ANTHROPOLOGIE • L/4 • pp. 379–390 • 2012

ADRIÁN NEMERGUT, MICHAL CHEBEN, MILOŠ GREGOR

LITHIC RAW MATERIAL USE AT THE PALAEOLITHIC SITE OF MORAVANY NAD VÁHOM-DLHÁ

ABSTRACT: The study of raw material distribution is a very important tool for understanding the economy and mobility of Palaeolithic hunters and gatherers. The aim is to determine the raw material used in production of the lithic industry from the Szeletian site in Moravany nad Váhom-Dlhá, and to create a distribution model of the raw materials. A total of 9821 artefacts from L. Zotz's and J. Bárta's excavations were analysed. All stone artefacts described petrographically were studied technologically. These artefacts were mainly produced from local radiolarite (90%), with less from local quartz, chert, siliceous sandstones, siliceous siltstones and quartz arenite, and supplemened by regional limnosilicite and chalcedony. The raw material spectrum is enlarged by isolated implements from exotic obsidian and felsitic metarhyolite.

KEY WORDS: Szeletian – Lithic raw materials – Model of distribution, Moravany nad Váhom-Dlhá site – Slovak Republic

INTRODUCTION

In connection with Palaeolithic societies, raw material provenance research is crucial in investigating how man interacts with his environment and other human communities. The main issue of studies in this area is related to the identification of lithic raw material sources. Over the past decades, studies based on raw material characterization of Szeletian assemblages have been more active at Moravia (Nerudová 1997, 2009, Oliva 1992, Svoboda, Přichystal 1987, Valoch *et al*. 1993), and also in Hungary (Markó *et al*. 2003, Ringer, Mester 2000, Simán 1986). Although the strategy of raw material utilization in these regions showed a preference for local raw materials, occasionally some of the Szeletian assemblages contain exotic raw materials. For example, the raw materials from Hungarian primary sources were recognised in some of the Moravian assemblages (Nerudová 1997: 85). The raw material composition of Slovak Szeletian assemblages were often

Received 22 February 2013; accepted 10 June 2013.

previously analysed in the form of preliminary reports without statistical evaluation (Bárta 1960, 1962, 1967, 1970, 1979, Mišík 1975, Prošek 1953, Zotz 1951). Even the collection of stone artefacts from the most important Szeletian site in Moravany nad Váhom-Dlhá was not thoroughly analysed. A lithic industry with a large number of Moravany-Dlhá-type leaf points was observed during archaeological excavations in the last century. Results from all excavations were not fully published (Bárta 1960, 1967, 1970, Nerudová, Valoch 2010, Zotz 1951), and they contained only rare information of raw material composition of stone artefacts (Bárta 1960, 1979, Mišík 1975, Zotz 1951). This prompted our analysis of the assemblage from the Moravany nad Váhom-Dlhá site.

The research goals of this study are to determine the raw material used in the stone implements from collections stored in the Archaeological Institute of Slovak Academy of Sciences depository, and to create a distribution model of used raw materials.

THE MORAVANY NAD VÁHOM-DLHÁ SITE

Site location

The Moravany nad Váhom-Dlhá site is located on the left bank of the Váh River, on the south-western slope of the Považský Inovec Mts. in western Slovakia (*Figure 1*). The Považský Inovec Mts. belong to the Tatra-Fatra Belt of core mountains with granitic core and cover units which includes Permian quartzites and quartzitic sandstones (Hromada 2000: 32). Approximately 2 km wide plateau with gentle slopes covered by Pleistocene loess layers exists between the Váh valley and the Považský Inovec ridge (Hynie 1927: 622). The Moravany nad Váhom-Dlhá site lies on a slight northern

