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RADIOMETRIC AGES AND POLYPHASIC CHARACTER OF GEMERIDE GRANITES

(3 tables, 3 figures)

Abstract: The Gemeride granites are referred to as product of onephasic intrusion mostly ranged to the Cretaceous, Variscan or even to the Neogene as for its age. The opinion about its Alpine age was supported by the existing geochronological data. The latest radiometric data confirmed the Alpine age of the southern belt of the Gemeride granites. In contrast to that, the granites at Hnilec and Podsúľová, i.e. of the northern belt, are Late Variscan. The Gemeride granites are polyphasic intrusions with intricate evolution of magmatism, postmagmatic processes, superimposed hydrothermal and tectonic processes. A detailed study of relationships among the Gemeride granites, metallogenetic processes and volcanism of Permian quartz porphyries is inevitable. The granite from Rochovce in the western continuation of the southern belt was radiometrically dated as Cretaceous, too.

Резюме: Гемеридные граниты считают продуктом однофазной интрузии, который относят в большинстве случаев к меловому-, иногда к варийскому, или даже к неогеновому возрасту. Мнение, что касается альпийского возраста, поддерживали существующие до сих пор геохронологические исследования. Новейшими радиометрическими датировками он был подтвержден для южного пояса гемеридных гранитов. Граниты около Гнилца и из Подсулевой, принадлежающие к северному поясу показывают, наоборот, молодоварийские возрасты. Гемеридные граниты представляют собой многофазные интрузии со сложным развитием собственного магматизма, послемагматическимх и на них залегающих гидротермальных и тектонических процессов. Появляется необходимость более подробного объяснения отношений гемеридных гранитов к металлогенетическим процессам и к вулканизму пермских кварцевых порфиров. У гранита около Роховец, лежащего в западном продолжении южного пояса были также определены меловые радиометрические возрасты.

Introduction

Since their discovery by L. Zeuschner in 1844 the Gemeride granites have been paid considerable attention particularly because of their relation to metallogenetic processes, because of pecularity of their structural, petrographical and petrochemical evolution, owing to their occurences in epimetamorphosed Early-Paleozoic series of the Spišsko-gemerské rudohorie (ore mountains), associated with intense contact metamorphosis a.o., and because of other characters different from those of dominantly Variscan granites from deeper metamorphosed series of core mountain ranges.

Whereas granite rocks of core mountain ranges are exposed in the form of large massifs the Gemeride granites crop out characteristically in smaller intrusions. Outcrops of elongated intrusions are about 6 km long in one case. Their usual length is smaller, occasionally even several hundred meters only.

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They were frequently encountered by mining operations and by drilling near the surface. Gemeride granites of the small intrusions are very variable. In the Spišsko-gemerské rudohorie (ore mountains) they are joined with the anticlinorial belt of the Volovec- the Gelnica group of Cambrian-Silurian age. Contact rocks are most frequently on the contact of the granites with the sedimentary-effusive complex of the Gelnica group. At Hnilec the contact metamorphosis also affected the Devonian overlaying phyllite-diabase series.

Besides brief references by older authors there are more exact data about the Gemeride granites in publications by J. Vachtl (1937), B. Kordiuk (1941), P. Schönenberg (1949), Nytko-Bocheńska (1951), P. Ončáková (1954), J. Kamenický — L. Kamenický (1955), J. Kantor (1957), J. Gubač (1962, 1977), J. Baran et al. (1970, 1971), M. Tréger (1972), E. Drnzík (1973), A. Bojko et al. (1974), L. Tauson et al. (1974), L. Snopko et al. (1977), J. Plančár et al. (1977), J. Pecho (1978) a.o.

The Gemeride granites became interesting again owing to findings of higher cassiterite concentrations both in eluvia and alluvia (J. Baran 1962) and in greisens (J. Baran et al. 1970, 1971).

The first finds of cassiterite in the Spišsko-gemerské rudohorie were on the pyrite-polymetallic deposit Alžbeta in Bystrý potok near Švedlár (concentrations up to 1 % Sn) and on quartz-chalcopyrite-siderite veins at Stará Voda (J. Kantor 1952, O. Fusán — J. Kantor 1953). Accessory cassiterite was found by J. Kamenický — L. Kamenický (1955) in greisens at Hnilec.

