chalcolithic, Bronze and Iron Ages had been discovered. A series of archaeological surveys and excavations has been performed in order to determine the chronology of these sites (Hurtley 1939; Simoska and Sanev 1976; Sanev 1994). Consequently, approximately 80 Neolithic tells have been localized what makes the most intense concentration of such settlements in Macedonia. Archaeologists from the museums of Bitola and Prilep as well as the Archaeological Museum of Macedonia, motivated by that fact focused their efforts on some of these sites and produced an outline of their origins and chronology within the phases of the Neolithic and later prehistoric periods. As a result the Pelagonian Neolithic has been defined with the so called Velushina-Porodin cultural group (Garašanin 1979; Sanev 1995). Pottery shapes and patterns, the presence of clay figurines, anthropomorphic house models, as well as the concentration of tells are the determinants for the Pelagonian Neolithic demonstrating its unique cultural character in comparison to other parts of Macedonia e.g. the Amzabegovo-Vrshnik group (Naumov *et al.* 2009).

As it was aforementioned, for almost a century the prehistory of Pelagonia attracted Macedonian and foreign archaeologists. Amongst the first researchers who had impact on its explorations were Etienne Patte, Vladimir Fewkes and Walter A. Heurtley (Naumov *et al.* 2009). Patte, the former soldier, documented the first Paleolithic tools in Pelagonia, while Fewkes besides the excavation of Crnobuki settlement was also surveying the sites in Bitola and Prilep region with his team of Harvard University (Andonovski 1954; Galović 1967; Simoska and Sanev 1976; Kuzman 1993). Fewkes and his team documented also the

Neolithic tells at Raštani and in Bitola (known as *Evrejski Grobišta*). At the same time a British archaeologist, Walter A. Heurtley discovered prehistoric settlements at Čepigovo, Optičari and Karamani. He published his results in a monograph entitled *Prehistoric Macedonia* where he presented his excavations at Karamani tell (Heurtley 1939). These discoveries encouraged Macedonian archaeologists to more profound surveys in Pelagonia what resulted in further numerous discoveries.

Besides the excavations by Walter A. Heurtley, Josip Koroshec and Radoslav Galović especially significant was the project *The First Agricultural Agglomerations in Pelagonia* carried out by Dragica Simoska, Jovan Todorović, Blagoja Kitanoski and Voislav Sanev in the 1970s. It resulted in discovering the majority of the Neolithic tells in Pelagonia known until now. The survey was followed by small-scale excavations focused mainly on the central part of Pelagonia (Simoska and Sanev 1975; 1977; Simoska *et al.* 1979; Simoska, Kuzman 1990). According to archaeological material and radiocarbon analysis, most of the tells belong to the Early and Middle Neolithic while only few are dated to the Late Neolithic, Chalcolithic and Bronze Age. Based on the results of this research two cultural groups were defined: the Early Neolithic Velushina-Porodin group and the Middle Neolithic Trn group (Simoska and Sanev 1977; Garašanin 1979). Later the chronology of these groups were reconsidered and shifted to the Middle Neolithic for the Velushina-Porodin group and the Late Neolithic for the Trn group (Sanev 1995).

Based on analyses of the samples an attempt to challenge the chronology of the beginning of the Neolithic in Pelagonia has been made. For the sites at Velushka Tumba, Porodin and Mogila the period between 6250 BC and 6030 BC was proposed, while for the Topolchani site in Prilep region, a date 7010 BC was suggested (Thissen 2000; Whittle *et al.* 2005). Due to the general uncertainties of radiocarbon dating (Thissen 2000; Perlés 2001) this lengthened chronology has not been widely accepted in Macedonian archaeology and the beginning of Pelagonian Neolithic is still presumed around 6000 BC. There are also certain geographical factors which could have disabled such early habitation of Pelagonia, namely the marshy ground and frequent water rise confirmed for the end of 7<sup>th</sup> millennium BC together with the isolation of the valley surrounded by high mountains and lakes. Moreover the Early Neolithic material from the Pelagonian settlements demonstrates typologically later features (Kitanoski *et al.* 1980; Benac 1989; Thissen 2000; Naumov *et al.* 2009; Naumov *in print*). Still, the cultural and chronological classification of the Pelagonian Neolithic based on small-scale excavations, selective documentation and publication of the archaeological material requires verification and further research. There are also no reliable interpretations regarding the Middle and Late Neolithic in Pelagonia. After the excavation at the Velushka Tumba and 'Golema Tumba' sites only Early Neolithic levels were determined and a Middle Neolithic one of the latter (Simoska and Sanev 1975; Simoska and Sanev 1977). However due to later systematization it has been revised (Sanev 1995). Namely, a large part of Velushka Tumba painted vessels considered as the Early Neolithic were then-connected with the Middle Neolithic phases, likewise the Middle Neolithic artifacts

from Trn redefined as the Late Neolithic ones after being confirmed as analogous to material of the so called Adriatic complex. In this paper the determinants of the Neolithic phases will not be presented for such systematization regarding Pelagonian Neolithic is still problematic. Only a basic overview of artifacts features will be provided.

The most distinctive in the material culture of the Neolithic in Pelagonia are white painted vessels, anthropomorphic clay figurines, house models, stamps and a large number of clay sling shots, not common in other part of Macedonia. The shapes of vessels are much similar to those in other Balkan regions, their distinctive feature is the decoration of the surface with white painted patterns. The motifs of wavy and angled lines, points, lozenges and triangles form both simple and very complex patterns. Many interpretations have been proposed for the chronological, cultural, typological, functional classification and the symbolic meaning of those vessels (Simoska and Sanev 1976; Garašanin 1979; Sanev 1994; Fidanoski 2009; Naumov *et al.* 2009; Naumov 2010a). By contrast the decoration of the Trn group's pottery is completely different and mainly consist of incised white incrustation in form of a triangle, lozenge with a net, as well as a zig-zag stripe, meander and circle.

One of the most specific features of the Pelagonian Neolithic are human representations. They can be divided into two visual categories: the miniatures and the hybrids. The miniature figurines represent stylized or partially realistic — in most of the cases — female body with an exaggeration in the size of buttocks, small breasts and hands positioned in the genital area. Although only occasionally analyzed in detail (Temelkoski and Mitkoski 2001; Naumov 2014a), the Pelagonian figurines are being presented quite frequently in publications (Sanev 2006; Karpuzova 2007; Naumov *et al.* 2009; Naumov 2009d; 2014b). They bear some general similarities to the ones from other parts of Macedonia, however significant differences can be noted. The shape of head and the modeling of face, the circular applications in genital area and the particular body and limbs positions distinguish human representations from Pelagonia. In that context, anthropomorphic house models further contribute towards the local, authentic corporeality associated with the visual hybridism. Those are artifacts larger than figurines, composed of two parts; the lower which is a hollow house model and the upper one, comprising of a “cylinder” representing human face (Fig. 2: 1–2, 5–6). Again, despite being considered in several papers (Sanev 2006; Naumov 2006; Čausidis 2007; 2008; 2010; Naumov 2009d; 2010b; Čausidis and Naumov 2011) and exhibition catalogues, the anthropomorphic house models and human representations from Macedonia in general require further, more detailed research.

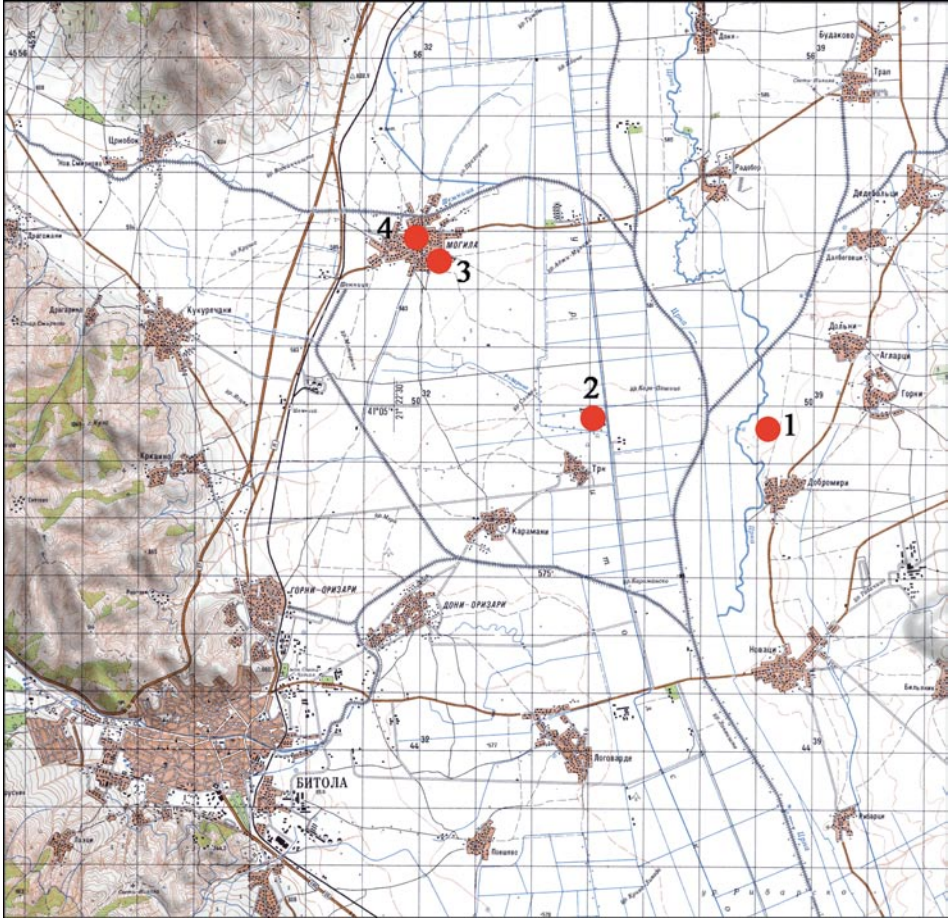
Excavations performed on Neolithic tells in the 1970s provide basic data about the construction of buildings. Those were mostly perpendicular objects with walls made of wattle and daub and floors tamped down with straw, pottery shards and stones — typical for the Balkan Neolithic (Grbić *et al.* 1960; Stalio 1968; Simoska and Sanev 1975; Simoska *et al.* 1979; Tolevski 2009). The clay house models help to learn the habitat house design giving the interior, openings and roof structures (Fig. 2: 3–4, 7–8). Beside the structure, recent research refers also to social and symbolic aspects of the Neolithic buildings in



