USE OF OBSIDIAN IN SLOVAK PREHISTORY

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Abstract: Obsidian near the Zemplín Hills comes from primary (Viničky) and secondary (Brehov and Cejkov) sources. In Viničky, primary sources of obsidian come from two phases of rhyolite volcanism. The older phase is represented by perlite breccias with obsidian found underneath rhyolite extrusive body, younger phase consists of obsidian and perlite bonded with intrusive dyke bodies.

The Brehov site is a primary source of secondary obsidian accumulations in Quaternary deluvial/fluvial deposits, partially covered by eolian sands in the area of Brehov and Cejkov. These allochthonous obsidian nodule occurrences with surface relief were the principal source of obsidian industry found at Palaeolithic – Neolithic archaeological sites.

Obsidian was mostly used by the cultures settled in Eastern Slovakia, in the vicinity of its sources. In the Palaeolithic, the cultures of Gravettian and Epigravettian prefered this raw material. In Spiš, it occurs in the Świderian culture and in other Late Palaeolithic and Mesolithic cultures. Mesolithic industry in Košice-Barca was made exclusively of obsidian. In the Neolithic, it was the most prevalent raw material in Eastern Linear Potter culture in the Eastern Slovak Lowland and in Bük culture. In other parts of Slovakia, obsidian was most favoured during the existence of Želiezovce group and Lengyel culture. In Eastern Slovakia, obsidian was used also in the Late Neolithic and the Eneolithic, and partly also in the Early Bronze Age.

INTRODUCTION

Apart from climate and environmental conditions, information on used lithic raw materials is an important aspect when evaluating life and activities of people of the Stone Age. It can reveal much about the mobility of both hunter and farmer societies as well as the extent of their contacts on the local and inter-regional levels. Therefore, it is important to be aware of what kinds of lithic raw materials were used and from what sources they came.

Slovakia’s sources of high-quality lithic raw materials are scarce. It was mostly radiolarites from the Klippen Belt and limnosilicites from various regions that were used, in Eastern Slovakia it was mainly obsidian (Kaminská 1991; 2013; Mišík 1969; 1975).

OBSIDIAN SOURCES

Abundant finds of obsidian tools of various ages, found within the area of the Zemplín Hills (Fig. 1) several years ago, suggested that a source of obsidian can be expected in the area (Janšák 1935). Official geological maps with scale of 1 : 50 000 point to the occurrence of obsidians in the southern part of the Zemplín Hills (Baňacký et al. 1988), in association with acid volcanism. The appearance of vineyards

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and wine cellars in the southern part of the Zemplín Hills also indicates that the products of rhyolitic volcanism in the vineyards of Viničky are the primary sources of obsidian (Ivan 1962; 1964; Kaminská/Ďuďa 1985; Šalát/Ončáková 1964).

Other sources of obsidian are located in the area of the Tokaj Hills in Northeastern Hungary. The geochemical differences in the composition of the obsidians allowed for the division of the sources into Carpathian group C1, associated with the Zemplín Hills, and Carpathian group C2 (subgroups C2a and C2b) linked to the Tokaj Region in Hungary (Williams Thorpe/Warren/Nandris 1984). Such a division was confirmed by later analyses (Biró 1984), leading to further division of group C1 into subgroups C1a and C1b. Subgroup C1a contains finds from the archaeological sites of Kašov and Cejkov, primary source located in Viničky was classified as subgroup C1b (Biró/Kasztovszky 2013; Kasztovszky/Biró/Kis 2014).
Viničky

Primary sources of obsidian occur in the peripheral parts of the extrusive rhyolite body near Malá Bara and in several places in the cadastral area of Viničky (Fig. 1; 2). In relation to these occurrences, more detailed results of investigation and dating by K/Ar method were published (Bačo et al. 2017). From the aspect of availability of the obsidian in the Stone Age, we consider the following findings and interpretations essential.

Obsidian in forms of nodules always occurs along with perlite, usually as obsidian nodules in perlite environment. In the area of Viničky, obsidian is associated with two types of geological/lithological settings corresponding with two phases of rhyolite volcanism.

The first type of geological/lithological setting discovered in new cellars (Tokaj Viničky Ltd./PROMACO Winecellars) is perlitized dyke body or bodies. Obsidian is found in their perlitized glassy parts. From them, they eroded to eluvial/deluvial sediments (Bačo et al. 2017, 215, fig. 9). Multiple re-disposition of obsidian after its creation (the period of Upper Sarmat to Pannon) leading to secondary cumulation of obsidian cannot be definitely excluded (Bačo et al. 2017, fig. 21). Obsidian from the same environment is located also in the vineyards near the cellars (Bačo et al. 2017, fig. 7: 2–3; 8).

Sizes of the collected obsidian nodules vary from 10 to 14 cm, although smaller ones are the most frequent. The surface of the nodules is usually smooth, however, initial sculpture in form of coarse surface and small dimples occurs on some of them (Bačo et al. 2017, fig. 10; 11c). Distinct sculpture of the surface of obsidian known from archaeological sites was not detected. On thin chips of obsidian from Viničky, fluidal texture can be seen (Bačo et al. 2017, 216; Kaminská/Ďuďa 1985, 122).