Greisens at Hnilec were already mentioned by J. Vachtl (1937), topaz and fluorite at the same locality and at Betliar by R. Schönenberg (1949). Even the oldest authors noticed the significant role of boron in the genesis of the Gemeride granites.

Although genetic relationship between the Gemeride granites and/or deeper parts of their native pluton to deposits-forming processes is genrally accepted, there still are contradictory opinions about the types and importance of such deposits. The same concerns the age of the granites. On the basis of geological criteria they were referred to as Variscan, Alpine or even Neogene. In the last time Cretaceous age of the intrusion is preferred.

Radiometric dating

Radiometric dating by the potassium-argon method on feldspars from the Betliar massif (J. Kantor 1957) resulted in the age 98 m.y. — in accordance with the opinion about the Alpine age of the intrusion.

Further geochronological analyses were made in the Soviet Academy of Science on material sampled by Academician B. Cambel and his collaborators. Autometamorphosed granite from Poproč was dated by the K-Ar — method to 70 m.y. (A. Bojko et al. 1974) in the Institute of Geochemistry of Siberian Dept. of the Soviet Academy of Science in Irkutsk.

Academician Cambel's samples of granite were also examined in the Institute of Geological Sciences of the Armenian Academy of Science in Erivan. The granite from Zlatá Idka was dated to 87 m.y., and granite from Čučma to 141 m.y. (G. P. Bagdasarjan et al. 1977), i. e. to Alpine age in both cases.

G. P. Bagdasarjan et al. (1977) also dated microcline from an ore vein at Čučma to 94 m.y. A similar ore-mineralization in the Čierna dolina (valley) at Čučma was dated some twenty years ago by J. Kantor (1959) to 93 m.y.

So the latest geochronological data from Soviet laboratories confirmed the Alpine age of both the granites and some ore- mineralizations.

According to the existing data the values of radiometric ages range from 70 to 141 m.y.

In the last time at the Dionýz Štúr Institute of Geology geochronological investigations of the West-Carpathian system are carried out again. To avoid duplicity we try to treat only samples that were presumably not sent abroad for radiometric datations. Unfortunately there is still no possibility to get any reliable information about such samples. In spite of that we believe that for instance the Gemeride granites are now not examined geochronologically in other countries.

For this reason, and because our radiometric dating of the granites gave many new results complementing and partly correcting former opinions about their position and age, we decided to present now at last a part of these results.

Samples of granites from the drill hole HG-1 at Hnilec (Fig. 1) were systematically examined. Other samples were from the drill hole PSS-1 in the valley Podsúľová between the Hnilec and the Betliar massifs of the Gemeride granites.

From the eastern part of the locality Betliar we examined samples obtained by mining operations at the stibnite deposit "Gabriela" and from the drill hole RS-1, about 3 km eastward.

From the most eastern occurences of the Gemeride granites from Poproč and Zlatá Idka were examined samples from both the surface outcrops and from drill holes IL-5 and IL-3.

The dating results are in Table 1.

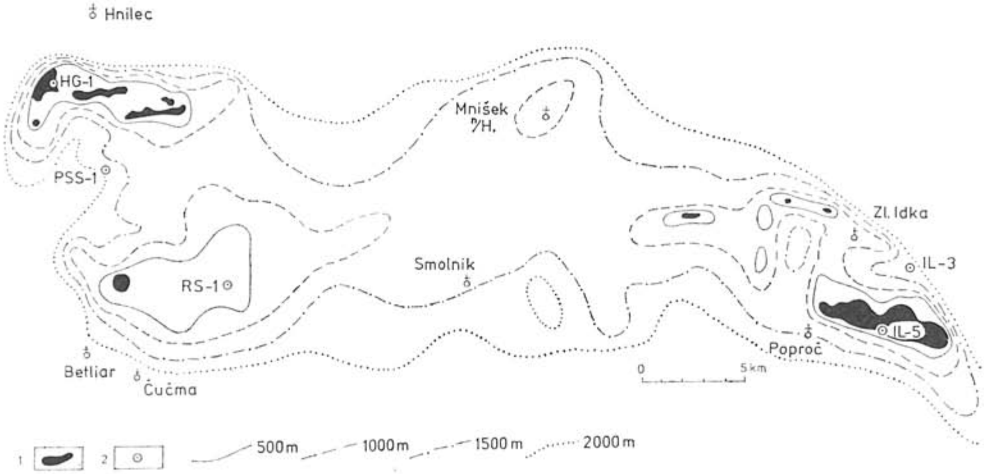

Fig. 1. Relief of gemeride granites according to gravity measurements (J. Barta et al. 1969, J. Plančár et al. (1978). 1 — Granite outcrops; 2 — Boreholes; 500 m — depth in m.

