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ROCK GLASSES OF FUSED LESSER CARPATHIAN GRANITOIDS

(Fig. 1—3)

Abstract: By fusing the granitoidic rocks at 1600 °C/4—12 h. rock glasses with refractive index 1.490—1.549, density 2.36—2.65 and specific refraction 0.1178—0.1244 were obtained.. The variation of these values and variation in chemical composition was used for comparison of the Bratislava and Modra massif.

Резюме: Пэд влиянием высокой температуры на гранитоидные породы (1600 °C) в течение 4—12 часов были получены стекла пород с показателем преломления 1.490—1.549, удельным весом 2,36—2.65 и с удельной рефракцией 0.1178—0.1244. Вариации этих данных и химического состава были использованы для сравнения братиславского и модранского массива.

Introduction

Petrological research offers a variety of methods which enable the evaluation of igneous rocks. The methods of chemical classification of the rocks need not always divide the studied rocks into particular mutually closer groups expressed e. g. by differentiation diagram.

The refractive index as the comprehensive expression of different properties is closely connected with chemical characteristic of compound. It can also render a convenient piece of information for comparison of the rock glasses obtained. Density of these glasses does not only express their mutual distinction based on chemical composition but it plays an important role in evaluating the degree of differentiation of the studied rock types.

Method

100—200 g of homogenized rock powder was pressed into pellets and heated in platinum foil at 1600 °C for 4—12 h. (heating duration depended upon rock acidity). After heating the specimen was quenched and controlled microscopicaly, to avoid the inhomogeneous sample measurement. The temperature chosen and chemical composition of the specimens (6—8 W $^0/_0$ $Na_2O + K_2O$) enabled to obtain satisfactory homogeneous rock melt.

We did not expect changes in chemical composition of rock glass in comparison with the composition of original rock, since J. C. Rucklidge et al. (1970) emphasized the agreement between original chemical analysis of the rock performed by classical method and electron probe analysis of the glass produced by rock fusion.

Granitoidic rock glass was transparent, yellow-brown suitable for optical measurement. The refractive index was determined by immersion method at 19—21 °C in monochromatic light $\lambda = 585\ \mu\mu$ with the accuracy $\pm$ 0,001. Density was calculated from chemical analysis by specific refractive capacities of individual oxides.

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Results and discussion

Previous papers on Lasser Carpathian granitoids dealing with these rocks (B. Cambel — J. Valach 1956) and their accessory minerals (M. Mišík 1955, J. Veselský 1972, M. Dyda 1972) informed in more detail about distinctions between Bratislava and Modra massifs. N. K. Huber — C. D. Rinehart (1966) paid atention to the problem of the comparison of eruptive rocks on the basis of refractive index of glass of the fused rocks. Thus they made a correlation of studied rocks. Analogicaly this method was used in volcanic rock stratigraphy by B. Mc Kee — P. Mc Kee (1970).

The refractive indices of glasses under investigation are in the interval from 1.490—1.549. In the Modra massif the differences in individual samples are greater than in Bratislava massif (Tab. 1) and in all analysed casses they have higher values (1.503—1.549). In Bratislava massif the refractive index has the narrower range and a relatively lower value (1.490—1.499).

Density of rock glasses varies in the range 2.36—2.65. It is lower for the Bratislava samples (2.36—2.48) and relatively higher for the Modra massif rock glasses (2.50—2.65).

The variation of refractive index value and density is caused by quantitative changes in the compounds present. However it is markedly influenced by the amount of SiO_2, $FeO + Fe_2O_3$ and $CaO + MgO$.

