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Interdisciplinary investigation of the possible burial mounds of the Yamnaya culture on the Hron Plain in southwest Slovakia

Jozef Bátora, Šárka Horáčková, Igor Murín & Matej Ruttkay

Abstract

With the availability of LiDAR data, it is possible to process geographically larger areas by semi-automated classification in a GIS environment, which can be advantageous in an otherwise long-term archaeological field prospection. In the territory of the Hronská pahorkatina hilly land (Slovakia), we have identified 124 similar shapes (possible mounds), 143 mounds on maps from the second military survey (1819–1869) and 316 apex points on maps from the first military survey (1764–1787) in the current geo-relief from the digital elevation model. Further, the first stage of barrow mounds identification was accomplished in the northern and central parts of the Hron Plain to verify selected barrow shapes. On its basis have been identified 21 barrow mounds; two of them were definitely confirmed as mounds by geophysical measurements. All detected mounds are situated on the right bank of the Hron River, in the flat terrain of the Hron Plain, in altitudes between 148.5 and 167.4 m a.s.l. It is noteworthy that the site of the Baden culture from the Middle Eneolithic and later the sites of the Kosihy-Čaka-Makó culture in the Late Eneolithic are situated on the periphery of the Hron Plain. The central part of the Hron Plain was not settled by either of the above-mentioned cultures. The mounds which probably belong to the Yamnaya culture bearers must

be located mainly in this 'free' central part of the Hron Plain. The given situation allows to consider the touch of two cultures with a specific form of symbiosis, which is also assumed for example in Upper Tisza territory. As for the Hron Plain, we suppose that the Yamnaya culture interfered in its territory a little later than in the Upper Tisza region. It probably happened as late as the late stage of the Yamnaya culture, which had been already strongly influenced by the Catacomb culture, i.e. in 2800/2700–2500/2400 calBC in absolute dating, i.e. in the Late Eneolithic, when a settlement of the above mentioned Kosihy-Čaka-Makó culture bearers was present in this region.

Keywords: Danubian Lowland, digital elevation model, geophysical measurements, surface survey, mounds, Yamnaya culture, Kosihy-Čaka-Makó culture, infiltration

1.1 Study area

Geomorphologically is the research area setting located in the south of Slovakia as the elevation of the Hronská pahorkatina hilly land, further divided into smaller parts of Hron Plain, Bešianska pahorkatina hilly land, Belianske kopce hills, Búčske terraces, Hurbanovské terraces and Ridge part (Mazúr & Lukniš 1978). It belongs to the wider geomorphological unit of the Danubian Lowland, specifically its eastern part on the margin of the western Carpathians.

Further prospected Hron Plain (Fig. 1) is connected to the Bešianska pahorkatina hilly land on the north and Belianske kopce hills connecting the tributary area of streams directed to the Hron River in the east (Atlas krajiny SR 2002).

This part of the Danubian Lowland is presented as wavy terrain or plain geo-relief with altitudes 100–300 m a.s.l. The significant parts of the geo-relief are formed by the alluvial activity of the Hron River creating subtle valleys as a result of periglacial processes. (Priechodská & Harčár 1988). Cross sections of the valleys are arranged into rectangular network, which is interpreted as a result of the tectonic activity. Also, higher-level Hron River terraces and their potential remains are present in the geo-relief of this region. Typical