Table 1

No	Locality	Mineral	K(%)	$^{40}A/10^{-6}Ncc.g^{-1}$/	t
73	Hnilec HG-1	muscovite	8,157 ± 0,16	74,96 ± 0,27	222 ± 5
70	Hnilec HG-1	muscovite	8,241 ± 0,14	78,23 ± 0,21	229 ± 4
76	Hnilec HG-1	muscovite	8,134 ± 0,13	80,15 ± 0,43	237 ± 5
68	Hnilec HG-1	muscovite	8,444 ± 0,05	84,47 ± 1,44	241 ± 5
72	Hnilec HG-1	biotite	7,195 ± 0,09	49,58 ± 1,05	169 ± 5
71	Hnilec HG-1	biotite	7,142 ± 0,16	57,51 ± 0,19	196 ± 5
75	Hnilec HG-1	felspar	8,433 ± 0,15	34,39 ± 0,36	102 ± 3
74	Hnilec HG-1	felspar	8,128 ± 0,12	41,85 ± 0,74	128 ± 4
78	Podsúľová PSS-1	muscovite	7,005 ± 0,07	57,17 ± 0,05	199 ± 2
79	Podsúľová PSS-1	muscovite	7,047 ± 0,05	67,37 ± 1,02	231 ± 5
84	Betliar	biotite	6,570	34,31	130
77	Čučma RS-1	biotite	6,29 ± 0,05	33,41 ± 0,78	132 ± 4
85	Čučma RS-1	muscovite	8,56	48,73 ± 1,02	141
81	Poproč, quarry	biotite	6,501 ± 0,03	32,74 ± 0,22	125 ± 1
80	Poproč IL-5	biotite	6,314 ± 0,04	26,81 ± 0,28	106 ± 2
82	Zl. Idka — Mexiko	biotite	5,54	23,30	105 ± 2
86	Zl. Idka IL-3	biotite	6,59 ± 0,09	37,20 ± 1,36	140 ± 6
44	Rochovce KV-3	biotite	6,295 ± 0,05	22,03 ± 0,20	88 ± 1
47	Rochovce KV-3	biotite	9,365 ± 0.04	27,89 ± 0.005	75
48	Rochovce KV-3	amphibole	0,80 ± 0,004	2,616 ± 0,015	82 ± 1

1. Hnilec

The granites are extremely variable in petrographic types and in petrochemical composition (J. Vachtl l.c., R. Schönenberg l.c., P.087áková l.c., J. Kamenický – L. Kamenický l.c., J. Gubač 1962, 1977, a.o).

We have got the most complete profile from the drill hole HG-1 (Fig. 2). Downward from the surface there are: muscovitic granites, partly aplitic or porphyric with local greisens, two-mica granite porphyry, muscovite-biotitic and biotitic granites with local small amounts of muscovite. There are no distinct boundaries among the varieties.

Among volatile elements boron is typical. It is manifested in intensive tourmalinization in the top, most acid parts of intrusions, rich in quartz.

Li, F and partly Sn display the same trend. Also low Ba, Sr, Zr-contents are typical of the Gemeride granites. Rubidium occurs in higher concentrations than in Hercynian granitoids of core mountain ranges. Some of basical quantitative data about trace elements were published by M. Ivanov – G. Kupčo (1965), J. Ďurkovičová (1968), J. Gubač (1972, 1977) a.o. The data were complemented by analyses by L. Tauson and collaborators (1974).

