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THE PROBLEM OF GENESIS OF GRANITOIDS FROM THE VEPORIDE CRYSTALLINE COMPLEX FROM THE POINT OF VIEW OF K-FELDSPAR, BIOTITE AND ZIRCON INVESTIGATION

(Tabs. 2, Figs. 4)

Abstract: On the basis of so far conducted field and laboratory study of K-feldspar megacrystals and chemical examination of biotites, as well as on the basis of morphologic study of zircon in granitoid rocks of the Veporide crystalline complex, in the presented paper it may be stated that the granitoid rocks of the Veporide crystalline mass, particularly those from the Veporide pluton did crystallize approximately within the temperature range 850 up to 600 °C and the prevailing part of the K-feldspar megacrystals is represented by porphyric phenocrysts crystallized from the magmatic melt during the final stage of congealing.

Резюме: Авторы статьи устанавливают на основе предыдущих полевых и лабораторних исследований биотита и также на основе исследований морфологии зирконов в гранитоидных породах вепорского кристаллиникума, что гранитоидные породы вепорского кристаллиникума прежде всего вепорского плутона, кристаллизировали приблизительно на расстоянии температур с 850 до 600 °Ц и что превосходящую часть мегакристаллов К-полевого шпата представляют порфирические фенокристы, которые выкристаллизировали из магматической выплавки во зремя окончания ее застывания.

In the Veporide crystalline complex also porphyric granitoid types appear among the granitoid rocks. Within the study of the largest granitoid pluton of the Veporide crystalline mass the Vepor type (V. Zoubek, 1964) and the Ipeľ type (E. Krist, 1978, 1979) were identificated.

The „Vepor" type appears in the central pluton, e.g. south of the settlement Dobroč in the region of the elevation point Strungovo, north of the elevation point Nad Králičkou, in the area of the elev. point Šopisko, Iľkovo and in the north-eastern part of the pluton.

The porphyric granite up to granodiorite of the „Ipeľ" type occurs predominantly in the south-eastern part of the central granitoid pluton. We find them in typical development, e.g. in the valley of Rimavica, in the region of Ďurkovka, NE of the elevation point 702.5, approx. 170 — 200 m, further south of the elev. point Hŕbok in the cut of the road leading to Utekáč and on other sites. They appear also in the area of the granitoids of the Rimavica type in the Kohút zone. (Fig. 1)

The above — mentioned types are characterized particularly by the presence of K-feldspar megacrystals (also the occurrence of plagioclase megacrystals was observed) the ratio of which to the ground mass varies remarkably. As previous microscopical investigations showed (E. Krist, 1978) the K-feldspar megacrystals are represented in these rocks by orthoclase, as well as by microcline. Intergrowth according to the Carlsbad law is frequent. Perthite

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development was observed, as well as inclusions of altered plagioclases (Fig. 2), biotite and other minerals participating in the composition of these rocks.

K-feldspars are developed in the Vepor type as minute grains filling up the interstitial spaces between the previously crystallized minerals and in form of megacrystals reaching the size up to 2 cm, locally even 4 cm. We may find triclinization of monoclinic K-feldspar by microscopic study. Microcline lattice is secondary and in megacrystals it is developed in certain parts only (Fig. 3 from thin section V-16, or V-18).

