

USE OF OBSIDIAN IN SLOVAK PREHISTORY¹

Ľubomíra Kaminská

DOI: <https://doi.org/10.31577/szausav.2021.suppl.2.15>

Keywords: prehistory, Slovakia, sources of obsidian, archaeological cultures, raw material use

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 preferred this raw material. In Spiš, it occurs in the Šviederian 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 Bükk 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

¹ This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-20-0521 and project VEGA 2/0084/18.

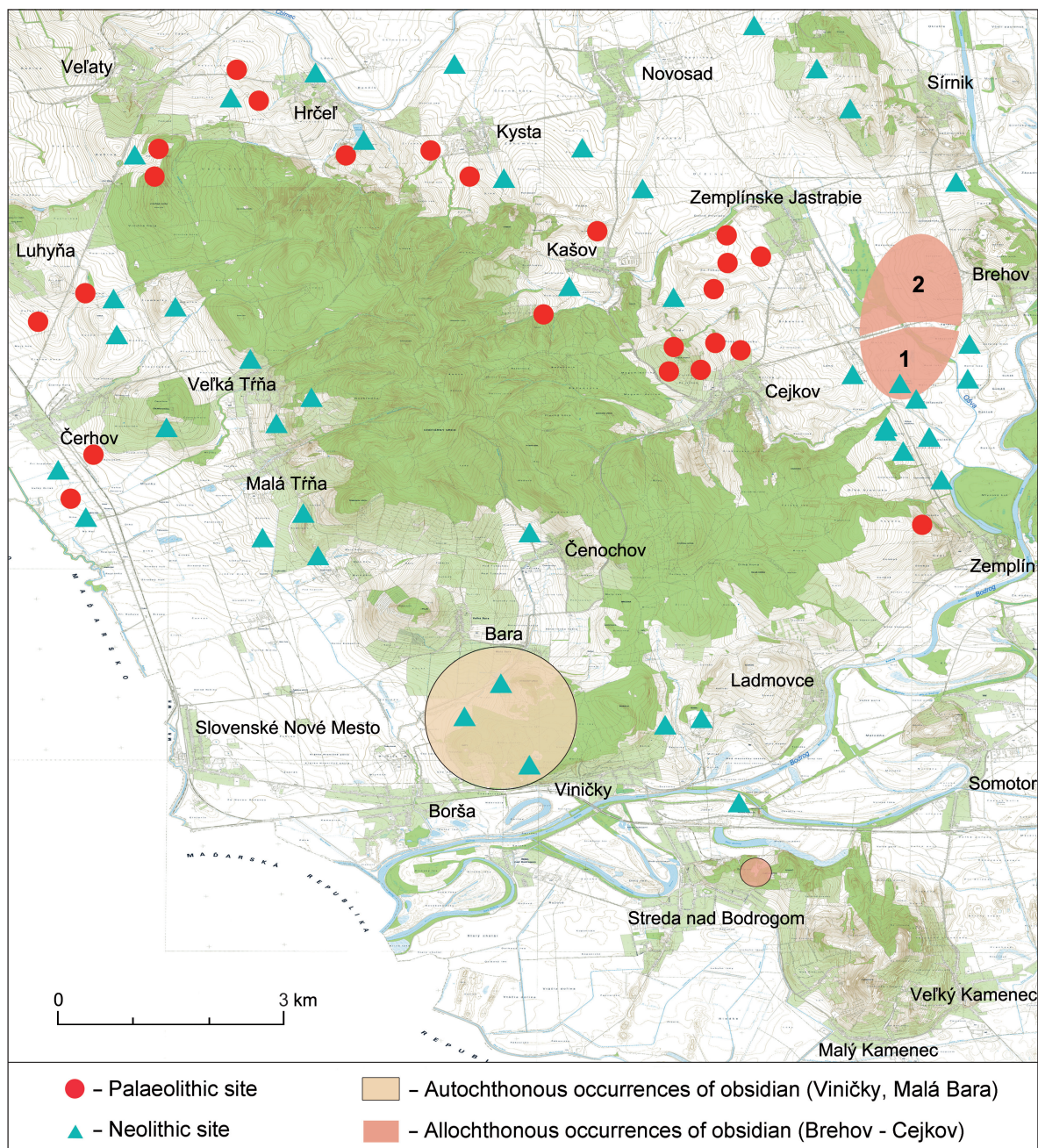


Fig. 1. Map of the area of the Zemplín Hills with autochthonous and allochthonous sources of obsidian, with sites from the Palaeolithic and Neolithic. Allochthonous sources from Brehov and Cejkov: 1 – Cejkov-Žihľavník; 2 – Brehov-Za alejou (Brehov 2).

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).

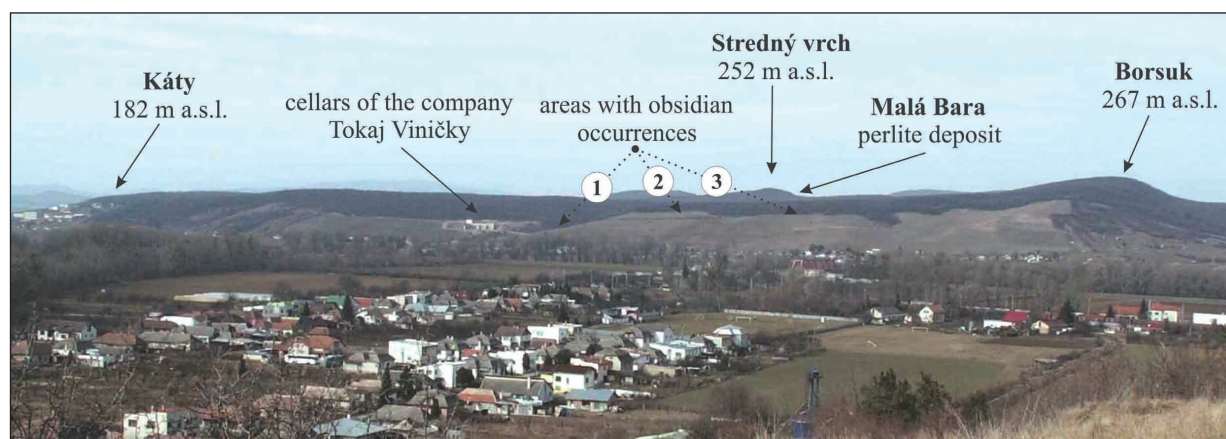


Fig. 2. Panorama of the SW side of the Borsuk rhyolite dome/flow next to the village Viničky with obsidian and perlite occurrences, including the Tokaj Viničky Ltd. Winecellars; 1–3 – obsidian occurrences. View from the southeast (photo by P. Bačo; after Bačo *et al.* 2017).