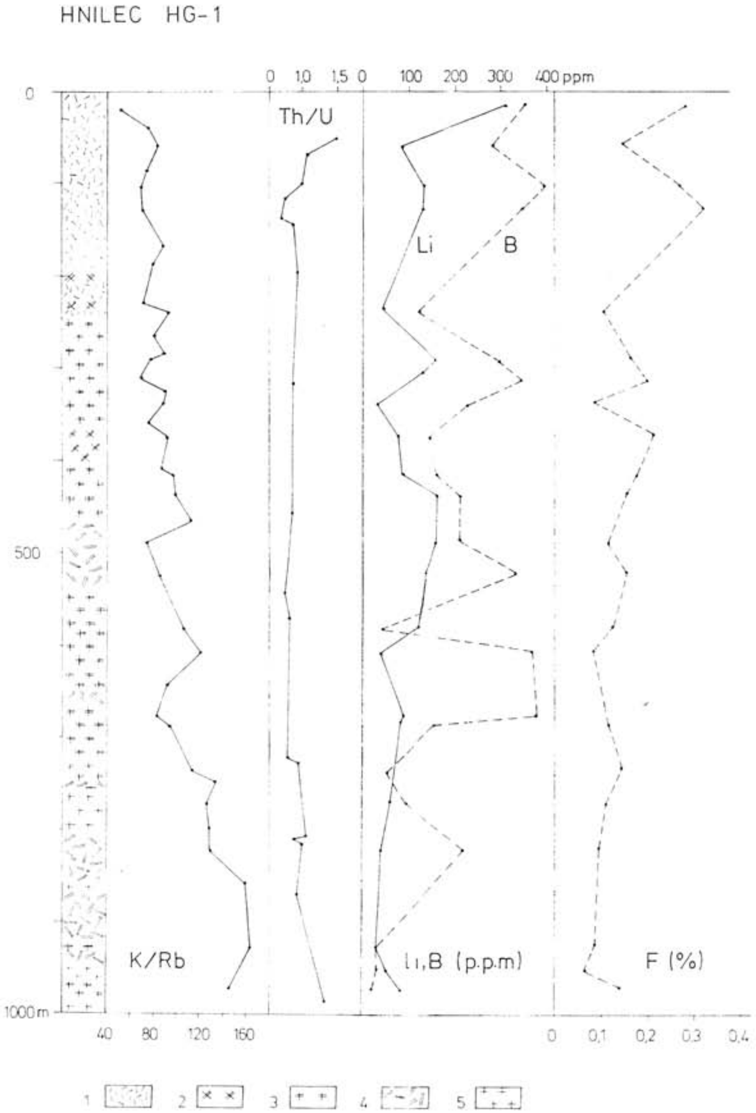

Fig. 2. Profile of the borehole HG-1. Contents of Li, B, F: K/Rb and Th/U — ratios (Compiled from data by J. Gubač 1977, M. Tréger 1972, L. Tauson et al. 1974). Granites: 1 – Muscovite gr; 2 – Two mica granitporphyry; 3 – Two mica gr.; 4 – Muscovite-biotite gr.; 5 — Biotite gr.

Some regularities of the distribution of trace elements are graphically illustrated on the profile of the drill hole HG-1 (Fig. 2).

Four samples of muscovite from the Hnilec granites were radiometrically dated to 241, 237, 229 and 222 m.y. (Tab. 1). So the Hnilec granite may be ranged to late-Variscan intrusions.

Two biotite samples were dated to 196 and 169 m.y. whereas two feldspar samples – to 128 and 102 m.y.

Spatial distribution of radiometric ages in the drill hole HG-1 has a similar trend like the arrangement of granite-types.

The most acid muscovitic granites rich in volatile components from the top parts of the drill hole were dated as youngest; biotitic and biotite-muscovitic granites from the lower parts were dated as older.

This is in accordance with the later formation of muscovitic granites, aplitic granites, greisens and various metasomatites in final phases of intrusive activity and in the course of postmagmatic processes.

Conditions in the drill hole HG-1 prove the complexity of magmatism, of postmagmatic activity and later superposed hydrothermal and tectonic processes. Magmatic activity commenced in late stages of the Variscan orogen whereas the following processes lasted up to the Cretaceous time.

2. *Podsúľová*

Granites were encountered by the drill hole PSS-1 localized by L. Snopko for checking gravimetric anomalies.

In the upper parts the rocks of Gelnica group, and from 381 m down to the final depth of 1806 m granites were penetrated by drilling.

According to oral communication by L. Snopko the granites are mostly light-coloured, rich in feldspars, medium to finegrained, aplitic and at places porphyric. They contain plentiful tourmaline, often porphyric K-feldspars, among micas muscovite dominates over biotite which is more frequent in deeper parts of the drill hole.

The granites are tectonically deformed more than in other localities of the Gemeride granites.

Radiometric ages of muscovites – 199 and 231 m.y. are indicative of a similar, more-or-less contemporaneous origin as the Hnilec granites. They correspond to Late-Hercynian magmatism with later, superposed processes – as already mentioned in connection with the Hnilec granites.