Fig. 1. Pelagonia (by G. Naumov and M. Trzeciecki)



Fig. 2. Anthropomorphic figurines and house models from Pelagonian tells: Suvodol (1), Porodin (2, 5, 8, 9), Dobromiri (3), Veliška Tumba (4, 7), Mogila (6). By G. Naumov and M. Trzeciecki



**Fig. 3.** The sites surveyed in 2013: Dobromiri — *Golema Tumba* (1), Trn — *Golema Tumba* (2), Mogila — *Ronjevska Tumba/Barutnica* (3), *Školska Tumba* and *Tumba-Sredselo* (4). By G. Naumov and M. Trzeciecki

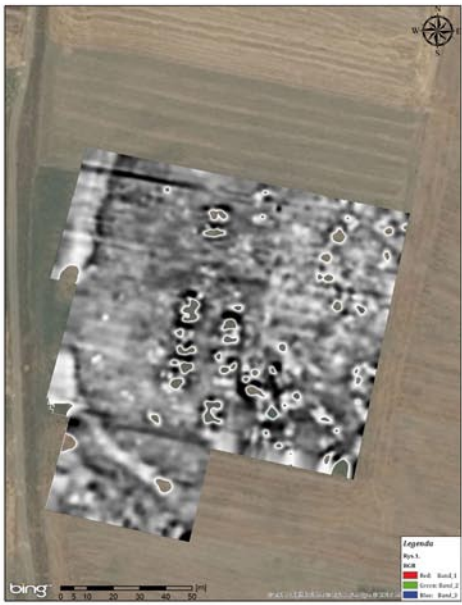
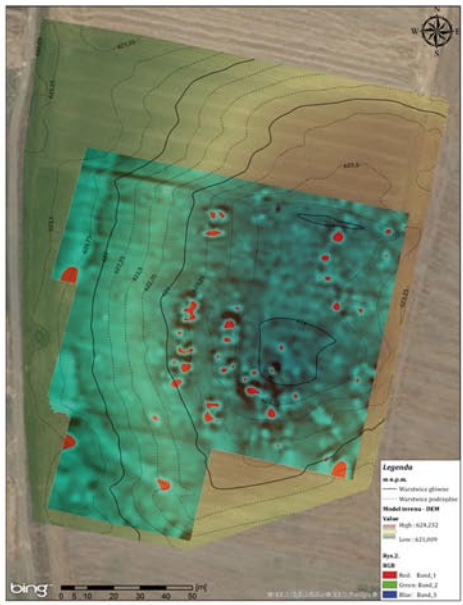
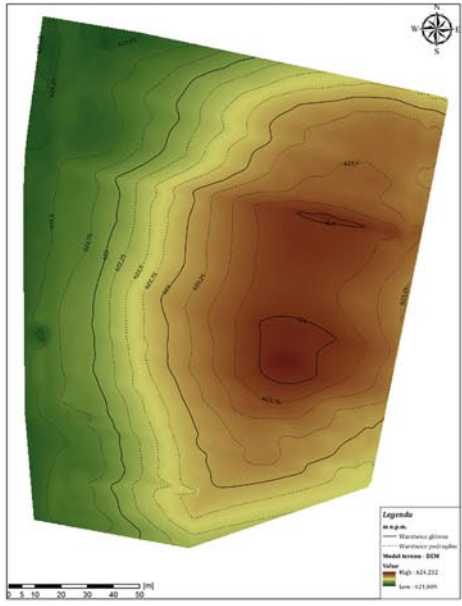


Fig. 4. Dobromiri — *Golema Tumba*. Location of the site on the satellite image (1), contour plan of the site (2), results of geophysical survey and elevation measurements imposed on the satellite image (3–4). By M. Chwiy

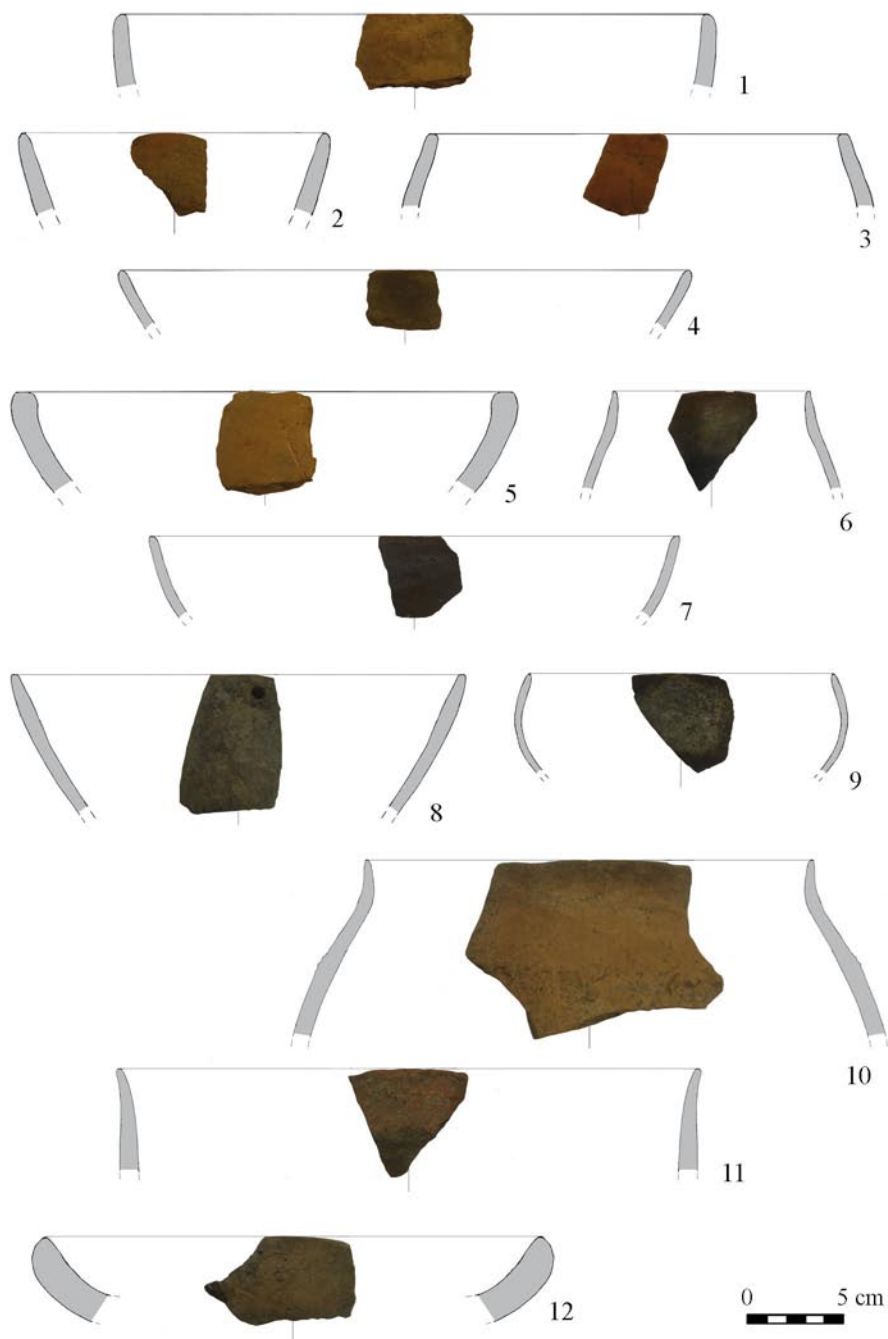


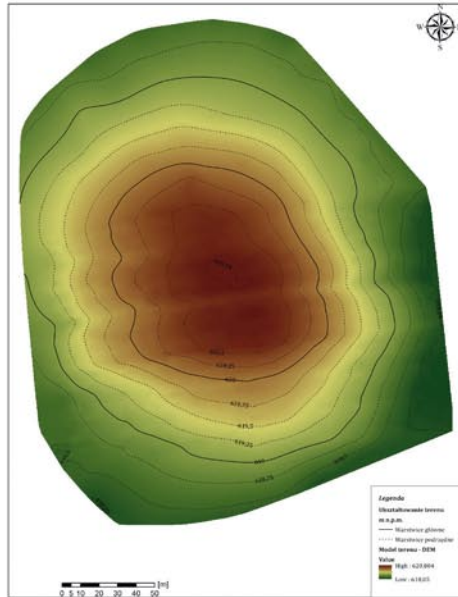
Fig. 5. Neolithic pottery from the survey. Dobromiri — *Golema Tumba* (1–5); Trn — *Golema Tumba* (6–9); Mogila — *Školska Tumba* and *Tumba-Sredselo* (10–12). By G. Naumov