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 redistribution 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/Ďud'a 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 volcanoclastic 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. Irisation 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 volcanoclastic 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 Hungary (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 perlitic 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 perlitic integrated within the intrusive bodies of dyke type – 11.19 ± 0.53 – 11.04 ± 0.34 MA

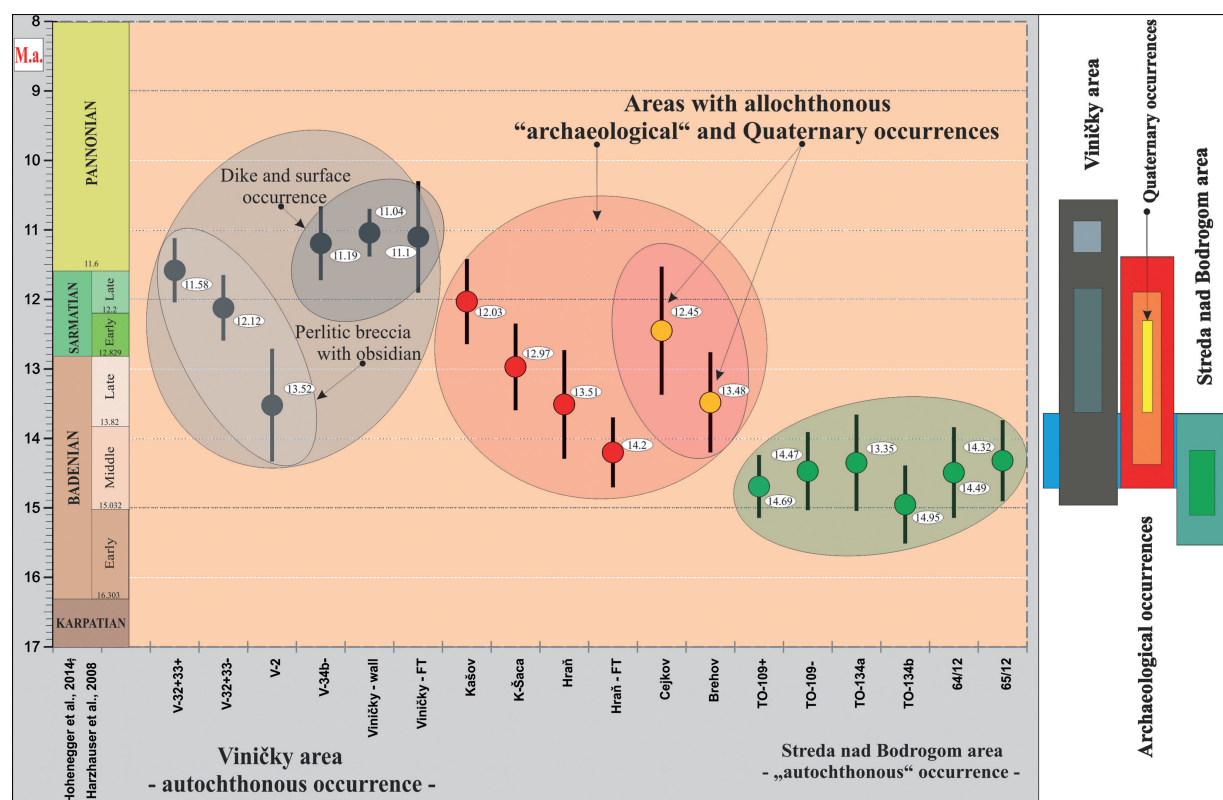


Fig. 3. Results of isotope dating of volcanic glasses in the Zemplín Hills region grouped in accordance with localities and the type of occurrence (after Bačo *et al.* 2017).

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-

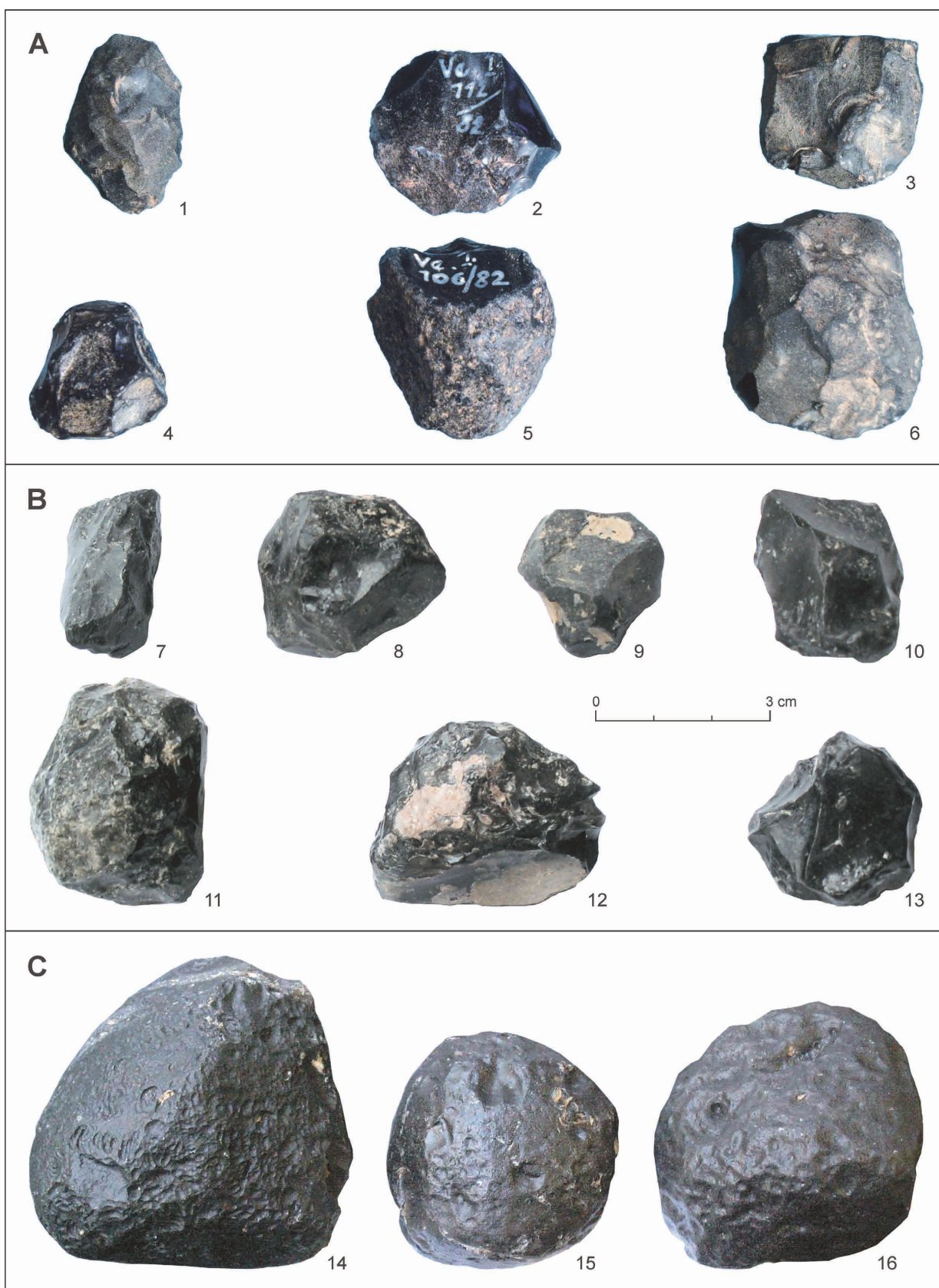


Fig. 4. Obsidian nodules with sculpture. A – Epigravettian site Veľatý I; B – Viničky, site 2 in fig. 2; C – Brehov-Za alejou (Brehov 2; photo by A. Marková and by P. Bačo; after Bačo *et al.* 2017, modified).

teristics was usually evaluated. Therefore, today we cannot say exactly at which archaeological sites the sculpture of obsidian is identical with that observed 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/Škrdl 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-Žihľavník (*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 Veľatý 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/Báčová 2014; Přichystal/Škrdl 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-Žihľavník, dated into the Middle Palaeolithic (*Přichystal/Škrdl 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 (Hôrka-Ondrej, Gánovce-Hrádok, Bojnice I and III, etc.). Six artefacts – five flakes and one borer – occurred in layer XIX associated with the Mousterian culture in the Obłazowa 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/Kozłowski/Škrdl 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 Čečejoyce (*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 Hrabovec I + II and only 4.95% at Nižný Hrabovec 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 Trňa. The finds have not been evaluated yet. Only the collection of leaf points from Čerhov and Veľká Trňa has been published. The sites are preliminarily assessed as Aurignacian, intervened by the Szeletian culture (*Volanská 2016, 13*). The leaf points are made of limnosilicite, flint and radiolarite. Most of the collected industry is made of obsidian (*Volanská 2016, 10*) and can be probably associated with the Neolithic settlement.