Granites from Podsúľová (PSS-1) and from Hnilec belong to the so-called northern belt of granites which follows a weakened zone in the northern part of the Volovec belt.

3. *Betliar*

The small intrusion about 3 km NNE-ward of the village Betliar (Fig. 1) belongs to the so-called southern granite belt.

Outcrops are leucocratic, tourmalinized, partly quartizified porphyric granites, granite-porphyries or aplitic varieties. In some places the granites are greisenized.

So far no deep drill hole has been realized in these granites and we therefore dated a sample of biotite granite porphyry from a surficial outcrop.

Radiometric age of biotite: 130 m.y.

Feldspar from granite porphyry of the same locality was dated (J. Kantor 1957) to 98 m.y.

These data are essentially lower than radiometric ages of the Hnilec granites. and correspond to Cretaceous age.

4. Čučma

The Gemeride granite was revealed by mining operations tracing the antimonite veins around the Gabriela pit, about 2,5 km east of the Betliar granite massif.

As showed by gravimetric measurements (J. Plančár et al., l.c.) both occurrences are in the same anomalous region. To follow its depth, the drill hole RS-1 was situated approximately 5 km east of the Betliar granite (Fig. 1).

To depth of 565 m the drill hole penetrated dominantly the Cambrian-Silurian volcanogenic complex of the Gelnica group — porphyroids with metadiabase intercalations. From 565 m to the final depth at about 1380 are Gemeride granites. In the upper parts there are acid, porphyric to aplitic varieties with muscovite and plentiful tourmaline, locally greisenized. They pass through two-mica granites into types with more biotite (L. Snopko et al. 1977 — manuscript).

Biotitic granite from the drill hole RS-1 was dated to 132 m.y. In respect of geological history of the granite magmatism, postmagmatic activity and later superposed processes, there is actually an agreement between radiometric ages of the Betliar granite and of the Čučma granite, from the drill hole RS-1.

Radiometric age of muscovite from muscovite-biotitic granite from the same drill hole is 141 m.y.

5. Poproč

The most extensive intrusion of Gemeride granites is exposed northeast of the village Poproč in the eastern part of the Spišsko-gemerské rudohorie (Fig. 1). Granite varieties are analogous there with those in other localities. Two-mica and biotitic granites, coarser and porphyric are, however, dominant. There is an old abandoned quarry near antimony mines at the western termination of the granite body.

Biotite from biotitic porphyric granite from this site was dated to 125 m.y. At the southern margin of the intrusion a shallow drill hole IL-5 revealed various types of granites and a body of microgranites — feldspatitized porphyroids. Biotite from this drill hole was dated to 106 m.y. Higher ages of the Poproč granite correspond roughly to ages of analogous rocks from Betliar and Čučma.

6. Zlatá Idka

Around the Zlatá Idka mines are many Gemeride granite intrusions (P. Rozlozsnik 1912) scarcely cropping out. Recently they were intercepted by deep drilling.

They are similar to the Poproč granites only they tend more to leucocrate, finegrained or aplitic varieties

Southeast of Zlatá Idka, at Mexiko is a small outcrop of granite very near to the Propoč intrusion. Biotite of medium grained granite was dated to 105 m.y.; i.e. the same as granite from the drill hole IL—5 in the southern part of the Poproč granite massif.

For the granite of the boring IL-3 near Zlatá Idka the biotite age of 140 m.y. was determined. It is close to the radiometric ages obtained for granites of the boring RS-1 in the eastern surroundings of Čučma.

Discussion

The considerable variability of radiometric ages and uniform nature of granites in all massifs require an explanation.

On the ground of existing results all the Gemeride granites are referred to as equally old products of a uniphasic intrusion to which Variscan, Cretaceous or Neogene ages were ascribed. A more extensive, more basic, and older intrusive body (R. Schönenberg, C. Varček l.c., a.o.) is presumed to exist in deeper parts below the granite outcrops. Its existence was confirmed by geophysical investigations (J. Plančár et al. 1977).

This interpretation is evidently based on the fact that so far it has not been possible to prove essential differences among the various granite massifs in their tectonic position, petrographic character, chemical composition a.o. In spite of considerable variability within one single massif, all occurrences of the Gemeride granites are ascribed common features.

All the occurrences display similar macro- and microchemical composition in which they differ from Variscan granitoids of core mountain ranges (Tab. 2).