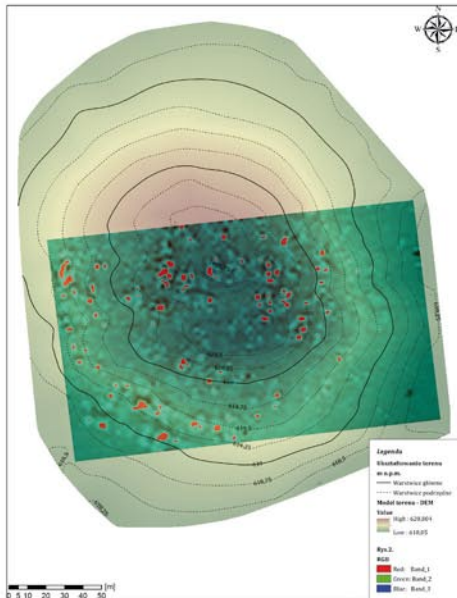


1

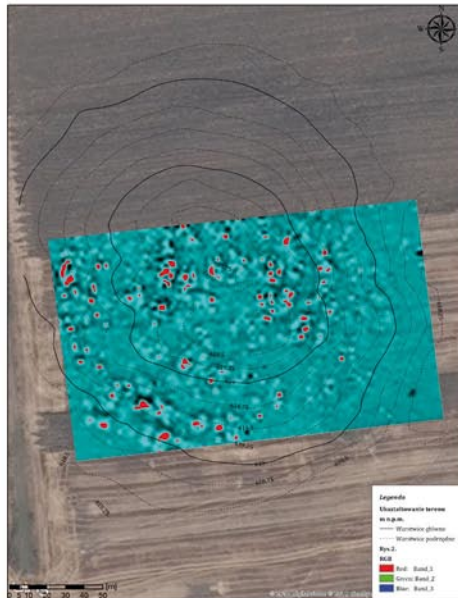
0 500 m



2



3



4

**Fig. 6.** Trn. Location of the *Golema Tumba* (A) and *Mala Tumba* (B) tells on the satellite image (1), contour plan of the site (2), results of geophysical survey and elevation measurements imposed on the satellite image (3–4). By M. Chwiej

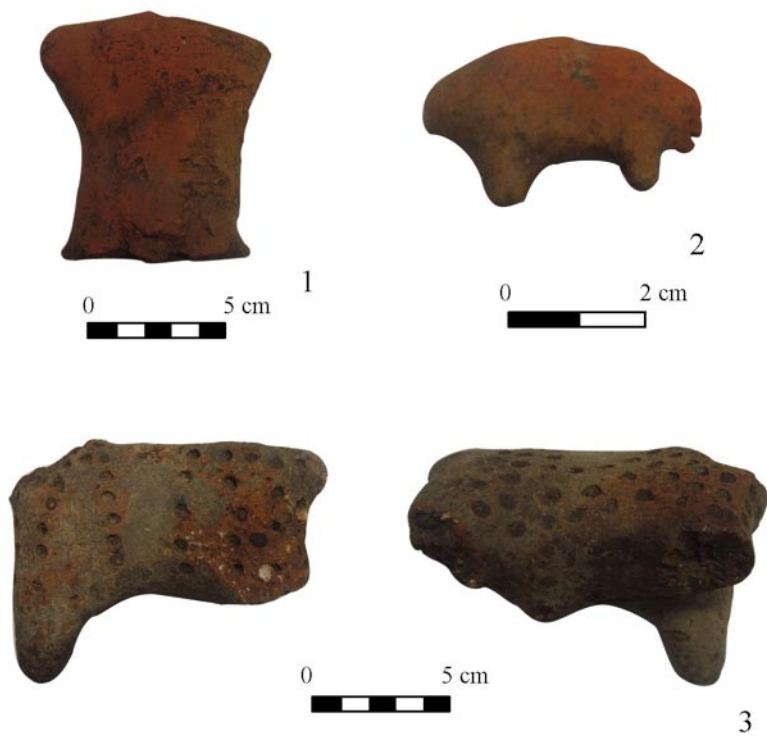


Fig. 7. Trn — *Golema Tumba*. Anthropomorphic and zoomorphic clay figurines found in 2013. By G. Naumov

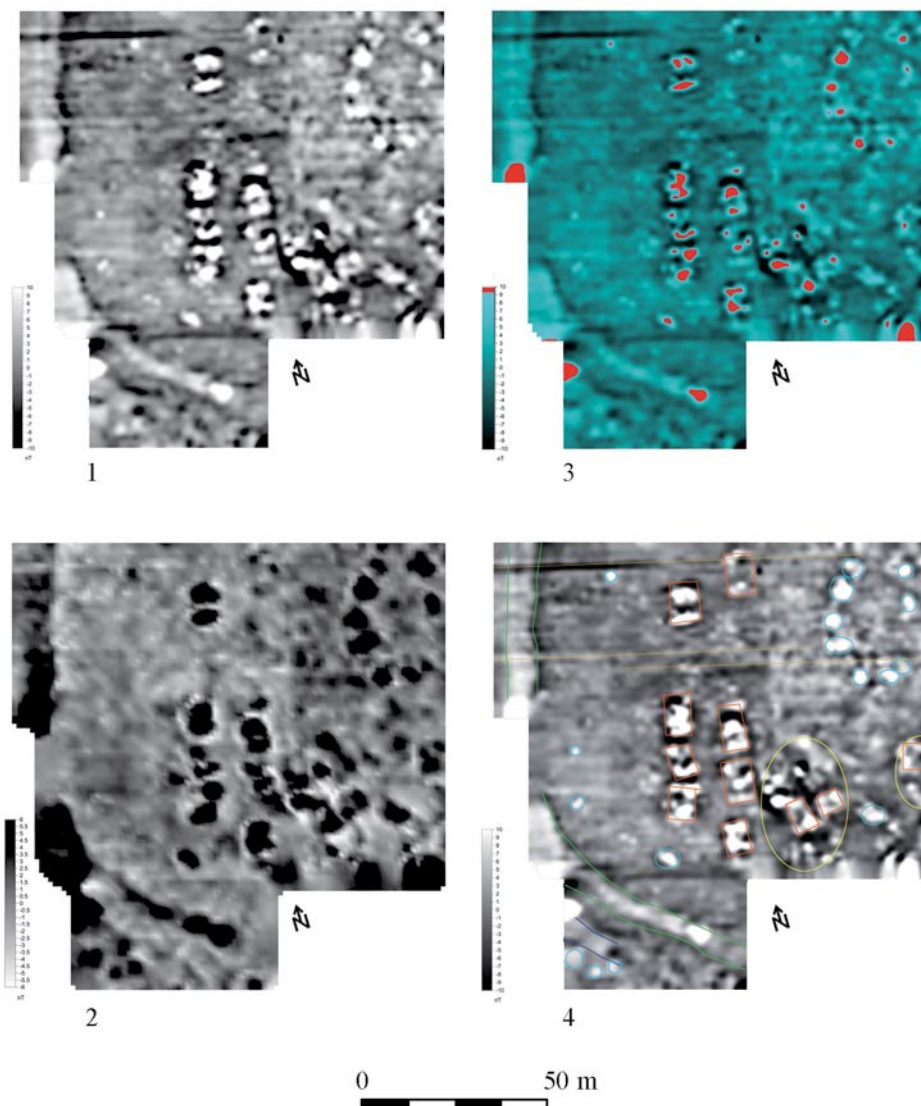


1



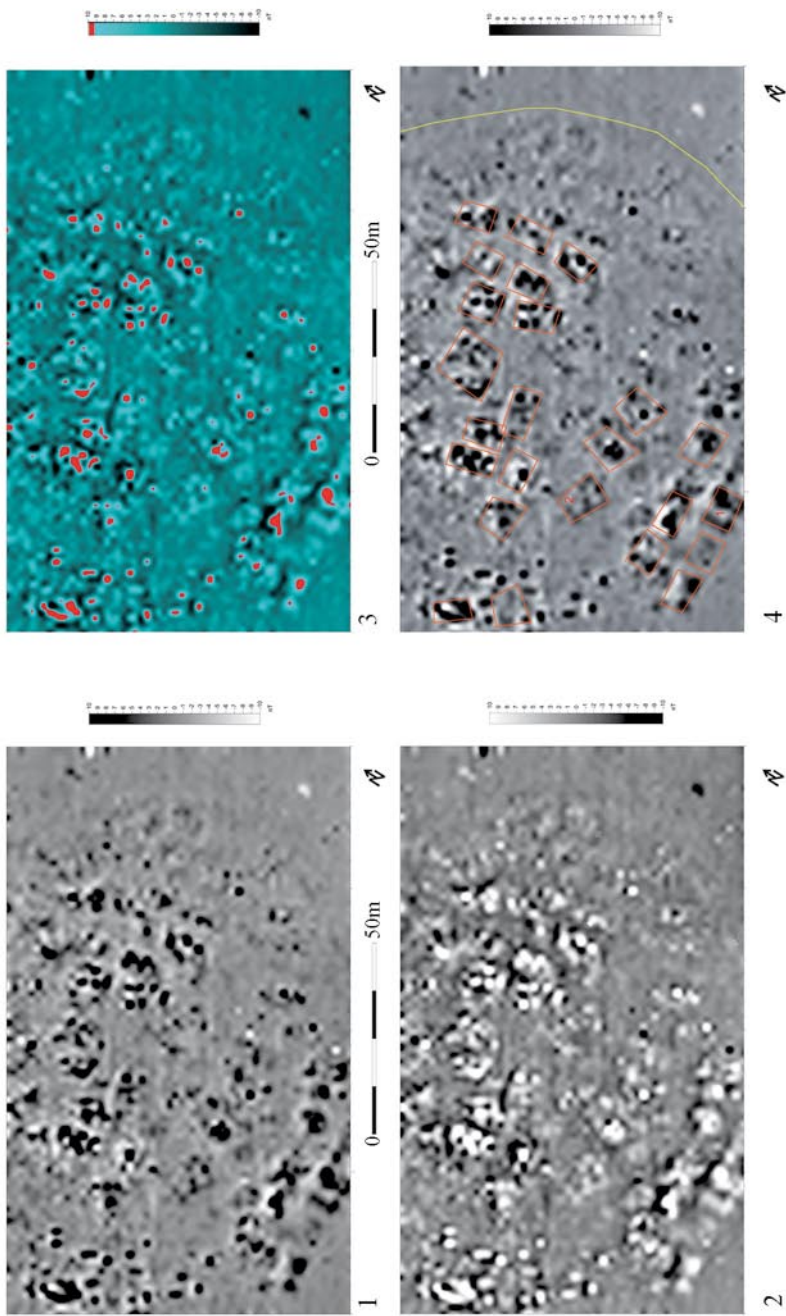
2

**Fig. 8.** Mogila. Location of tells mentioned in the text (1): A — *Ronjevska Tumba/Barutnica*, B — *Školska Tumba*, C — *Tumba-Sredselo*. Area of geophysical survey at *Ronjevska Tumba/Barutnica* tell on the satellite image. By G. Naumov and M. Trzeciecki