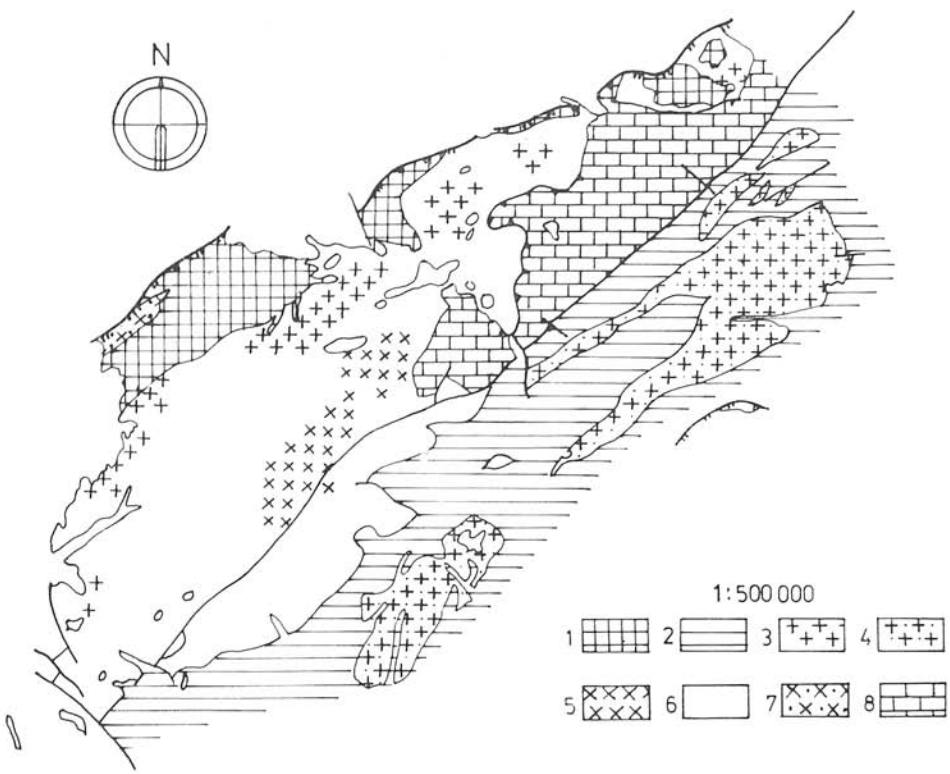

Fig. 1. Scheme of extension of basic granitoid rock types in the Veporide crystalline complex. Constructed according to the map 1:500 000.
Explanations: 1 — crystalline schists of the Jarabá Group, 2 — crystalline schists of the Kokava Group, 3 — biotite granites of the Vepor type, 4 — granitoids of the Sinec type (= Rimavica type, J. K a m e n i c k ý, 1977), 5 — granite to granodiorite of the Ipeľ type, 6 — granodiorite up to tonalite of the Sihla type, 7 — granite of the Hrončok type, 8 — Muráň karst — silicicum.

In the „Ipeľ" type the potassium feldspars make up megacrystals reaching 1—3 cm size. Unlike the Vepor type, these K-feldspars are of pink colour. Their confinment is allotriomorphic or idiomorphic and under the microscope perthite development is recognizable. Also in this type the K-feldspar megacrystals carry much enclosures, most frequently plagioclase and biotite.

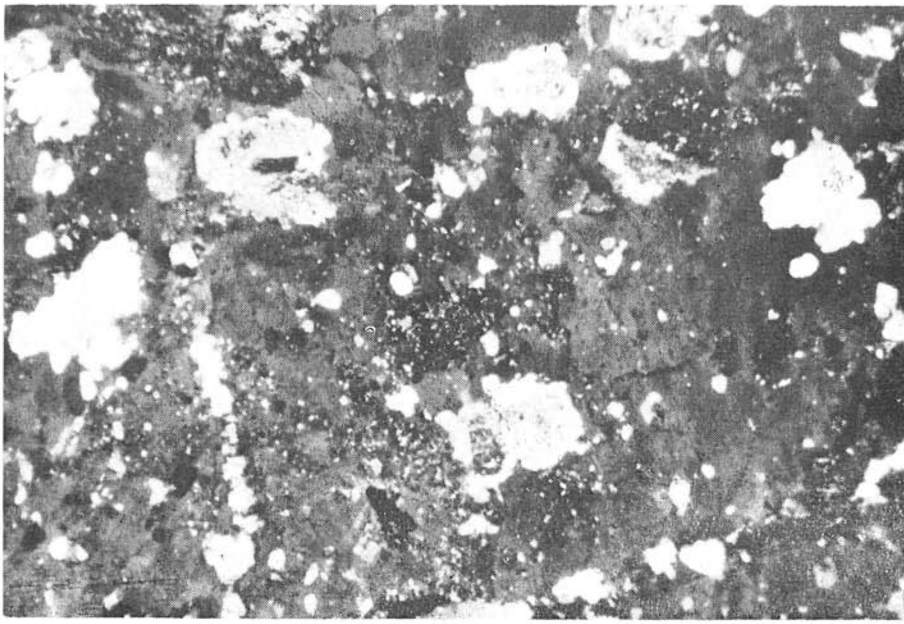

Fig. 2. Plagioclase inclusions in orthoclase. Around transformed plagioclases on the contact with the K-phase a new-formed acid rim is originating. Biotite granite of the Vepor type. Locality: Rimavica valley, 200 m NE of the el. point 702.5. Photo: E. Krist.