Table 3 is a survey of average contents of radioactive elements and K in granite rocks of the West Carpathians according to Ľ. Kucharič (1978). There is evident difference in Th- and U- contents between the Hnilec granites on the one hand, and the Poproč and Betliar granites on the other.

Certain mineralogical and petrochemical relation of the Gemeride granites to tin-bearing granites in other regions was already revealed by J. Kamenický – L. Kamenický (l.c). It was also proved by the latest geochemical researches (J. Baran, J. Gubač, L. Drzníková, L. Tauson a.o., Tab. 2.).

In the Spišsko-gemerské rudohorie (ore mountains) the Gemeride granites are associated with two zones: 1. the northern zone – occurrences around Hnilec; some authors also refer the granite from the Hummel valley north of Medzev, to this northern zone; 2. the southern zone extending from Betliar through Čučma to Poproč and Zlatá Idka.

Radiometric ages are in accordance with this division.

The highest ages are those of the Hnilec granites: muscovite 241–222 m.y., less resistant biotites 196–169 m.y. In this respect there belong granites from the drill hole PSS-1 at Podsúľová. Their muscovites were dated to 231–199 m.y.

The northern zone granites are Late-Variscan.

Granites of the southern zone between Betliar and Poproč – Zlatá Idka have lower radiometric ages: biotites 140–105 m.y.; muscovite from the drill hole RS-1 was dated to 141 m.y.

Table 2

	%			p.p.m.											
	Na_2O	K_2O	F	Li	Rb	Cs	Be	Sr	Ba	B	Sn	W	Zn	Pb
WEST CARPATHIANS 1. Gemeride granites	3,6	3,4	0,2	84	201	27	2,4	44	164	364	39	11	43	13
2. Gemeride gr.	2,39	3,32	0,18	84	595	49	2,7	39	136	570	120	14	40	9
3. Core Mts granites	2,9	2,6	0,04	44	89	9,5		504	1117	25	5,7	6,3	70	29
4. Core Mts acide differenciates							4,4	336	640	15	11			
ORE MTS-NW BOHEMIA 5. "Ore Mts" — gr.	2,2	3,8	0,34	340	570			40	150		35	14	28	14
6. "Mountain" gr.	2,3	3,3	0,08	50	150			300	2000		2,8	1,3	48	34
TRANSBAIKALIA 7. Kukulbey-Kharalghin-gr.	2,8	4,1	0,26	80	350			100	200		11,2	4,7	37	26
8. Kirine gr.	2,9	3,4	0,05	56	140		2,4	200	650		5,7	1,0	52	20

1, 3, 5—8 Zoubek et al. 1972; 2, 4 Tauson et al. 1974;

Table 3

	N	K(%)	U(p.p.m.)	Th(p.p.m.)	Th/U
Suchý + Magura Mts	22	3.38	3,09	8,05	2,61
Žiar Mts	27	3.00	2,95	9,02	3,05
M. Fatra Mts	23	2.75	4,91	14,39	2,93
V .Fatra Mts	46	3,18	3,82	8,49	2,22
N. Tatry Mts-West	38	2,88	3,38	14,12	4,17
Prašivá					
Hrončok	54	3,91	3,35	12,12	3,62
N. Tatry Mts-East					
Kráľova hoľa	52	2,50	3,87	14,98	3,87
Kohút	141	2,90	3,48	19,08	5,48
Hnilec	148	2,76	7,17	8,98	1,25
Poproč	88	3,75	3,60	14,82	4,23
Betliar	17	3,26	3,44	12,82	3,72

K, U, Th — contents in granitoids of the West Carpathians (Ľ. Kucharič 1978)

