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Metasomatites (listvenites) replacing ultrabasics (Paleozoic, Inner Western Carpathians)

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Метасоматиты (листвепиты) по ультрабаитам. (Палеозой, внутренние Западные Карпаты)

В палеозоическом вулкано-осадочном комплексе, который до сих пор относили к раковецкой группе, был определён целый ряд метасоматитов по ультрабазитах (лиственитах) в прошлом с большей части интерпретированных как метасоматические анкериты или магнезиты. В их составе принимают участие: бреуннерит, железистый доломит, кварц, хлорит, фухсит, хромспинелид, магнетит, гематит и другие минералы. Наличие лиственитов повышает металогенетическую перспективность этой територии и свидетельствует о материалах океанической коры в геологическом строении региона.

Metasomatites (listvenites) replacing ultrabasics (Paleozoic, Inner Western Carpathians)

Several occurences of metasomatized ultrabasic rocks (listvenite) have been found to occur in volcano-sedimentary complexes of Paleozoic age ranged hitherto among the Rakovec group. The bodies have been formerly assumed to represent metasomatic ankerite or magnesite. Mineral assemblages are composed of breunerite, Fe-dolomite, quartz, chlorite, fuchsite, chromspinelids, magnetite, hematite and others. The presence of listvenites increases metalogenetic perspectives of the entire area.

The North-Gemeric zone is a belt of peculiar structural edifice bordering the northernmost structural-tectonic unit of the Internal West Carpathians, the Gemeric unit, in places of its contacts with more northernly units of the Central West Carpathians. The belt is built prevailingly by Paleozoic and but less Mesozoic complexes. Paleozoic age have the Rakovec (Devonian ?), Dobšiná (Middle to Upper Carboniferous) and Krompachy groups (Permian, fig. 1). From all these units, the

Rakovec group has the largest areal extent and, from the viewpoint of reconstruction of the geotectonic development, it appeared hitherto as the most important in the area. The majority of authors is inclined in assuming it to represent an incomplete ophiolite sequence or, at least, agrees with its generation upon a suboceanic crust (Dianiška — Grecula, 1979, Grecula — Varga, 1979, Bajaník — Hovorka, 1981, Maheľ, 1981 a. c.). An important stimulus to such interpretation was the finding of meta-ultrabasite bodies near Vyšný Klátov, Bukovec and Dobšiná-Tešnárky localities (Dianiška — Grecula, 1979, Hovorka — Ivan, 1981a) as members of the Rakovec group. The present paper gives evidence on rich representation of ultrabasic masses at least in the part of complexes ranged into the Rakovec group.

From the wider surroundings of Košické Hámre locality, several bodies of ankerite and dolomite-magnesite composition have been described by J. Ilavský — R. Ďuďa (1970) and R. Ďuďa (1976). Carbonates contain subordinated quartz, chlorite, fuchsite, sericite and ores as pyrite, chalcopyrite, tetrahedrite and cinnabar. Bodies were regarded to represent metasomatic analogues of quartz-ankerite (± sulphides) veins developed in suitable environment "of carbonatic to diabasic composition" (Ďuďa, l. c.). Results of own investigations of the author point to different mineral composition of these bodies substantiating also different genetic interpretation. Structural, mineralogical and geochemical features allow to interpret them as hydrothermally altered ultrabasics i. e. as metasomatites of listvenite type.

Geological characteristics

Listvenites in the surroundings of Košické Hámre occur exclusively in Paleozoic volcano-sedimentary complex represented by multiply alternating epimetamorphic and pelitic sediments. Moreover, also sesediments with carbonate admixture and

Fig. 1. Geological sketch-map of the Spišsko-gemerské rudohorie Mts. Framed areas of metasomatite occurences after ultrabasite rock. 1 — Veporic, 2 — Tatric (1—2 units of the Central West Carpathians), 3 — Gelnica group, 4 — Rakovec group, 5 — complex of higher-metamorphic rocks (Klátov group), 6 — Dobšiná group (except of the Ochtiná member), 7 — Krompachy group, 8 — Ochtiná member, 9 — Črmeľ group (3—9 — Paleozoic of the Gemeric unit), 10—11 — Mesozoic of the Gemeric unit

graphite phyllite are present. The whole complex has been ranged to the Rakovec group by M. Maheľ (1954).