The second setting with the outcrops of obsidian are perlite breccias. Their occurrence is directly verified also in the new cellars (Tokaj Viničky Ltd./PROMACO Winecellars). These perlite breccias are interpreted as bedrock breccias of an extrusive body (Borsuk) which has a form of a massive lava stream in this part (Bačo et al. 2011). Their dating falls to the Middle Baden-Pannon (Bačo et al. 2017, fig. 21). Obsidian in these breccias makes fragments of 10–15 cm, however, smaller on average, with surface without a distinct sculpture (Bačo et al. 2017, 216–218, fig. 12; 13). Geological settings in Malá Bara is similar to the settings in the neighbouring Viničky.

Streda nad Bodrogom

Perlite with obsidian is also known from Streda nad Bodrogom. The name “marekanite” is used for the obsidian from this source. It occurs in the settings of redeposited rhyolite and rhyodacite volcaniclastic rocks and its primary source is unknown. Dating of obsidian by K/Ar method pointed to a different – older – age than that of the obsidians from the territory of Viničky (Bačo et al. 2017, fig. 21; table 1). Sizes of the obsidians varied between 0.5–5 cm, being mainly about 2.5 cm big. Large nodules were rare. Iridisation visible on trommels is typical for the obsidian from this location. Geological position of horizons...
containing obsidian, discovered in the quarry, gave rise to natural outcrops of the material in the past, which was thus could have been freely collected in the Stone Ages.

Brehov

Allochthonous locations of obsidian with surface with sculpture as known from the obsidian from archaeological sites were discovered in the territory of Brehov and the neighbouring village of Cejkov. Originally assumed source of obsidian might have been a site with common occurrence of strong glass rhyodacite with local perlitic evolution. The site was detected by exploring the underneath of an andesite extrusive body of Veľký vrch, north of Brehov (Fig. 1). Obsidian might have eroded from the site and transported to secondary sites in the vicinity (Bacsó et al. 1995a; 1995b; Bačo et al. 2003).

One of the secondary sites is Brehov-Za alejou (Bacsó et al. 1995b; Bačo et al. 2003). Obsidian was preserved within the loamy weathered rhyodacites and their breccias (Fig. 1). They are covered with eolian sands of thickness up to 2 m. Obsidian was found in the form of nodules, with no traces of modification. The size of the obsidian fragments varies from 5 mm to 10 cm. Their surface relief frequently varies, sometimes rather indistinct (Bačo et al. 2017, 219, 220, fig. 18; 19). The area west of Brehov with the occurrence of obsidian is called Brehov 2 (the sites of Ošva, Trávnický kopec, Kereškeň) and it overlaps the site of Brehov-Za alejou.

Other numerous finds of obsidian fragments with sculpture are located in the fields southeast of the Zemplín – Cejkov – Brehov crossroads, as far as the Ošva River, and are identical with the finds from the sites with frequent occurrence of obsidian, presented by Š. Janšák (1935, 56). The site southwest of Brehov, in the cadastral area of Cejkov, called Cejkov–Žihľavník (Přichystal/Škrdla 2014, 219) or Cejkov – Malé lúky–Žihľavník (Bačo et al. 2017, 219), are particularly important. Trenches have confirmed the occurrence of fragmentarily preserved red or white clays that are considered to be transformed volcanlastic rocks in these two locations (Přichystal/Škrdla 2014, 219). Today, they are partly covered by eolian sands or clay (Přichystal/Škrdla 2014, 217). It is assumed that the obsidian was brought in this territory from its primary source, as deluviofluvial sediments, or comes from gravel-sand deposits of the local rivers.

Obsidian fragments with average size of 5–10 cm are found at the studied secondary sites, however, a core of 2.59 kg was also discovered (Přichystal/Škrdla 2014, 221). The obsidian surface was secondarily shaped by water, in the time when of deposition in permeable rocks, most probably tuffs (Přichystal/Škrdla 2014, 217). Besides obsidian nodules, partly modified raw material such as flakes and rarely tools suggest at least primary testing of raw material or preparation of cores in the studied area. Secondary sources of obsidian in the territory of Brehov – Cejkov – Zemplín spread over an area of 6 km² (Přichystal/Škrdla 2014, 224). They represent a newly discovered source of the raw material used for production of obsidian industry whose primary location was probably situated underneath the andesite horizon at Veľký vrch near Brehov (Bačo et al. 2003; 2017, 224; Přichystal/Škrdla 2014, 217).

DATING OF OBSIDIAN

Geological position and radiometric dating of products of rhyolite volcanism in Eastern Slovakia, which are associated with the creation of obsidian, classify this type of volcanism into the period of Upper Sarmat/Lower Pannon (Lexa/Kaličiak 2000). Obsidians from Viničky was dated to the previous period, using the fission track dating method which identified their age to 11.1 ±0.8 MA years (Repčok 1977). The age of the obsidian from the archaeological site of Hraň near Brehov was set to 14.2 ±0.5 MA years (Repčok/Kaličiak/Bacsó 1988). Further dating (Bigazzi et al. 1990) showed differences in the ages of primary sources of obsidian from Tokaj in Northeastern Hungay (10 million years) and those from the Zemplín Hills including most obsidian artefacts from the Tokaj region (15 million years).