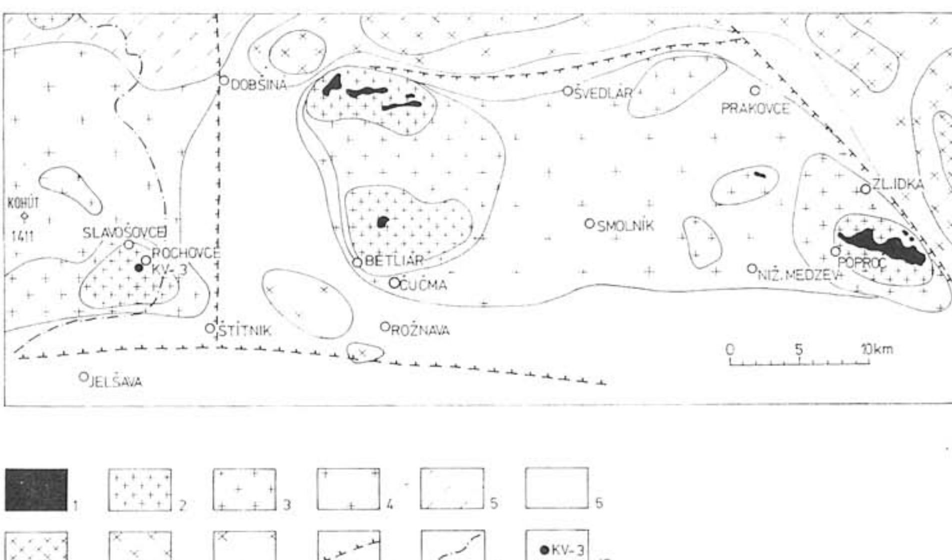

Fig. 3. Essential structures of gravity field in the Slovenské rudohorie Mts. J. Šefara et al. 1978, modified. 1 — Granite outcrops; 2—4 Gravity anomalies related dominantly to granites (decreasing intensity); 5 — Anomalies related to lighter masses in greater depth; 6 — Anomalies related dominantly to carbonate rocks; 7—9 Anomalies related dominatly to basic rocks (increasing intensity); 10 — Anomalies related to Neogene sedimentary rocks; 11 — Zones of maximum gravity gradient; 12 — Boundary between the Gemerides and Veporides; o — Boring KV-3.

There are two interpretations possible for differences in radiometric ages between the two granite belts:

1. Regard all Gemeride granites as Late-Variscan, more—or—less contemporaneous intrusions. Then it must be admitted that the southern zone granites were affected by much more intense Cretaceous superimposed processes which have let to complete Ar—losses from minerals, about 130—140 m.y. ago. This also concerns resistant muscovites of the southern zone. But in the Hnilec — Podsúľová granites of the northern zone the muscovite preserved both Ar and their Late—Variscan ages.

2. Regard the Gemeride granite intrusions as polyphasic process with older granites in the northern zone (Hnilec — Podsúľová) and younger granites associated with the southern zone.

In places, the Hnilec granites display marked tectonic deformation (J. Kamenický — L. Kamenický l.c.) yet not to such an extent as granites from the drill hole PSS-1 at Podsúľová (L. Snopko — oral communication). This fact, also mentioned by J. Pecho (1968) is in accordance with Late-Variscan radiometric ages of these granites.

Former dating of granites of the southern zone indicated Alpine age of the intrusions (Cretaceous, Upper Jurassic). The Gemeride granites may thus represent polyphasic intrusions.

We have already mentioned complexity of magmatic, postmagmatic and superposed hydrothermal and tectonic processes, and possible differences in thermal history. They were very significant for the Gemeride granites. We shall deal with the problem in detail later.

In connnection with polyphasic character of intrusions of the Gemeride granites there is a demand for certain revision and more deailed study of mineralizations in the Spišsko-gemerské rudohorie regarding their chronology.

There is also the question of mutual relation between the Hnilec granites and volcanism of quartz porphyries whose deep—seated equivalents are still unknown. The volcanism was particularly intense in the Middle Permian of the North-Gemeride syncline. It is only rudimentary in the southern part of the Spišsko-gemerské rudohorie. In the Choč nappe mighty accumulations of Permian volcanic rocks occur. In contrast to the Nort—Gemeride syncline, basic effusive rocks — melaphyres are dominant there. Acid differentiates — quartz porphyries are generally scarce (I. Rojkovič — J. Vozár 1972).

Detailed informations about petrochemical character and trace elements in the Permian quartz porphyries of the North—Gemeride syncline were published by I. Rojkovič (1968). Average contents of microelements:

Sr 26 ppm	Ba 279 ppm	Sn 24 ppm
Zn 11	Pb 1 (?)	Cu 105
Mo 4	U 15,9	Ni 14
Co 8	Cr 9	V 18
Y 29	Zr 255	Ga 17

In connection with the tin-bearing Gemeride granites the Sn contents of the quartz porphyries are interesting. Sn-concentrations 15—19 ppm are also in some basic differentiates — in Permian porphyrites from Košická Belá and N. Klátov (I. Rojkovič — J. Vozár 1972). Increased Sn, Li, B, Rb, and partly Be concentrations were found in quartz porphyries by G. Kupčo (M. Ivanov — G. Kupčo 1965, M. Ivanov 1957).

