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RADIOMETRIC AGES OF SOME BASALTS OF SLOVAKIA BY $^{40}\text{Ar}/^{40}\text{K}$ METHOD

(Figs. 1—2)



Abstract: Many radiometric data exist for the Westcarpathian neovolcanites. Meanwhile they were missed for basalts. By the argon method a basanitoid group of ages of about 7,5 mil. years near B. Štiavnica and N from Lučenec [Mašková, Podrečany], and about 2,5 mil. years old basanites in surroundings of Filákovovo was separated.

Резюме: Для западнокарпатских неовулканитов существуют многочисленные радиометрические датировки. Для базальтов пока их еще нет. Аргоновым методом выделили группу базанитоидов с возрастными приблизительно 7,5 млн. лет около г. Банска Штиавница и на север от г. Лученец (Машкова, Подречаны) и около 2,5 млн. лет старые базаниты в окрестностях г. Филяково.

By a significant measure products of the Neogene (young Cenozoic) volcanism take part in the West Carpathian geological structure.

These are, first of all, different types of andesites and rhyolites with subordinate occurrences of granodiorites, diorites, dioritic porphyrites, dacites etc. These are spread on the large regions of Central — (Kremnicko-štiavnické pohorie Mts, Vtáčnik, Poľana, Tribeč, Javorie Mts.) and Eastern Slovakia (the Slánske vrchy Mts., Popričný, Vihorlat Mts.).

Basaltic volcanism did not reach by far the intensity of the andesite-rhyolite one. It had acted especially southerly, near the inner limitation of the West Carpathian arc. By the extensive and numerous occurrences of basalts s.l., especially the region of the Filákovská vrchovina Mts. and marginal parts of the Lučenec and Rimavská kotlina depressions are significant. A part of basalts of this zone reaches over to Northern Hungary. The mentioned alkali basaltic rocks of Southern Slovakia are represented mainly by basanites and basanitoids (F. Fiala, 1939, A. Miháliková, 1966).

Basaltic rocks of different types occur also in the region of Middle Slovakian neovolcanites. They are:

1. plagioclase basalts (Ostrá Lúka, Lomno)
2. amphibole basalts (Bacúrov, Babiná)
3. basanites (Banská Štiavnica, Žakýl-Kyshýbel, Brehy, Tekovská Breznica)

More recent petrographic data are given especially in the works of F. Fiala (1939, 1952) and of M. Šímová (1965).

Basaltoid andesites and andesitoid basalts, eventually also olivinic andesites of this region represent a further group of basaltic effusives. According to D. Hovorka (1978) they represent products of subsurficial differentiation processes of calc-alkaline magma with products calc-alkaline basalt — andesite — dacite.

From the up to the present geological researches it follows, that basaltic rocks of the West Carpathians present final phases of the young-Cenozoic

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volcanism in the range of the Pliocene — Preglacial. The detail stratigraphic position of the individual occurrence, except of basalt from the surroundings of Hajnačka is missed yet what is the same as for the radiometric dating. The purpose of our brief report is partly to fill this gap.

Mašková

The locality is situated about 6 km W from Lučenec near the village Mašková (Fig. 1). In its surroundings a contact between the Neogene filling of Lučenec depression and south salients of neovolcanites of the Štiavnické pohorie Mts. is realized.

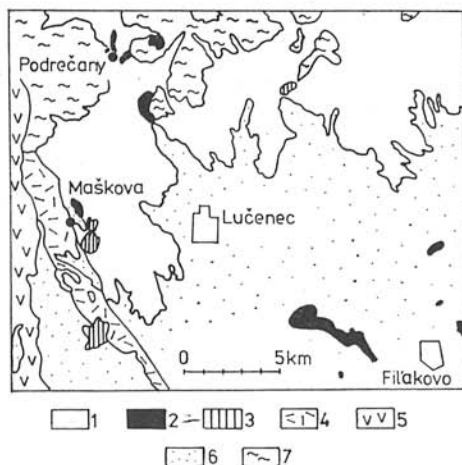


Fig. 1. 1 — The Poltár formation; 2 — Basalts; 3 — Pyroclastics of basalts; 4 — Pyroclastics of rhyodacites; 5 — Pyroclastics of pyroxene andesites; 6 — Miocene sediments; 7 — Pre-Tertiary formations.

Among the newer authors, especially A. Miháliková (1966) and D. Hovorka (1978) have directly studied these problems. Some next data are contained also in publications by A. Miháliková — M. Šímová (1965), J. Forgáč — G. Kupčo (1973), D. Hovorka (1978a).

Alkali basalt from Mašková is considered as basanitoid by A. Miháliková (1965). D. Hovorka (1978) uses the term basanite and he justifies it by contents of normative nepheline above 10 % and by the presence of modal nepheline.