We can currently work with several K/Ar datings of obsidian from primary sources as well as from archaeological sites (Bačo et al. 2017, fig. 21; table 1). Based on the dating, we can determine the age of obsidian from primary and secondary sources, as well as from archaeological sites (Fig. 3). Primary sources of obsidians in Viničky can be divided into two phases of rhyolitic volcanism with defined geological position. The older phase is represented by perlite breccias with obsidian in the bedrock of the rhyolite extrusive body within 13.52 ±0.81–11.58 ±0.46 MA years. The younger phase consists of obsidian and perlite integrated within the intrusive bodies of dyke type – 11.19 ±0.53–11.04 ±0.34 MA
years. Obsidian – marekanite from Streda nad Bodrogom comes from a currently unknown source and it is older – 14.95 ±0.56–14.32 ±0.58 MA years.

Several obsidian fragments from secondary positions and archaeological sites have been dated as follows: Cejkov – 12.45 ±0.92 MA years, Brehov – 13.48 ±0.72 MA years, Hraň – 13.51 ±0.78 MA years and 14.02 ±0.50 MA years, Kašov – 12.03 ±0.61 MA years and Košice-Šaca – 12.97 ±0.62 MA years. Most recently, obsidian from Hraň was dated by the fission-track dating method (12.45 ±0.40 Ma) so was the obsidian from Brehov (11.62 ±0.24 Ma) and Viničky (12.19 ±0.21 Ma; Kohút et al. 2021). The span of data of these obsidian fragments is rather wide, but the dating overlaps the dating of the known primary and secondary sources of obsidian originating in Eastern Slovakia.

USE OF OBSIDIAN SOURCES

As a high-quality raw material for production of chipped tools, obsidian was used mainly by the cultures settled in the region of the Zemplín Hills, where its natural sources are located (Fig. 1). By the means of contacts with other cultures, obsidian occurs also in more distant territories. The best-known work dealing with the occurrence of obsidian industry at the sites near the Zemplín Hills was written by Š. Janšák (1935). Since then, new information on the importance of obsidian for prehistoric societies has been obtained. The extent of use of obsidian by individual archaeological cultures in the lithic periods varied. The use of obsidian decreased with increasing distance from its natural source. Other local rocks were also used; they were of more or less similar quality, including, e.g., radiolarite, limnosilicite, chert, silified sandstone, and andesite (Kaminská 1991; 2001; 2013). The presence of raw materials originating in distant sources has been confirmed at individual sites (flint from the territory of Poland, Volhynian flint, limnosilicite and quartz porphyry from Northeastern Hungary, etc).

Until now, no special attention was paid to the sculpture of obsidian nodules, artefacts and flakes when studying obsidian industry in Slovakia. Only the presence of sculpture without detailed charac-
Fig. 4. Obsidian nodules with sculpture. A – Epigravettian site Veľaty I; B – Viničky, site 2 in fig. 2; C – Brehov-Za alejou (Brehov 2; photo by A. Marková and by P. Bačo; after Bačo et al. 2017, modified).
teristics was usually evaluated. Therefore, today we cannot say exactly at which archaeological sites the sculpture of obsidian is identical with that observe on the material from Brehov and Cejkov or the one from Viničky. Sculpture of obsidian fragments from the sources near Brehov and Cejkov is distinct (Přichystal/Škrdla 2014, 217). However, obsidian with less developed sculpture also occurred at following sites (Fig. 4: C), Brehov-Za alejou (Bačo et al. 2017, 219, fig. 18) and Cejkov-Žíhlavník (Bačo et al. 2017, 219, fig. 16). Obsidian with original sculpture can be collected in Viničky (Fig. 4: B) even today (Bačo et al. 2017, 215, fig. 8; 10a). Most obsidians from archaeological sites have distinct sculpture, but the specimens with sculpture of initial working phase occur as well. Comparable sculpture can be seen on obsidian from the Epigravettian site of Vefaty I (Fig. 4: A). Which source does the obsidian used for the production of chipped industry come from? With regard to the amount of obsidian finds at archaeological sites, it is obvious that the sources located in the Zemplín Hills were used. Developed sculpture on obsidians occurs in the currently known sources in Cejkov and Brehov. The majority of obsidians, especially at the sites rich in finds, such as Kašov-upper layer, had been reduced from decorticated cores and, thus, it is difficult to identify where they came from. In the Neolithic in particular, settlement sites surrounded the Zemplín Hills from all sides, and it is difficult to imagine that they would have ignored the sources at Viničky (if they were accessible – and we have no reason not to think so). The amount of currently visible obsidian in Viničky is incomparably larger than the amount of the raw material at the allochthonous occurrence of obsidian nodules in the quaternary sediments at Cejkov and Brehov. Moreover, we cannot exclude possible existence of another source yet unknown. Thus, we think it is very probable that several sources of obsidian near the Zemplín Hills were used in prehistory (Kaminská 2018).

Secondary accumulations of obsidian nodules in Cejkov and Brehov, probably from the primary sources in Brehov, are now considered the main source (Bačo et al. 2003; 2017, 226; Bačo/Bačová 2014; Přichystal/Škrdla 2014, 224), and the Viničky was probably only a subordinate source of obsidian.