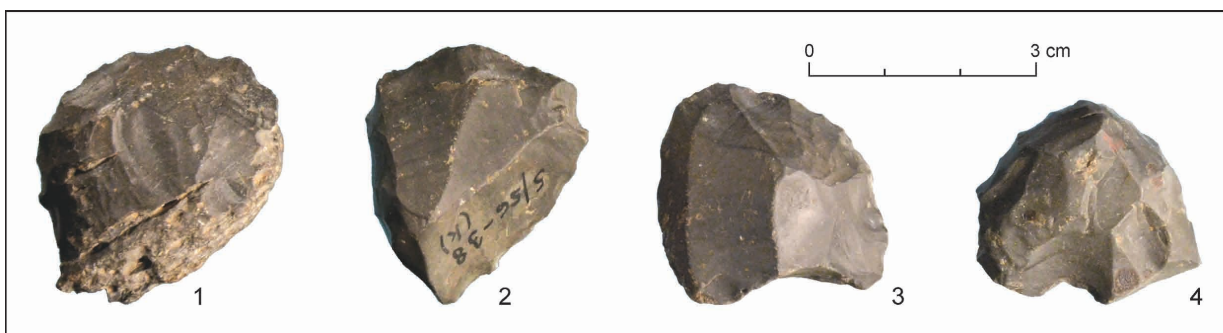


Fig. 5. Tibava. Carinated endscrapers made of patinated obsidian. Aurignacian (photo by A. Marková).

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 (*Přichystal/Škrdla 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*), Hrčeľ, Veľatý (*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 Trňa 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 Trňa and Čerhov (*Voľanská 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-Nowak 2008*). Untypical 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

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 ^{14}C method to $20,700 \pm 350$ 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 (Kozłowski 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-Svetlá 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. Bárta (1988) in Trenčianske Bohuslavice included 0.7% of artefacts made of obsidian (Žaár 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-Čermán I, obsidian was rare (Kaminská/Kozłowski 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 1969; Bánesz et al. 1992), 47.29% in Hrčel-Nad baňou (Bánesz/Kaminská 1984), and as much as 69.95% in Hrčel-Pivničky (Fig. 6), similarly in Veľaty, 66.45% of artefacts were made of obsidian (Kaminská 1995). The upper layer from Kašov I, dated by ^{14}C to $18,600 \pm 390$ 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 (Bárta 1980a; Kaminská/Nemergut 2014) and at several open-air settlements in the region of Ipel' River Basin (Veľká Ves nad Ipľom) in Southern Slovakia (Bárta/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 (Bárta 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 (Bárta 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 (Bárta 1980b), as well as at the site of Lučivná/Svit-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, Podolíneč, 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/Javorský 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/Wąs 2007).



Fig. 6. Hrčel-Pivničky. Obsidian artefacts and cores from the Epigravettian site (photo by A. Marková).



Fig. 7. Košice-Barca I. Mesolithic chipped industry made of obsidian (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-Nowak/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 Trňa 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 Černochovej, 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 (Čaplovič/Gašaj/Olexa 1977; Gašaj/Jurečko/Olexa 1980; Janšák 1935, 67–69), Viničky (Chovanec 1999; Janšák 1935, 70), Zemplín (Andel 1955, 146; Horváthová/Mirošayová 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, Hraň, Novosad, Kysta, Hrčel (Chovanec 1988; 2004; Kaminská 1987).

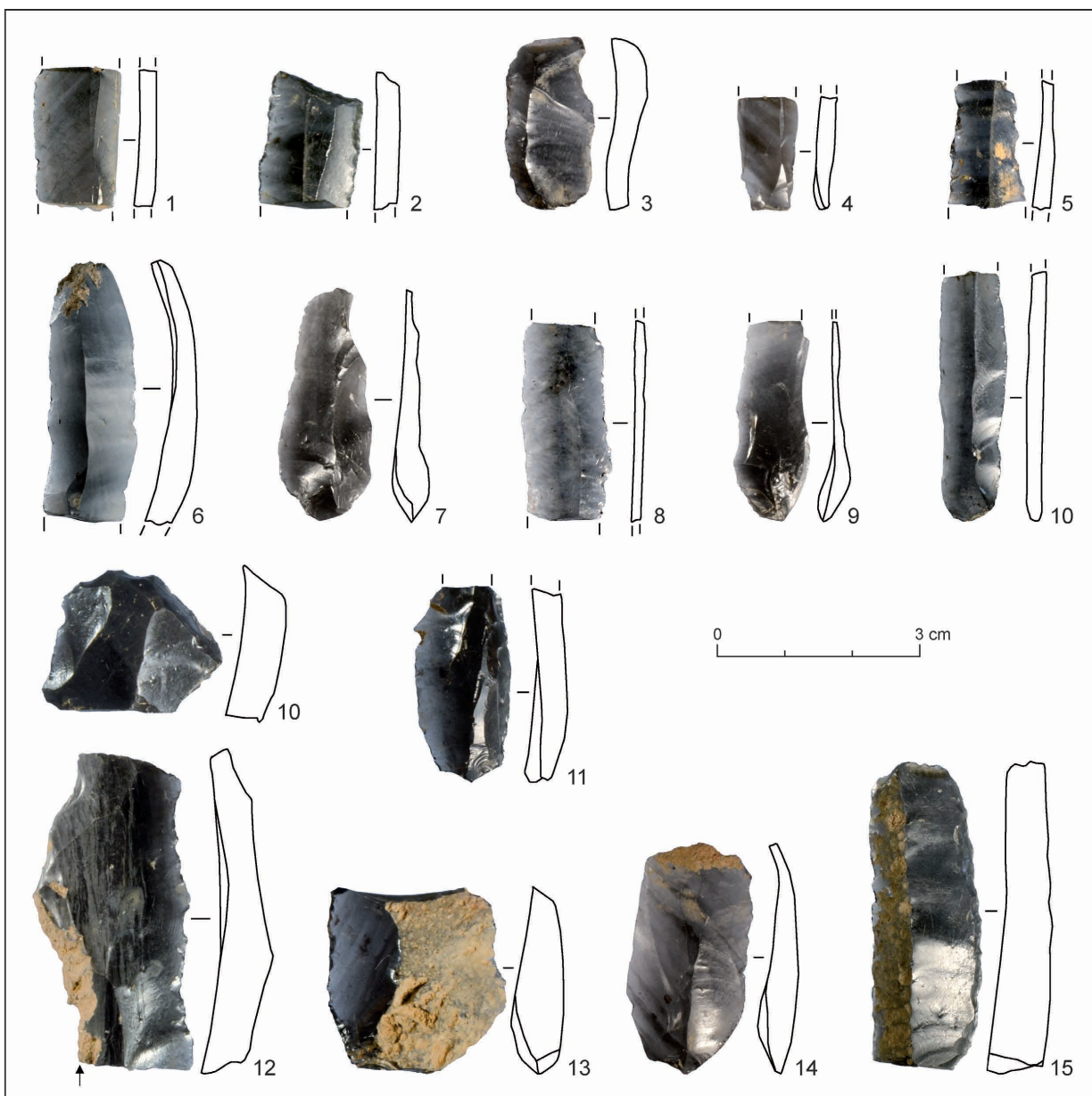


Fig. 8. Košice-Galgovec III, feature 9/97. Eastern Linear Pottery culture, Tiszadob group (photo by A. Marková).