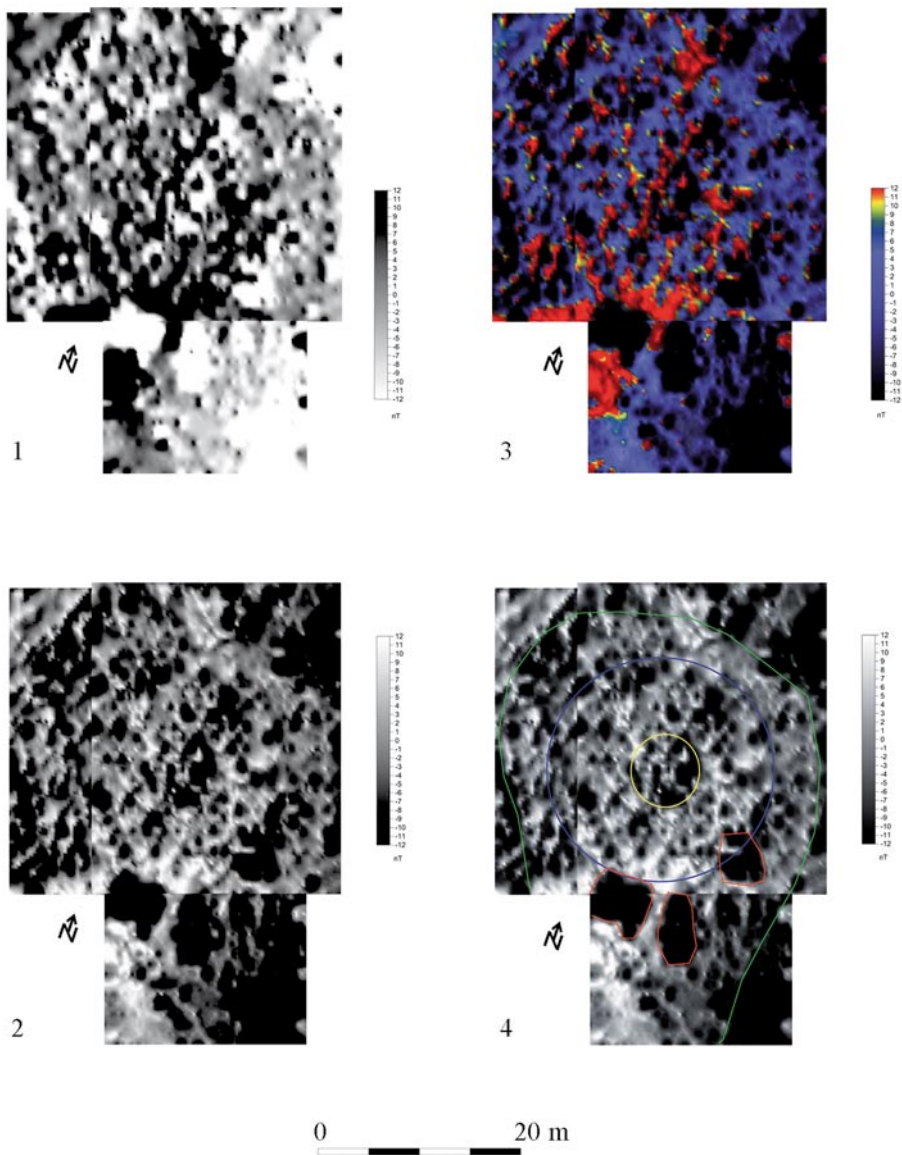


**Fig. 9.** Dobromiri — *Golema Tumba*. Magnetic maps in the range -10/10 nT in the grayscale (1–2). Magnetic map in the range -10/10 nT in the color scale with the highest values emphasized (3). Magnetic map in the range -10/10 nT in the grayscale with chosen anomalies outlined in the following colors: red — termo-remanent anomalies (burned buildings); yellow — `zonal` termo-remanent anomalies; blue — anomaly points of increased magnetic field intensity interpreted as pits, green and navy-blue — linear anomalies of increased magnetic field intensity interpreted as ditches; brown — linear anomalies of increased magnetic field intensity produced by the presence of the modern balks demarcating the fields (4).

By M. Przybyła



**Fig. 10.** Trn — Golema Turnba. Magnetic maps in the range -10/10 nT in the grayscale (1–2). Magnetic map in the range -10/10 nT in the colour scale with the highest values emphasized (3). Magnetic map in the range -10/10 nT in the grayscale with chosen anomalies outlined in different colours: red — anomalies connected with high temperature interpreted as remnants of burned buildings; yellow — the foot of the hill (4). By M. Przybyla



**Fig. 11.** Mogila — *Ronjevska Tumba/Barutnica*. Magnetic maps in the range -10/10 nT in the grayscale (1–2). Magnetic map in the range -10/10 nT in the colour scale with the highest values emphasized (3). Magnetic map in the range -10/10 nT in the grayscale with chosen anomalies outlined in the following colors: green — 'zonal' anomaly of increased magnetic field intensity; blue and yellow — circular array of anomalies; red — anomalies of decreased magnetic field intensity (4). By M. Przybyła

Pelagonia (Naumov 2013). Excavations on Pelagonian tells revealed also single burials, mostly located below or next to dwellings. (Veljanovska 1990; 2000; Naumov 2007; 2014b). Relatively low frequency of intramural burials seems to be a specific feature of the Pelagonian Neolithic.

Most of the Pelagonian tells ceased to function after the Late Neolithic. We know just a few sites with the Chalcolithic or Bronze Age layers. Excavations have not confirmed occupation of tells in the Iron Age, Classical, Roman period. At the beginning of the Middle Ages some tells were used as cemeteries (Grbić *et al.* 1960; Simoska *et al.* 1979; Todorovic *et al.* 1980; Sanev and Simoska 1983). Today most of them are exposed to gradual destruction both because of cultivation and development of the contemporary villages.

The signs of a high distinctiveness of the Pelagonian Neolithic together with a low-level recognition motivated us to launch a research project in cooperation of the Euro Balkan University and the Institute of Archaeology and Ethnology, Polish Academy of Sciences. In 2013 the reconnaissance, the magnetic and topographic prospection have been carried out, resulting in new and important information. The research was focused on the Central Pelagonia, the Mogila, Trn, Karamani and Dobromiri villages. According to the *Archaeological Map of Macedonia*, there are 77 Neolithic sites, mostly tells, approximately 60 of which belong to the Bitola region while the rest are situated in the administrative area of Prilep (Dimče *et al.* 1996). Almost 60 out of 77 tells are localized within the municipalities surrounding Bitola, what may be a result of a more intensive reconnaissance performed there. It is also worth mentioning that the concentrations of the tell sites can be noted in the very villages or their vicinities (Mogila — eight tells, Ribarci — five tells, Dobromiri, Logovardi, Kukurečani and Optičari — three tells each). This sort of regularity has not been observed in other parts of Macedonia. Our survey aimed at mapping, documenting and magnetic prospection of the sites selected by the following criteria: accessibility for surveying, visible land form suitable for Digital Elevation Modeling and state of archaeological research. Four locations were chosen that way: *Golema Tumba* in Dobromiri, *Golema Tumba* in Trn, *Školska Tumba* and *Ronjevska Tumba/Barutnica* in the Mogila village (Fig. 3).

## ARCHAEOLOGICAL RECONNAISSANCE

### Dobromiri

There are three tells registered in the Dobromiri district: *Gorna Tumba*, *Golema Tumba* and *Arapski Grobishta*. They are situated to the north of the village, in one line, relatively close to each other. Giving intensive cultivation, the extents of these sites are not quite evident. The site of *Golema Tumba* has the most visible land form, despite its permanent modification with heavy agricultural machines (Fig. 4).