Palaeolithic

Obsidian was used in the territory of Slovakia since the Upper Palaeolithic. A single tool found at the site of Cejkov-Žíhlavník, dated into the Middle Palaeolithic (Přichystal/Škrdla 2014, 223), is not considered sufficient evidence of the use of obsidian in the Middle Palaeolithic. Middle Palaeolithic settlement in the vicinity of the Zemplín Hills has not been archaeologically confirmed, and obsidian artefacts have not been discovered at any other Middle Palaeolithic site in Slovakia (Hőrka-Ondrej, Gáňovce-Hrádok, Bojnice I and III, etc.). Six artefacts – five flakes and one borer – occurred in layer XIX associated with the Mousterian culture in the Oblazowa cave in Southern Poland (Valde-Nowak 2003, 32, table. 2). Obsidian (35 artefacts) was found in the stone industry collection from the Szeletian settlement in Moravany nad Váhom-Dlhá in Western Slovakia (Nemergut 2010; Nemergut/Cheben M./Gregor 2012), dated to 33,600 ±300 BP (Poz-29011; Kaminská/Kozlowski/Škrdla 2011).

The production of chipped lithic industry of the Aurignacian culture, detected at sites in the Košice Basin, was almost exclusively based on the use of limnosilicite coming from the sources in the Slanské Hills (Kaminská 1991; 2001; 2013). Obsidian represented only a small number of finds in Košice-Barca I, Košice-Barca II, Kechnec I (Bánesz 1968) and Čečejovce (Kaminská 1990). Most frequently, endscrapers were made of it. Dating of the Aurignacian of the Košická kotlina basin is set to 35.41–28.34 ka BP (Chu et al. 2018; 2020; Verpoorte 2002, 326, table 9). In the Eastern Slovak Lowland and in the middle Ondava River Basin, obsidian was only found in small numbers, too. It represented 5.10% of the finds at the site of Nižný Hrabovce I + II and only 4.95% at Nižný Hrabovce III (Kaminská et al. 2000). Obsidian was more frequently used (19%) in Tibava (Bánesz 1960). According to geochemical analyses, the obsidian came from Hungarian sources labelled as Carpathian group C2, not from Slovakia (Williams Thorpe/Warren/Nandris 1984, 195). The distinctly patinated obsidian artefacts in Tibava include mainly carinated and massive endscrapers (Fig. 5), blades and blade flakes.

The evidence of Aurignacian settlement is absent within the area of the Zemplínske Hills. In the last few years, higher concentration of sites and finds of chipped lithic industry was detected in the area of Čerhov – Veľká Třiňa. The finds have not been evaluated yet. Only the collection of leaf points from Čerhov and Veľká Třiňa has been published. The sites are preliminarily assessed as Aurignacian, intervened by the Szeletian culture (Voľanská 2016, 13). The leaf points are made of limnosilicite, flint and radiolarite. Most of the collected industry is made of obsidian (Voľanská 2016, 10) and can be probably associated with the Neolithic settlement.
In the Eastern Slovak Lowland, the use of obsidian increased most significantly in the middle and late stages of the Upper Palaeolithic, when the surroundings of the Zemplín Hills were inhabited by the hunters-gatherers groups of the Late Gravettian and Epigravettian cultures. Mainly the northern periphery of the Zemplín Hills was settled, in the immediate vicinity of the newly confirmed sources of obsidian of Carpathian group C1a, located west and southwest of Brehov (Prichystal/Shkrdla 2014). Obsidian artefacts are frequently found in the fields within the cadastral areas of the neighbouring villages, such as Cejkov, Kašov, Zemplínske Jastrabie (Bánesz 1976, 241–243), Kysta (Bánesz 1980, 34), Hrčef, Veľaty (Kaminská 1995). The above-mentioned sites surround the Zemplín Hills from northeast and north and are nearer to the sources in the Cejkov – Brehov – Zemplín area. Nevertheless, the finds from Zemplín and Malá Tŕňa are presented in older collections (Andel 1955, 146). Absence of other sites on the western side of the Zemplín Hills is probably a result of insufficient research, as shown by increasing number of Upper Palaeolithic sites from the cadastral areas of Veľká Tŕňa and Čerhov (Volanská 2016).

With regard to the amount and the character of the artefacts, stratigraphic information and dating, the sites of Cejkov and Kašov are the most important. In Cejkov, Gravettian and Epigravettian settlement is located on the hilltop and the slopes of Tokaj Hill (Cejkov I–V). Numerous chipped lithic collections from several sites come from the long-term research of L. Bánesz (1960; 1969; 1993; 1996), as well as from the revision excavations in 2001 (Kaminská/Tomášková 2004). On the majority of these sites, obsidian prevails. However, limnosilicite of various provenance and patinated flint from distant sources were also quite frequent. Individual sites in the Cejkov area were being repeatedly re-settled and thus the industry found mainly in the topsoil cannot be accurately dated into individual chronological stages. Sites which were fully excavated and where finds could be dated are few. Raw material composition of the lithic industry points to certain directions of hunter groups’ movement in the territory of Eastern Slovakia. The oldest finds come from Cejkov I and III (Bánesz 1959), where occurrence of limnosilicite (probably from Hungary) and Volhynian flint from Transcarpathian Ukraine has been recorded. The main settlement of Late Gravettian culture in Cejkov I has been chronologically set by several datings between 24.36–21.50 ka BP (Kaminská/Tomášková 2004; Verpoorte 2002). Hunters of Late Gravettian culture brought obsidian to the site not only for immediate use but also to have a reserve. During the excavation at Cejkov I in 1969, an accumulation of small obsidian nodules with sculpture was uncovered in Trench II, over an area of 50 x 35 cm (Bánesz 1974, fig. 4). They represented an imported raw material and artefacts that were made of it later, in the area of the settlement.