All listvenite occurrences concentrate into several parallel belts of NW—SE strike conciding with the general structural pattern of the area (fig. 2). Listvenites

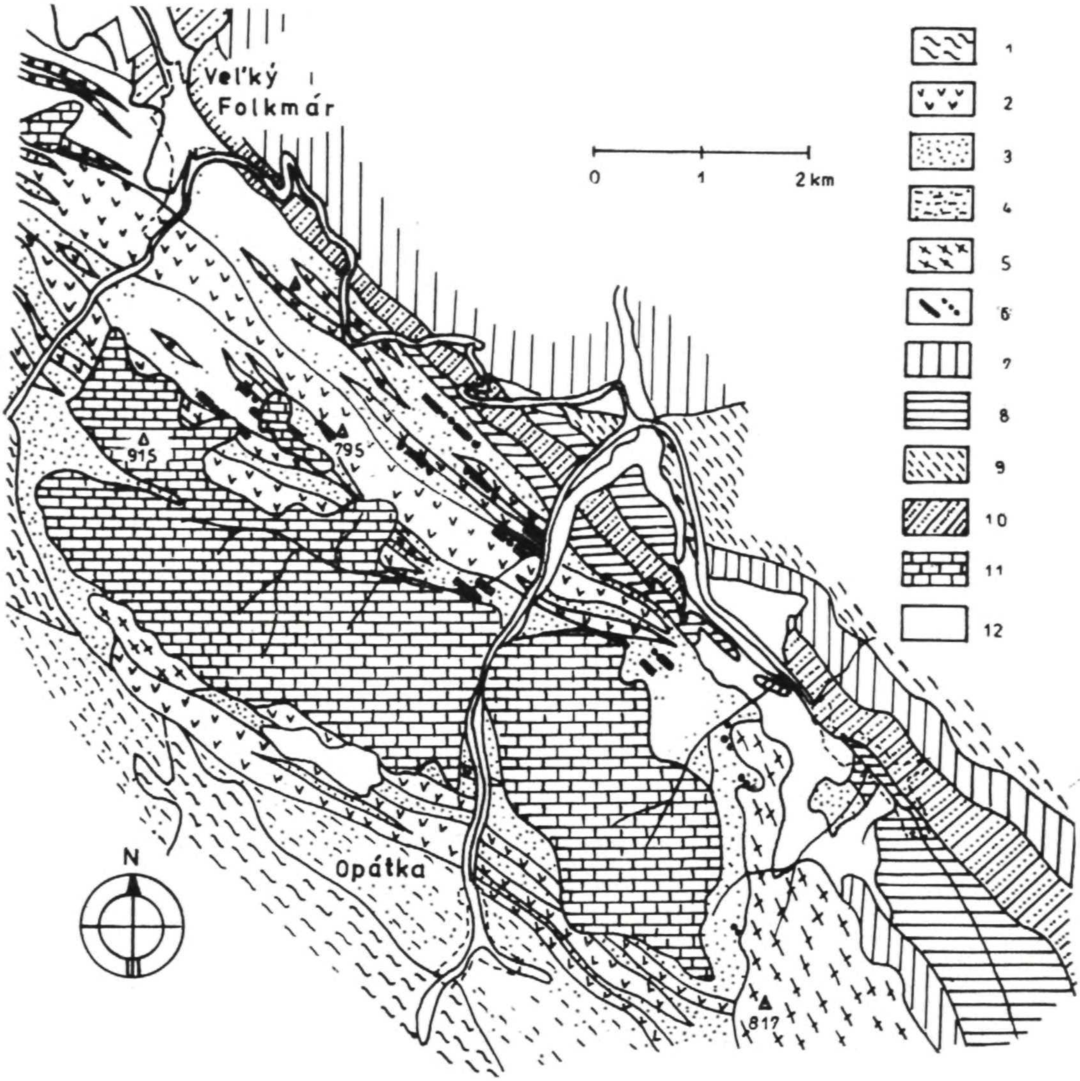

Fig. 2. Geological map of the surroundings of Košické Hámre (modified after Snopko et al., 1973). 1 — Gelnica group, 2 — epimetamorphosed basalt, tuff and spilite, 3 — green phyllite with epimetamorphosed tuff and tuffite layers (2—3 — Rakovec and Dobšiná group undifferentiated), 4 — laminated green chlorite-sericite phyllite (Rakovec group), 5 — rocks of higher metamorphic degree (mainly gneiss and amphibolite, Klátov group), 6 — listvenite body known and presumed, 7 — Ochtiná member, 8 — Krompachy group, 9 — Črmeľ group, 11, 12 — Mesozoic of the Gemeric unit

after ultrabasics create lense-shaped bodies of various size. Names of single occurrences and their more detailed geographic location are in fig. 3. Commonly, thicknesses do not surpass 20 m, the strike lengths attain first hundred metres.

On the most of localities, listvenites appear sharply in morphology creating cliffs several metres high above the terrane or boulder outcrops among the enclosing rocks. Boundaries of bodies toward the enclosing rocks are sharp. In the exocontact zone, features of phyllonitization and subsequent hydrothermal alteration are observable to some metres distance. Anchimonomineral chlorite rock preserved only locally and represent the product of contact-metasomatic reactions between serpentinized ultrabasite and enclosing rocks still before listvenitization.