*Golema Tumba* was excavated in 1977 and 1978. Unfortunately no detailed information, but short reports have been published (Simoska and Sanev 1976; Simoska 1978; 1983; 1996a). Generally at the settlement two phases were distinguished: Velushina-Porodina III and IV, assigned primarily to the Early Neolithic, then reassigned to the Middle Neolithic (Sanev 1995). During the 1978 excavation an eight meters long house with tamped down floor, wattle and daub walls constructed with straw and poles (Sanev and Simoska 1983). For the majority of the tells that were excavated in Pelagonia there is no evidence of the Neolithic intramural burial (despite the Ovche Pole and Skopje Valley settlements; Nemeskéri and Lengyel 1976; Veljanovska 2006; Naumov 2007; Naumov 2013; Stojanova Kanzurova 2011; Fidanoski 2012). On one hand, it can be assumed that the Neolithic communities inhabiting Pelagonia used to bury their relatives out of villages, likewise in other regions (Naumov 2014). On the other hand, the geochemistry of soil could have had an impact on skeletal material preservation as there is no animal bones mentioned in the field reports.

The house was damaged by the Medieval graves, what is, by the way, quite common for the tells in Pelagonia. At *Golema Tumba* apart from white painted *barbotine* globular vessels, dishes and *pythoi* also an exceptional house model an exceptional house model had also been found – it has an untypical, spherical roof and no anthropomorphic cylinder applied on the top (Fig. 2: 3).

The 2013 reconnaissance confirmed some of the data gathered during the 1977 and 1978 excavations. A large number of undecorated pottery fragments (dishes, pots, *pythoi* etc.) and some with the *barbotine* ornament dated to the Middle and Late Neolithic have been found on the site's surface (Fig. 5: 1–5). Some of the pottery finds demonstrate the Late Neolithic or even the Chalcolithic features. The future excavations at the site would verify if either the tell was occupied also in later periods or these fragments were scattered from other sites due to intensive cultivation.

No remains of anthropomorphic house models or figurines has been found during the reconnaissance and during the 1977 and 1978 excavations only few fragments of this kind were discovered. Besides the numerous pottery shards there were several daub pieces with traces of fire. In the excavation report such daub fragments were interpreted as being burned *in situ* in buildings (Sanev and Simoska 1983). An important information giving the stage of research at the site has been provided by a satellite image of the tell showing a ditch enclosing the settlement, what was later confirmed by magnetic prospection.

## Trn

Five tells have been registered during the reconnaissance of Trn district, although only three of them are marked on the *Archaeological Map of Macedonia* (Simoska 1996b). The other two are situated in the village, the largest one in its center. According to the 1972 reconnaissance it had a height of 5 meters. Today many houses are standing on its surface,



which is also covered with vegetation, so that the visual land form of the tell is very different than a few decades ago. The other two tells, known as *Mala Tumba* and *Golema Tumba*, are out of village, approximately 300 meters to the north. Our reconnaissance was focused on the latter (the Big Tell; Fig. 6). These tells are situated next to each other. When they were surveyed for the first time in 1972 and 1973 their visual land forms were different than today. The *Mala Tumba* (the Little Tell) was damaged by a local road and a huge shed for agricultural machines. According to the 1970s information the *Golema Tumba* tell had a height of 5.70 meters, while the *Mala Tumba* tell, due to the damages, only 1.70 meters. However, the new satellite images show that *Mala Tumba* is actually much larger than the *Golema Tumba*.

The first excavation at *Golema* and *Mala Tumba* took place in 1973. It proved that the tells were occupied at the same time. According to the field reports, at both sites there were two cultural horizons — an Early and Middle Neolithic (Simoska and Sanev 1977). This stratigraphic situation was later reinterpreted and the chronology was shifted to the Middle and Late Neolithic (Sanev 1995). Regarding the Middle Neolithic at Trn, there are features typical for the Velushina-Porodin settlements, while the Late Neolithic material shows the distinctive features of the so called West-Adriatic complex. Due to its distinctiveness, Trn became the eponymous site for the cultural group (Simoska and Sanev 1977; Benac 1979). According to the catalogue on the prehistory of Central Pelagonia the particular archaeological material confirms an Early Neolithic phase prior to Velushina-Porodin group at the *Mala Tumba* site, beside some later Chalcolithic artifacts (Simoska and Sanev 1976). The same statement can be found in the unpublished field report of the *Golema Tumba* site. There is not much information on the material from the earliest level. All we know is that pottery was made of fine clay and have shiny reddish, brown and gray surface, occasionally decorated with white painted patterns. Some anthropomorphic figurines, a three leg “altar”, discoid plates and clay sling shots have also been found. The concentrations of daub may have belonged to buildings. There is much more information on the later strata, namely on the pottery shapes (plates, bowls, jars, *askoi* and vases), as well as for their decoration with incised and incrustated triangle, quadrangle, rhombic and meander motifs. There are also bone and stone tools (awls, spatulas, axes and adzes), stamps, clay sling shots, discoid plates, a four leg “altar” and a leg of rhyton which together with the pottery decoration style draws analogies to the West-Adriatic cultural complex (Simoska and Sanev 1977).

The 2013 reconnaissance amended to some extent the cultural and chronological range of this specific site. The survey performed on the *Golema Tumba* provided numerous pottery shards (Fig. 5: 6–9), stone tools, daub fragments as well as two anthropomorphic and two zoomorphic figurines (Fig. 7). Their form suggests a Late Neolithic dating, although some of their features are common for the Chalcolithic figurines in the region. It is worth mentioning that not a single fragment decorated with the typical white incrustation was found. The large number of shards and house walls pieces found on the surface seem to be

a result of intensive cultivation (with tractors and combine harvesters). Besides the Neolithic pottery, there were numerous later pottery fragments, dated to the Bronze and Iron Ages, and also to the Early Classical and Roman periods, documented neither during the 1970s reconnaissance nor excavations. There are a few possible explanations. Either there was a later settlement or — with constant cultivation — the archaeological material was being scattered on the tell surface, or — lastly — soil from other places was being scattered on the site in order to improve its fertility.

## Mogila

During the 2013 reconnaissance the main focus was on the tells in the Mogila village, one of the most specific settlement complexes in Pelagonia. After the first reconnaissance and the 1970s excavation eight tells were localized (Simoska 1996b). Six of them are situated in the village while two other are situated north and south of it (Fig. 8). Due to the village development the tells are now largely devastated. It remains unclear however, if the three tells in the village center were not parts of a bigger one divided in the process of development of the village. Therefore, the geophysical research has been carried out only at the *Ronjevska Tumba* site (also known as *Barutnica*) and archaeological survey was limited to registration of the contemporary damages and collecting pottery fragments.

The 1975, 1977 and 1987 excavations at the sites *Tumba-Sredselo* and *Shkolska Tumba* in the very center of the village provided the most detailed information. Part of it has been published in archaeological journals, but the majority remains still unpublished (Simoska et al. 1979; Todorović et al. 1980; Simoska 1988; 1989). The 1975 and 1977 fieldwork's focus were the Neolithic phases of the tells, while the last archaeological campaign was concentrated on the Medieval graves. According to the excavators, the tells make two separate sites with identical stratigraphy. The height of the tells in the 1970s exceeded 6 meters, what makes them one of the highest tells in Pelagonia. During the excavation three cultural layers have been distinguished and each of them provided the Velushina-Porodin material (Simoska et al. 1979; Todorović et al. 1980). The first layer was dated to the Early Neolithic, the second — to the Middle Neolithic, and the last one — to the final stages of the Velushina-Pordin group and to the Bronze Age. However the upper layer had been disrupted by the medieval pits and burials, what must have hindered the interpretation. The shards found in all three levels belonged mostly to monochrome vessels (sometimes decorated with *barbotine* and *impresso* ornaments) and white painted pottery. (Simoska et al. 1979; Todorović et al. 1980). Numerous anthropomorphic figurines, house models and 'altars' have also been found (Fig. 2: 6). The Medieval burials had been dug into the upper layer of the site (Simoska et al. 1979; Todorović et al. 1980; Simoska 1988; 1989). Based on the grave goods those were Christian graves dated to the 5<sup>th</sup>, 9<sup>th</sup>–11<sup>th</sup> and 19<sup>th</sup> centuries AD. The Medieval reuse of the Neolithic tells seems to be specific for Pelagonia, being already confirmed for the tells in Dobromiri, Optičari, Porodin, Slavej, Trn (most likely),

Kukurečani, Dolno Aglarci, Dragozani, Raštani and many other villages in the Bitola region (Sanev and Simoska 1983; Veljanovska 1990; Grbić *et al.* 1960; Mitkoski 2005; Koco *et al.* 1996).

## GEOPHYSICAL SURVEY

The 2013 geophysical and topographic survey was the first prospection of this kind carried out in Macedonia. The research was conducted from June 17 through June 21.

### The method

For investigating the tells in Pelagonia we've chosen the magnetic prospection method for it allows a high rate of data acquisition. A magnetometer detects variation in the local magnetic field and registers magnetic anomalies produced by human activity. Clearly legible anomalies (anomaly points or linear anomalies of increased magnetic field intensity) are produced especially in soils disturbed by human occupation, marked by archaeological features such as pits, post holes, ditches and buildings. Specific high-amplitude anomalies are related to furnaces, fireplaces, burnt buildings, or other objects subjected to high temperature, while dipolar anomalies are often caused by the presence of ferrous metallic objects. Under relevant conditions clear anomalies can be produced by relics of brick buildings and – to a lesser degree – stone ones. Human activity tends to increase susceptibility of the topsoil, being manifested as “zonal” magnetic anomalies (English Heritage 2008, 20–21; Misiewicz 2006, 78). The magnetic method allows therefore relatively complete recognition of archaeological sites, especially prehistoric ones. Its main disadvantage is however the small depth of penetration, slightly exceeding 1 meter (David *et al.* 2008, 16).