According to the mentioned authors basanites form a lava flow which is well uncovered in deserted quarry SE from the village (Fig. 1).

Macroscopically they are represented by dark-grey compact types of rocks. Nearly 5 cm long crystals of amphibole (pyroxene) and also assemblages of olivine (A. Miháliková, l.c.) are irregularly dispersed in them. The last ones characterized as enclosures of spinel peridotites by D. Hovorka (1978).

Calcite veinlets are numerous and also irregular forms of carbonate with long-prismatic crystals of aragonite which are interpreted as fillings of vugs.

In the lava flow columnar jointing is locally developed. In the highest parts of the quarry and the flow effusive types prevalently occurred.

Microscopical characteristics [A. Miháliková, l.c., D. Hovorka, 1978]:

As porphyric phenocrysts occur brown amphiboles, pyroxenes, olivines (they are originated also by an overgrowing of rounded olivines by idiomorphic border) and seldom also plagioclases. Phenocrysts are usually affected by different intensive changes. Brown amphibole is replaced by rhönite (?), olivine and pyroxene are opacitized etc.

The ground mass of trachytic, microdoleritic to ophitic texture. The main minerals are plagioclases, magnetite, olivine, pyroxene and less — also nepheline. As characteristic ones — microlitic assemblages of pyroxenes and also the abundance of undeterminable crystallizing centres passing towards submicroscopical dimensions are reported.

Round the porphyric phenocrysts and enclosure plates of plagioclases show significantly fluid structure.

Seldom also amygdaloidal types occur with the carbonate filling of amygdalites and small amounts of glass in the matrice.

In the comprehensive publications on the West Carpathian basalts up to now [A. Miháliková, l.c., A. Miháliková — M. Šimová, l.c.] the „porphyric phenocrysts” were interpreted as the products of common intratellurian development.

D. Hovorka (1978) directed attention towards the fact that many among so called „porphyric phenocrysts” are not mineralogically homogeneous and they represent typical polymineral angular xenolithes. Besides the minerals of xenolithes are different form similar minerals of the surrounding basanites. The size of enclosures is the most often about 1—5 cm, seldom till cca 20 cm. Locally it reaches only 2—3 mm.

From xenolithes olivine is reported, orthopyroxene close to bronzite, clinopyroxene close to diopside-chromdiopside and Cr-spinel (picotite). According to the quantitative representing the rocks, known as „spinel lherzolites, spinel wehrlites and spinel olivinic clinopyroxenites” result.

By D. Hovorka (1978) mentioned xenolithes are considered as residuum of the upper mantel, lifted to the surface by the basanite lava. The author shows possibilities of finding of similar xenolithes also in the other localities of alkali basalts in the West Carpathians.

The substance of this presumption is supported by relics of the upper mantle rocks found in basalts from the East Alps in Austria [G. Kurat, 1971, W. Richter, 1971].

Determination of the radiometric age of basanite from Mašková appeared interesting not only for the fact that dating of the West Carpathian basalts was missed till now, but also with respect to the presupposed origin of xenolithes and some porphyric phenocrysts in the upper mantle.

These ages were found by the Argon/Kalium method:

Sample	K(%)	Ar(10^{-6} Nccm.g $^{-1}$)	t(10^6 r)
pyroxene	$0,69 \pm 0,02$	$0,2061 \pm 0,0066$	$7,67 \pm 0,47$
pyroxene	$0,69 \pm 0,01$	$0,2020 \pm 0,0081$	$7,45 \pm 0,41$

Podrečany

In the immediate surroundings of the village Podrečany, about 9 km NNW from Lučenec more bodies of basalt rocks occur. (Fig. 1). Localities from the village and also the major occurrence on Holín, nearly 2 km NE from Podrečany were after the geological and petrographical sides elaborated by F. Fiala [1938] more in detail.

Majority of the rocks is characterized as nephelinitic basanitoids (occurrences are E and S directions from the village). From its north surroundings the nephelinitic basalts are described and from the summit of the hill Holín — slag till pumiceous feldspathic basalts.

About 2 km SE from Podrečany a larger body of the plagioclastic basanite occur. The more recent petrographical data about it are from A. Miháliková [1966].

The rock is microscopically fine-grained, with small grains of olivine and with microlites of feldspars. The structure is holocrystalline — porphyric with the doleritic development of the ground mass. There are prevalent the plagioclases (Ab₄₀An₆₀), farther there are present olivine (pseudomorphosed to iddingsite), magnetite, pyroxenes, titanomagnetite, ilmenite, apatite. Nepheline seldom occurs that means only in the ground mass. Locally it contains the amygdaloidal cavities which are filled by palagonite. The mentioned rock was defined by A. Miháliková [l.c.] as a plagioclastic basanite of the Podrečany type.