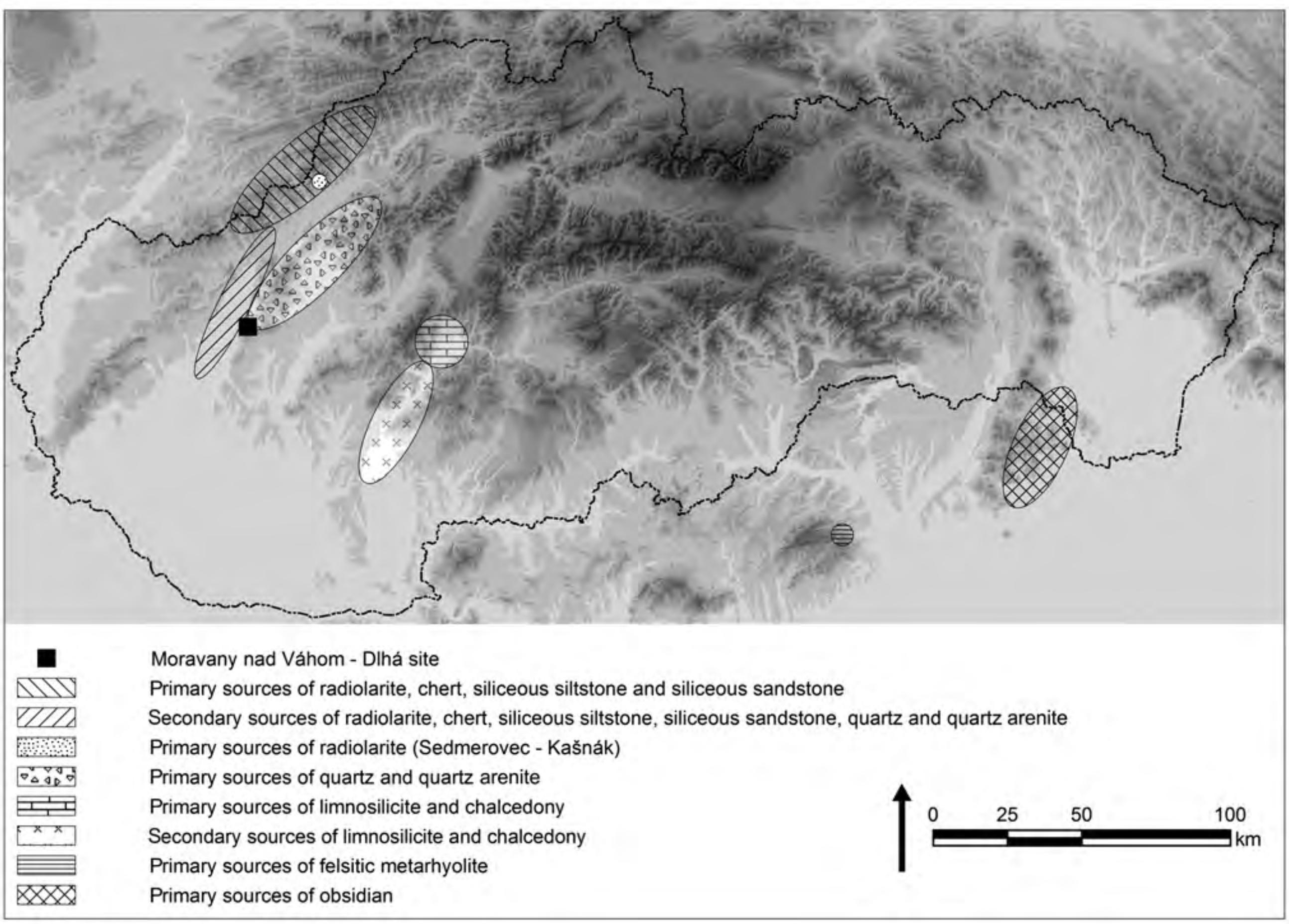

FIGURE 1. Sources of raw materials used on the Moravany nad Váhom-Dlhá site.

slope to the Váh River valley at an altitude of 330 m, and its distance from the current Váh River is less than 3 km. The site is also less than 2 km from the nearest brook, named Striebornica.

Research history

The first systematic excavation at the site was carried out by L. Zotz who uncovered lithic assemblage with approximately 200 leaf points (Zotz 1951: 181). Next excavations performed by K. Absolon in 1946 were later reported by Z. Nerudová and K. Valoch (2010). However, the precise location of the trenches in both excavations remains unknown. Although excavations to determine lithic assemblages were made by J. Bárta in 1963 and 1990, only preliminary reports were published (Bárta 1967, 1970). Excavation continued in 2008 with several new trenches, but few artefacts were found in intact deposits from which soil micro-morphological analytic samples were possible (Kaminská *et al.* 2011a: 39). The last excavation occurred in 2012. During a few days excavation, we attempted to locate the exact position of the trenches of the previous excavations and also to collect organic samples for subsequent dating. Unfortunately, no organic samples were available.

Stratigraphy and dating

Based on documentation from J. Bárta's excavation, the artefacts were contained in two layers (Nemergut 2010: Obr. 4). He defined the first layer under the holocene soil as fossil soil, and the second light-yellow loess layer contained additional artefacts (Bárta 1970: 39). Artefacts were found only in trench III/2008 in the 2008 excavation (Kaminská *et al.* 2011b: 122), and the stratigraphic sequence in this trench is described as follows: Holocene soil (0–25 cm), B soil horizon (25–70 cm), and a light-brown loess layer between 75 and 110 cm. The artefacts lay at a depth of 50 cm (Kaminská *et al.* 2011a: 40).

The AMS dating of a fragment of *Picea* sp./*Larix* sp. from L. Zotz's 1943 excavation was 33,600 ± 300 (Poz-29011), while CalPal and Hulu-2007 calibration set it at 39,000 years BP (Kaminská *et al.* 2011a: 40).

THE LITHIC RAW MATERIALS AT MORAVANY NAD VÁHOM-DLHÁ SITE

The studied assemblage consists of 9821 stone artefacts from the depository of the Archaeological Institute of the Slovak Academy of Science. The stone artefacts of Moravany nad Váhom-Dlhá site rest in few institutions. There are three collections in the depository of the Archaeological Institute of the Slovak Academy of Science. Two of these containing 5026 recently analysed artefacts are from J. Bárta's excavations (Nemergut 2010), while the third, comprising the remaining 4795 unanalysed artefacts, is from L. Zotz's excavation. In addition, while part of L. Zotz's collection is missing (Bárta 1960: 299, Nerudová, Valoch 2010: 11), there is a further collection of lithic industry housed in the Piešťany muzeum. This latter collection was partly published by J. Bárta (1960).

The distribution model of our study was created based on petrographic characterisation of the archaeological lithic assemblages. Artefacts were initially analysed macroscopically and problematic samples were examined under a polarising microscope. These samples did not show any characteristic signs in stereomicroscope (fossils, mineral inclusions, textures) which could be used for better determination of studied raw material. Colour, lustre or the texture at higher magnifications did not resemble any know type of siliceous rocks. All suspicious samples are artefacts, therefore it was not possible to make thin section from them for better mineralogical and petrographic characterisation. The assemblage was divided into two parts: the chipped stone industry comprised 9646 artefacts while the heavy stone industry contained 175 artefacts. The chipped stone artefacts were studied and allocated technological categories in the following production sequence: cores, blades, flakes and production waste consisting of small flakes, unspecified fragments of blades and flakes, unspecified knapped pieces and burin spalls. These were followed by partly retouched artefacts and retouched tools. The heavy stone industrial artefacts were divided into pebbles and fragments, blocks and fragments and worked stones and dye.

Chipped stone industry

J. Bárta's excavations yielded a collection of 5012 chipped stone artefacts, of which 4680 emanate from the 1963 excavation and the remaining 332 are from the 1990 excavation. Meanwhile, the lithic assemblage from L. Zotz's excavation contained 4634 artefacts, and slight differences in the percentage of some technological groups were discovered when these collections were compared. While production wastes strongly dominate J. Bárta's collections, the flakes group were paramount in that of L. Zotz's. In addition, a higher proportion of cores and retouched tools were identified in L. Zotz's assemblage compared to those of J. Bárta. These differences are most likely related to their different

TABLE 1. The relation between raw materials and major technological groups of the chipped stone industry.

	Radiolarite	Quartz	Chert	Radiolarite from Sedmerovec – Kašnák	Siliceous sandstone	Siliceous siltstone	Quartzite	Burnt	Limnosilicite	Chalcedony	Obsidian	Felsitic metarhyolite	Other	Total	%
Cores	218	28	7	4	2		5		2	1				267	2.8
Blades	507	7	8	6	3	3			2		4			540	5.6
Flakes	3730	157	52	39	30	8	7	7	6		14			4050	42.0
Waste	3887	254	53	38	9	6	6	5	3		17			4278	44.3
Partially retouched	153		1	1		1			1					157	1.6
Retouched tools	321	3	4	13	2	4			3			2	2	354	3.7
Total	8816	449	125	101	46	22	18	12	17	1	35	2	2	9646	100.0
%	91.4	4.7	1.3	1.0	0.5	0.2	0.2	0.1	0.1	0.0	0.4	0.0	0.0	100.0	

excavations methods. However, since raw materials are the most important components of this study, these assemblages were merged together (*Table 1*).