Based on raw material composition, we can estimate the routes of expansion of the culture, especially those going to the north, to the Carpathian passes which were important connection routes connecting the region with the territory of Southern Poland. Late Gravettian settlement was not concentrated only in the Eastern Slovak Lowland, it expanded to areas further to the north, along the Ondava and Topľa River basins. This direction of expansion of the Late Gravettian is documented by the finds of chipped industry from the site of Marhaň (Valde-Novák 2008). Unypical shouldered points occur in the typological composition of the industry and the range of raw materials includes limnosilicite and Volhynian flint, as well as radiolarite.

The sites of Cejkov (Bánesz 1959, 770; 1988) and Kašov I-lower layer (Bánesz 1969; Novák 2002) are dated to the end of the Late Gravettian. Erratic silicite from Silesia is also represented in the inventories from the sites. A considerable portion of artefacts (49.32%) from the site of Kašov I-lower layer was reduced

Fig. 5. Tibava. Carinated endscrapers made of patinated obsidian. Aurignacian (photo by A. Marková).
from patinated flints (erratic flint from Silesia, Kraków-Jurassic and Volhynian flint). Obsidian artefacts created 33.26% of the collection (Bánesz 1969; Novák 2002). The lower layer was dated by ^14C method to 20,700 ±350 BP (Bánesz 1993).

Erratic silicite was probably imported by the groups of Gravettian hunters who migrated from Southern Poland over the Carpathians to Russian flatlands because of the aggravated climatic conditions in the end of the Last Glacial Maximum (Kozlowski 1986; Lengyel 2018, 148, 149; Svoboda et al. 2000, 11; Wilczyński 2009, 116). Some of them might have arrived in the Eastern Slovak Lowland and Košice Basin along the Carpathian passes.

West of the Eastern Slovak Lowland, Late Gravettian sites have been recorded. Košice-Barca-Svetlā III is the most significant one. Obsidian occurred there, however, patinated flint prevailed (Bánesz 1967).

In the Late Gravettian period, obsidian sporadically occurred also at the sites in Western Slovakia. The finds from the excavations of J. Bártka (1988) in Trenčianske Bohuslavske included 0.7% of artefacts made of obsidian (Žáár 2007). Only a small number of obsidian artefacts was obtained from the excavations of 2008 (Vlačíky et al. 2013, 49) and 2017 (Wilczyński et al. 2020, 282, table 3). In Nitra-Čermáň I, obsidian was rare (Kaminská/Kozlowski 2011).

In the following period of Epigravettian, obsidian prevails at Eastern Slovak sites. At all open-air Epigravettian sites near the Zemplín Hills, obsidian was predominant raw material. It made 81.73% at Kašov I-upper layer (Bánesz et al. 1992), 47.29% in Hrčef-Nad baňou (Bánesz/Kaminská 1984), and as much as 69.95% in Hrčef-Pivničky (Fig. 6), similarly in Vefaty, 66.45% of artefacts were made of obsidian (Kaminská 1995). The upper layer from Kašov I, dated by ^14C to 18,600 ±390 BP (Bánesz 1992), is one of the richest Epigravettian sites in central Europe. The suggestion to call the Epigravettian industry in the eastern part of Central Europe after the Last Glacial Maximum, by the term of Kašovien (Bánesz 1990; Svoboda/Novák 2004), encounters a problem, since most of the 43,500 artefacts from the upper layer have been only partially processed (Bánesz et al. 1992). At Gravettian and Epigravettian sites, single- and double-platform cores were made of obsidian, mostly the one with sculpture. We have not detected any connections between a certain type of tool and obsidian, but various kinds of retouched tools, such as endscrapers, burins, perforators, blades, points, backed bladelets, etc. were made of obsidian (Kaminská 2016).

Obsidian was also found in Western Slovakia, at the Epigravettian site at Nitra III (Bártak 2018a; Kaminšká/Nemergut 2014) and at several open-air settlements in the region of Ipeľ River Basin (Veľká Ves nad Ipľom) in Southern Slovakia (Bártak/Petrovský-Šichman 1962).

Contacts with the territory of Southern Poland in the north continued in the Epigravettian. They are documented by the Polish site of Targowisko 10, where 46 artefacts made of obsidian with sculpture were discovered (3%, which is 250 specimens with chips). The site is classified as Epigravettian, having analogies in Kašov-lower layer with dating around 15,000 BP (Wilczyński 2009).

Movement to the north and north-west became more intense in the Epipalaeolithic period. Obsidian has been recorded in the Topľa River Basin, in the village of Sol (Šiška 1991a) or in the region of Upper Zemplín, in the town of Humenné (Bártka 1985). In the end of the Palaeolithic, obsidian “travels” even further to the north, to the sites in Southern Poland (Ginter 1986; Sobkowiak-Tabaka et al. 2015). At Polish sites, obsidian occurs mainly in the Late Palaeolithic, in form of imported cores, blades and tools (Szeliga 2002). The use of obsidian in the Late Palaeolithic became more frequent mainly in the north-west regions and in the region of Spiš. It occurs also in the inventories obtained from Epipalaeolithic – Mesolithic sites in Orava (Bártka 1984).

