



## Alkali basalts: raw material of the Neolithic and Aeneolithic implements (Slovakia)

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**Abstract.** On sites within, or adjacent, to the Late Tertiary volcanic province, artefacts of various size and shape and namely of various utilization, made from basalts, were collected in the past. In the Late Tertiary/Quaternary volcanic province two genetical basalt clans (e.g. calc-alkali and alkali) are known to occur. Due to mostly phyrlic (plagioclases up to 10 mm) pattern of the calc-alkali basalts, Neolithic/Aeneolithic stone artefacts producers carefully selected alkali basalts for the subsequent elaboration. Their experience is based on the fact that alkali basalts have only fine-phyric (up to 0,5, very seldom up to 1 mm) pattern. Alkali basalts belong to the local/semilocal raw material type. Mostly secondary deposits (river gravels and slope blocks) have been used for implements construction.

**Key words:** alkali basalts, stone artefacts, Neolithic and Aeneolithic sites, Slovakia

### Introduction

Among several raw material types alkali basalts belong to the less occurring one. For the Carpatho-Pannonian megaunit Late Cenozoic basalts are members of too genetic clans:

- a) calc-alkali, and
- b) alkali (Hovorka, 1978).

– Basalts of alkali series are described as basaltoid-andesites, andesitoid basalts or leucobasalts and represent the most basic members of the CA volcanic series rhyolite – dacite – andesite – andesitoid basalt. In contrast to alkali basalts they are older and their age is high as 8 million years. They have variable contents of main oxides namely  $\text{SiO}_2$  and also variable contents of trace elements. CA basalts are poorer in alkalies.

– Alkali basic efusives in the inner side of the Carpathian Arc and in Pannonian Basin they bear character of alkali olivine basalts with typical Upper Mantle spinel peridotite xenolith and basanites with substantial presence of nepheline.

Basalts are products of the Late Tertiary and Quaternary volcanic activity (Pontian up till Pleistocene), which is known from several central European volcanic provinces.

They occur in the Lower Austria (Burgenland), in Hungary – namely in the Balaton lake area (esp. Tihany peninsula), in southern Slovakia (Novohrad Mts.) and in the Tertiary volcanice province of central Slovakia) and adjacent northern Hungary. Small occurrences in Silesia belong to the Cretaceous teschenite-picrite volcanic province in the Carpathians of the Czech Republic and as well as Poland territories.

### Alkali basalts

Alkali basalts in Slovakia (Fig. 1) are known to occur in central Slovakia (Kalvária in Banská Štiavnica, Putiková vršok by Nová Baňa and massives Karanč and Šiator by Filákov town (Hovorka and Fejdi, 1980).

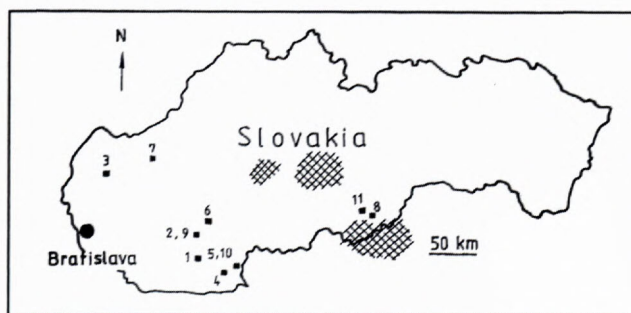


Fig. 1 Map of Slovakia. Archaeological sites (1-11) and area of alkali basalts occurrences in the Western Carpathians - in the central Slovakia and in the southeast Slovakia (by Ivan & Hovorka, 1993, simplified):

1 – Bajč, 2 – Nitriansky Hrádok, 3 – Senica, 4 – Svodín, 5 – Malé Kosičky, 6 – Zlaté Moravce, 7 – Opatovce, 8 – Stránska, 9 – Nitriansky Hrádok, 10 – Malé Kosičky, 11 – Rimavská Sobota

On the territory of Slovakia more than 30 rock types used for production of the tools, weapons and various ornamental or symbolic implements have been described (review see in Hovorka and Illášová, 2000). Artefacts like axes, hammer-axes and wedges made from alkali basalts were present mostly on the archaeological sites adjacent to the central Slovakian young volcanic area. The arte-



Table 1 Archaeological sites with artefacts made from basalts.