Radiolarite

The dominant raw material in the chipped stone artefacts is radiolarite, with 8816 samples of different colours. In order of occurrence, the colours are prevailing reddish-brown followed by brown, greyish-green, yellow and combinations of different colours (*Figures 2:6, 8, 10*). This order was identified in all technological groups (*Table 1*). The primary sources of radiolarite are located in the Pieniny Klippen Belt (*Figure 1*; Mišík 1975: 97). A field survey was carried out over the past ten years, and this focused on the primary sources of raw materials in the central part of the Biele Karpaty Mts. (The White Carpathians), between Vršatské Podhradie and the Vlára River basin (Cheben, Cheben 2010). Here, although the radiolarite contains the same basic rock types seen in the Pieniny Klippen Belt (*Figure 3:A*), there is also a mustard-yellow coloured radiolarite (*Figures 2:6, 3:B*) which does not correspond to the most common radiolarite of the Vršatské Podhradie type (Přichystal 2009: 108). The primary sources of this type of radiolarite are most likely situated around the township of Nové Mesto nad Váhom in the Biele Karpaty Mts., but these outcrops have not been currently documented. They were not studied properly in the past, also the mineralogical or petrographic analysis of this type of radiolarite were not performed. The presence of the radiolarite pebble cortex (*Figures 2:16, 17*) indicates a collection of the raw material in the nearby gravel sediments of the Váh River (*Figure 1*).

A specific colour variety was identified in 101 samples of radiolarite in the chipped stone industry collection. This was discovered in an outcrop of limestones in the Pieniny Klippen Belt in the Biele Karpaty Mts., at the Sedmerovec – Kašnák site adjacent to Sedmerovec village (Cheben, Cheben 2010: 19, Schreiber 2009: 47). From a geological viewpoint, this radiolarite is connected with the Drietoma Formation (Mello *et al.* 2005). It has a combination of yellow, brown-yellow, grey and dark grey colours, and no other similar outcrops were discovered in the region (*Figure 2:7*). The radiolarites occur as nodules, with the specific characteristic of the radiolarite core passing to a yellow coloured hornstone or limestone cover. Close examination under higher stereomicroscopic magnification revealed the presence of sponge spicules and very occasionally also radiolarian indications in a grey siliceous matrix (*Figure 3:C*). Here, detailed mineralogical and petrographical analysis was performed to differentiate artefact cores, blades, flakes, production waste, partly retouched artefacts and retouched tools. Although the Sedmerovec – Kašnák site is most likely the primary source of this radiolarite, the raw material and very rare pebble cortex emanate from the secondary sources of gravel sediments in the Váh River. In addition, prehistoric mining of this radiolarite was recognized during our field investigations (Cheben, Cheben 2010: 19, Schreiber 2009: 47).

The study of this lithic collection also uncovered a different type of radiolarite, described by Polish archaeologists as flysch radiolarite (Valde-Nowak 2009:

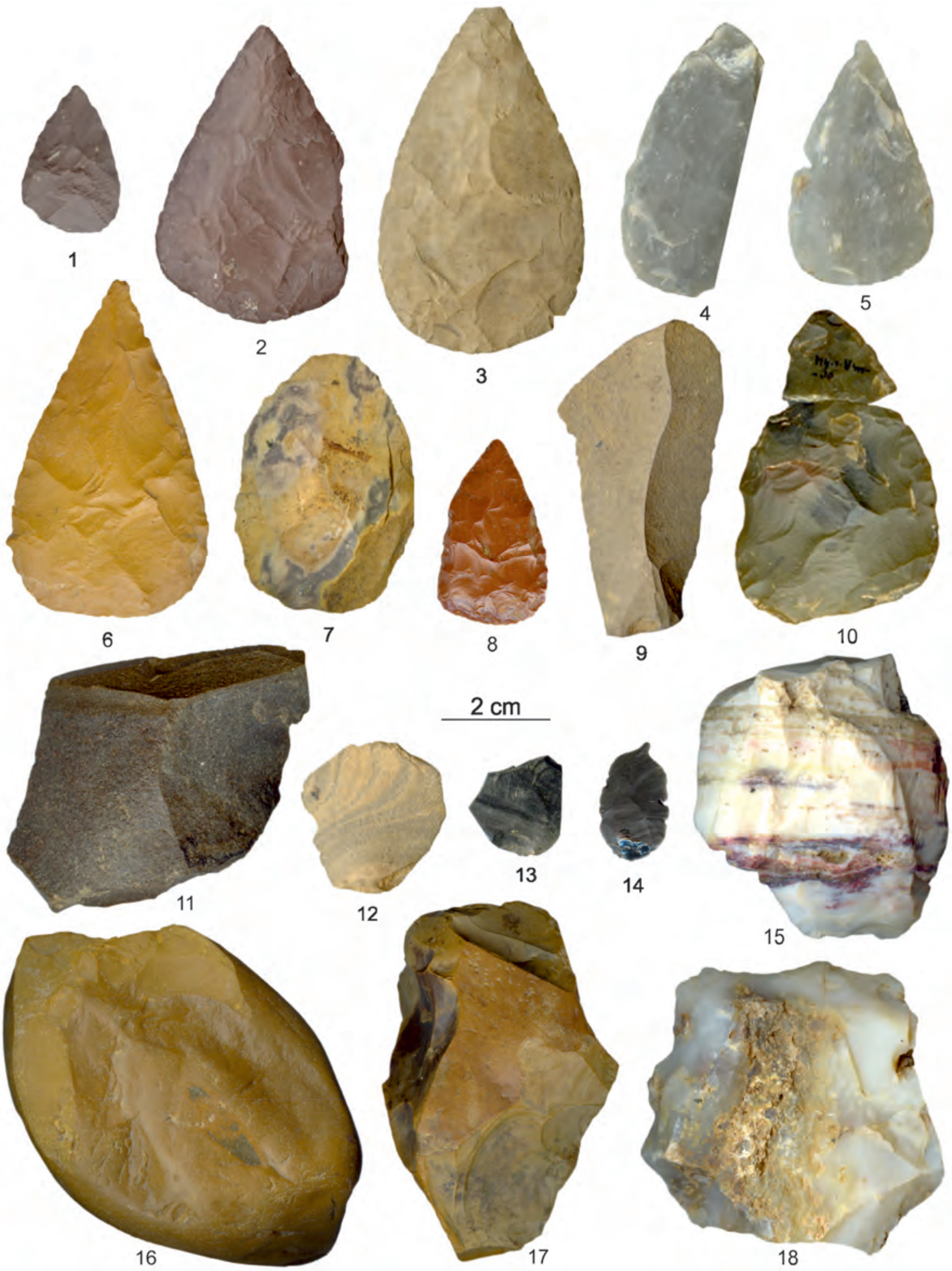

FIGURE 2. Moravany nad Váhom-Dlhá. Selection of various raw materials. 1, 2, other; 3, siliceous siltstone; 4, 5, felsitic metarhyolite; 6, 8, 10, 16, 17, radiolarite; 7, radiolarite from Sedmerovec – Kašnák; 9, 11, 12, siliceous sandstone; 13, 14, obsidian; 15, chalcedony; 18, limnosilicite.

125). Its primary sources are located in southern Poland, in the Polish Carpathians (Valde-Nowak 2009: 125), and it possesses a typical steel-green colour and a light brown cortex. This radiolarite was also collected from secondary river gravel sediment sources, and it was initially described in Slovakia at the Palaeolithic site in Stará Ľubovňa – Pod Štokom (Valde-Nowak *et al.* 2007). Since this type of radiolarite also occurred in the Moravany nad Váhom-Dlhá collections, we presume it comes from the secondary sources of gravel sediments in the Váh River, following transportation from its most likely primary sources in the Pieniny Klippen Belt.

Chert

A total of 125 samples of chert artefacts were identified, and these were spread throughout all technological groups (*Table 1*). Chert is a fine-grained silica-rich microcrystalline or cryptocrystalline sedimentary rock which can contain fossils. Although it varies greatly in colour, it is most often gray, grayish brown or light green to rusty red. It has a characteristic conchoidal break which makes this sedimentary rock a perfect material for the chipped industry. Chert usually occurs in irregular nodules in limestones, and also occasionally in dolostones. The primary sources of this raw material are connected with limestone and dolostone formations in the Pieniny Klippen Belts, and also to the Mesozoic sequences in the Tatricum crystalline basement. An example of this latter basement is found in the Považský Inovec Mts. (Mahel' 1986).

Siliceous sandstone

A total of 46 samples of different coloured siliceous sandstone (*Figures 2:9, 11, 12*) were also identified in the chipped stone industry as cores, blades, flakes, production waste and retouched tools. Some of these artefacts are composed of fine laminated siliceous sandstone, with clearly observable yellow and grey layers (*Figure 2:12*). The primary sources are connected with Flysch zone sediments of the Biele Karpaty Mts., with the raw material at the Moravany nad Váhom-Dlhá site most likely emanating from secondary sources in the gravel sediments of the Váh River (*Figure 1*).

Siliceous siltstone

In addition, the artefacts included 22 samples of compact and fine grained sedimentary siliceous siltstone rock. This raw material was present in all technological groups (*Table 1*), and although it can easily be confused with radiolarite, closer inspection under higher magnification and in thin section confirms the typical texture of clastic sedimentary rock (*Figure 3:D*). Radiolarian indications are missing from this sedimentary rock. Primary sources are connected with Flysch zone sediments of the Biele Karpaty Mts. (Fusán 1972: 112, Přichystal 2009: 121, 124), while pebble surface relics indicate that the raw material originates from the terraces of the Váh River (*Figure 1*).

Quartz

Massive and milky quartz provided a low quality raw material for chipped stone artefact production in this collection. Here, it was occasionally difficult to differentiate which fragments were products of knapping and which were coarse stones. The quartz chipped industry included 449 samples of cores, blades, flakes, production waste and some questionable retouched tools. Most samples correspond to the quartz-feldspar-muscovite zone of granitic pegmatite (Uher, Ozdín 2011: 131). Quartz artefacts generally have a milky colour, but occasionally they are brown or reddish from iron oxides or hydroxides. Quartz is not transparent even on its edges or in small chips, and its raw composition is either in small blocks or often in cracked elements. There is a large quantity of quartz from pegmatite, but its quality is quite low. Since coarse crystalline quartz is often cracked, the use of this raw material for stone tools is quite limited. The parent pegmatite outcrop is situated near the archaeological excavations at Moravany nad Váhom-Striebornica (*Figure 1*), and the pebble cortex presence indicates that this raw material most likely came from gravel sediments of the Váh River.

Quartz arenite

Quartz arenite is a clastic sedimentary rock composed of more than 90% detrital quartz. Similar to quartz, this raw material is a low quality material for producing chipped stone artefacts, and here it supplied only 18 samples, including cores, blades and flakes. Its colour is often milky or greyish, but occasionally it exhibits the rusty red colour of iron oxides and hydroxides. This raw material is typical of Mesozoic sedimentary sequences of the Tatric crystalline basement of the lower Triassic unit, as in the Považký Inovec, Tribeč and Malé Karpaty Mts. (Mišík, Jablonský 2000). The raw material used on the Moravany nad Váhom-Dlhá site most likely originated from primary sources in the Považský Inovec Mts., or from secondary sources in the gravel sediments of the Váh River (*Figure 1*).

Limnosilicite

Artefacts made from this specific rock type were present in all technological groups, and are connected with post-volcanic activity of neogene volcanism in Central Slovakia. This raw material corresponds to limnosilicite, and it is also known as limnokvarcit, limnoopalit (Biró 2010: 196), or limnoquartzite (Ciesarik, Planderová 1965). Limnosilicites have great variability in colour, including white, black and a reddish hue (*Figure 3:E*), remnants of fossil flora, especially Typha, are clearly visible at higher magnification, in stereo-microscopic image and also in thin section. The grey milky matrix of these silicites is opaque except on its edges and in thin chips. Small inclusions of iron oxides are occasionally present. Most limnosilicite outcrops are located in the Žiarska kotlina valley, including the well-known localities of Stará Kremnička – Na Kotlišti, Bartošova Lehôtka, Slaská, Lutila, and many others. Artefacts were constructed from this type of rock at the beginning of the 20th century, but they were also used in the Middle Ages and in prehistoric times (Cheben, Illášová 2002, Mišík 1975: 94, Přichystal 2009: 112).