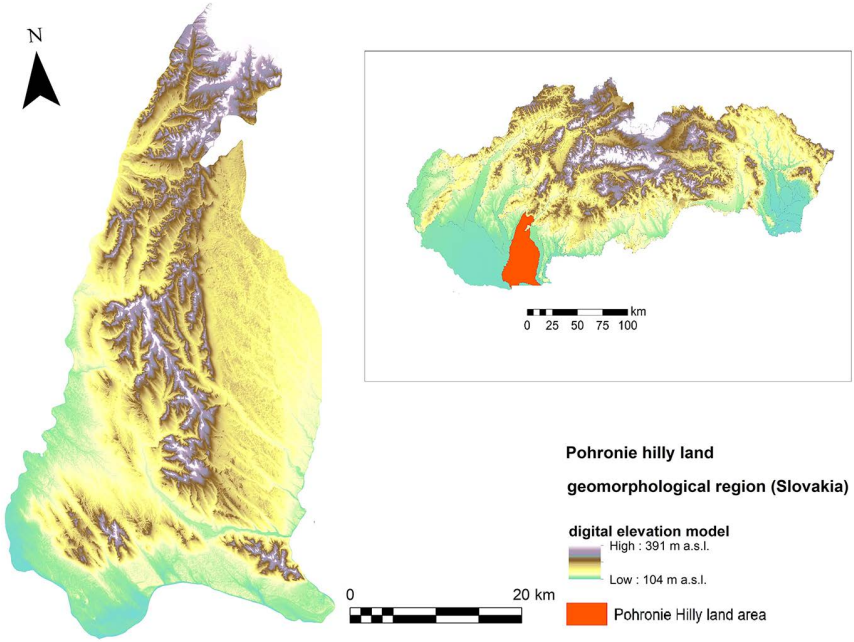

Figure 1. Localisation of Hronská pahorkatina hilly land in Slovakia.

geomorphological-morphometrical type of geo-relief of the area is defined as vertically and horizontally dissected plains (Atlas krajiny SR 2002).

From the geological point of view, the sedimentary base is formed of Pleistocene alluvial sediments infill of the Danube Basin of the Baden-Dak age (Vass 2002). In most of the area, the abundantly spread fluvial sediments are covered with the loess sediment of significant depths (Šujan & Rybár 2014). Fertile soils such as chernozems and brown soils (luvisols) developed on the sedimentary base of loess in this region that were influenced mostly by agricultural activity with further erosion and degradation processes (Smetanová et al. 2017).

The occurrence of the Lower Pleistocene fluvial sediments on the ridges of the northern part of the Hronská pahorkatina hilly-land brings up the fact

that after regression of the Pliocene lake, the Hron probably flowed in the southwesterly direction, to the area of what is today the valley of the Žitava River. It created its typical bent to the south during the Early Pleistocene (Lehotský & Rusnák 2022). Since then the lower reach of Hron heads to the existing valley between the Hronská and Ipeľská pahorkatina hilly lands. The asymmetry of its terrace staircase points to the gradual migration of the riverbed to the east, probably as the result of the tectonic tilting of this area (Lacika 2004).

1.2 Geophysical survey results

The geophysical prospection was applied on selected tumuli where several methods were used comprising magnetometry, electric resistivity tomography (ERT) and georadar. The survey aimed to examine these earthen mounds and confirm their origin. They represent the remains of the original tumuli, which are spread to the surrounding area as a result of agricultural activity. The first geophysical survey was made by S. Hecht (2012). The second surveys were made in 2020 and 2021. The geophysical results revealed the internal composition of the surveyed tumuli and helped us to determine their parameters.

Two localities Bajka and Kuraľany were surveyed. The ERT measurement was applied on both sites. An example from Kuraľany can be seen in Figure 2. It shows ERT vertical profile across the tumulus. In the results a ditch around the original tumulus is visible. Based on this information we can assume that the tumulus in Kuraľany had an original diameter of c 35 m, with a remaining high of about 2 m. The tumulus in Bajka had originally c 40 m in diameter based on the ERT results with a recent, preserved high of about 2 m. At locality, Bajka was applied a magnetometry survey which shows that the tumulus was composed of several layers with an anomalous zone in the centre of the tumulus (Hecht 2012). The georadar has not brought satisfactory results, due