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 Čečejevce 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

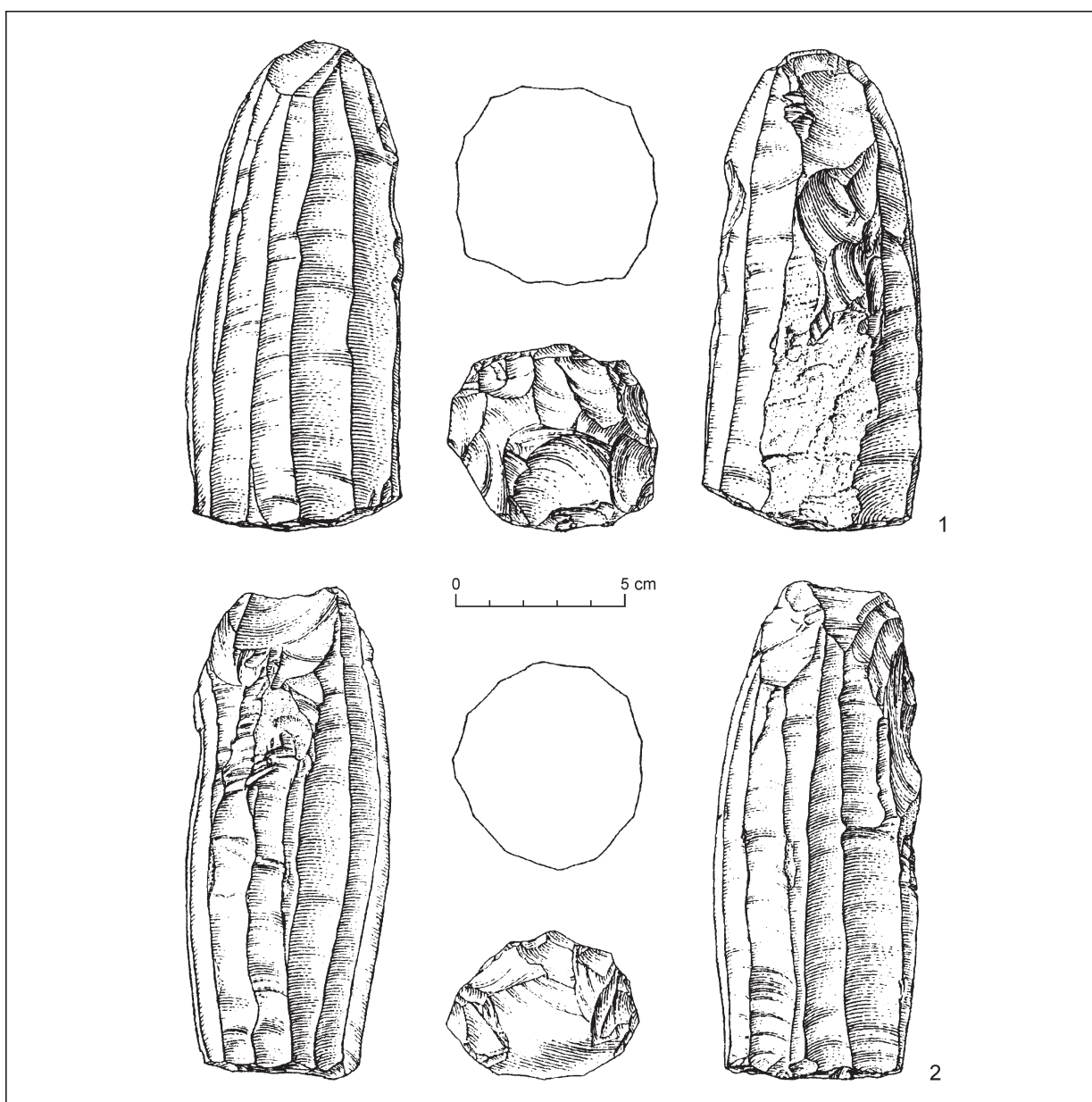


Fig. 9. Kašov-Čepegov I. Blade cores made of obsidian. Bükk culture (after Bánesz 1991, modified).

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 59 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 Csőszhalom-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 Csőszhalom-Oborín group in Hrčel, 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 Konopiansky in Zemplínske 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-Všechsvätých (*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.

Translated by Viera Tejbusová

BIBLIOGRAPHY

- Allard/Klaric/Hromadová 2017 P. Allard/L. Klaric/B. Hromadová: Obsidian blade debitage at Kašov-Čepegov I (Bükk culture), Slovakia. *Bulgarian e-Journal of Archaeology* 7, 2017, 17–35.
- Andel 1955 K. Andel: Výsledky archeologického prieskumu na zemplínsko-užskej nížine v rokoch 1953–1954. In: *Vlastivedný zborník I. Košice* 1955, 144–171.
- Bacsó et al. 1995a Z. Bacsó/E. Kaličiaková/M. Košarková/J. Seliga/J. Komoň/Š. Staňa/I. Zeman/R. Velich/A. Zlinská: *Subvulkanické telesá východného Slovenska, polymetalické, drahokovové, vzácnokovové a ortuťové rudy*. Závěrečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 1995. Unpublished.
- Bacsó et al. 1995b Z. Bacsó/P. Malachovský/V. Hrinko/M. Repčiak/E. Kaličiaková/M. Košarková/J. Seliga/J. Komoň/Š. Staňa/A. Zlinská: *Brehov-západ*. Závěrečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 1995. Unpublished.
- Bačo et al. 2003 P. Bačo/P. Baláž/K. Čechovská/J. Derco/R. Fischerová/L. Kovaničová/M. Repčiak/L. Tuček/M. Vancáková: *Obsidiánová industria – prehistorické sídliská Hraň, Čejkov, Zemplín*. 45. Fórum pre nerudy. Sprievodca. Košice – Viničky 2003.
- Bačo et al. 2011 P. Bačo/Z. Bačová/P. Konečný/V. Konečný/J. Derco/Z. Péczkay/M. Kováčová: *Extruzívne ryolitové teleso Borsuk pri Viničkách – banské diela*. Závěrečná správa. Archive of State Geological Institute of Dionýz Štúr. Bratislava 2011. Unpublished.
- Bačo et al. 2017 P. Bačo/L. Kaminská/J. Lexa/Z. Péczkay/Z. Bačová/V. Konečný: Occurrences of Neogene Volcanic Glass in the Eastern Slovakia – Raw Material source for the Stone Industry. *Anthropologie* 55, 2017, 207–230.
- Bačo/Báčová 2014 P. Bačo/Z. Bačová: Autochtónne výskyty vulkanických skiel spojené s neogénnym vulkanizmom na východnom Slovensku. In: O. Žaár/M. Gregor (eds.): 3. *Geologicko-Paleontologicko-Archeologická Diskusia (GEPAAARD)*. Zborník abstraktov. Bratislava 2014, 8.
- Bañacký et al. 1988 V. Baňacký/M. Elečko/M. Kaličiak/J. Lexa/P. Straka/D. Vass/J. Vozár/A. Vozárová: *Geologická mapa južnej časti Východoslovenskej nížiny a Zemplínskych vrchov 1 : 50 000*. Bratislava 1988.
- Bánesz 1959 L. Bánesz: Čejkov II–III, nové paleolitické stanice s obsidiánovou industriou. *Archeologické rozhledy* 11, 1959, 769–780.
- Bánesz 1960 L. Bánesz: Die Problematik der paläolithischen Besiedlung in Tibava. *Slovenská archeológia* 8, 1960, 7–58.
- Bánesz 1962 L. Bánesz: Nálezy drobnotvarej štiepanej industrie pod Vysokými Tatrami. *Študijné zvesti AÚ SAV* 10, 1962, 5–20.
- Bánesz 1967 L. Bánesz: Paleolitické sídliskové objekty z Barce-Svetlej III. *Archeologické rozhledy* 19, 1967, 285–295.
- Bánesz 1968 L. Bánesz: *Barca bei Košice. Paläolithische Fundstelle*. Bratislava 1968.
- Bánesz 1969 L. Bánesz: Gravettské súvrstvia s obsidiánovou a pazúrikovou industriou v Kašove a Čejkove. *Archeologické rozhledy* 21, 1969, 281–269.
- Bánesz 1974 L. Bánesz: Hromadný nález obsidiánovej suroviny na gravettskom sídlisku v Čejkove, okr. Trebišov. *Archeologické rozhledy* 26, 1974, 51–54.
- Bánesz 1976 L. Bánesz: Nové paleolitické lokality a nálezy z východného Slovenska. *Archeologické rozhledy* 28, 1976, 241–246.
- Bánesz 1980 L. Bánesz: Nové paleolitické nálezy z prieskumov na východnom Slovensku. *AVANS* 1978, 1980, 31–36.
- Bánesz 1988 L. Bánesz: Výskumy v okolí Čejkova. *AVANS* 1987, 1988, 29.
- Bánesz 1990 L. Bánesz: Súčasná problematika paleolitu východného Slovenska a severovýchodnej časti Karpatskej kotliny. *Historica Carpatica* 21, 1990, 9–19.
- Bánesz 1991 L. Bánesz: Neolitická dielňa na výrobu obsidiánovej industrie v Kašove. *Východoslovenský pravěk* 3, 1991, 39–68.
- Bánesz 1992 L. Bánesz: Prvé absolútne datovanie nálezov z paleolitickej stanice Kašov I metódou ¹⁴C. *AVANS* 1991, 1992, 16.