Tourmaline is referred to as a common accessory mineral. It is most frequent in quartz porphyries of the central part of the North—Gemeride syncline.

The Sn—concentrations show increasing trend beginning with the Variscan granites of core mountains (5,7 ppm) through their acid differentiates (11 ppm), Permian quartz porphyries (24 ppm) to the Gemeride granites (39 ppm). Besides other, increased Sn and U concentrations are a common feature of the Gemeride granites and the North-Gemeride quartz porphyries.

Geochemical characteristic of granitoid rocks of the West Carpathians based on trace elements is in Table 2.

Conclusions

In the Spišsko-gemerské rudohorie the Gemeride granites intrude in Cambrian —Silurian sedimentary—volcanogenic rocks of the Gelnica group. They form small, mostly elongated bodies joining into an extensive intrusion in depth — as proved by geophysical measurements.

The granites are extremely variable, they have increased B, Li, F, Sn, Rb, a.o. contents and positive metallogenetic relation to certain mineralizations in this region.

On the ground of the existing data and their common features the Gemeride granites of all granite massifs are regarded as products of a uniphasic intrusion whose age is most frequently placed in the Alpine tectono-magmatic cycle (Cretaceous) but some also ascribe it Variscan or Neogene age.

Granites from Hnilec and Podsúľová belonging to the northern granite zone. should be ranged to Late—Variscan magmatites on the ground of the latest radiometric data.

From such ranging follows close relationship between the granites and quartz porphyries of the Middle Permian volcanism, participating as an important member in the structure of the North — Gemeride syncline. Their deep equivalents are unknown so far. The same concerns much more abundant quartz porphyries of Early Paleozoic volcanism in the Spišsko-gemerské rudohorie Mts.

For granite massifs of the southern zone Betliar — Čučma — Poproč — Zlatá Idka highest radiometric ages of micas 141—130 m.y. were determined. In this Alpine time another phase of granite formation (or metamorphosis?) might have set on.

Radiometric ages determined by the $^{40}A/^{40}K$ method display a wide range of values. It is given by the time between the commencement of the generation of granites, the evolution of single types, their metasomatites, greisens, and other products of postmagmatic processes following intrusions. The wide range of age values is also caused by later superposed hydrothermal and tectonic processes particularly when less resistant minerals are concerned. The fading out of these processes may be traced by radiometrical methods up to the Upper Cretaceous.

On the Conference on plate tectonics (Smolenice 1976) we pointed out the significance of radiomeric ages 130—140 m.y. for exotic pebbles of the Klippen Belt.

In connection with geochronological research of the Gemeride granites we want to mention our radiometric data on rocks form Rochovce near the boundary of the Gemerides with the Veporic. A high positive magnetic and a lower negative gravimetric anomalies (J. Plančár et al., l.c.) were revealed there by geophysical measurements. The locality Rochovce is on the western continuation of the southern granite zone from the Spišsko-gemerské rudohorie (ore mountains).

In the area of the anomaly the drill hole KV-3 penetrated biotite phyllites of the Hladomorná dolina (valley) group with a gabbrodiorite body underlayed in turn by granitoid rocks at depth 700—1560 m (A. Klinec, personal communication).

Among the granites the coarser porphyric type with pink orthoclase phenocrysts is dominant. In the top part are greisen, bodies of light, aplitoid granites and aplite veinlets. In places indications of sulphidic mineralization and of fluorite occur in tiny veinlets.

Biotite and feldspar from biotite porphyric granite with pink orthoclase phenocrysts were dated to 88 and 75 m.y., hornblende from gabbrodiorite — to 82 m.y.

Alpine metamorphosis was proved by radiometric methods not only in the area mentioned but also farther west in wider surroundings of Hnúšťa, even on rocks without any sings of retrograde metamorphosis (J. Kantor 1961). The alpine metamorphosis was also confirmed by the latest radiometric datations by G. Bagdasarjan et al. (1977).

Our radiometric data show both the polyphasic character of the Gemeride granites and singificance of Cretaceous processes in the southern zone of the Spišsko-gemerské rudohorie Mts. as well as the westward influence of the processes behind the Gemeride/Veporide boundary.

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