As for the Epipalaeolithic in Spiš, the use of obsidian is known from the sites with the Świderian culture, although radiolarite prevails. At the site of Veľký Slavkov-Burich, obsidian artefacts also occurred (Bártka 1980b), as well as at the site of Lučivná/Svít-Pod Skalkou (Soják 1998; 2002). There are numerous Epipalaeolithic to Mesolithic sites in the territory of Spiš without exact classification into individual cultures. Chipped lithic industry including obsidian artefacts from older collections (Spišská Belá, Kežmarok, Podhorany, Podolinec, Stará Ľubovňa) were preliminarily evaluated by L. Bánesz (1962). As far as more recent collections are concerned, obsidian occurred at the sites of Bušovce, Krížová Ves, Spišská Teplice-Brehy (Soják 2002). At the site of Smižany-Hradisko I, in the collection of Epipalaeolithic industry comprising of 89 artefacts, obsidian represented 50% of it (Kaminská/Favorsky 1996). Three obsidian artefacts were discovered in the collection that is considered to be Magdalenian, discovered during the research at Stará Ľubovňa-Pod Štokom II (Valde-Nowak/Soják/Wäs 2007).
Fig. 6. Hrčel-Pivničky. Obsidian artefacts and cores from the Epigravettian site (photo by A. Marková).
Mesolithic

Mesolithic settlements have not been documented evenly in the territory of Slovakia. They create several local concentrations. Mesolithic stone industry in the Eastern Slovak Lowland was found in Čičarovce, where obsidian prevailed (Kaminská 2019). In the Košice Basin, at the site of Košice-Barca I (Fig. 7), all artefacts were made of obsidian (Prošek 1959). Obsidian occurred also among the finds from the Medvedia cave near Ružín (Bárta 1990). In the north of Slovakia, mainly in Spiš, obsidian occurs in unsorted Epipalaeolithic-Mesolithic collections (Bánesz 1962). It occurred very sporadically during new excavations at two sites at Spišská Belá (Soják 2002; Valde-Novák/Soják 2010). Mesolithic settlement of Southwestern Slovakia, mainly at the sand dunes near Sereď, where obsidian was not used, is most numerous and best studied one (Bárta 1972).

Neolithic and Eneolithic

Popularity of obsidian continued in the Neolithic and the Eneolithic. This applies mainly to the Middle Neolithic cultures with good access to the raw material. The groups of the Eastern Linear Pottery culture, settled in the Eastern Slovak Lowland, used obsidian already in the beginning of their existence. The groups of Linear Pottery culture from the Eastern Slovak Lowland obtained obsidian from the sources in the Zemplín Hills gradually, mainly via contact with the Tiszadob and Raškovce groups.

According to the results of current datings, the sites in the Eastern Slovak Lowland are older than those in the Košice Basin. The site of Moravany in the Ondava River Basin is one of them. There, occupancy by all three groups of the Eastern Linear Pottery culture (Proto-Kopčany, Kopčany and Raškovce) dated between 5500 and 5150 BC (Nowak 2015, 226) is documented. Obsidian was the main raw material used in all phases of the occupancy, to almost 90% (Kaczanowska/Kozłowski/Wasilewski 2015, 172). Individual artefacts represented various phases of obsidian processing – from the imported nodules, through cores, flakes, fragments and chips, to blades and tools. Similarly, obsidian prevailed since the oldest phases of the Eastern Linear Pottery culture, as suggested also by other collections from the sites in the Eastern Slovak Lowland (Kaczanowska/Kozłowski/Nowak 2013; Kozłowski 1997). Proportions of used obsidian were 90.7% in Zbudza, 96.3% in Slavkovce, 67–90% in Zalužice, 97.6% in Zemplínske Kopčany (Kaczanowska/Kozłowski 1997, 220, 221; Šiška 1989). 110 obsidian artefacts come from Slavkovce, feature E/88 (Proto-Kopčany phase). They include 34 nodules, one of which was an obsidian nodule with one scar, weighing 2.9 kg (Kaczanowska/Kozłowski 1997, 177, table VI-3; fig. VI-1–3). Obsidian represented 91.7% of the raw material composition of the chipped industry from the settlement in Veľké Raškovce (Vizdal 1973, 102).