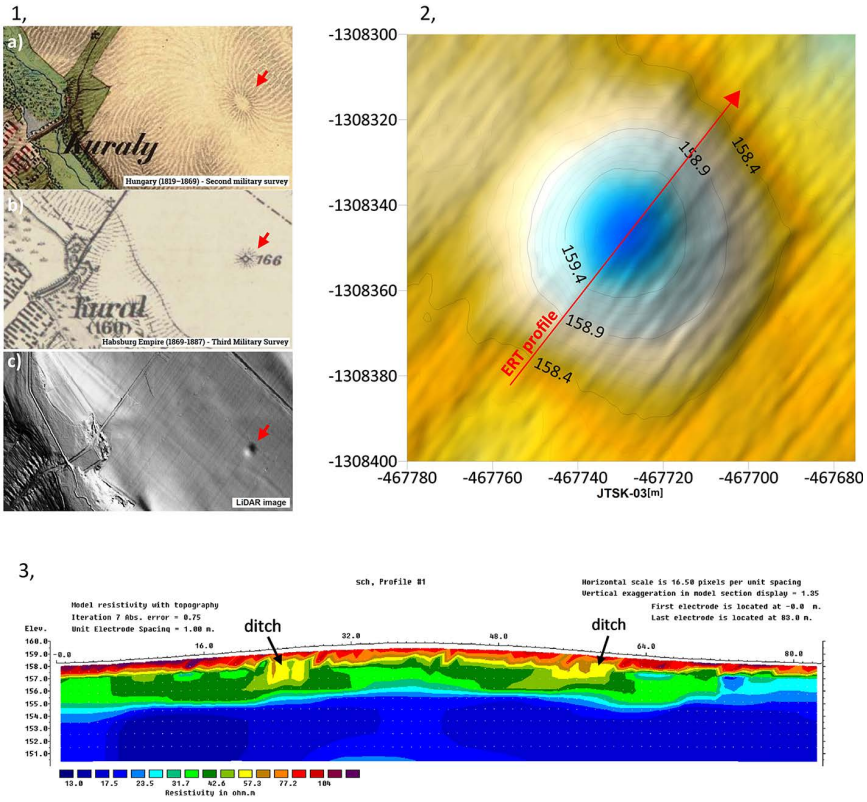

Figure 2. Kuraľany, district Levice, location Druhé siatie. 1A – mound marked with an arrow on the historical map from the 1st military survey; 1B – mound marked with an arrow on the historical map from the 2nd military survey; 1C – mound marked with an arrow on the digital elevation model; 2 – the position of the ERT profile on the mound in Kuraľany; 3 – the ERT profile across the mound at Kuraľany. Source: Old maps – historical maps of Slovak cities, www.staremapy.sk; the Geodesy, Cartography and Cadastre Authority of the Slovak Republic (ÚGKK SA), www.skgeodesy.sk.

to disturbance of the subsurface caused by agricultural activities and shallow penetration of the emitted EM signal.

1.3 Localization and topography of mounds on the Hron Plain

Based on the study of historical maps from the first and second military surveys as well as LLS data, we carried out the first stage of the surface survey in the northern and central parts of the Hron Plain to verify selected barrow shapes. Thus, we were able to identify 22 barrow mounds (Fig. 3); two of them were confirmed as mounds by geophysical measurements (Bajka, Kuraľany). All detected mounds are situated on the right bank of the Hron River, in the

► Figure 3. Soils of the Hron Plain and Bešianska pahorkatina hilly land with sites of barrows possibly identified as the Yamnaya culture. 1 – Kalná nad Hronom, district Levice, location Veľký les; 2 – Lok, district Levice, location Slaniská; 3 – Horný Pial, district Levice, location Niže mosta; 4 – Bajka, district Levice, location Horný hon – two barrows; 5 –Tekovský Hrádok, district Levice, location Pri hrádockej ceste; 6 – Šarovce, district Levice, location Prvé siatie; 7 – Šarovce, district Levice, location Tretie siatie; 8 – Tekovské Lužany, district Levice, location, Pri hulvinskom lese; 9 – Tekovské Lužany, district Levice, location Pahorky – Zalágoš; 10 –Tekovské Lužany, district Levice, location Veľký Chlm, 160.7 m a. s.l.; 11 –Tekovské Lužany, district Levice, location Veľký Chlm, 162.6 m a.s.l.; 12 – Želiezovce, part Svodov, district Levice, location Veľké blato; 13 – Čaka, district Levice, location Kopec; 14 –Málaš, district Levice, location Šikšana; 15 – Farná, district Levice, location Málašský hon; 16 – Nýrovce, district Levice, location Pustatina; 17 – Nýrovce, district Levice, location Maďarské; 18 – Farná, district Levice, location Pri chotári; 19 – Farná, district Levice, location Chlmok; 20 – Kuraľany, district Levice, location Druhé siatie; 21 – Hronovce, part Domaša, district Levice, location Za Vrbovcom. Source: soil types from BPEJ codes available at www.datagov.sk.