### The magnetic field survey

Magnetic measurements were taken with a fluxgate magnetometer 4.032 DLG Foerster Ferrex, equipped with one sensing probe of a resolution of 0,2 nT. It measures the gradient of the vertical component of Earth's magnetic field. The data have been collected in a unidirectional format for *Barutnica* tell and in bidirectional format for Trn and Dobromiri (10 measurements for a square meter were taken). The survey was performed in June 2013, under very dry soil conditions.

A large number of anomalies of various character have been registered and mapped using the “kriging” interpolation rendered by the software SURFER. Those maps were then processed in Archeo Surveyor program in order to shed the distortions caused by bidirectional format of data acquisition.

## Dobromiri — the *Golema Tumba* tell

The tell is situated on a field under cultivation of different crops. The magnetic survey has been performed over an area of 1,48 ha (eight polygons measuring: 50 x 50 m, 50 x 40 m, 50 x 30 m, 50 x 20 m and 50 x 6 m). The survey covered the top of the tell, a large part of its western slope and a small part of its northern and southern slopes (Fig. 4: 3–4; 9: 1–4). The fieldwork area must have been limited — in the west due to the presence of an unsurfaced road, draining ditches and a high balk, in the north, south and east — because of the crops. In the central part of the investigated area a group of high amplitude anomalies has been registered. The characteristics of these anomalies make it strong candidates for large thermo-remanent archaeological features. Their oval, near-rectangular shape and dimensions (4–6 x 7–10 m) indicate that they could have been produced by the remnants of burned buildings with clay floors and walls (Fig. 9: 4 — outlined in red). Such buildings are common at Neolithic sites in Macedonia (Tolevski 2009, 39–40). In some of the cases it is possible to determine the limits of buildings, while the other anomalies form amorphous aggregations (Fig. 9: 4 — outlined in yellow). The latter may prove either derangement of the settlement by deep cultivation, or piling up of heterochronous thermo-remanent objects (such as fireplaces and furnaces). Anomalies similar to those in Dobromiri, produced by well preserved buildings of this kind, had been detected e.g. at a large settlement of Tripolje culture in Taliانki, Ukraine (Kruts *et al.* 2013, 78, fig. 3, 4) and at the settlement of Starčevو culture in Movila lui Deciov, Romania (Maillol *et al.* 2004, 218, fig. 3). The clearest anomalies potentially related to buildings have been discovered on the top of the tell and on its western slope. They are linearly disposed and as such could indicate the north-south orientation of the supposed buildings.

In north-western part of the area under investigation a group of large anomaly points (of a diameter of 4–7 m) of increased magnetic field intensity has been marked out (Fig. 9: 4 — outlined in blue). They are likely to have derived from large pits with fills clearly different in terms of their chemico-physical properties from the surrounding soils. The anomalies form a characteristic oval-shaped configuration measuring 15 x 20 m. Single anomalies of similar character, although of minor dimensions have been discovered in other parts of the site. In the lower part of the tell's northern and western slopes there is a clear, linear, 5 meters wide anomaly of increased magnetic susceptibility. The source of this anomaly is likely a ditch. Its course is probably disturbed in the center of its western part, what suggests that there was an entrance. Regrettably the inaccessibility of the field in that very part of the tell did not allow to widen the survey and resolve that problem. Close to the southern edge of the investigated area a similar anomaly can be pointed out, however it has been observed only in a very short section (Fig. 9: 4 — outlined in navy-blue). It could be related to another ditch surrounding the settlement.

A few linear west-east-lying anomalies have also been discovered at the site. They are produced by the presence of the modern balks demarcating the fields (Fig. 9: 4 — outlined

in brown). It is worth mentioning that there were no minor dipolar anomalies caused by ferrous metallic objects. It could be assumed therefore that the tell was not inhabited at the times of common use of iron.

### **Trn — the *Golema Tumba* tell**

The tell is situated entirely on a cultivated area. The magnetic survey has been carried out over an area of 1,35 ha (six polygons of dimensions: 50 x 50 m and 50 x 40 m). It covered the top of the tell, most of its southern slope and some parts of western and eastern slopes (Fig. 6: 4; 10: 1–4). Numerous magnetic anomalies have been detected, most of them produced by the presence of thermo-remanent (burned) features. Their shapes and dimensions indicate that they were related to buildings with clay floors and walls, what has been confirmed by a large number of daub fragments found among other artifacts on the surface of the ground. Their presence proves a high level of destruction of archaeological objects at the site, which can also be observed in the irregular character of the anomalies. Moreover, it seems that both much bigger number of anomalies and their more irregular arrangement may indicate overlapping of heterochronous objects. In the light of this situation only in a few cases we may attempt to determine the limits of particular buildings (Fig. 10: 4 — outlined in red). For some of them however it is possible to point out the course of the walls (Fig. 10: 4, feature 1) or even the partitions dividing the building into two parts (Fig. 10: 4, feature 2). A certain concentration of anomalies related to the buildings was identified near the top of the hill. On its southern slope the linear anomalies suggest the presence of buildings oriented along a west-east axis, not exceeding the foot of the hill (Fig. 10: 4 — outlined in yellow). At the site some minor dipolar anomalies likely caused by ferrous metallic objects have been detected. It is not possible to determine whether their sources are modern or earlier iron objects.

### **Mogila — the *Ronjevska Tumba/Barutnica* tell**

This tell is different from the two tells presented above. It has been completely leveled in modern times. That is why the survey has been carried out in its potentially oldest part. The extent of the surveyed area was delimited by the village buildings and asphalt roads. The available area was covered with greensward and few trees. The magnetic survey has been carried out over an area of 0,133 ha (three polygons measuring: 20 x 14 m, 30 x 10 m and 30 x 25 m, Fig. 11). A large number of anomaly points of both increased and decreased magnetic field intensity as well as minor dipolar anomalies have been detected. The magnetic survey map of the Barutnica tell shows an extensive “zonal” anomaly of increased magnetic field intensity (Fig. 11: 2 — outlined in green). It may point out the area of human activity likely related with the functioning of the oldest phase of the tell. In the central part of the surveyed area the minor “point”-anomalies of increased and decreased magnetic

field intensity form a circle of a diameter of approximately 25 m (Fig. 11: 2 — outlined in blue). Inside the circle there is another, similar configuration of anomalies of a diameter of approximately 7 m (Fig. 11: 2 — outlined in yellow). In the southern part of the investigated area there are three large anomalies of decreased magnetic field intensity (Fig. 11: 2 — outlined in red). Their near-rectangular shape of distribution and the dimensions (5–10 x 7–15 m) suggest that they might have been produced by the dugouts. Giving the present exploitation of the tell, namely as a place for bonfires during festive gatherings, it is possible, that these very activities caused the anomalies arranged in circular structures.

In the Mogila village an electrical resistivity survey at the *Shkolska Tumba* tell and three other small-scale magnetic surveys have been performed. However due to modern “landscape consumption” it is not possible to interpret their results.

## TOPOGRAPHIC SURVEY

### The method

The development of Global Positioning Systems (GPS), which is now commonly used by a wide range of specialists on regular basis, enables to determine the position in relation to a map with constantly increasing precision. It is particularly important during geodetic survey, which requires high accuracy of undertaken measurements. We can achieve that effect by implementing RTK measuring system, one of the GPS (DGPS) methods. The measuring technique in RTK (Real-Time Kinematic) mode determines the relative position of a measured object in real time by computing corrections for each satellite signal. Those corrections were being passed from the base station (a reference receiver) to a remote receiver (rover) thus avoiding the time consuming post-processing phase. In order to acquire such precision in the field two high quality GPS receivers are required. The first one is a transmitter (base) which is placed on the reference station of a known geographic coordinates from which the point data is being transmitted in a standard international format defined by Radio Technical Commission Marine (RTCM). Corrections were broadcasted to the second remote receiver in a form of differential corrections by radio link, placed on a point of unknown coordinates. Accuracy of such measurements falls into a range of a few centimeters and depends on a distance between those two receivers and the quality of the equipment (Wasilewski and Rzepecka 2001). Though it is fast and precise positioning technique it requires relatively good GPS tracking conditions (clear view of at least 10 degrees of the sky, limited obstructions, considerable distance from the tower of electromagnetic wave transmitter and a high tension cable) and constant base-rover communication (*SOUTH* n.d.).

## The results of the survey

Two topographic surveys using GPS RTK technique have been carried out. Both sites are situated on the plane of Pelagonia, one in the Dobromiri village (Fig. 4), the other — three kilometers east of Dobromiri — in the Trn village (Fig. 6). Measurements have been taken with the GPS RTK HI-TARGET V30 equipment. Points have been collected in approximately 4 meters intervals. The total number of 3D points gathered is 3938. They have been then interpolated using Natural Neighbor method in order to create the Digital Elevation Models (DEM) and construct contours in order to enhance differences in elevation. Then the points, from respective locations, were triangulated using Delauney triangulation provided by ESRI software forming Triangulated Irregular Networks (TIN). TINs were used as a frame to drape the DEMs and contours over them. Thus newly created data was combined into one image approximating the view of surveyed area, complemented with the geomagnetic data (Fig. 4: 3–4; 6: 3–4).

## CONCLUSION

In conclusion a few issues concerning both strictly scientific and methodological aspects as well as cultural heritage should be addressed. Our research filled some of the key data gaps and in so doing made a considerable knowledge contribution regarding the processes and patterns of human settlement in the Neolithic of Macedonia. The state of research outlined above confronted with the results of the 2013 fieldwork show that despite Pelagonia's importance as a region little primary research has taken place and it remains relatively poorly recognized. The knowledge on settlements' organizational patterns in micro scale (site) is still insufficient to reconstruct human settlement processes in macro scale (region). With its position between Mediterranean, the Balkans and the Central Europe Pelagonia is of key importance in constructing an overall "Big Picture narrative" for the Balkan Neolithic.