## Neolithic

Sites	Artefacts	Culture
Bajč <sup>1</sup>	1 axe	Želiezovská
Nitriansky Hrádok <sup>2</sup>	3 axes and 3 axe-hammers	Lengyel I a II
Senica <sup>3</sup>		
Svodín <sup>4</sup>	15 axe-hammers, 4 axes, 1 hoe, 1 semi-product, 1 base	Lengyel I a II
Malé Kosihy <sup>5</sup>	1 axe-hammer, 1 hammer,	Neolithic
Zlaté Moravce <sup>6</sup>	1 axe-hammer	Neolithic

## Aeneolithic

Sites	Artefacts	Culture
Opatovce <sup>7</sup>	1 axe-hammer	Aeneolithic
Stránska <sup>8</sup>	1 axe	Baden
Nitriansky Hrádok <sup>9</sup>	1 axe, 13 axe-hammers, 1 hoe	Baden
Malé Kosihy <sup>10</sup>	1 axe-hammer	Aeneolithic
Rimavská Sobota <sup>11</sup>	2 axes, 2 axe-hammers	Neolithic / Aeneolithic

## Explanation to Table 1

<sup>1</sup>Bajč - Hovorka, D. & Cheben I., 1997: Raw materials of the Neolithic polished stone artefacts from the site Bajč ( SW Slovakia ). *Min. slovac* 29, 210 – 217.

<sup>2</sup>Nitriansky Hrádok - Illášová L. & Hovorka D., 1999: Typologická a patrografická analýza kamenných artefaktov z Nitrianskeho Hrádku - Zámečka. *Študijné zvesti Archeol. ústavu SAV*, 32, Nitra, 99-185.

<sup>3</sup>Senica - Hovorka D., Cheben I. & Husák L., 2000: Raw materials of Neolithic/Aeneolithic stone implements from sites around Senica (Western Slovakia). *Archeologické rozhledy* 1, 11, Praha, 465-470.

<sup>4</sup>Svodín - Hovorka D. & Illášová L., (in print)

<sup>5</sup>Malé Kosihy - Illášová L., (unpublished): Archaeological Institute of the Slovak Academy of Sciences. Documentation centre, Nitra, Slovakia.

<sup>6</sup>Zlaté Moravce, <sup>7</sup>Opatovce, <sup>8</sup>Stránska - Illášová L., (unpublished): Archaeological Institute of the Slovak Academy of Sciences. Documentation centre, Nitra, Slovakia.

<sup>9</sup>Nitriansky Hrádok - Illášová L. & Hovorka D., 1999: Typologická a petrografická analýza kamenných artefaktov z Nitrianskeho Hrádku - Zámečka. *Študijné zvesti Archeol. ústavu SAV*, 32, Nitra, 99-185.

<sup>10</sup>Malé Kosihy - Illášová L., (unpublished): Archaeological Institute of the Slovak Academy of Sciences. Documentation centre, Nitra, Slovakia.

<sup>11</sup>Rimavská Sobota - Hovorka D. & Illášová L., (base analyses, unpublished)



Fig. 2 Poorly expressed fluidal pattern of an alkali basalt. In the middle of the micrograph the olivine phenocryst: plagioclases have a lathy morphology. Thin section: S - 27, X polar. magn. 90x (by Hovorka et al., 2000).

facts have already been mentioned in several published papers (see Hovorka and Illášová, l.c.) however the raw material types have not been described in detail yet. Therefore the presented paper gathers and synthesises existing information and add new ones.

As it is shown at (Table 1) in the stone age from the alkali basalts made artefacts have been found up to date on several Neolithic and Aeneolithic sites.

On the territory of the Slovak Republic basalts occur as not uniform genetic types and of various stratigraphy. They are known from several geological units, forming bodies of various size, shape and intensity of metamorphic recrystallization.

Alkali basalts have dark-grey up to black colour, they are mostly of fine-phyric and massive patterns. The surface of artefacts, deposited thousands years in the soil, is characteristic by tiny pores, representing empty spots after disoluted feldspars.