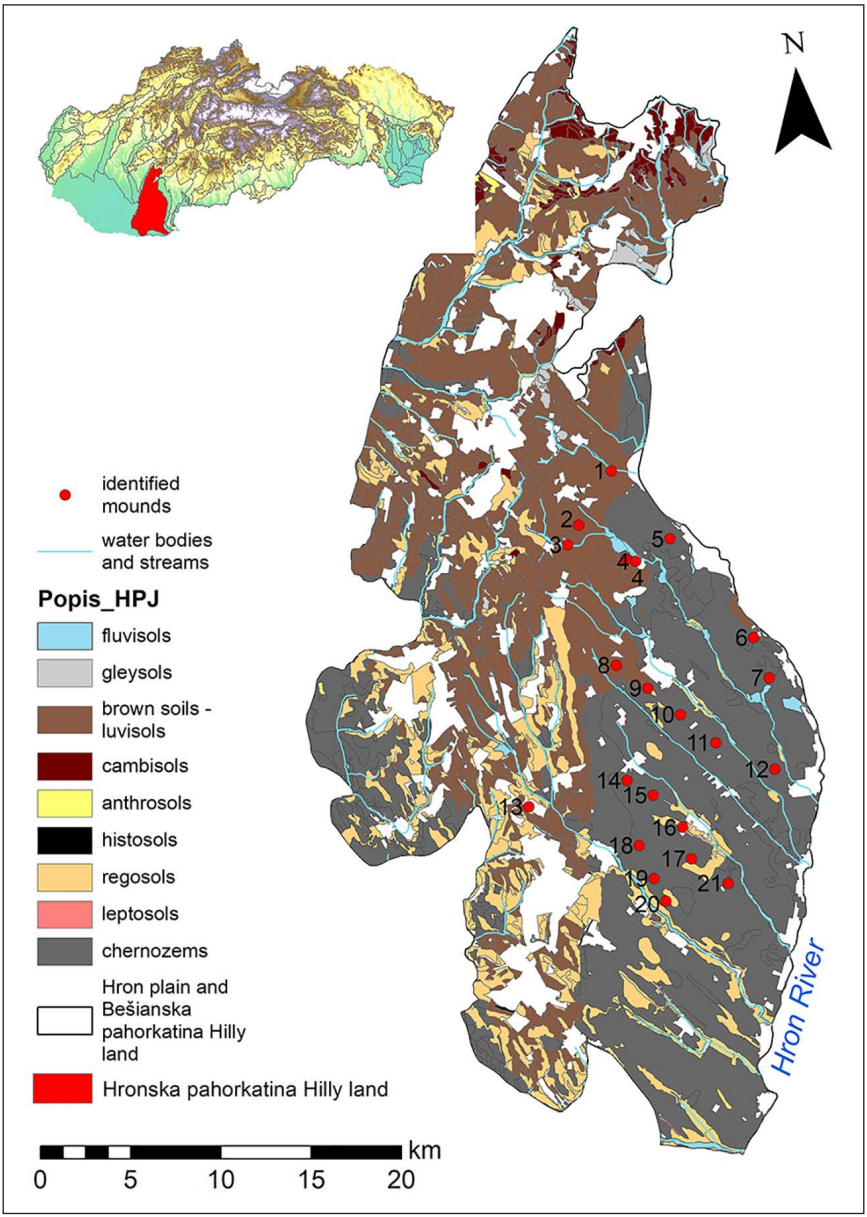
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Figure 4. Tekovské Lužany, district Levice, location Veľký Chlm, 162.6 m a.s.l. View of the mound from the west. Photo J. Bátora, Archive of the Archaeological Institute of the Slovak Academy of Sciences.

flat terrain of the Hron Plain, in altitudes between 148.5 and 167.4 m a.s.l. (Fig. 4). The number of mounds discovered so far and their distribution suggest that the Hron Plain could be named 'Barrow landscape'. We assume that this term, used by Q. Bourgeois in his work dealing with extensive mound fields from the 3rd to 2nd millennium BC in the Netherlands and Denmark (Bourgeois 2013: 3) and later applied by A. Vávrová in association with the frequent occurrence of mounds – mainly from the Hallstatt period – in the territory of Žitný ostrov in southwestern Slovakia (Vávrová 2020: 32), is appropriate also in the case of the Hron Plain.