The magnetic prospecting method allows to make a high-productivity survey that gives a quick insight into the patterning of archaeological sites. It enables to determine the area development within respective settlements and to define the differences and similarities between the sites. The complementary topographic survey permits to mark the areas that are the most promising for future excavation and to precisely localize the trenches regarding the distribution of magnetic anomalies recorded during the survey. Based on the archaeological material provided by the prospection accompanying the topographic and magnetic surveys it is possible to verify the chronology of the sites and to define the level of their destruction. The precise positioning within RTK mode and Digital Elevation Models (DEM) makes a framework for the future presentation and processing of research results. Furthermore the current "shapes" of the sites are documented what is very important giving their progressive destruction.

The 2013 geophysical survey revealed the first images of the Neolithic tells in Macedonia. It also provided new data for archaeology in this part of the Balkans. The enclosures surrounding the settlement in Dobromiri, currently known through geophysical survey, have not been noted so far at the Neolithic or Chalcolithic sites in Macedonia. Only a short section of a probable ditch was recorded during the excavations at the Govrlevo site (Skopje region), but for the moment it cannot be confirmed whether it was a part of a circular defensive system (Fidanoski 2012). Nevertheless, the enclosures are well-known for the sites of Balkan prehistory, so the Dobromiri tell fits into this Neolithic and Chalcolithic settlements “spatial pattern”. Similar enclosures are common for e.g. the Late Neolithic and Chalcolithic sites in Greece: Nea Nikomedeia, Makriyalos, Otzaki and Dimini (Titov 1969; Pyke 1996; Pappa and Besios 1999; Souvatzis 2008); Bulgaria: Poljanica, Ovčarovo, Golyamo Delčevo, Vinica, Trgovište and Dolnoslav (Whittle 1996; Radunčeva 2003; Chapman *et al.* 2006); Serbia: Valač, Gradac and Stubline (Chapman *et al.* 2006; Crnobrnja 2010); Romania: Parta, Uivar, Iclod, Tarpești and Traian (Lazarovici and Lazarovici 2003; Schier 2006); Bosnia: Okolište (Müller 2006); and Croatia: Zadubravlje (Chapman *et al.* 2006). The enclosures or so called roundels are also common for prehistoric settlements in the Central and Western Europe (Varndell and Topping 2002; Bradley 2005; Harding *et al.* 2006). Considering the spatial organization of sites the geomagnetic survey provided the initial information for the disposition of buildings within the settlements in Dobromiri and Trn. These neighboring tells situated on opposite sides of the Crna river, probably had quite different spatial organization. The future research should provide a better understanding of the settlement patterns of the Dobromiri and Trn tells.

The research presented above could serve as a “starting point” for creating a fieldwork strategy based on noninvasive methods, directed on the full documentation of relics of settlement forms specific for this part of the Balkans. The combination of “traditional” archaeological prospection and magnetic and topographic surveys allows a relatively quick and complete reconnaissance of sites for which we had so far only approximate locations. The Neolithic tells are surely the most ancient anthropogenic element of the Pelagonian landscape, and what is more, until quite recently they were “present” in the social life, being still in use by local communities — as locations for cemeteries, communal gatherings etc. Now the tells are the vanishing elements of the landscape. The greatest threat to those sites are the natural post depositional processes and deep cultivation of the last few decades. In the long run the priority is therefore to document what has not been destructed so far in order to create a rescue and protection program for this part of cultural heritage.

### **Acknowledgements**

The authors would like to express their sincere gratitude to the people whose enthusiasm, administrative and logistics support and information provided stood out during our survey in Pelagonia: Engin Nasuh, Ljiljana Hristova, Boris Grozdanovski, Boris Talevski, Damjan Donev, Stevo Pivkovski, Ognjen Cubalevski and Icko Koltovski.



## References

- Andonovski G. H. 1954. Beleški za Neolitot vo Makedonija, *Vesnik na muzejsko-konzervatorskoto društvo na NRM* 1–2, 2–5.
- Babić B. 1986. *Materijalnata kultura na makedonskite Sloveni vo svetlinata na arheološkite istraživanja vo Prilep: prilog za isorijata na kulturata na makedonskiot narod*. Prilep: Institut za staroslovenska kultura.
- Bradley R. 2005. *Ritual and Domestic Life in Prehistoric Europe*. London: Routledge.
- Beluch J. and Krzyżek R. 2005. Pozyskiwanie informacji technologią RTK GPS dla opracowania map numerycznych. In *Kartografia numeryczna i informatyka geodezyjna: I ogólnopolska konferencja naukowo-techniczna, Rzeszów — Polańczyk 28–30 września 2005: materiały konferencyjne*. Rzeszów.
- Benac A. 1979. Prelazna zona. In A. Benac (ed.), *Praistorija Jugoslavenskih Zemalja 2: Neolitsko doba*. Sarajevo, 363–472.
- Benac A. 1989. Neki problemi odnosa Makedonije i zapadnog Balkana u neolitskom dobu. *Macedoniae Acta Archaeologica* 10, 9–24.
- Chapman J., Gaydarska B. and Hardy K. 2006. Does Enclosure Make a Difference? A View from the Balkans. In A. Hardning, S. Sievers and N. Venclova (eds.) *Enclosing the Past: Inside and Outside in Prehistory*. Sheffield: J.R. Collis Publications, 20–43.
- Crnobrnja A. 2012. Investigation of Late Vinča House 1/2010 at Crkvine in Stubline. *Starinar* 52, 45–64.
- Čausidis N. 2007. Ženata kako personifikacija na prostorot za živeenje (od neolitot do sovremeniot folklor). In J. Lužina (ed.), *Makedonskiot teatar vo kontekst na Balkanskata teatarska sfera*. Skopje, 45–101.
- Čausidis N. 2008. Otvorite na neolitskite žrtvenici od tipot „Majka — Kukja”. *Macedoniae Acta Archaeologica* 18, 75–92.
- Čausidis N. 2010. Neolithic Ceramic Figurines in the Shape of a Woman-House from the Republic of Macedonia. In D. Gheorghiu and A. Cyphers (eds.) *Anthropomorphic and Zoomorphic miniature figures in Eurasia, Africa and Meso-America: morphology, materiality, technology, function and context*. Oxford, 25–35.
- Čausidis N. and Naumov G. 2011. Neolitski antropomorfni modeli na kući od Govrlevo. In G. Naumov and N. Čausidis (eds.), *Neolitski antropomorfni predmeti vo Republika Makedonija*. Skopje, 21–36.
- David A., Linford N. and Linford P. 2008. *Geophysical Survey in Archaeological Field Evaluation*. Swindon.
- Dimče K. et al. 1996. *Arheološka karta na Republika Makedonija 2*. Skopje.
- Fidanoski L. 2009. Pottery Production. In G. Naumov, L. Fidanoski, I. Tolevski and A. Ivkovska, *Neolithic Communities in the Republic of Macedonia*. Skopje, 65–80.
- Fidanoski L. 2012. *Cerje-Govrlevo and Miloš Bilbija*. Skopje.
- Galović R. 1964. Neue Funde der Starcevo — Kultur in Mittelserbien und Makedonien. *Bericht der Romisch-Germanischen Kommission* 43–44.

- Garašanin M. 1979. Centralno — balkanska zona. In A. Benac (ed.), *Praistorija Jugoslavenskih Zemalja 2: Neolitsko doba*. Sarajevo, 79–212.
- Grbić M., Mačkić P., Nadj Š. Simoska D. and Stalio B. 1960. *Porodin: kasno-neolitsko naselje na Tumbi kod Bitolja*. Bitolja.
- Harding A., Sievers S. and Venclova N. (eds.) 2006. *Enclosing the Past: Inside and Outside in Prehistory*. Sheffield.
- Heurtley W. A. 1939. *Prehistoric Macedonia: An archaeological reconnaissance of Greek Macedonia (West of the Struma) in the Neolithic, Bronze and Early Iron Ages*. Cambridge.
- Janakievski T. 1999. Prilog kon prašanjeto za ubikacija na gradot Pelagonija vo antičkiot period. *Macedoniae Acta Archaeologica* 15, 183–194.
- Karpuzova K. 2007. *Neolitska antropomorfna plastika na teritorijata na Republika Makedonija*. Skopje (unpublished MA thesis stored in the Archive of the University of Skopje).
- Kitanoski B., Simoska D. and Todorović J. 1980. Naselbata Pešterica i problemot na raniot neolit vo Pelagonija. *Macedoniae Acta Archaeologica* 6, 9–20.
- Koco D. et al. 1996. *Arheološka karta na Republika Makedonija 2*. Skopje.
- Kruts V., Korvin-Piotrovskiy A. and Chabanyuk V. 2013. *Shatilo L. 2013. Talianki — Settlement-Gigant of the Tripolian Culture. Investigations in 2012*. Kiev.
- Kuzman P. 1995. Podatoci za paleolitskite kulturi vo Makedonija. In G. Stardelov, C. Grozdanov and M. Matevski (eds.), *Civilizacii na počvata na Makedonija 2*, 11–20. Skopje.
- Lazarovici G. and Lazarovici M. 2003. The Neo-Eneolithic Architecture in Banat, Transylvania and Moldavia. In D. V. Grammenos (ed.), *Recent Research in the Prehistory of the Balkans*. Thessaloniki, 369–486.
- Maillol J., Ciobotaru D. and Moravetz I. 2004. Electrical and Magnetic Response of Archaeological Features at the Early Neolithic Site of Movila lui Deciov, Western Romania. *Archaeological Prospection* 11, 213–226.
- Mikulčić I. 1966. *Pelagonija u svetlosti arheoloskih nalaza: Od egejske seobe do Avgusta*. Skopje.
- Mikulčić I. 2007. *Heraclea: Ancient city in Macedonia*. Skopje.
- Misiewicz K. 2006. *Geofizyka archeologiczna*. Warszawa.
- Mitkoski A. 2005. Sadova keramika od Vrbjanska Čuka. *Macedoniae Acta Archaeologica* 16, 29–53.
- Müller J. 2006. Demographische Variablen des Bosnischen Spätneolithikums. Zur Frage der Bevölkerungsrekonstruktion im Südosteuropäischen Neolithikum. In N. Tasić and C. Grozdanov (eds.), *Homage to Milutin Garašanin*. Belgrade, 171–192.
- Naumov G. 2006. Sadot, pečkata i kukjata vo simbolička relacija so matkata i ženata (neolitski predložki i etnografski implikacii). *Studia Mythologica Slavica* 9, 59–95.
- Naumov G. 2007. Housing the Dead: Burials inside houses and vessels from Neolithic Balkans. In C. Malone and D. Barowclough (eds.), *Cult in Context*. Oxford, 255–265.
- Naumov G. 2009. *Patterns and Corporeality: Neolithic Visual Culture from the Republic of Macedonia*. Oxford (=British Archaeological Reports. International Series 1910).
- Naumov G. 2010a. Symmetry analysis of Neolithic painted pottery from Republic of Macedonia. In