Fig. 1 showing the relation of refractive index of the glass to weight % SiO_2 gives evidence of decreasing tendency of refractive index value with increasing of silica content. These results roughly confirmed relation curve between refractive index and silica content in the rock glasses determined by W. H. Mathews (1951). However this relation cannot be considered as unambiquous, since the increased amount of SiO_2 does not always cause the decrease of the refractive index value. The difference in refractive index of the studied glasses with the same silica content was e. g. 0.013

Table 1. Physical properties of rock glasses

No.	n	ρ	r
8/63	1,495	2,44	0,1195
37/63	1.497	2,45	0,1194
46/63	1,498	2,48	0,1182
50/63	1,499	2,36	0,1244
51/63	1.490	2,41	1,1200
52/63	1,498	2,44	1,1201
15/63	1,508	2,53	0,1178
17/63	1,515	2,53	0,1192
18/63	1,518	2,57	0,1179
23/63	1,520	2,55	0,1192
25/63	1,503	2,50	0,1182
33/63	1,549	2,65	0,1200

Table 2. Weight % of the oxides used from chemical analyses of Lesser Carpathian granitoids

No.	SiO_2	$FeO + Fe_2O_3$	$\frac{SiO_2}{FeO + Fe_2O_3}$	$CaO + MgO$	$\frac{SiO_2}{CaO + MgO}$
8/63	67,00	1,88	35,64	4,79	13,99
37/63	70,51	2,77	25,45	3,58	19,70
46/63	68,48	2,77	24,72	3,03	22,60
50/63	69,09	2,89	23,91	3,41	20,26
51/63	73,68	1,48	49,78	1,89	38,98
52/63	67,79	2,60	26,07	4,54	14,93
15/63	67,05	2,16	31,04	1,66	40,39
17/63	66,14	3,31	19,99	4,62	14,32
18/63	56,26	3,16	20,97	4,79	13,83
23/63	64,53	3,50	18,44	5,42	11,91
25/63	66,66	2,75	24,24	3,66	18,21
33/63	56,78	6,85	8,29	11,40	4,98

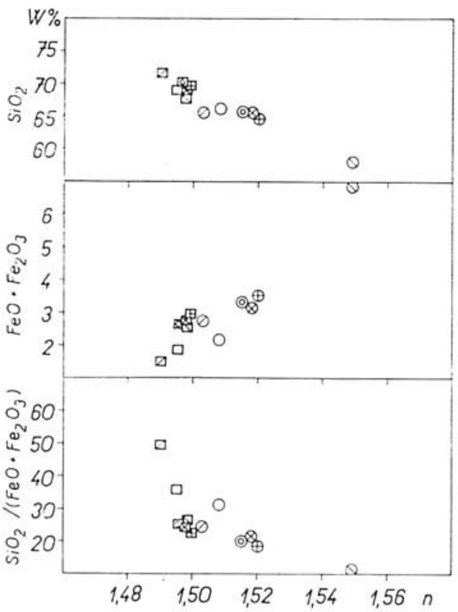

Fig. 1. Variation of refractive index with chemical composition (SiO_2, $FeO + Fe_2O_3$, SiO_2/$FeO + Fe_2O_3$) of Lesser Carpathian granitoidic rock glasses.

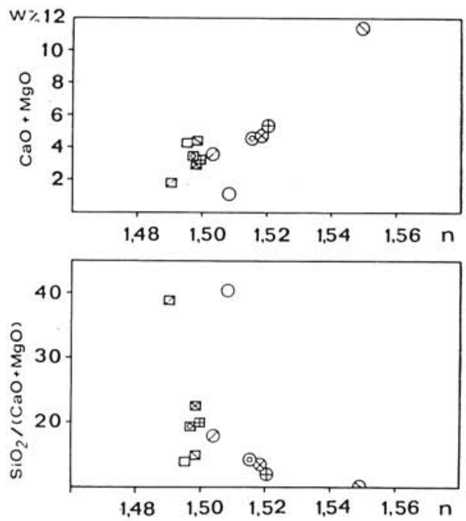

Fig. 2. Variation of refractive index with chemical composition ($CaO + MgO$, SiO_2/$CaO + MgO$) of rock glasses.

(samples No. 8—15) and at 1 weight % SiO_2 difference it was as high as 0.023 (samples No. 8—18). But the variation of the remained components has to be taken into account. If the assimilation influences the magmatic differentiation (what can be expected in Modra massif) relation between silica content and refractive index will not be kept (W. H. Mathews, cit.) and we can expect disordered dispersion of the obtained values.