Chalcedony

There is only one core in the analysed collection composed of this quartz- chalcedony microcrystalline structure (*Figure 2:15*). Chalcedony has great variety in colours and textures. It can be distinguished by colour, as in red for carnelian and apple green for chrysoprase, and other tints include brown. The texture can be massive or banded, and here, agates possess concentrical layers of different colours. The raw material of the studied core corresponds to banded chalcedony. The matrix has a milky colour, with thin reddish layers at higher magnification under the stereo-microscope. Small voids with tiny quartz crystals were occasionally observed, while the raw material is opaque except at the edges and in thin chips. Although this mineral is usually bound to volcanic rocks, it can also occur in other geological settings. The closest volcanic rock outcrops are in the Vtáčnik Mts. and the Kremnické vrchy Mts., but the chalcedony could also have been transported with limnosilicites from the Žiarska kotlina valley region which is surrounded by volcanic mountains (Mišík 1975: 101).

Felsitic metarhyolite

Felsitic metarhyolite is an exotic raw material from northern Hungary, and the studied raw material has only two leaf points (*Figures 2:4, 5*). This rock type is one of the most important raw materials from the Hungarian Palaeolithic, and it is also occasionally called "Szeletian" felsitic metarhyolite or porphyry (Kasztovszky *et al.* 2008, Simán 1986). The leaf points made from felsitic metarhyolite exhibit a typical greyish, slightly greenish colour with massive texture. While typical white patination is absent, the raw material is slightly transparent, mainly on the edges of the artefacts. Small colourless crystals, most likely composed of quartz, are visible under higher magnification. The felsitic metarhyolite may come from primary outcrops located at the villages of Bukksszentlászló and Bukkszentkereszt near Miskolc (Kasztovszky *et al.* 2008, Vértes, Tóth 1963). According to K. Simán (1986), only samples from Bukksszentlászló village are resposible for producing the chipped industry. Moreover, the felsitic metarhyolite here is imported from a 200 km distant source (*Figure 1*).

Obsidian

Among the artefacts were 35 pieces of flakes, blades and other unspecified small samples from Carpathian obsidian. No doubt, this raw material is bound to volcanic rocks, especially to rhyolites and their pyroclastic derivates. The obsidian artefacts have a typical black to greyish colour with their perennial fluidal texture and glassy lustre (*Figures 2:13, 14*). This raw material is transparent only at the edges, and characteristic patination was not observed in obsidian from Streda nad Bodrogom. Outcrops of obsidian can be found only in south-eastern Slovakia, especially in the Zemplínske vrchy Mts., and also in north-eastern Hungary in the similar localities of the Tokaj – Zempléni Mts. (Biró, 1984, Thorpe *et al.* 1984). Obsidian raw material in this collection was transported from approximately 285 km distant (*Figure 1*).

Other

Unspecified raw material was identified on two leaf points (*Figures 2:1, 2*). Although the dark violet to dark red colour is very similar to the colour of radiolarites from the Pieniny Klippen Belt, closer examination reveals no circular radiolarian indications or any other fossil organism remnants (*Figure 3:F*). In addition, the siliceous matrix exhibits different characteristics to the radiolarites, as it is massive but completely opaque even on the edges and in thin chips. Their magnetic susceptibility here was $0.26 \cdot 10^{-6}$ SI which indicates a volcanic origin. Future prospecting for the source of this raw material in the Flysch zone is likely to prove rewarding.

Heavy stone industry

The heavy stone industry was also represented in this artefact collection, where quartz blocks and fragments were especially common (*Table 2*). Pebbles with quite