The sites from the late phase of the Eastern Linear Pottery (Raškovce group) and Bükk cultures are usually more frequent in the cadastral areas of many villages in the nearest vicinity of the Zemplín Hills. It is often impossible to categorise the obsidian industry into the groups of the Eastern Linear Pottery culture and the Bükk culture. Malá and Veľká Tríha are the sites with high amount of obsidian, as stated by Š. Janšák (1935, 67–69) and other authors, after sporadic surveys at several places in the cadastral area of the villages (Chovanec 1999; 2005; Kaminská/Cheben I. 1983; Polla 1996). The cadastral area of the village of Černochov, with Neolithic finds accompanied by obsidian, is located further to the south (Janšák 1935, 69–70). As for the density of Neolithic occupancy, similar situation is identified in Bara (Caplovic/Gašaj/Olexa 1977; Gašaj/Jurečko/Olexa 1980; Janšák 1935, 67–69), Vinčíky (Chovanec 1999; Janšák 1935, 70), Zemplín (Anđel 1955, 146; Horváthová/Miroššayová 2002; Janšák 1935, 57), and Streda nad Bodrogom (Janšák 1935, 75; Polla 1964; Šiška 1979; 1989). Similar situation was found on the northeastern and northern sides of the Zemplín Hills, in the cadastral areas of Zemplínske Hradište, Zemplínske Jastrabie, Hrań, Novosad, Kysta, Hrčef (Chovanec 1988; 2004; Kaminská 1987).
Obsidian was less frequent in the Eastern Linear Pottery culture in the Košice Basin. In the proto-Linear phase at the site of Košice-Červený rak, obsidian was less frequent than limnosilicite (only 29.3%; Kaminská/Kaczanowska/Kozłowski 2008, 90, table 1). Obsidian created 36.5% of raw materials in Košice-Barca III and 32.7% in Čečejovce in the following period of Barca III group (Kozłowski 1989). Obsidian in the first two groups of the Eastern Linear Pottery culture in the Košice Basin probably comes from Hungarian sources. It is associated with the shift of the occupancy from the territory of Northeastern Hungary along the Hornád River to the areas further to the north (Csengeri 2018). Groups of the first farmers brought obsidian from the region of Tokaj. Later, in the Tiszadob group, they started to use obsidian from the exploitation area in the Zemplín Hills. The use of obsidian increased to 36.23% at the site of Košice-Galgovec (Fig. 8). In the following phase of occupancy, the transition phase between the Tiszadob group and the Bükk culture, the proportion of obsidian increased to 63.75% (Kaminská 2020, table 20).

In the following Bükk culture, proportion of used obsidian varies at individual sites according to the proximity of the sources of the raw material. Obsidian prevails at the settlements in the Eastern Slovak Lowland and Košice Basin. Obsidian constitutes 96% of artefacts in Zemplínske Kopčany, even though
it makes only 25.5% in Šarišské Michaľany, in the region of Šariš (Kaczanowska/Kozłowski/Šiška 1993, 42, 43, table 9). 13 pyramidal obsidian cores (Fig. 9) come from Kašov, Čepegov site. Along with them, blades and obsidian flakes as well as sherds of the Bükk culture were found in the same feature (Šiška 1991b). L. Bánesz (1991) interpreted the finds as specialized on-site workshop produced cores which might have been an article of further exchange. The obsidian raw material must have been rather large, as the final core’s size was 148 x 39 x 50 mm and some blades were 10–12 cm long. According to the new research performed on the finds, it was not a workshop; it was rather an object for producing domestic assemblage (Allard/Klaric/Hromadová 2017, fig. 2; 6: 1). Similar situation has been found in Humenné, where the amount of obsidian is 99.47% (Kaczanowska/Kozłowski 2002, 83).

Bükk culture in the Košice Basin used obsidian for producing chipped lithic industry more extensively. Obsidian share reached 84.10% at Košice-Galgovec site (Kaminská 2020, table 20). It absolutely prevailed in the features of Bükk culture at the neighbouring site of Košice-Červený rak (Kaminská/Novák 2002).

Obsidian as a raw material or finished cores “travelled” outside the territory of Eastern Slovakia, as documented by numerous finds. Obsidian cores in the hoard from the Hungarian site of Nyírlugos, dated
to the Middle Neolithic, are of Slovak origin (Kasztovszky/Biró/Kis 2014). In the environment of Želiezovce group, obsidian industry occurs in Western Slovakia and Southern Poland. Increasing numbers of sites with finds of obsidians in Western and Central Slovakia were detected in the beginning of the Lengyel culture, when obsidians appear in the Middle Danube region as well (Šiška 1998). Later, in individual phases of Lengyel culture, the share of obsidian among the finds from Western Slovakia decreases. In Western Slovakia, obsidian occurred at the site of Nitra-Selenec in Eneolithic Ludanice group, in form of two specially modified artefacts (Nemergut/Cheben M. 2019).

Differences in the amounts of obsidian used at various settlements and burial grounds can be observed in the cultures of the Late Neolithic and Early Eneolithic in the Eastern Slovak Lowland. In graves of the Csôszhalom-Čičarovce group in Čičarovce, artefacts made of Volhynian flint prevailed over obsidian artefacts, but the share of obsidian in settlement features was almost 50% (Vizdal 1980). At the settlement of Csôszhalom-Oborín group in Hrččí, obsidian (74.81%) prevailed over other raw materials (Kaminská/Pelisiak 1991).

**Eneolithic – Early Bronze Age**

In the Eneolithic, even greater difference in number of obsidian industry at the settlements and at the burial grounds is recorded. It is significant in the Tiszapolgár culture, where Volhynian flint was the most frequently used material at the burial grounds at Tibava (Šiška 1964) and Veľké Raškovce (Vizdal 1977). Nevertheless, artefacts from the settlement at the site of Konopianky in Zemplin Hradište were made exclusively of obsidian. The chipped industry discovered at Baden culture settlement was also made of obsidian (Chovanec 1988).

Interest in obsidian becomes poorer in the end of the Eneolithic. Various kinds of flint of foreign provenance (banded Krzemionki flint from Poland, Volhynian flint from Transcarpathian Ukraine) were preferred to obsidian in the cultures of the Epi-Corded Ware cultural complex (group of the East Slovak Barrow Group in the northern part of Eastern Slovakia; Budinský-Krička 1991). At the end of the Eneolithic and in the beginning of the Bronze Age, Nyírség-Zatín culture was spread in the southern part of Eastern Slovakia. Only a few sites have been partly studied, chipped industry being discovered in Čičarovce, with prevailing obsidian blades and flakes (Kaminská 2010, 64).