- Bánesz 1993 L. Bánesz: K absolútnemu datovaniu paleolitických staníc s obsidiánovou a pazúrikovou industriou v Kašove a Cejkove. *AVANS* 1992, 1993, 22.
- Bánesz 1996 L. Bánesz: Predmety umeleckého prejavu z paleolitickej stanice pri Cejkove a Kašove. *Slovenská archeológia* 44, 1996, 7–24.
- Bánesz/Kaminská 1984 L. Bánesz/L. Kaminská: Výskum archeologickej lokality v Hrčeli. *Historica Carpathica* 15, 1984, 255–281.
- Bánesz et al. 1992 L. Bánesz/J. Hromada/R. Desbrosse/I. Margerand/J. K. Kozłowski/K. Sobczyk/M. Pawlikowski: Le site de plein air du Paléolithique supérieur de Kašov I en Slovaquie orientale. *Slovenská archeológia* 40, 1992, 5–28.
- Bárta 1972 J. Bárta: Die mittlere Steinzeit in der Slowakei. *Acta Praehistorica et Archaeologica* 3, 1972, 57–76.
- Bárta 1980a J. Bárta: Významné paleolitické lokality na západnom Slovensku. Nitra 1980.
- Bárta 1980b J. Bárta: Wieki Sławków – pierwsza osada świdurskiej kultury na Słowacji. *Acta Archaeologica Carpathica* 20, 1980, 5–17.
- Bárta 1984 J. Bárta: Prvé nálezy zo staršej doby kamennej na Orave. *Krásky Slovenska* 11, 1984, 10–15.
- Bárta 1985 J. Bárta: Kľúč k slovenskému praveku? *Magazín Východoslovenských novín Košice* z 28. 6. 1985. Košice 1985, 3.
- Bárta 1988 J. Bárta: Trenčianske Bohuslavice. Un habitat gravettien en Slovaquie occidentale. *L'Antropologie* 92, 1988, 173–182.
- Bárta 1990 J. Bárta: Mezolitický lovci v Medvedej jaskyni pri Ružíne. *Slovenská archeológia* 38, 1990, 5–30.
- Bárta/Petrovský-Šichman 1962 J. Bárta/A. Petrovský-Šichman: Paleolitické nálezy z Ipeľskej kotliny. *Archeologické rozhledy* 14, 1962, 297–308.
- Bigazzi et al. 1990 G. Bigazzi/P. Márton/P. Norelli/L. Rozložník: Fission track dating of Carpathian obsidians and provenance identification. *Nuclear Tracks and Radiation Measurements* 17, 1990, 391–396.
DOI: [https://doi.org/10.1016/1359-0189\(90\)90062-3](https://doi.org/10.1016/1359-0189(90)90062-3)
- Biró 1984 K. T. Biró: Distribution of obsidian from the Carpathian Sources on Central European Palaeolithic and Mesolithic sites. *Acta Archaeologica Carpathica* 23, 1984, 5–42.
- Biró/Kasztovszky 2013 K. T. Biró/Z. Kasztovszky: Obsidian Studies Using Nuclear Techniques in Hungary. *Science for Heritage* 1, 2013, 6–9.
- Budinský-Krička 1991 V. Budinský-Krička: K otázke skupiny východoslovenských mohýl. *Východoslovenský pravek* 3, 1991, 96–111.
- Csengeri 2018 P. Csengeri: A short report on the research of the Earliest Alföld Linear Pottery Culture in Hernád Valley, North-Eastern Hungary. In: Valde-Nowak et al. eds. 2018, 329–336.
- Čaplovič/Gašaj/Olexa 1977 D. Čaplovič/D. Gašaj/L. Olexa: Archeologický prieskum Medzibodrožia a Košickej kotliny. *AVANS* 1976, 1977, 88–99.
- Gancarski 2002 J. Gancarski: Kultura Otomani-Füzesabony po północnej stronie Karpat. In: J. Gancarski (ed.): *Miedzi Mykenami a Baltykiem. Kultura Otomani-Füzesabony*. Krosno – Warszawa 2002, 103–126.
- Gašaj/Jurečko/Olexa 1980 D. Gašaj/P. Jurečko/L. Olexa: Výsledky prieskumov v Košickej kotline a na Východoslovenskej nížine. *AVANS* 1979, 1980, 73–79.
- Ginter 1986 B. Ginter: Obsidianimporte im Spätpaläolithikum and Mesolithikum in Südpolen. In: B. Chropovský (ed.): *Urgeschichtliche Besiedlung der Ostslowakei in Bezug zu den Nachbargebieten*. Nitra 1986, 71–76.
- Horváthová/Miroššayová 2002 E. Horváthová/E. Miroššayová: Nové nálezy z katastra obce Zemplín. *AVANS* 2001, 2002, 65–67.
- Chovanec 1988 J. Chovanec: Sídliisko ľudu s bukovohorskou kultúrou v Zemplínskom Hradišti. *AVANS* 1987, 1988, 57–58.
- Chovanec 1999 J. Chovanec: Archeologické výskumy a nálezy v južnom Zemplíne 1969–1999. *Múzejníček* 3, 1999, 1–20.
- Chovanec 2004 J. Chovanec: Okres Trebišov. In: L. Gačková (zost.): *Archeologické dedičstvo Zemplína. Pravek až včasný stredovek*. Michalovce 2004, 427–570.
- Chovanec 2005 J. Chovanec: Archeologické výskumy a nálezy v južnom Zemplíne 2000–2004. *Múzejníček* 4, 2005, 1–20.
- Chu et al. 2018 W. Chu/G. Lengyel/Ch. Zeeden/A. Péntek/L. Kaminská/Zs. Mester: Early Upper Palaeolithic surface collections from loess-like sediments in the Northern Carpathian Basin. *Quaternary International* 485, 2018, 167–182.
DOI: <https://doi.org/10.1016/j.quaint.2017.05.017>
- Chu et al. 2020 W. Chu/L. Kaminská/N. Klasen/Ch. Zeeden/G. Lengyel: The Chronostratigraphy of the Aurignacian in the Northern Carpathian Basin Based on New Chronometric/Archeological Data from Seňa I (Eastern Slovakia). *Journal of Paleolithic Archaeology* 3, 2020, 77–96.
DOI: <https://doi.org/10.1007/s41982-019-00044-2>