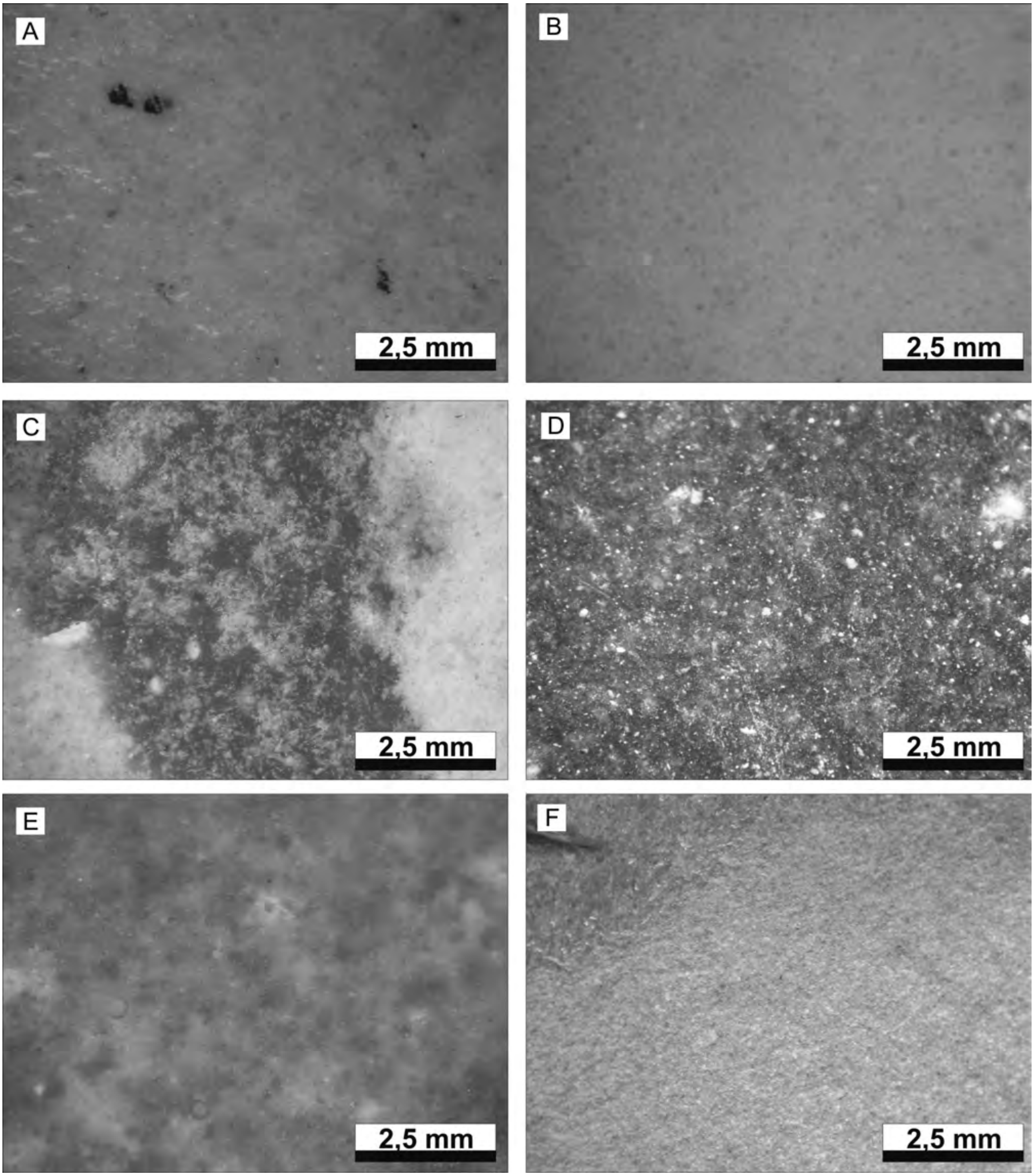

FIGURE 3. Microscopic details of selected raw materials. A, radiolarite of Vršatské Podhradie type; B, mustard-yellow radiolarite; C, radiolarite from Sedmerovec – Kašnák site; D, siliceous siltstone; E, limnosilicite; F, unspecified raw material.

TABLE 2. The relation between raw materials and heavy stone industry.

	Radiolarite	Quartz	Radiolarite from Sedmerovec – Kašnák	Siliceous sandstone	Quartzite	Hematite	Magnetite	Siltstone	Granite	Limestone	Total	%
Pebbles and fragments	28	2	1	2	4			1	1	3	42	24.0
Blocks and fragments		69			20				1		90	51.4
Worked stones								4	1		5	2.9
Dye						31	7				38	21.7
Total	28	71	1	2	24	31	7	5	3	3	175	100.0
%	16.0	40.6	0.6	1.1	13.7	17.7	4.0	2.9	1.7	1.7	100.0	

variable petrographic composition were also frequently found in gravel sediments from the Váh River. Most of these were used as raw material in the chipped stone industry for stone tablets or knapping tools. Judging by their magnetic susceptibility, some samples correspond to iron oxides, while their dark colour and the metallic lustre are reminiscent of magnetite. In addition, although the dark reddish samples with earthy lustre may correspond to hematite, precise mineralogical analysis must be performed to determine the exact mineralogical composition of this specimen.

DISTRIBUTION MODEL

The different categories of raw materials used in the Moravany nad Váhom-Dlhá site delineate the three following distinct scales of supply territories, local resources available within less than 5 km, regional resources within 70 km, and exotic resources over 70 km distant (*Figure 1*).

Most of the artefacts in from the analysed collections were made from radiolarite (91%). The presence of the pebble cortex (*Figures 2:16, 17*) indicates that this raw material type was collected from the nearby local gravel sediments of the Váh River. These pebbles appear an ideal element for production in the chipped stone industry due to the following two factors: (1) the pebble raw materials have high quality, formed by moving from primary to secondary sources. Through natural processes, pieces with the highest quality remain as pebbles while those of less quality are crushed. (2) the shape and size of the pebbles present the easiest option for core preparation. Once a cap was detached, a simple striking platform was formed and used for reduction. Siliceous sandstones and siltstones also form part of local raw materials. These occur as pebbles and they most likely collected in gravel sediments. The raw material spectrum is enlarged by local quartz and quartz arenite with the rare presence of pebbles. From a technological viewpoint, almost all local raw materials were detected in each technological group (*Table 1*), and this demonstrates that knapping took place on-site. The prevailing category represents waste (mainly small flakes, unspecified fragments of blades and flakes and unspecified knapped pieces) followed by flakes, blades and blade fragments, retouched tools, cores including pre-cores, prepared cores, exploited cores (discoidal cores, single-platform cores and cores with changed orientation) and the exhausted cores. The partly retouched artefacts are represented the least of all.

Regional limnosilicite and chalcedony are bound to volcanic rocks of neogene volcanism in central Slovakia, with a minimum distance of 70 km to the east. Their production sequence is difficult to define because of the small number of implements available. Regional raw materials were most likely transported to the site as cores (*Figures 2:15, 18*), or blades and flakes, because of the absence of preparation pieces. Knapping on the site is documented only for limnosilicite. Chalcedony is represented by only one core.

Exotic raw materials are in isolated artefacts created from felsitic metarhyolite and obsidian, at a minimum distance of 200–285 km to the east. Just a few flakes, blades and unspecified fragments were made from obsidian. Only two leaf points from felsitic metarhyolite were present (*Figures 2:4, 5*). The fact that other artefacts were absent indicates that they were not made on-site. This same situation is noted in two additional leaf points which are constructed from raw material with unclear classification. These, also, were most likely transported to the site as retouched tools (*Figures 2:1, 2*).

Although inadequate information on the raw material composition is available and chronological problems were encountered, we are confident in stating that assemblages of other Szeletian sites in the Váh valley have similar composition to the Moravany nad Váhom-Dlhá assemblage. Based on approximately 1000 pieces, the lithic industry in the Ivanovce site was classified as Szeletian by F. Prošek (1953: 142), but this classification has recently been queried by Ľ. Kaminská *et al.* (2008: 218). These artefacts were mainly produced from local radiolarite, with less coming from quartzite and other siliceous rocks and supplemented by a coarse leaf point from flint (Kaminská *et al.* 2011a: 33). The raw material composition of the chipped stone industry from the Trenčianske Teplice-Pliešky site, comprising over 600 pieces, has a predominance of local radiolarite, accompanied by siliceous sandstone and limnosilicite (Kaminská *et al.* 2011a: 40). The smaller collections from excavated sites, such as Vlčkovce (Bárta 1962: 300), or from surface sites such as Trenčianská Turná-Hámre (Kaminská *et al.* 2008: 200), and the Piešťany region (Hromada 2000: 54) show intensive use of local raw materials.