On the whole sample of this locality the radiometric dating was provided by the ⁴⁰Ar/K⁴⁰ method:

Sample	K(%)	Ar(10 ⁻⁶ Nccm.g ⁻¹)	t(10 ⁶ r)
The whole rock	1,567 ± 0,003	0,4362 ± 0,0129	7,15 ± 0,23

Bulhary

Larger surrounding of Fiľakovo is the region with the most occurrences of the basaltoid rocks in Slovakia. Here also the locality Hajnáčka belongs, famous with its rich faunal occurrences especially in pyroclastic sediments. On its basis also a part of the eruptions are ranged into the Upper Pliocene to Lower Pleistocene (O. Fejfar, 1961).

We had at disposal the nephelinitic basanite with augite and aegirinaugite determined NE from Fiľakovo as the Bulhary type (A. Miháliková, l. c.) from this region. The rock is fine-grained nearly entire, locally with cavities filled by arragonite and zeolites. The structure is holocrystalline — glomerophyric with microdoleritic ground mass.

Mineralogical composition : pyroxenes (augite with aegirinaugite), olivine with prevalent forsterite component, plagioclase, nepheline, rhönite, pargasite, titanaugite, ilmenite.

Radiometric dating:

Sample	K(%)	Ar(10 ⁻⁶ Nccm.g ⁻¹)	t(10 ⁶ r)
the whole rock	1,687 ± 0,003	0,1686 ± 0,0048	2,57 ± 0,08

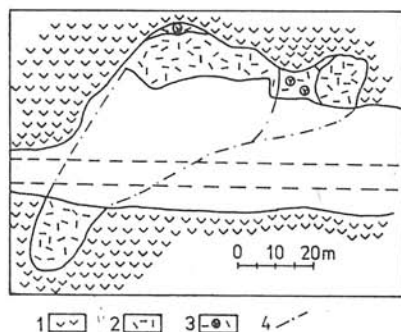
Banská Štiavnica — Žakýl

In Banská Štiavnica and its surrounding 2 occurrences of the alkali basalts are known: the Kalvária hill just in the town and near the locality Žakýl (Kyshýbel) NE from Banská Štiavnica.

Basalt from the Kalvária hill belongs to the classical localities what is dated in geological literature still since Beudant era. Quite a detailed petrographical description is by F. Fiala 1938). The main mass of porphyric basalt is determined by him as a limburgitic nepheline basanitoid and the rock from the south slope as a doleritic nepheline basanite with analcime.

Fig. 2. The volcanic neck of nepheline basanite Žakýl (Kyshýbel). V. Konečný et al. 1974.

1 — Amphibole-biotite andesite; 2 — Nepheline basanite; 3 — Breccia from the amphibole-biotite andesite and nepheline basanite; 4 — Assumed limitation of the neck.



The alkali basalt from the incision of the railroad-line near the village Kyshýbel forms a typical neck cutting the amphibole-biotitic andesites (V. Konečný et al. 1974). In its marginal parts occur breccias consisting of rounded andesite blocks, cemented by slag nepheline basanite (Fig. 2).

The neck filling is formed by the black-grey, fine-grained, porphyric and in marginal parts amygdaloidal rock, whose cavities are filled by zeolites and carbonates.

According to V. Šimová (l.c.) the structure is holocrystalline, porphyric and the matrix is doleritic. Pyroxenes and plagioclases form glomerophyric aggregates.

Olivine is only seldom preserved as relic in the secondary minerals chlorite and boulangerite.

Among pyroxenes Ti-augites, egrine-augites and locally also Ca-pyroxenes are mentioned. Basaltic amphiboles and strongly pleochroic biotites occur only seldom.

Plagioclases [An₇₅₋₈₂] used to be corroded, often replaced by sanidine or albite. Nepheline occurs partly in the form of phenocrysts, more often it is as a part of the ground mass.

Rocks from the incision of the railroad-line are signed as a nepheline basanite. They belong rarely to limburgitic basanites till tephroites.

For the nepheline basanite these values were found by the ⁴⁰Ar/⁴⁰K method:

Sample	K(%)	Ar(10 ⁻⁶ Nccm.g ⁻¹)	t(10 ⁶ r)
the whole rock	1,39 ± 0,03	0,3960 ± 0,0046	7,32 ±

The radiometric age agrees with the Pannonian and it is close to the values obtained for pyroxene from the nepheline basanite from Mašková and Podrečany.

Translated by L. Lehotská — Halmová

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Review by J. LEXA

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