For the mineral composition of alkali basalts two main phases are characteristic: plagioclases and clinopyroxenes, in several artefacts also olivine, amphibole and ore minerals have been identified (Fig. 2).

Among them clinopyroxene and olivine form fine (up to 1 mm) phyric crystals. Mentioned minerals are present in the matrix, too. For the Late Cenozoic alkali basalts characteristic is the presence of the Upper Mantle perovka xenoliths of the spinel peridotite type (Hovorka and Fejdi, 1980). They reach several centimeters diameter, but mentioned authors (l.c.) described also desintegrated xenoliths. In this case in the groundmass only individual



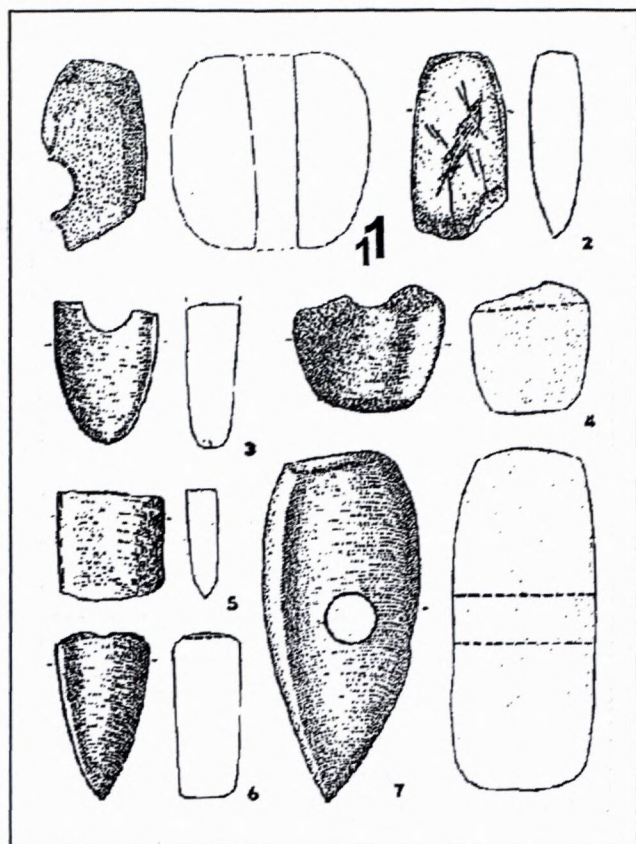


Fig. 3 Polished stone artefacts from alkali basalts from Nitriansky Hrádok site : 1, 3, 4, 6 - hammer-axes (fragments), 2 - axe, 5 - axe (fragment), 7 - hammer-axe

crystals (representing formerly constituents of xenoliths) are detectable in thin sections.

For the effusives of the calc-alkali clan the presence of phyrlic plagioclases, in size up to 10 mm (but mostly 2 - 5 mm) is characteristic. Due this aspect Neolithic and Aeneolithic people left such phyrlic varieties, as the artefacts made from such rock type would be damaged already in the process of their completion or during first attempts of their use.

### Stone implements

Alkali basalts belong to the raw material type, which has been used in the Neolithic and Aeneolithic sporadically only. Stone artefacts made from this raw material type are known from rare Neolithic and Aeneolithic sites in the country. From the Middle Neolithic - Želiezovce culture - site Bajč (Cheben, 2000) stone implement of axe to wedge morphology is known, which bears traces of beginning of boring. From the alkali basalts are made mostly axes of concave shape (Fig. 3: 2), which we know from the site Nitriansky Hrádok (Lengyel culture, phase I and II). In this case we have to do with massive big axes, of the approximate size 120 x 80 x 35 mm. Their final surface elaboration has not been perfect in comparison to artefacts made from the antigorite serpentinites and greenschists.

From the site Kozárovce stone semiproduct of wedge shape is documented. It represents the biggest semiproduct of the unique size, which has been ranked among Palaeolithic artefacts. Its size is 170 x 65 x 85 mm, and its weight is equal to 1,20 kg (Fig. 4).