Features of such character were also selected automatically utilizing GIS (geographic information systems) revealing the number of forms of the same character in the surrounding territory with arable soil. With LiDAR data availability it is easier to analyse buried landforms within large agricultural areas. Many archaeological sites are hidden in the landscape and methods of remote sensing are a key tool before initialising field prospecting. In the territory of the Hronská pahorkatina hilly land, we have identified 124 similar shapes (possible mounds), 143 mounds on maps from the second military survey (1819–1869) and 316 apex points on maps from the first military survey (1764–1787) in the current relief from the digital elevation model (Institute of Geodesy and Cartography in Bratislava 2023). These sites are the potential group contributing to the database for future archaeological investigation of this territory. As far as the sizes of the mounds are concerned, their heights vary between 0.25 m (Tekovské Lužany – according to automatic selection from the digital model of geo-relief) and 2 m (Kuraľany); their

diameter is from 15 m up to 65 m (Kuraľany). However, as follows from the maps from the first and second military surveys, they were probably taller in the 18th and 19th centuries. Soil erosion caused by external factors, among intensive agricultural activity played an important role, especially in the 20th century, it has considerably reduced the original height of the mounds by up to 4 m in some cases, compared to the situation at the end of the 18th and in the 19th century (e.g. the mound in Bajka). Unlike the height, the diameter of the mounds increased by several metres due to the above-mentioned cultivation activities and consolidation of fields during collectivization in 1949–1960.

If we compare mounds of the Yamnaya culture from relatively close geographical and similar geomorphological environment in the eastern Tisza River basin in Hungary, the height of most mounds of the Yamnaya culture there varies between 1 and 10 m and their diameter is up to 20–70 m (Ecsedy 1979: 14).

The mounds on the Hron Plain were arranged either in a line (Tekovské Lužany, Želiezovce-Svodov; Maláš, Farná, Nýrovce, Hronovce-Domaša) or they are scattered (Kalná nad Hronom, Lok, Horný Pial, Bajka, Tekovský Hrádok). Spaces among the mounds arranged in lines vary between 1.5 and 3.8 km, distance among the scattered mounds reaches from 2.0 to 8.2 km. Mounds were situated mainly along the right-side tributaries to the Hron River (Ďurský potok stream, Vrbovec, Lužianka, Malianka, Nýrica and Keťský potok stream) and they confirm clear association with the local streams as well as the fact that hydrological situation considerably determined use of the landscape also for burials (Chrastina 2009: 344). Water streams have been confirmed as one of the most important parameters influencing the location of mounds even later in the Hallstatt period, in the Kalenderberg culture, on Žitný ostrov island and in southwestern Slovakia (Vávrová 2020: 74–76). Most of the mounds on the Hron Plain are situated on chernozems and only the mounds in its northern part (villages Kalná nad Hronom, Lok, Horný Pial, Tekovské Lužany) and in Čaka were located on brown soils.

1.4 Contextualization of preliminary results

It is noteworthy that the site of the Baden culture from the Middle Eneolithic and later the sites of the Kosihy-Čaka-Makó culture in the Late Eneolithic are situated on the periphery of the Hron Plain (Tóth 2010: Maps 17–18), i.e. on the eastern side, right on the edge of the Hron's right bank or nearby and on the western side, sites of both cultures spread on the eastern foothills of the Hronská pahorkatina hilly land (Tóth 2010: Map 17). It seems that the central part of the Hron Plain was not settled by either of the above-mentioned cultures. The mounds which probably belong to the Yamnaya culture bearers(?) must be located mainly in this 'free' central part of the Hron Plain.

Another interesting fact is that a similar situation in terms of localization of the Baden culture settlement was observed also in the southern part of the Upper Tisza region, in the Great Hungarian Plain in Hungary (Horváth 2011: Fig. 23), which is very close to the Hron Plain with its geomorphology. It is even similar in the fact that in the analogous free space, in the so-called no man's land, in the forest-steppe land, the so-called puszta and inundation zone of the Upper Tisza region (mainly the districts of Hortobágy, Nagykunság, Tiszaug and the Körös River area), mounds of the Yamnaya culture are located (Escedy 1979: 14; Horváth 2011: 89). Concerning the much smaller size of the Hron hilly land territory, which is 405.665 km^2 (its maximum length is 45.88 km and maximum width is 13.48 km), a similar model of settlement with two parallelly co-existing cultures with different ways of life – farmers settled on one side and on the other side mobile nomads – cattle breeders – is very hard to imagine, but it cannot be denied.