The mentioned observations, as it was indicated already in the report (E. Krist, 1978) lead to the statement, that these feldspar megacrystals are the recentmost constituent in the crystallization scheme of the formerly classified granitoid rocks. With regard to the fact that they comprise inclusions of ground mass minerals, I considered them in agreement with other authors (J. Kamenický, 1962; D. Hovorka in M. Kuthan, 1963 et al.) to be a product of potassium metasomatism, combined also with a contribution of a minor amount of natrium and SiO_2. Nevertheless, in this place should be stated that some authors regard orthoclase as a magmatic and microcline as a metasomatic mineral (J. Kamenický, 1977). S. Vrána (in A. Klinec, 1963) interprets the genesis of these feldspars as a manifestation of magmatic crystallization.

Due to these discording views concerning the genesis of K-feldspar megacrystals in granitoid rocks of the Vepor pluton, Š. Dávidová (1980) paid attention to this problem. Her results obtained so far are given in Table 1.

The views on orthoclase genesis may be summarized as follows: 1. Some authors plead for the opinion of primary orthoclase formation from the melt (V. Belov, 1965; F. Laves, 1952; B. M. Šmakin and G. G. Afonina, 1967 et al.), other authors regard its primary genesis as little probable (E. E. Senderov and A. M. Byčkov, 1979 et al.). The presence of K-feldspar megacrystals in granitoid Veporide rocks is important not only from the point of view of genesis, but also from the point of view of the genesis of

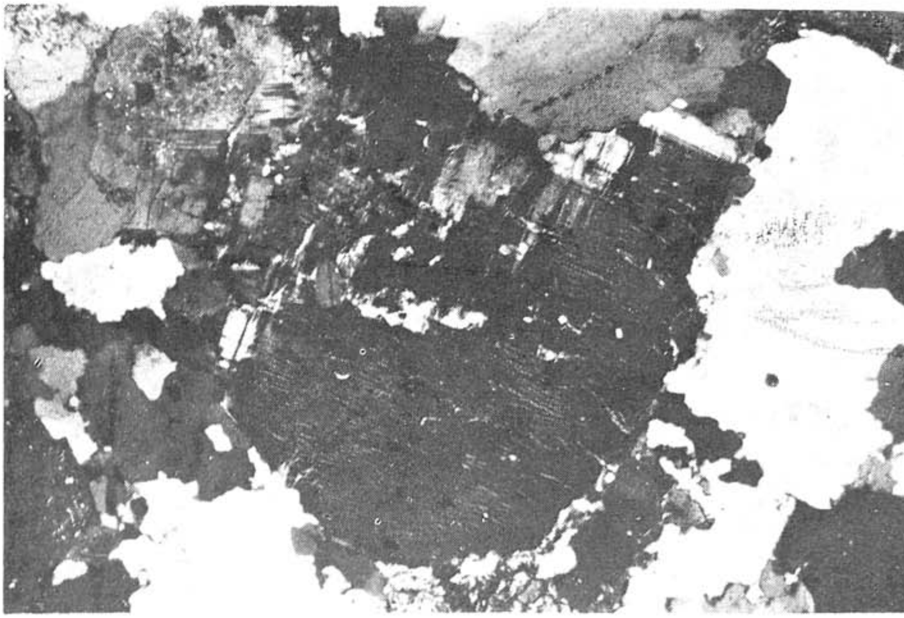

Fig. 3. Secondary formation of microcline lattice in perthitic orthoclase. Biotite granite of the Vepor type. Loc.: cut of the state road Sihla — Utekáč, 500 m SE of the el. point 932.3. Photo:E. Krist.