Similar raw material composition has been reported in Moravia. Here, sites were supplied by raw materials from the closest sources containing, for example, Jurassic and Cretaceous hornstones (Oliva 1992: 42). Occasionally, exotic materials have also been recorded. These include felsitic metarhyolite from the Ořechov II, Ondratice I (Nerudová 1997: 85), obsidian from Neslovice I (Oliva 1989) and Hungarian radiolarite from Ořechov II (Nerudová 1997: 84).

Understanding the mobility of Szeletian hunters and gatherers, based on raw materials procurement strategy on the Moravany nad Váhom-Dlhá site carries some difficulties. Generally, we have limited notion of Szeletian community structures, or seasonality which largely relates with the absence of Szeletian site and their contemporaneity. However, the predominance of local raw materials reflects the using of sources close to the site, which could have been exploited easily and efficiently in the course of a few hours movement from the site. On the other side, there are raw materials with sources located far beyond any normal daily movement from the site. These raw materials overcome large territorial movements either by individual hunters and gatherers groups, or possibly some form of exchange relationships with neighbouring groups.

CONCLUSION

The most important results from our study of raw materials at the Szeletian site of Moravany nad Váhom-Dlhá are summarised as follows:

- The stone artefacts were mainly produced from local raw materials, with 99% emanating from the gravel sediments of the Váh River. There was also 0.1% from regional raw materials, most likely obtained from the Žiarska kotlina valley, and 0.4% exotic raw materials from primary sources in south-eastern Slovakia and north-eastern Hungary.
- All local raw materials were transported to the Moravany nad Váhom-Dlhá site as pebbles, with additional regional raw materials consisting of cores and most likely also of blades and flakes. Meanwhile, exotic raw material – felsitic metarhyolite were transported as retouched tools. In the case of exotic obsidian, just few flakes and blades were found.
- Knapping on-site is supported for all local raw materials and regional limnosilicite, while obsidian utilization remains questionable because there were only a few small blades and flakes available for analysis.
- In conclusion, raw material use at the Moravany nad Váhom-Dlhá site appears very similar to that in other Szeletian sites in the Váh valley region and also in Moravia, despite the scarcity of data available on raw material composition and the problems encountered with Szeletian chronology.

ACKNOWLEDGEMENTS

We would like to express our gratitude to Antonín Přichystal for determining of problematic raw material samples. We also would like to express our thanks to Ondrej Žaár, Bibiána Hromadová, to the two anonymous reviewers and the editors for their stimulating comments on the text. This article was elaborated within the frame of grants agency VEGA projects 2/0027/11 and 2/0147/13.

REFERENCES

BÁRTA J., 1960: K problému listovitých hrotov typu Moravany-Dlhá. *Slovenská archeológia* 8: 295–324.

BÁRTA J., 1962: Vlčkovce – sprašový profil a jeho paleolitické industrie. *Slovenská archeológia* 10: 285–318.

BÁRTA J., 1967: Stratigraphische Übersicht der paläolitischen Funde in der Westslowakei. *Quartär* 18: 57–80.

BÁRTA J., 1970: Sídliská zo staršej doby kamennej na okolí Moravian nad Váhom. *Almanach Balneologického múzea v Pieštanoch:* 31–40.

BÁRTA J., 1979: K problematike proveniencie surovín na výrobu štiepanej kamennej industrie v paleolite Slovenska. *Slovenská archeológia* 27: 5–15.

BIRÓ K. T., 1984: Distribution of obsidian from the Carpathian sources on Central European Palaeolithic and Mosilithic sites. *Acta Archaeologica Carphatica* 23: 5–42.

BIRÓ K. T., 2010: Terminological practice for siliceous rocks in Hungary from petroarchaeological point of view. *Archeometriai Műhely* 7, 3: 195–202.

CIESARIK M., PLANDEROVÁ E., 1965: Geologická pozícia limnokvarcitov ložiska Stará Kremnička. *Geologické práce, Správy* 35: 87–98.

FUSÁN O., 1972: Geológia. In: *Slovensko 2: Príroda.* Pp. 19–123. Obzor, Bratislava.

HROMADA J., 2000: *Moravany nad Váhom. Táboriská lovcov mamutov na Považí.* Slovenská Akadémia Vied, Archeologický Ústav, Bratislava.

HYNIE O., 1927: Geologická stavba širšího okolí lázní Piešťan a jejich thermální žřídla. In: *Sborník státního geologického ústavu Československé republiky, svazek VII*. Pp. 619–650. Státní geologický ústav Československé republiky, Praha.

CHEBEN I., CHEBEN M., 2010: Research on radiolarites of the White Carpathian Klippen Belt. *Slovenská archeológia* 58, 1: 13–52.

CHEBEN I., ILÁŠOVÁ Ľ., 2002: Chipped industry made of limnoquarzite from Žiarska kotlina hollow. In: I. Cheben, I. Kuzma (Eds.): *Otázky neolitu a eneolitu našich krajín 2001*. Pp. 105–112. Slovenská Akadémia Vied, Archeologický Ústav, Nitra.

KAMINSKÁ Ľ., KOZŁOWSKI J. K., SOBCZYK J., SVOBODA J., MICHALÍK T., 2008: Štruktúra osídlenia mikroregiónu Trenčína v strednom a mladom paleolite. *Slovenská archeológia* 56, 2: 179–238.

KAMINSKÁ Ľ., KOZŁOWSKI J. K., ŠKRDLA P., 2011a: New approach to the Szeletian – Chronology and cultural variability. *Eurasian Prehistory* 8, 1–2: 29–49.

KAMINSKÁ Ľ., NEMERGUT A., ŽAÁR O., 2011b: Prieskum stredného Považia. *AVANS 2008*: 122–124.

KASZTOVSZKY Z., BIRÓ K. T., MARKÓ A., DOBOSI V., 2008: Cold neutron prompt gamma activation analysis-a non-destructive method for characterization of high silica content chipped stone tools and raw materials. *Archeometry* 50, 12–29.