**Early Bronze Age**

The cultures of the Early Bronze Age used obsidian as raw material only for certain types of tools, such as arrowheads with surface retouch. This type of industry is known from the burials of Košťany culture in Valaliky-Všechnyvých (Pástor 1962, 44, pl. VI: 11–13), Valaliky-Košťany (Pástor 1962, 40, pl. VI: 8–10), and Košice (Pástor 1969). Arrowheads made of other raw materials were discovered also at the settlement and the burial ground of the Otomani culture (Gancarski 2002) in Nižná Myšľa. Tools were only sporadically made of lithic raw materials in the cultures of following periods. They were replaced with metal objects, thus, artefacts made of obsidian also occur only sporadically.

**CONCLUSION**

Technological properties and the appearance of obsidian led to its popularity in the Stone Ages. The use of obsidian, however, is territorially limited and it is associated mainly with the Zemplín Hills. Obsidian was a universal lithic raw material and was used for production of a wide range of artefacts (endscrapers, burins, retouched blades, flakes, cores, etc.). No close association between obsidian and a particular type of tools has been observed in any archaeological culture.

Obsidian occurs in the raw material composition of Aurignacian culture in the Upper Palaeolithic in Eastern Slovakia, but it comes from the Hungarian sources in the territory of Tokaj. After the chipped industry from the cadastral areas of the villages of Čerhov and Veľká Trňa is evaluated, we might be able to document the use of obsidian also from the sources in the Zemplín Hills.

Obsidian is the most commonly used material in the Late Gravettian and mainly Epigravettian in Eastern Slovakia, where the sites are located in the vicinity of obsidian sources. The percentage of obsidian used in the assemblages of lithic industries in the Epigravettian reaches more than 80%. Obsidian also plays an important role in the composition of Epipalaeolithic and Mesolithic collections in Spiš. Obsidian prevails in the Mesolithic of the Košice Basin (collection from Košice-Barca I).
In the Neolithic, obsidian prevails in individual phases of Linear Pottery culture in the Eastern Slovak Lowland. It is typical of the Bükk culture in the Eastern Slovak Lowland and in the southern part of the Košice Basin. In the time of existence of Bükk culture, obsidian is maximally spread also in the environment of Middle Neolithic cultures in Western Slovakia. In the end of the Neolithic, in the Eneolithic and the Early Bronze Age, the importance of obsidian diminishes and other raw materials start to prevail.

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Vyúžitie obsidiánu v praveku Slovenska

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Súhrn

Obsidián z okolia Zemplínskych vrchov pochádza z primárných (Viničky) a sekundárnych zdrojov (Brehov a Cejkov). Vo Viničkách sú primárne zdroje obsidiánu z dvoch fáz rýolitového vulkanizmu. Staršiu fázu predstavujú perlitové brekcie s obsidiánom v podloží rýolitového extruzívneho telesa a mladšiu fázu tvoria obsidiány a perlity spojené s intruzívnymi telesami dajkového typu.

V oblasti Brehova a Cejkova boli zistené a overené alochtónne polohy výskytu obsidiánu so skulptúrou. Ich predpokladaným zdrojom by mohla byť poloha silne sklovitého ryodacitu miestami s perlitym vývojom, zistená v podloží andezitového telesa Veľký vrch, severne od Brehova. Z nej mohli byť obsidiány vyvétané a transportované do sekundárnych polôh v okolí, kde sú prekrýtými viatymi pieskami alebo ílom. Zistené boli v polohy Brehov-Za alejou (Brehov 2) a v polohе Cejkov-Zihľavník. Predstavujú hlavný zdroj surovín na výrobu obsidiánovej industrii na paleolitických až neolitických lokalítach.


Obr. 1. Mapa okolia Zemplínskych vrchov s autochtónnymi a alochtónnymi zdrojmi obsidiánu, s lokalítami z paleolitu a neolitu. Alochtónne zdroje z Brehova a Cejkova: 1 – Cejkov-Zihľavník; 2 – Brehov-Za alejou (Brehov 2).
Obr. 2. Panoramatický pohľad od juhozápadnej strany na lávový prúd rýolitového telesa Borsuk pri obci Viničky so zdroji obsidiánu a perlítov, vrátane vinných pivnič vínárstva Tokaj Viničky; 1 – 3 – zdroje obsidiánov.
Obr. 4. Obsidiánové hľuzy so skulptúrou. A – epigravettienska lokalita Veľaty I; B – Viničky, lokalita 2 na obr. 2; C – Brehov-Za alejou (Brehov 2; foto A. Marková a P. Bačo; podľa Bačo et al. 2017, upravené).
Obr. 5. Tibava. Kýlovité škrabadlá z patinovaného obsidiánu. Aurignacien (foto A. Marková).
Obr. 6. Hrčeľ-Pivničky. Obsidiánové nástroje a jadrá z epigravettienskej lokality (foto A. Marková).
Obr. 7. Košice-Barca I. Mezolitická štiepaná industria z obsidiánu (foto A. Marková).

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