Veporide granitoid rocks as a whole. The question of temperature at which orthoclase genesis occurs is of importance too. I. S. Sedova and N. V. Kotov (1967) mention the existence of orthoclase between 600 °C and 700 °C. Above 700 °C the existence of sanidine and up to 600 °C the presence of microcline. According to F. Laves (1952) orthoclase can originate above the temperature of 700 °C as a stable unoriented modification. Below the temperature of 700 °C as a metastable modification. E. E. Senderov and A. M. Byčkov (1979) indicate that microcline has its field of stability below the temperature of 500 °C and thus its origin as a primary mineral by crystallization from the magmatic melt is fow probable. From these cited opinions it follows that orthoclase originates as a primary mineral by crystallization of the magmatic melt up to a temperature of 600 °C. Proceeding from this statement, as well as from the study of Š. Dávidová (1980), who claimed that K-feldspar megacrystals in Veporide granitoids had crystallized prevalently as orthoclase, they should be hold for porphyric phenocrysts and not for porphyroblasts of metasomatic origin. By this statement the action of K-metasomatism in the Veporide granitoid rocks is not precluded. The above data, as partial data along with those obtained by the study of zircon morphology and biotites, make possible a more concrete interpretation of the thermic conditions of Veporide granitoids genesis.

Zircon as a constantly occuring accessory mineral in granitoid rocks, is marked in general by numerous crystal shapes, reflecting different chemical and P — T conditions of the environment in which they were crystallizing.

Table 1

Structural — optic characteristics of potassium feldspars of Vepor granitoids (According to Š. Dávidová)

Sample number	Granitoid type	2 Vα		d_{201}	Plag. in %	Type of K-feldspar
V—1	Hrončok granite	84 — 88	0.96	4.230	0	maximal microcline
V—11	granodiorite of the Sihla type	72 — 74	0.00	4.231	0	orthoclase
V—14	granodiorite of the Sihla type	76 — 78	0.30	4.230	0	interstitial orthoclase
V—16	Vepor granite	84 — 86	0.88	4.231	0	maximal microcline
V—17	Vepor granite	78	0.67	4.230	0	interstitial microcline
V—19	granite up to granodiorite of the Ipeľ type	72 — 74	0.00	4.225	3	orthoclase
V—20	granite up to granodiorite of the Ipeľ type	78 — 82	0.00	4.220	4	orthoclase with microcline admixture
V—23	Sinec type	84 — 88	0.95	4.230	0	maximal microcline
V—25	Sinec type	84	0.88	4.231	0	maximal microcline
V—27	Sinec type	82 — 84	0.88	4.230	0	maximal microcline

Table 2

Approximate crystallization temperatures of the maximal amount of zircon crystals in granitoids of the Veporide crystalline complex (according to J. Határ and J. Greguš, 1980)

Type of granitoid rock	Start of crystallization	Maximum of crystallization	End of crystallization
	at temperature		
Sihla type	850 °C	800—700 °C	650—600 °C
Vepor type	800—700 °C	650—600 °C	not declared
Ipeľ type	850 °C	800—700 °C	650—600 °C
Sinec type	750 °C	650—600 °C or 700—600 °C	not declared

From this aspect attention was paid to this mineral in the Veporide granitoid rocks. From the point of view of morphological studies of zircons conducted by J. H a t á r (in J. G r e g u š — J. H a t á r — P. H v o ž ď a r a, 1980), the approximate temperature of crystallization of maximum amount of the zircon crystals for the individual basic granitoid types of the Veporides may be established.