We assume that the situation observed on the Hron Plain allows us to consider the touch of two cultures with a specific form of symbiosis, which is also assumed in the above-mentioned Tisza territory (Horváth 2011: 89). As for the Hron Plain, we suppose that the Yamnaya culture interfered in its territory a little later(?) than in the Upper Tisza region. It probably happened as late as the late stage of the Yamnaya culture, which had been already strongly

influenced by the Catacomb culture, i.e. in 2800/2700–2500/2400 calBC in absolute dating (Horváth 2011: 96), i.e. in the Late Eneolithic, when the settlement of the above mentioned Kosihy-Čaka-Makó culture bearers was present in this region. The above-described symbiosis of both cultures is suggested by the result of the previous investigation of a mound from the Late Bronze Age – the Čaka culture at the eponymous site in Čaka, which is located beyond the western periphery of the Hron Plain, in the eastern part of the Bešianska pahorkatina hilly land on the right bank of the Keťský potok stream in altitude of 176 m a.s.l. A study of the excavation documentation showed that the Čaka culture mound from the Late Bronze Age was built on an older Late Eneolithic mound of the Kosihy-Čaka-Makó culture (Bátora 2021: Fig. 14). Its existence is also pointed out by the circle filled with dark soil, which is widening northwards (Točík & Paulík 1960: Figs. 3–4). Obviously, this widening represents an eroded mound shell occurring as a result of the older origin mound located on a slope falling steeply northwards. In the central burial I, which had been secondarily opened (robbed), fragments of pottery from the Late Bronze Age – Čaka culture – were found together with fragments of pottery from the Late Eneolithic period – the Kosihy-Čaka-Makó culture. It should be noticed that two other cremation burials of the Kosihy-Čaka-Makó culture were also located in the area enclosed with the circle filled with dark soil (Točík & Paulík 1960: Fig. 4; Bátora 2021: Fig. 14). It obviously also points out to the fact, that the construction of the Čaka culture mound in the Late Bronze Age used the already existent mound of the Late Eneolithic. Covering cremation burials of the Kosihy-Čaka-Makó culture with mounds might be considered a result of the above-explained symbiosis resulting in evident hybridization in the burial rite – the cremation rite as a Inner Carpathian component and the mound as a steppe component. This process of 'kurganization' – 'kurgan effect' – can be chronologically associated with one of the waves, in which nomadic societies penetrated in the Young and Late Eneolithic not only the Upper Tisza region in today's Hungary, but also the northwestern Balkans, Vojvodina (Koledin et al. 2020: 350) and the northwestern part of the Carpathian Basin. It had been confirmed also by

previous excavations of mounds in the northwestern part of today's Hungary (Rajka-Modrovich puszta: Figler 1994: 22; Gönyü: Bóna 1965: 40), in Austrian Burgenland (Neusiedler am See: Ruttkay 2003: 445) and in southwestern Slovakia (Šurany: Novotná & Paulík 1989: 368; Bátora 2021: Fig. 12). In the central burial of the mound in Šurany, the Lower Ponitrie region, which is only 21 km far from the neighbouring Hron Plain in the western direction, sherds with features of the Balkan-Danubian complex pottery from the Early Bronze Age and close to the Somogyvár-Vinkovci culture were found (Novotná & Paulík 1989: 368–373). It should be noted that closer analogies to part of the pottery from the Šurany mound can be found in the western part of Transylvania in Romania (Bátora 2021: Fig. 13B), where it was discovered in Late Eneolithic mounds of the Livezile cultural group in Ampoita-Peret (mounds II and IV) (Ciugudean 1991: Fig. 22:8, 23:5, 20) and Livezile-Deaul Sarbului (Ciugudean 1996: Fig. 21:12). The Livezile group is a result of mixed layers of the local Cotofeni culture substrate with elements of the Glina-Schneckenberg culture. In terms of the discussed topic, it is important that in the pottery material from Šurany we can see – similarly to the mound in Sárrétudvar-Örhalom in the Upper Tisza region – the domestic component represented by pottery close to the Makó culture (Kulczár & Szeverényi 2013: Fig. 6:1–2) and a foreign component represented by pottery close to the Livezile group. Analysis of strontium and oxygen isotopes confirmed mobility between the Livezile group population and the Yamnaya-Catacomb culture population buried in the mound of Sárrétudvar on the Great Hungarian Plain (Gerling & Ciugudean 2013: 181–182). The occurrence of similar foreign pottery in the mound of Šurany allows us to assume that it could be evidence of mobility analogous to Sárrétudvar.