The increased $FeO + Fe_2O_3$ content in glass with nearly the same silica content causes the increase in the refractive index value. In the investigated glasses the difference among the samples with 1 weight % difference in the $FeO + Fe_2O_3$ content can reach the value 0.023 (samples No. 8—18). From graphical representation (Fig. 1) it is also evident, that the samples with similar $SiO_2/FeO + Fe_2O_3$ ratio differ in refraction index. Similar increase of this value was observed with the increased $CaO + MgO$ content (Fig. 2) at close SiO_2 and $FeO + Fe_2O_3$ contents (samples No. 8—15). This increase is not so expressive and is more scattered than at $FeO + Fe_2O_3$ variation. Relation $SiO_2/CaO + MgO$ did not enable to emphasize the influence of this ratio on the refractive index value.

From the density and refractive index data it was also possible to distinguish the samples in individual massifs, but specific refraction of these glasses (0.1178—0.1244) did not allow distinction in this case.

It follows from Fig. 3 that even if the intervals of the range of the refractive index and density data are not mutually overlapped, they form the degree of relation of Lasser Carpathian granitoidic rocks.

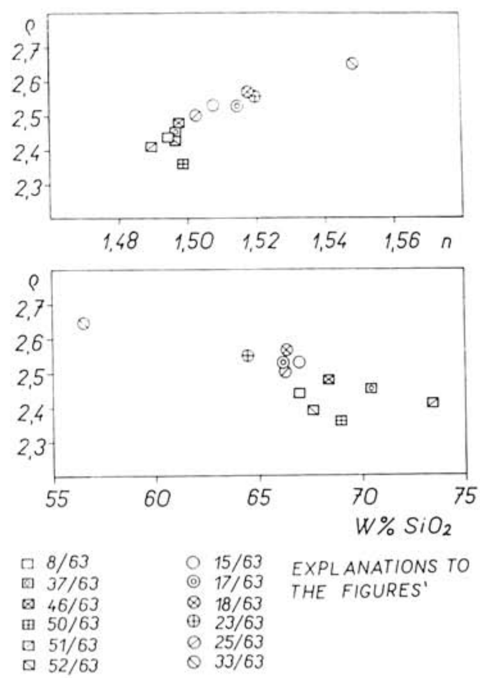

Fig. 3. Variation of density with refractive index and silica content of rock glasses.

In conclusion it may by stated, that the refrective index and density of the rock glass obtained by fusing the granitoidic rocks has sufficient reproducibility of the data. This supports the fact, that similar systematic procedure may find a wide application in the study od rock types suitable for the technique of rock fusion.

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Sample localization

Modra massif (samples No. 15, 17, 18, 23, 33) builts northeastern part of Lesser Carpathian granitoidic complex. It is separated from southwestern Bratislava massif (samples No. 8, 37, 46, 50, 51, 52) by Pezinok-Pernek crystalline complex.

Modra massif:

No. 15/63JV. Metasomatic granite. Píla, Píla valley, elevation 561,2.
No. 17/63JV. Medium to coarse-grained albitite. Píla, Píla valley, NW from elevation 538.
No. 18/63JV. Autometamorphe quartz-granodiorite. Píla, Kamenný potok valley, elevation, 435,5..
No. 23/63JV. Medium-grained biotite granodiorite. Harmónia, quarry in Žliabok valley, elevation 467,7.
No. 25/63JV. Medium-grained biotite granodiorite. Harmónia, Kamenný potok valley.

Bratislava massif:

No. 8/63JV. Fine-grained quartz two-mica granodiorite. Bratislava, Železná studnička.
No. 46/63JV. Fine-grained quartz two-mica granodiorite. Karlova Ves — Devín road, elevation 146.
No. 50/63JV. Fine-grained granite. Karlova Ves — Devín road, elevation 56,3.
No. 51/63JV. Medium-grained quartz two-mica granodiorite. Karlova Ves — Devín road.
No. 52/63JV. Fine-grained quartz two-mica granodiorite. Bratislava, Rössler quarry.

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