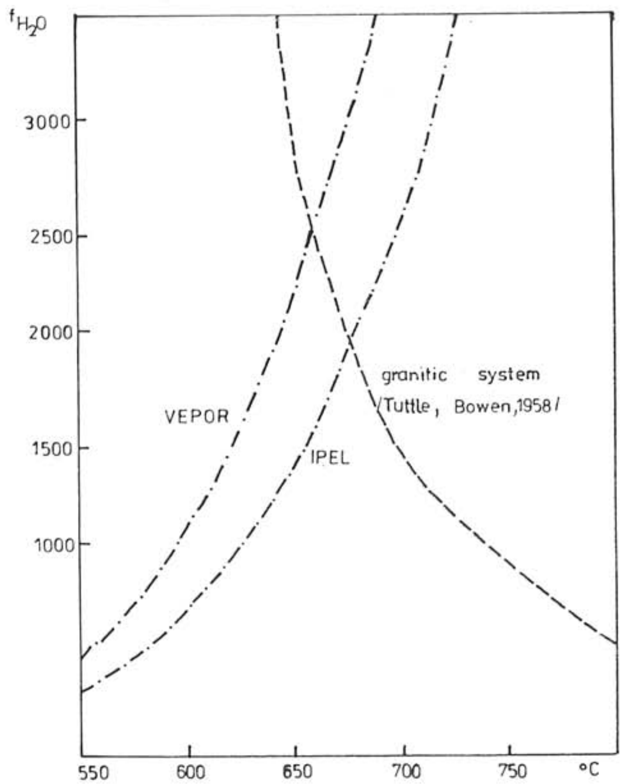

Fig. 4. Stability of biotites from granitoids of the Vepor and Ipeľ types calculated according to the equation of D. R. W o n e s (1972). (V. F e j d i o v á, 1980).

For the Sihla and Ipeľ types of granodiorite it makes up 800—700 °C, where the beginning of crystallization may be shifted up to 850 °C and the end up to 650 °C. At the Vepor type and in leukocratic granite maximum of zircon crystallization falls within the temperatures 650—600 °C, and the start of zircon crystallization lies at the temperature 800 °C. The temperature of start of crystallization at zircons of the Rimavica type (= Sinec type) lies at about 750 °C, with the maximum falling within the range of 700—600 °C.

From the petrogenetic aspect attention was paid also to biotite studies in four differentiated granitoid rock types of the Veporide crystalline complex. Biotite research was based on their chemical composition and was conducted by V. F e j d i o v á (in Š. D á v i d o v á — V. F e j d i o v á, 1980). From her study it results that the biotites from granitoids of the Sihla type differ by charge balance unambiguously from those of the Vepor type. The biotites deriving from granitoids of the Ipeľ type are very close to biotites of the Vepor type, while the Sinec type represents a transitional type between the Sihla and the Vepor type. From biotite research it resulted that the biotites from the Sihla and Sinec granodiorite types represent relict biotites, oxidized during anatexis by additional rock overheating. On the other hand, biotites in granites of the Vepor type and in granites to granodiorites of the Ipeľ type are new-formed biotites. In Figure 4, representing the stability of biotites from granitoids of the Vepor and the Ipeľ type, calculated according to the equation of D. R. Wones it may be seen that both, the Ipeľ and the Vepor granitoid type had originated approximately under the same conditions. The Ipeľ type at the temperature 675 °C and pressure fH_2O 186 MPa. The Vepor type at 660 °C and at a pressure of fH_2O 245 MPa.

Comparing the results obtained by biotite and zircon investigation we may state, that granitoid rocks of the Veporide crystalline complex, particularly those of the Vepor pluton did crystallize approx. in the temperature range of 850 °C up to 600 °C. These data along with values of X-ray examination of K-feldspar megacrystals, as well as the statement resulting from microscopical observation according to which triclinization of K-feldspar megacrystals is secondary, lead to the conclusion that the K-feldspar megacrystals in granitoid rocks of the Veporide crystalline complex, particularly in the Vepor and Ipeľ type, should be interpreted as porphyric phenocrysts crystallizing from the magmatic melt (over or up to the temperature 600 °C), under suitable P — T conditions and chemical composition.

The occurrence of porphyric granitoid rocks varieties mainly in the marginal and more apical parts of the bodies and the appearance of the monoclinic K-feldspar modification in them indicates faster cooling of these parts of the pluton, where time for crystallization of the oriented form of K-feldspar was lacking.

The presence of maximum microcline in the Hrončok granite may be related with its comparatively intensive tectonic reworking during Alpine folding, namely with the subhercynian phase of this folding. Analoguous interpretation may be suggested also in the case of granitoid rocks of the Rimavica type, nevertheless, in comparison with the Hrončok granite, they do not show such intensive tectonic reworking.

Finally, it should be emphasized, that by the above — mentioned results the action of K-matasomatism in granitoid rocks of the Veporide crystalline mass cannot be eliminated, because even though not in the same extent as it was so far suggested, it had acted in granitoid rocks, as well as in crystalline schists.

Data obtained by the study of K-feldspar megacrystals along with the values gained by zircon morphology and biotite study based on their chemical composition, make it possible to present a more concrete interpretation of the conditions of granitoid rock genesis in the Veporide crystalline complex.

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