- T. Biró Katalin (ed.), *Data Management and Mathematical Methods in Archaeology* (= *Archaeologia e Calcolatori* 21). Roma, 255–274.
- Naumov G. 2010b. Neolithic Anthropocentrism: imagery principles and symbolic manifestation of corporeality in the Balkans. *Documenta Praehistorica* 37, 227–238.
- Naumov G. 2013. Embodied houses: social and symbolic agency of Neolithic architecture in the Republic of Macedonia. In D. Hoffman and J. Smyth (eds.), *Tracking the Neolithic house in Europe – sedentism, architecture and practice*. New York, 65–94.
- Naumov G. 2014a. *Neolitski antropomorfizam: tretmanot na teloto na Balkanot od VII do V milenium p.n.e.* Skopje (unpublished PhD. Dissertation).
- Naumov G. 2014b. Neolithic Privileges: the selection within burials and corporeality in the Balkans. *European Journal of Archaeology* 17(2), 184–207.
- Naumov G. *in print*. Formiranjeto na prvite neolitski zaednici vo Makedonija. *Macedoniae Acta Archaeologica* 21.
- Naumov G., Fidanoski L., Tolevski I. and Ivkowska A. (eds.) 2009. *Neolithic Communities in the Republic of Macedonia*. Skopje.
- Nemeskéri J. and Lengyel L. 1976. Neolithic Skeletal Finds. In M. Gimbutas (ed.), *Neolithic Macedonia: As Reflected by Excavation at Anza, Southeast Yugoslavia*. Los Angeles, 375–410.
- Pappa M. and Besios M. 1999. The Makriyalos Project: Rescue Excavations at the Neolithic Site of Makriyalos. In P. Halstead, *Neolithic Society in Greece*. Sheffield, 108–120.
- Perlès C. 2001. *The Early Neolithic in Greece. The first farming communities in Europe*. Cambridge.
- Pyke G. 1996. Structures and Architecture. In Wardle K. A (ed.), *Nea Nikomedeia I: The excavation of an Early Neolithic village in northern Greece 1961 – 1964*: 39 – 54. London.
- Radunčeva, A. 2003. *Kasnoneolitnoto Obštstvo v Balgarskite Zemi. Razkopki i Proučvanija* 32. Sofija.
- Sanev V. 1994. Mlado kameno vreme. In Dimče K. *et al.*, *Arheološka karta na Republika Makedonija* 1. Skopje, 26–42.
- Sanev V. 1995. Neolito i neolitskite kulturi vo Makedonija. In G. Stardelov *et al.* (eds.) *Civilizacii na počvata na Makedonija* 2. Skopje, 21–46.
- Sanev V. 2006. Anthropomorphic Cult Plastic of Anzabegovo-Vršnik Cultural Group of the Republic of Macedonia. In N. Tasić and C. Grozdanov (eds.) *Homage to Milutin Garašanin*. Beograd, 171–191.
- Sanev V. and Simoska D. 1983. *Neolitskite naselbi Veluška Tumba kaj selo Velušina, Mala i Golema Tumba kaj selo Trn vo razvitokot na prvite zemjodelski zaednici vo Centralna Pelagonija*. Bitola (unpublished report).
- Schier, W. 2006. Neolithic House Building and Ritual in the Late Vinča Tell Site of Uivar, Romania. In N. Tasić and C. Grozdanov (eds.), *Homage to Milutin Garašanin*. Belgrade, 325 – 339.
- Simoska D. 1988. *Preliminaren izveštaj za 1987 godina od arheološkite iskopuvanja na lokalitetot Tumba v Sredselo (Tumba I) selo Mogila*. Bitola (unpublished report).
- Simoska D. 1996a. Dobromiri. In *Arheološka karta na Republika Makedonija* 28. Skopje.
- Simoska D. 1996b. Trn. In *Arheološka karta na Republika Makedonija*, 45. Skopje.

- Simoska D. 1996c. Mogila. In *Arheološka karta na Republika Makedonija*, 36. Skopje.
- Simoska D. and Kuzman P. 1990. Tumba Optičari, povećeslojna neolitska naselba. *Arheološki Pregled* 29, 63–66. Ljubljana.
- Simoska D. and Sanev V. 1975. Neolitska naselba Veluška tumba kaj Bitola, *Macedoniae Acta Archaeologica* 1, 25–85.
- Simoska D. and Sanev V. 1976. *Praistorija vo Centralna Pelagonija*. Bitola.
- Simoska D. and Sanev V. 1977. Neolitska naselba na Mala Tumba kaj selo Trn, Bitola. *Macedonia Acta Archaeologica* 3, 215–237.
- Simoska D., Kitanoski B. and Todorović J. 1977. Praistoriska naselba Tumba vo selo Karamani kaj Bitola. *Macedonia Acta Archaeologica* 3, 9–25.
- Simoska D., Kitanoski B. and Todorović J. 1979. Neolitska naselba vo selo Mogila kaj Bitola. *Macedonia Acta Archaeologica* 5, 9–30.
- SOUTH n.d. *SOUTH. Simple manual*. Available at: [http://www.southgnss.com/English/Upload-File/download/manual/simple\\_manual.pdf](http://www.southgnss.com/English/Upload-File/download/manual/simple_manual.pdf) (accessed 31 March 2014).
- Souvatzis S. 2008. *A Social Archaeology of Households in Neolithic Greece: An Anthropological Approach*. Cambridge.
- Stalio B. 1968. Naselje i stan neolitskog perioda. In L. Trifunović (ed.), *Neolit Centralnog Balkana*. Beograd, 77–106.
- Stojanova-Kanzurova E. 2011. Arhitektonski nedvižni objekti od Tumba-Madžari. *Macedoniae Acta Archaeologica* 20, 35–52.
- Temelkoski D. and Mitkoski A. 2001. Neolitski antropomorfni statuetki vo predistoriskata zbirka na Zavod i muzej Prilep. *Makedonsko nasledstvo* 17, 53–69.
- Titov V. S. 1969. *Neolit Grecii: Periodizacija i Hronologija*. Moskva.
- Thissen L. C. 2000. *Early Village Communities in Anatolia and the Balkans 6500 – 5500 cal BC: Studies in chronology and culture contact*. Leiden.
- Todorović J., Simoska D. and Kitanoski B. 1980. *Začetokot i razvojot na prvite zemjodelski zaednici vo neolitskiot period i nivniot premin vo metalno doba na podračjeto na Pelagonija* (Unpublished report). Bitola.
- Todorovski S. 2002. *Arheološki naodi od sreden vek vo arealot na Bitola*. Skopje: Makedonska civilizacija.
- Tolevski I. 2009. Architecture. In G. Naumov, L. Fidanoski, I. Tolevski and A. Ivkowska, *Neolithic communities in the Republic of Macedonia*. Skopje, 35–44.
- Varndell G. and Topping P. 2002. *Enclosures in Neolithic Europe: Essays on Causewayed and Non-Causewayed Sites*. Oxford: Oxbow Books.
- Veljanovska F. 1990. *Tumba — Optičari, Bitola: Antropološki izveštaj*. Skopje (unpublished report).
- Veljanovska F. 2000. *Antropološki karakteristiki na naselenieto na Makedonija od neolit do Sreden Vek*. Skopje.
- Veljanovska F. 2006. Neolitski skeletni naodi od Pista — Novo Selo. *Macedoniae Acta Archaeologica* 17, 341–350.

- Wasilewski A. and Rzepecka Z. 2001. Zastosowanie GPS w geodezji inżynierskiej. *Prace Instytutu Geodezji i Kartografii* 48(102), 71–86.
- Wesołowski S., Siedlecki J., Grądzki K. n.d. *O technologii pomiarów GPS RTK (Real Time Kinematic)*. Available at: <http://www.geodezja-szczecin.org.pl/images/2008-04-29/GPS%20RTK%20opracowanie.pdf> (accessed 31 March 2014).
- Whittle A. 1996. *Europe in the Neolithic*. Cambridge.
- Whittle A., Bartosiewicz L., Borić D., Pettit P. and Richards M. 2005. New Radiocarbon Dates for the Early Neolithic in Northern Serbia and South-East Hungary: Some Omission and Corrections. *Antaeus* 28, 347–355.