- Ivan 1962 L. Ivan: *Informatívna zpráva (nálezozá zpráva) o ložiskách a východoch perlitov a hornín perlitického typu v južnej časti Zemplínskeho pohoria (Geofond)*. Závěrečná správa. Archive of State Geological Institute of Dionýz Štúr. Košice 1962. Unpublished.
- Ivan 1964 L. Ivan: Geologická pozícia perlitov v južnej časti Zemplínskych vrchov. In: *Zpráva o geologických výskumoch v roku 1963*. Bratislava 1964, 143–145.
- Janšák 1935 Š. Janšák: *Praveké sídliská s obsidiánovou industriou na Slovensku*. Bratislava 1935.
- Kaczanowska/Kozłowski 1997 M. Kaczanowska/J. K. Kozłowski: Lithic industries. In: J. K. Kozłowski (ed.): *The Early Linear Pottery Culture in Eastern Slovakia*. Kraków 1997, 177–254.
- Kaczanowska/Kozłowski 2002 M. Kaczanowska/J. K. Kozłowski: Bükk Culture lithic assemblage from Humenné, Eastern Slovakia. *Študijné zvesti AÚ SAV* 34, 2002, 65–90.
- Kaczanowska/Kozłowski/Nowak 2013 M. Kaczanowska/J. K. Kozłowski/M. Nowak: Raw materials of chipped industries at the Eastern Linear Pottery Culture site at Moravany, Eastern Slovakia. In: *Mester ed.* 2013, 111–130.
- Kaczanowska/Kozłowski/Šiška 1993 M. Kaczanowska/J. K. Kozłowski/S. Šiška: *Neolithic and Eneolithic chipped stone industries from Šarišské Michaľany, Eastern Slovakia. Linear Pottery, Bükk and Baden Cultures*. Kraków 1993.
- Kaczanowska/Kozłowski/Wasilewski 2015 M. Kaczanowska/J. K. Kozłowski/M. Wasilewski: Chipped, ground and polished stone industries at the early neoithic settlement of Moravany. In: J. K. Kozłowski/M. Nowak/M. Vizdal (eds.): *Early farmers of the Eastern Slovak Lowland. The settlement of the Eastern Linear Pottery Culture at Moravany*. Kraków 2015, 163–196.
- Kaminská 1987 L. Kaminská: Príspevok k osídleniu Hrčľa v mladšej a neskoršej dobe kamennej. *Archeologické rozhledy* 39, 1987, 481–506.
- Kaminská 1990 L. Kaminská: Aurignacké stanice v Čečejovciach. *Archeologické rozhledy* 42, 1990, 3–12.
- Kaminská 1991 L. Kaminská: Význam surovínovej základne pre mladopaleolitickú spoločnosť vo východokarpatskej oblasti. *Slovenská archeológia* 39, 1991, 7–58.
- Kaminská 1995 L. Kaminská: Katalóg štiepanej kamennej industrie z Hrčľa-Pivničiek a Veliat. Nitra 1995.
- Kaminská 2001 L. Kaminská: Die Nutzung von Steinrohmaterialien im Paläolithikum der Slowakei. *Quartär* 51/52, 2001, 81–106.
- Kaminská 2010 L. Kaminská: Čičarovce-Veľká Moľva. *Výskum polykultúrneho sídliska*. Nitra 2010.
- Kaminská 2013 L. Kaminská: Sources of raw materials and their use in the Palaeolithic of Slovakia. In: *Mester ed.* 2013, 99–110.
- Kaminská 2016 L. Kaminská: Gravettian and Epigravettian lithics in Slovakia. *Quaternary International* 406, 2016, 144–165.
DOI: <https://doi.org/10.1016/j.quaint.2015.08.083>
- Kaminská 2018 L. Kaminská: Use of obsidian from the Paleolithic to the Bronze Age in Slovakia. *Archeometriai Műhely* 15, 2018, 197–212.
- Kaminská 2019 L. Kaminská: Mezolitické artefakty z Čičaroviec. *AVANS* 2014, 2019, 82–87.
- Kaminská 2020 L. Kaminská: Košice-Galgovec. *Osídlenie polohy v strednom neolite*. Nitra 2020.
- Kaminská et al. 2000 L. Kaminská/J. K. Kozłowski/B. Kazior/M. Pawlikowski/K. Sobczyk: Long term stability of raw materials procurement systems in the Middle and Upper Palaeolithic of Eastern Slovakia: a case study of the Topľa/Ondava River valleys. *Præhistoria* 1, 2000, 63–81.
- Kaminská/Cheben I. 1983 L. Kaminská/I. Cheben: Výsledky prieskumu Východoslovenskej nížiny. *AVANS* 1982, 1983, 128–130.
- Kaminská/Ďuďa 1985 L. Kaminská/R. Ďuďa: K otázke významu obsidiánovej suroviny v paleolite Slovenska. *Archeologické rozhledy* 37, 1985, 121–129.
- Kaminská/Javorský 1996 L. Kaminská/F. Javorský: Drobnotvará štiepaná kamenná industria zo Smižian. *Študijné zvesti AÚ SAV* 32, 1996, 5–14.
- Kaminská/Kaczanowska/Kozłowski 2008 L. Kaminská/M. Kaczanowska/J. K. Kozłowski: Košice-Červený rak and the Körös/Eastern Linear Transition in the Hornád Basin (Eastern Slovakia). *Přehled výzkumů* 49, 2008, 83–91.
- Kaminská/Kozłowski 2011 L. Kaminská/J. K. Kozłowski: Nitra I-Čermán v rámci štruktúry osídlenia gravetienskej kultúry na Slovensku. *Slovenská archeológia* 59, 2011, 1–85.
- Kaminská/Kozłowski/Škrdl 2011 L. Kaminská/J. K. Kozłowski/P. Škrdl: New approach to the Szeletian – chronology and cultural variability. *Eurasian Prehistory* 8, 2011, 29–50.
- Kaminská/Nemergut 2014 L. Kaminská/A. Nemergut: The Epigravettian chipped stone industrie from Nitra III site (Slovakia). In: K. T. Biró/A. Markó/K. P. Bajnok (eds.): *Eolian scripts new ideas on the lithic world studies in honour of Viola T. Dobosi*. Budapest 2014, 93–119.
- Kaminská/Novák 2002 L. Kaminská/M. Novák: Sídliskové nálezy bukovohorskej kultúry v polohe Košice-Červený rak. *AVANS* 2001, 2002, 82, 83.