MAHEĽ M., 1986: *Geologická stavba Československých karpát I.* Slovenská akadémia vied, Bratislava.

MARKÓ A., BIRÓ K., KASZTOVSZKY Z., 2003: Szeletian felsitic porphyry: non-destructive analysis of a classical Palaeolithic raw material. *Acta Archeologica Academiae Scientiarum Hungaricae* 54: 297–314.

MELLO J., BOOROVÁ D., BUČEK S., FILO I., FORDINÁL K., HAVRILA M., IGLÁROVÁ Ľ., KUBEŠ P., LIŠČÁK P., MAGLAY J., MARCIN D., NAGY A., POTFAJ M., RAKÚS M., RAPANT S., REMŠÍ A., SALAJ J., SIRÁŇOVÁ Z., TEŤÁK F., ZUBEREC J., ZLINSKÁ A., ŽECOVÁ K., 2011: *Vysvetlivky ku geologickej mape stredného Považia.* Štátny geologický ústav Dionýza Štúra, Bratislava.

MIŠÍK M., 1975: Petrograficko-mikropaleontologické kritériá pre zisťovanie proveniencie silicitových nastrojov na Slovensku. In: *Folia Facultatis Scientiarum Naturalium Universitatis Purkynianae Brunensis Tomus 16. Geologica 27.* Pp. 89–107. Univerzita Jana Evangelistu Purkyně, Brno.

MIŠÍK M., JABLONSKÝ J., 2000: Lower Triassic quartzites of Western Carpathians: Transport directions, soursce of clastiscs. *Geologica Carphatica* 51, 4: 251–264.

NEMERGUT A., 2010: Paleolitické osídlenie v Moravanoch nad Váhom-Dlhej. Výsledky výskumov Juraja Bártu z rokov 1963 a 1990. *Slovenská archeológia* 58, 2: 183–206.

NERUDOVÁ Z., 1997: K využití cizích surovin v szeletienu na Moravě. *Acta Musei Moraviae, Sci. Soc*. 82: 79–86.

NERUDOVÁ Z., 2009: Archeologie szeletienské vrstvy 0 z Moravského Krumlova IV. In: P. Neruda, Z. Nerudová (Eds.): *Moravský Krumlov IV. Vícevrstevná lokalita ze středního a počátku mladého paleolitu na Moravě*. Pp. 148–173. Anthropos 29, N. S. 21). Moravian Museum, Brno.

NERUDOVÁ Z., VALOCH K., 2010: *Moravany nad Váhom. Katalog paleolitických industrií z výzkumu prof. Karla Absolona.* Moravské Zemské Muzeum, Brno.

OLIVA M., 1989: Paleolit. In: L. Belcredi (Ed.): *Archeologické lokality a nálezy okresu Brno-venkov*. Pp 8–32. Muzeum Brněnska, Brno.

OLIVA M., 1992: The Szeletian occupation of Moravia, Bohemia and Slovakia. *Acta Musei Moraviae, Sci. Soc*. 77: 35–58.

PROŠEK F., 1953: Szeletien na Slovensku. *Slovenská Archeológia* 1: 133–194.

PŘICHYSTAL A., 2009: *Kamenné suroviny v pravěku východní části střední Evropy.* Masarykova univerzita, Brno.

RINGER Á., MESTER Z., 2000: Résultats de la revision de la grotte Szeleta enterprises en 1999 et 2000. *Anthropologie* 38: 261–270.

SCHREIBER P., 2009: *Štiepaná a hladená industria doby kamennej z oblasti Ilavy až Považskej Bystrice.* Unpublished diploma work. Univerzita Komenského, Bratislava.

SIMÁN K., 1986: Felsitic quartz porphyry. In: K. T. Biró (Ed.): *Papers for the 1st international conference on prehistoric flint mining and lithic raw material identification in the Carphatian Basin, Budapest-Sümeg 1986, Vol. 1*. Pp. 271–275. Magyar Nemzeti Múzeum, Budapest.

SVOBODA J., PŘICHYSTAL A., 1987: Szeletská industrie z Vincencova. *Acta Musei Moraviae, Sci. Soc*. 72: 5–19.

THORPE W. O., WARREN S. E., NANDRIS J. G., 1984: The distribution and provenance of archaeological obsidian in Central and Eastern Europe. *Journal of Archaeological Science* 11: 183–212.

UHER P., OZDÍN D., 2011: Minerálne inklúzie v beryle, živcoch a kremeni z granitového pegmatitu Moravany nad Váhom

– Striebornica (Považský Inovec, západné Slovensko): chemické zloženie a genetické aspekty. *Bulletin mineralogicko-petrologického oddělení Národního muzea v Praze* 19: 130–137.
VALDE-NOWAK P., 2009: Problem rádiolaritu fliszowego w pradziejach. In: J. Gancarski (Ed.): *Surowce naturalne w Karpatach oraz ich wykorzystanie w pradziejach i wczesnym średniowieczu*. Pp. 121–128, Muzeum Podkarpackie, Krosno.
VALDE-NOWAK P., SOJÁK M., WAS M., 2007: On the problems of late paleolithic settlement in northern Slovakia Example of Stará Ľubovňa site. *Slovenská archeológia* 55, 1: 1–22.
VALOCH K., KOČÍ A., MOK W. G., OPRAVIL E., VAN DER PLICHT J., SMOLÍKOVÁ L., WEBER Z., 1993: Vedrovice V, eine Siedlung des Szeletien in Südmähren. *Quartär* 43, 44: 7–93.
VÉRTES L., TÓTH L., 1963: Der Gebrauch des glasigen Quarzporphyrs im Paläolithikum des Bükk-Gebirges. *Acta Archaeologica Academiae Scientiarum Hungaricae* 15: 3–10.
ZOTZ L., 1951: *Alsteinzeitkunde Mitteleuropas.* Ferdinand Enke Verlag, Stuttgart.

Adrián Nemergut
Michal Cheben
Institute of Archaeology
Slovak Academy of Sciences
Akademická 2
949 21 Nitra
Slovak Republic
E-mail: adrian.nemergut@savba.com
E-mail: nraumche@savba.sk

Miloš Gregor
Natural History Museum
Slovak National Museum
Vajanského nábrežie
810 06 Bratislava
Slovak Republic
E-mail: milos.gregor@snm.sk