More implements made from alkali basalts are known to occur in the site Svodín, which represents one of the most typical Lengyel culture site. On the site under consideration, axes, hammer-axes, hoes and semiproducts have been documented. Hammer-axes from mentioned site belong to long and narrow types such as pickaxes or mattocks.

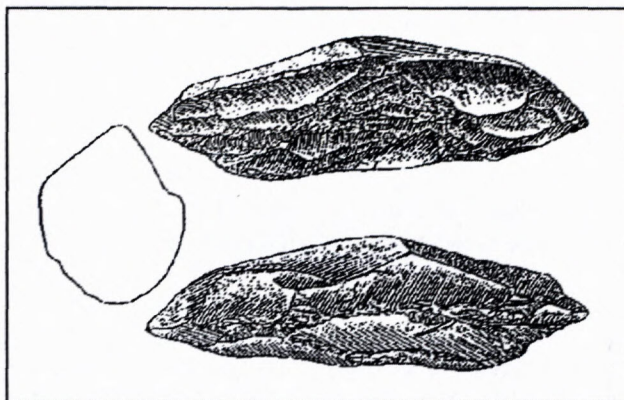


Fig. 4 Semiproduct of wedge from the Kozárovce site.

In the Baden culture from the Nitriansky Hrádok site there were found massive and large hammer-axes, in the length more than 200 mm (Fig. 3: 7). On this place there have been found also smaller hammer-axes. They have mostly angular bat-side (Fig. 3: 4).

Massive hammer-axes are known from the sites in the proximities of the Zlaté Moravce as well as Rimavská Sobota towns. They are stored in local museums of mentioned towns. They are mostly partly damaged being of the length of 200-220 mm. Their weight is up to 2 kg.

From the presented brief survey on finds of stone artefacts made from alkali basalts it should be summed up, that mentioned implements are massive, pronouncedly bigger, in the case of hammer-axes flat and angular in the but part. On the surface patination is present as the product of weathering processes.

Neolithic and Aeneolithic communities for the production of stone implements used alkali basaltic sources from the country territory, which are presented on the map. Stone artefacts analyses from the Spiš county region (northern Slovakia) univocally proved utilization of basalts located on the territory of southern Poland (Mts. Wzar and area south of Sztiawnicza: Hovorka and Soják, 1998).

### Conclusion

In the case of the basalts as the raw material of Neolithic and Aeneolithic artefacts they are represented by less numerous set of stone artefacts. They are known to occur in individual cultures of the Neolithic till Early



Bronze Age and their number is generally low. Alkali basalts belong to firm rocks with strenght in pressure 1500–4000 kg/cm<sup>2</sup>, they are resistive and stabile agains grinding.

The stone artefacts made from Early Paleozoic or Mesozoic basalts belong to rare occurring one. They occur on individual sites in limited numbers (1–2 per site). From the alkali basalts mostly axes and hammer-axes are made. They were documented, for example from sites of Bajč (Želiezovce group), Nitriansky Hrádok (Lengyel culture phase I and II, Fig. 3: 2, 3), Svodín (Lengyel culture phase III–IV), Stránska (Baden culture), Nitriansky Hrádok (Baden culture, Fig. 3: 1, 4, 6, 7) and the others.

From the alkali basalts mostly axes and hammer-axes are made. They were documented, for example, from sites of Bajč (Želiezovce group), Nitriansky Hrádok (Lengyel culture, phase I and II), Svodín (Lengyel culture, phase I), Stránska and Nitriansky Hrádok (Baden culture) and the others (Table 1).

The typical extent of production of stone artefacts made from alkali basalts has culmination in the Early Bronze Age. From the till now realised microscopic determinations of sets of stone artefacts from several sites of the country territory is evident that prevailing abiotic raw material type of the Neolithic and Aeneolithic cultures have been greenschists (Hovorka et al. 1997; Hovorka and Cheben, 1997; Illášová and Hovorka, 1995).

The stone artefacts made from Early Paleozoic or Mesozoic basalts belong to rare occurring ones. They occur on individual sites in limited numbers (1–2 per site). Stone artefacts made from basalts differ from the others by their surface design, higher weight, they are bigger and they

have different surface final elaboration. Mentioned differences are based on properties of the raw material used - in discussed case of alkali basalts.

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