- Kaminská/Pelisiak 1991 L. Kaminská/A. Pelisiak: Štiepaná kamenná industria skupiny Tiszapolgár-Csöszhalom-Oborín z Hrčeľa. *Východoslovenský pravek* 3, 1991, 26–38.
- Kaminská/Tomášková 2004 L. Kaminská/S. Tomášková: Time space systematics of Gravettian finds from Cejkov I. In: J. A. Svoboda/L. Sedláčková (eds.): *The Gravettian along the Danube*. Brno 2004, 198–216.
- Kasztovszky/Biró/Kis 2014 Z. Kasztovszky/K. T. Biró/Z. Kis: Prompt Gamma Activation Analysis of the Nyírlugos obsidian core depot find. *Journal of Lithic Studies* 1, 2014, 151–163. DOI: <https://doi.org/10.2218/jls.v1i1.784>
- Kohút et al. 2021 M. Kohút/J. A. Westgate/N. J. G. Pearce/P. Bačo: The Carpathian obsidians – contribution to their FT dating and provenance (Zemplín, Slovakia). *Journal of Archaeological Science: Reports* 37, 2021, 102861. DOI: <https://doi.org/10.1016/j.jasrep.2021.102861>
- Kozłowski 1986 J. K. Kozłowski: The Gravettian in Central and Eastern Europe. *Advances World Archaeology* 5, 1986, 131–200.
- Kozłowski 1989 J. K. Kozłowski: The lithic industry of the Eastern Linear Pottery Culture in Slovakia. *Slovenská archeológia* 37, 1989, 377–410.
- Kozłowski 1997 J. K. Kozłowski: Introduction. In: J. K. Kozłowski (ed.): *The Early Linear Pottery Culture in Eastern Slovakia*. Kraków 1997, 5–6.
- Lengyel 2018 G. Lengyel: Lithic analysis of the Middle and Late Upper Pleistocene in Hungary. *Folia Quaternaria* 86, 2018, 5–157.
- Lexa/Kaličiak 2000 J. Lexa/M. Kaličiak: Geotectonic aspects of the Neogene volcanism in Eastern Slovakia. *Mineralia Slovaca* 32, 2000, 205–210.
- Mester ed. 2013 Zs. Mester (ed.): *The lithic raw material sources and interregional human contacts in the Northern Carpathian regions*. Kraków – Budapest 2013.
- Mišík 1969 M. Mišík: Petrografická príslušnosť silicítov z paleolitických a neolitických artefaktov Slovenska. *Acta geologica et geographica. Universitatis Comenianae. Geologica* 18, 1969, 117–135.
- Mišík 1975 M. Mišík: Petrograficko-mikropaleontologické kritériá pre zisťovanie proveniencie silicítových nástrojov na Slovensku. *Folia Facultatis Scientiarum Naturalium Universitatis Purkynianae Brunensis* 16. *Geologia* 27/10, 1975, 89–107.
- Nemergut 2010 A. Nemergut: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bárta z rokov 1963 a 1990. *Slovenská archeológia* 58, 2010, 183–206.
- Nemergut/Cheben M. 2019 A. Nemergut/M. Cheben: Unique grinded obsidian finds from Eneolithic site at Nitra-Selenec. In: A. Markó/K. Szilágyi/K. T. Biró (eds.): *International Obsidian Conference: Program Abstracts Field Guide*. Budapest 2019, 47.
- Nemergut/Cheben M./Gregor 2012 A. Nemergut/M. Cheben/M. Gregor: Lithic raw material use at the Palaeolithic site of Moravany nad Váhom-Dlhá. *Anthropologie* 50, 2012, 379–390.
- Novák 2002 M. Novák: Gravettianske osídlenie spodnej vrstvy Kašova I. *Slovenská archeológia* 50, 2002, 1–52.
- Nowak 2015 M. Nowak: Absolute chronology of the settlement of the Eastern Linear Pottery culture at Moravany. In: J. K. Kozłowski/M. Nowak/M. Vizdal (eds.): *Early farmers of the Eastern Linear Pottery culture at Moravany*. Kraków 2015, 215–234.
- Pátor 1962 J. Pátor: Pohrebisko z počiatkov doby bronzovej na východnom Slovensku. *Nové obzory* 4, 1962, 37–51.
- Pátor 1969 J. Pátor: *Košické pohrebisko*. Košice 1969.
- Polla 1964 B. Polla: Neolitické a eneolitické nálezy v Strede nad Bodrogom. *Sborník SNM* 58. *História* 4, 1964, 97–116.
- Polla 1996 B. Polla: *Archeológia na Slovensku v minulosti*. Martin 1996.
- Prošek 1959 F. Prošek: Mesolitická obsidiánová industrie ze stanice Barca I. *Archeologické rozhledy* 9, 1959, 145–148, 193.
- Přichystal/Škrdla 2014 A. Přichystal/P. Škrdla: Kde ležel hlavní zdroj obsidiánu v pravěku střední Evropy? *Slovenská archeológia* 62, 2014, 215–226.
- Repčok 1977 I. Repčok: Stopy delenia uránu a možnosti ich využitia pre datovanie na príklade vulkanických skiel. *Západné Karpaty, séria mineralógia, petrografia, geochemia, ložiská* 3, 1977, 175–196.
- Repčok/Kaličiak/Bacsó 1988 I. Repčok/M. Kaličiak/Z. Bacsó: Vek niektorých vulkanitov východného Slovenska určený metódou stôp po štiepení uránu. *Západné Karpaty, séria mineralógia, petrografia, geochemia, ložiská* 11, 1988, 75–88.
- Sobkowiak-Tabaka et al. 2015 I. Sobkowiak-Tabaka/Zs. Kasztovszky/J. Kabačinski/K. T. Biró/B. Maróti/K. Gmeling: Transcarpathian contacts of the Late Glacial societies of the Polish Lowlands. *Przegląd Archeologiczny* 63, 2015, 5–28.
- Soják 1998 M. Soják: Doterajšie výsledky archeologického výskumu na diaľnici v okrese Poprad. In: P. Roth (ed.): *Archeológia v múzeách*. Poprad 1998, 63–82.