The territory of the Hron Plain was mainly a flat forest-steppe landscape which might have provided suitable pastures for cattle of the Yamnaya culture bearers too. Alongside with possible massive shepherding, the nomadic population was probably attracted to southwestern Slovakia and the Hron Plain also by sources of non-ferrous metals, i.e. copper, gold and silver, which were located in the nearby volcanic mountain ranges of central Slovakia. As

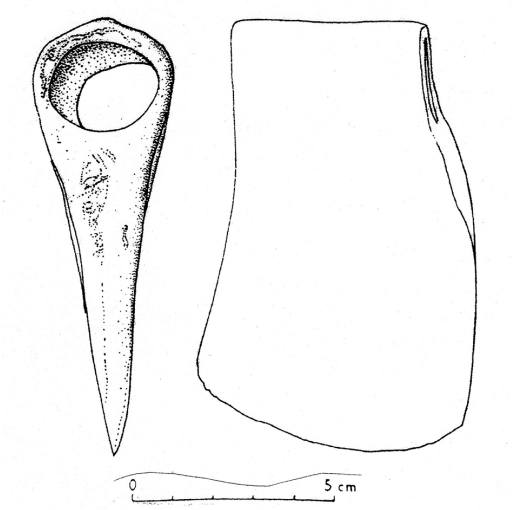

Figure 5. Dolný Pial, district Levice, location Badice. Copper axe with a shaft-hole in the back (adapted from Vladár 1970).

a result of clear zonation in massifs, lodes of individual ores outcropped on the surface at multiple places (Sedliak 2005: 59). In terms of exploitation of copper, it was mainly the territory of Špania dolina and as far as exploitation of gold and silver is concerned, it was the territory of the Kremnické and Štiavnické vrchy Mountains. Moreover, apart from primary sources, gold was found at secondary sites after erosion, in alluvial sediments of streams and rivers, where it was panned by the then prospectors. The nearest places to the Hron Plain offering such opportunity occurred at the southern tip of the Štiavnické vrchy Mountains, e.g. in the cadastral area of today's Devičany, in the valley of the stream running in the Sovia dolina valley, in Pukanec on the Pukanský potok stream and on the small river of Sikenica between Žemberovce and Horša (Jahn 2016: 21).

Among the artefacts from the period of Young or of the Late Eneolithic in the Hron Plain territory which can be associated with presence of the Kosihy-Čaka-Makó culture and the Yamnaya culture bearers, we can mention the copper axe with a shaft-hole in the back from Dolný Pial (Fig. 5; Vladár 1970: Obr. 1–2). It is a Baniabic-type axe which belongs to the group of the oldest copper axes with shaft holes in the back in Europe (Bátora 2006: 29). Their ancient age is suggested mainly by their typological similarity with the second group of the Maikop culture axes in the northern Caucasus (Korenevskij 1974: 24).

In association with the studied topic, it is important that they arrived in central and southeastern Europe from this Eurasian territory with the Yamnaya culture bearers. In the case of Dolný Pial, it is an accidental find of an axe in the cadastral area of the village, in location Badice, where further surface survey confirmed that a settlement of the Kosihy-Čaka-Makó culture was situated there. Remarkably, only 4.5 km northeast of the above-mentioned settlement in Dolný Pial, one of the mounds probably of the Yamnaya culture is located in the cadastral area of Bajka. Metallographic analysis of content of individual trace elements showed that the axe was made of copper; its chemical composition corresponds with the composition of Slovak copper ore. Therefore, we can assume that the axe from Dolný Pial was made of copper exploited in the territory of today's Slovakia (Págo 1970: 20–21).

The information collected in the territory of the Hron Plain allows us to suggest that future field excavation will bring relevant results that could fully confirm the assumed arrival of the Yamnaya culture bearers in the region as well as the wider territory of the northwestern Carpathian Basin in the in the period of the Young and Late Eneolithic.

The natural environment where these culture bearers arrived had probably been influenced by humans to some extent. However, in the Hungarian Tisza region, steppe areas without woods which were suitable for cattle shepherding prevailed. The area of Hron Plain is currently considered a territory with originally natural forest growth of xerothermophilous oaks in the early Holocene (Nowaczinski et al. 2015) and later, from the Eneolithic, it was a forest steppe and a territory of xeric grasslands which was gradually more or less intensely deforested by people (Dúbravková & Hajnalová 2012). Whether the initial forest degradation and creation of open areas was caused by man or nature, the warmer and drier climate of the middle Holocene is still not clear (Magyari et al. 2010).

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