- Soják 2002
M. Soják: Osídlenie horného Spiša na sklonku staršej doby kamennej. In: J. Gancarski (ed.): *Starsza i środkowa epoka kamienia w Karpatach polskich*. Krosno 2002, 255–278.
- Svoboda et al. 2000
J. Svoboda/B. Klíma/L. Jarošová/P. Škrdla: The Gravettian in Moravia: climate, behaviour and technological complexity. In: W. Roebroeks/M. Mussil/J. Svoboda/K. Fennema (eds.): *Hunters of the Golden Age. The Mid Upper Palaeolithic of Eurasia 30,000–20,000 BP*. Leiden 2000, 197–217.
- Svoboda/Novák 2004
J. A. Svoboda/M. Novák: Eastern Central Europe after the Upper pleniglacial: changing points of observation. *Archäologisches Korrespondenzblatt* 34, 2004, 463–477.
- Szeliga 2002
M. Szeliga: Stań badań nad napływem obsydianu na ziemiach polskich w starszej i środkowej epoce kamienia (na tle znalezisk środkowoeuropejskich). In: J. Gancarski (ed.): *Starsza i środkowa epoka kamienia w karpatach polskich*. Krosno 2002, 339–357.
- Šalát/Ončáková 1964
J. Šalát/P. Ončáková: *Perlity, ich výskyt, petrochémiá a praktické použitie*. Bratislava 1964.
- Šiška 1964
S. Šiška: Pohrebisko tiszapolgárskej kultúry v Tibave. *Slovenská archeológia* 12, 1964, 293–356.
- Šiška 1979
S. Šiška: Die Bükker Kultur in der Ostslowakischen Tiefebene. *Slovenská archeológia* 27, 1979, 245–290.
- Šiška 1989
S. Šiška: *Kultúra s východnou lineárnou keramikou na Slovensku*. Bratislava 1989.
- Šiška 1991a
S. Šiška: Zisťovací výskum v okolí solných prameňov v Soli. *AVANS* 1989, Nitra 1991, 98–99.
- Šiška 1991b
S. Šiška: Keramika a datovanie neolitickej dielne v Kašove. *Východoslovenský pravek* 3, 1991, 69–74.
- Šiška 1998
S. Šiška: Obsidián v prostredí spoločenstiev doby kamennej na strednom a západnom Slovensku (Súpis nálezísk). *Východoslovenský pravek* 5, 1998, 63–90.
- Valde-Nowak 2003
P. Valde-Nowak: Archaeology. In: P. Valde-Nowak/A. Nadachowski/T. Madeyska (eds.): *Oblazowa cave. Human activity, stratigraphy and palaeoenvironments*. Kraków 2003, 23–80.
- Valde-Nowak 2008
P. Valde-Nowak: Paleolityczne zabytki ze stanowiska Marhań, okr. Bardejov (Słowacja). In: J. Machnik (ed.): *Archeologia i środowisko naturalne Beskidu niskiego w Karpatach. Część II. Kurimská brázda*. Kraków 2008, 139–156.
- Valde-Nowak/Soják 2010
P. Valde-Nowak/M. Soják: Contribution to the Mesolithic in the Slovak Carpathians. *Slovenská archeológia* 58, 2010, 1–12.
- Valde-Nowak/Soják/Wąs 2007
P. Valde-Nowak/M. Soják/M. Wąs: On the problems of the Late Paleolithic settlement in Northern Slovakia. Example of Stará Ľubovňa site. *Slovenská archeológia* 55, 2007, 1–22.
- Valde-Nowak et al. eds. 2018
P. Valde-Nowak/K. Sobczyk/M. Nowak/J. Żrałka (eds.): *Multas Per Gentes et Multa per Saecula*. Kraków 2018.
- Verpoorte 2002
A. Verpoorte: Radiocarbon dating the Upper Palaeolithic of Slovakia: results, problems and prospects. *Archäologisches Korrespondenzblatt* 32, 2002, 311–325.
- Vizdal 1973
J. Vizdal: *Zemplín v mladšej dobe kamennej*. Košice 1973.
- Vizdal 1977
J. Vizdal: *Tiszapolgárske pohrebisko vo Veľkých Raškovciach*. Košice 1977.
- Vizdal 1980
J. Vizdal: *Potiská kultúra na Slovensku*. Košice 1980.
- Vlačíky et al. 2013
M. Vlačíky/T. Michalík/M. Nývltová Fišáková/D. Nývlt/M. Moravcová/M. Králík/J. Kovanda/K. Péková/A. Přichystal/A. Dohnalová: Gravettian Occupation of the Beckov Gate in Western Slovakia as Viewed from Interdisciplinary Research of the Trenčianske Bohuslavice – Pod Tureckom Site. *Quaternary International* 294, 2013, 41–60.
DOI: <https://doi.org/10.1016/j.quaint.2011.09.004>
- Voľanská 2016
A. Voľanská: Leaf Point finds from Zemplín Hills Area, Eastern Slovakia. *Litium* 4, 2016, 9–18.
- Wilczyński 2009
J. Wilczyński: Targowisko – a new Late Glacial site in Southern Poland. *Eurasian Prehistory* 6, 2009, 95–118.
- Wilczyński et al. 2020
J. Wilczyński/O. Žaár/A. Nemergut/B. Kufel-Diakowska/M. Moskal-del Hoyo/P. Mroczek/B. Páll-Gergely/T. Oberc/G. Lengyel: The Upper Palaeolithic at Trenčianske Bohuslavice, Western Carpathians, Slovakia. *Journal of Field Archaeology* 45, 2020, 270–292.
DOI: <https://doi.org/10.1080/00934690.2020.1733334>
- Williams Thorpe/Warren/Nandris 1984
O. Williams-Thorpe/S. E. Warren/J. G. Nandris: The distribution and provenance of archaeological obsidian in Central and Eastern Europe. *Journal of Archaeological Sciences* 11, 1984, 183–212.
- Žaár 2007
O. Žaár: *Gravettienska stanica Trenčianskych Bohuslaviciach*. MA. Thesis. Constantine the Philosopher University in Nitra. Faculty of Arts. Nitra 2007. Unpublished.

Využitie obsidiánu v praveku Slovenska

Lubomíra Kaminská

Súhrn

Obsidián z okolia Zemplínskych vrchov pochádza z primárnych (Viničky) a sekundárnych zdrojov (Brehov a Cejkov). Vo Viničkách sú primárne zdroje obsidiánu z dvoch fáz ryolitového vulkanizmu. Staršiu fázu predstavujú perlitové brekie s obsidiánom v podloží ryolitového 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 perlitickým vývojom, zistená v podloží andezitového telesa Veľký vrch, severne od Brehova. Z nej mohli byť obsidiány vyvetrávané a transportované do sekundárnych polôh v okolí, kde sú prekryté viatymi pieskami alebo ílom. Zistené boli v polohe Brehov-Za alejou (Brehov 2) a v polohe Cejkov-Žihľavník. Predstavujú hlavný zdroj suroviny na výrobu obsidiánovej industrie na paleolitických až eneolitických lokalitách.

Obsidián bol najviac využívaný kultúrami, ktoré sídlili na východnom Slovensku v blízkosti jeho zdrojov. V paleolite, v aurignacienskej kultúre, bol obsidián používaný len okrajovo a pochádzal pravdepodobne z maďarských zdrojov. Oveľa väčšie zastúpenie mal obsidián v industriách gravettien a epigravettien, najmä na lokalitách v blízkosti Zemplínskych zdrojov. Sporadicky sa vyskytol aj na západnom Slovensku (Trenčianske Bohuslavice, Nitra I-Čermáň, Nitra III). Na Spiši sa obsidián objavuje v kultúre šwiderien a v iných neskoropaleolitických a mezolitických kultúrach. V Košiciach-Barci bola mezolitická industria štiepaná len z obsidiánu.

V neolite dosiahol najväčšiu prevahu v kultúre s východnou lineárnou keramikou na Východoslovenskej nížine, menej v Košickej kotline. V bukovohorskej kultúre prevažoval na lokalitách Východoslovenskej nížiny aj v Košickej kotline. V ostatných častiach Slovenska sa obsidián najviac rozšíril počas trvania železovskej skupiny a lengyelskej kultúry.

Na konci neolitu (skupina Csöszhalom-Čičarovce) a na začiatku eneolitu (tiszapolgárska kultúra) sa obsidiánové artefakty častejšie vyskytli na sídliskách ako v hroboch. Čiastočné používanie obsidiánu pretrvalo na východnom Slovensku až do staršej doby bronzovej (koštianska a otomanská kultúra).

Obr. 1. Mapa okolia Zemplínskych vrchov s autochtónnymi a alochtónnymi zdrojmi obsidiánu, s lokalitami z paleolitu a neolitu. Alochtónne zdroje z Brehova a Cejkova: 1 – Cejkov-Žihľavník; 2 – Brehov-Za alejou (Brehov 2).

Obr. 2. Panoramatický pohľad od juhozápadnej strany na lávový prúd ryolitového telesa Borsuk pri obci Viničky so zdrojmi obsidiánu a perlitov, vrátane vinných pivníc vinárstva Tokaj Viničky; 1–3 – zdroje obsidiánov. Pohľad z juhovýchodu (foto P. Bačo, podľa Bačo et al. 2017).

Obr. 3. Výsledky izotopového datovania vulkanických skiel v oblasti Zemplínskych vrchov zoskupené podľa lokalít a typu výskytu (podľa Bačo et al. 2017).

Obr. 4. Obsidiánové hľuzy so skulptúrou. A – epigravettienka 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. Hrčef-Pivničky. Obsidiánové nástroje a jadrá z epigravettienkej lokality (foto A. Marková).

Obr. 7. Košice-Barca I. Mezolitická štiepaná industria z obsidiánu (foto A. Marková).

Obr. 8. Košice-Galgovec III, objekt 9/97. Kultúra s východnou lineárnou keramikou, skupina Tiszadob (foto A. Marková).

Obr. 9. Kašov-Čepegov I. Jadrá na čepele z obsidiánu. Bukovohorská kultúra (podľa Bánesz 1991, upravené).

doc. PhDr. Lubomíra Kaminská, DrSc.

Archeologický ústav SAV

Oddelenie pre výskum východného Slovenska

Hrnčiarska 13

SK – 040 01 Košice

kaminska@saske.sk