Metasomatic rocks of analogous type have also been found near to the eastern termination of the Rakovec group near Bukovec village (fig. 1). Listvenites occur along the margins of antigorite serpentinite body confined to the contact of epimetamorphites of the Rakovec group with the gneiss-amphibolite complex. Due to

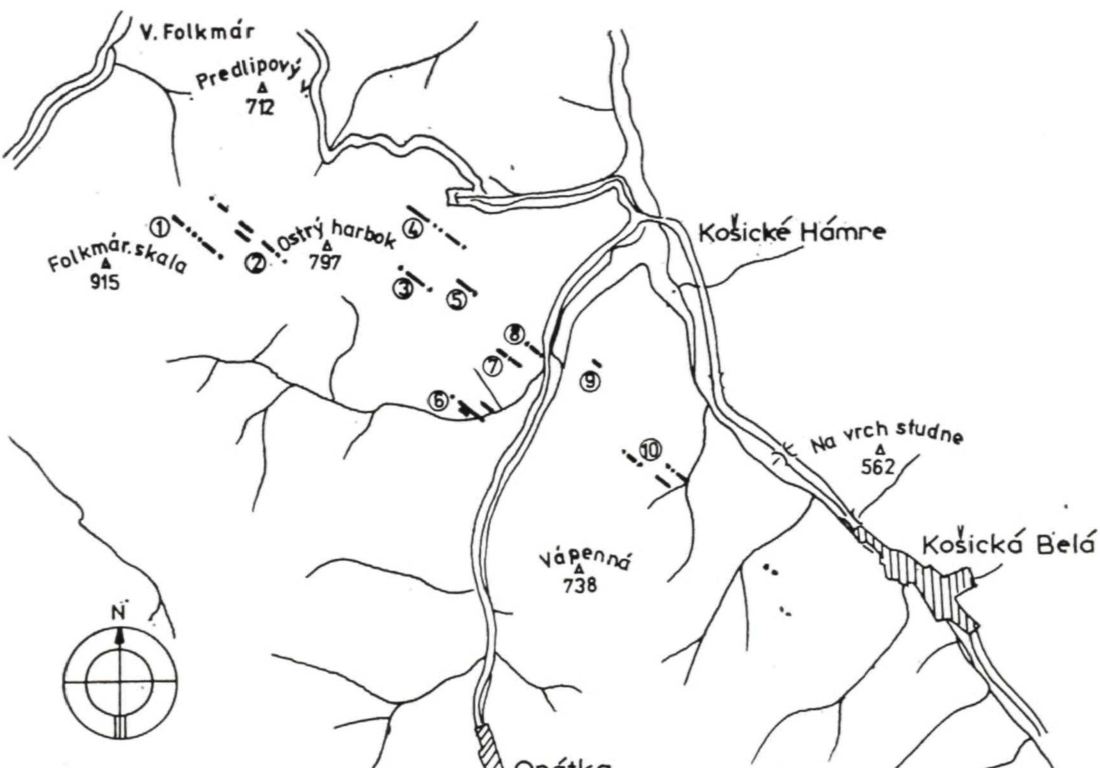

Fig. 3. Distribution of metasomatites after ultrabasics (listvenite) in the surroundings of Košické Hámre. Localites: 1 — Folkmárska skala cliff, 2 — Ostrý harbok, 3 — Rimasgrund, 4 — Teplý potok, 5 — Predné nové, 6 — Zlatník, 7 — Za Prieložky, 8 — Nad Prieložky, 9 — Roveň, 10 — Slatviny

bad outcrops, the occurrence has not been examined in detail.

Petrography and mineralogy

Results of petrographic investigations revealed variable mineral composition of listvenites from the area so in qualitative as in quantitative proportions. In the whole, rock varieties may be classified into several well defineable basic types. Unambiguously, metasomatites after ultrabasics are represented by rocks of the following composition: talc + carbonate, chlorite + quartz + carbonate (breunnerite), chlorite + quartz + charbonate (Fe-dolomite) and fuchsite + quartz + carbonate.

If compared with the original ultrabasite, the talc-carbonate rocks underwent the less alterations. These are rocks foliated to various degrees and, by nacked eye, of brownish-grey to brownish-yellow colours. As a rule, the rocks are composed of fine flaky talc aggregate enclosing idioblasts or clusters of irregular carcarbonate grains (breunerite or breunerite + Fe-dolomite) in various proportions. From the primary minerals of ultrabasics, only chomspinelids are preserved as disseminated grains retaining original idiomorphic shapes and but slightly altered by cataclasis (fig. 4a). Chromspinelids, however, mostly altered in the course of metamorphic alterations as they lost transparency and a chlorite rim developed around the grains indicating the depletion of Al and simultaneously even of Mg with their substitution by iron. Talc-carbonate rocks do not create considerable masses but as small enclaves (2—3 m) occur within other metasomatic rock types on Ostrý harbek, Rimasgrund and Slatviny localities.

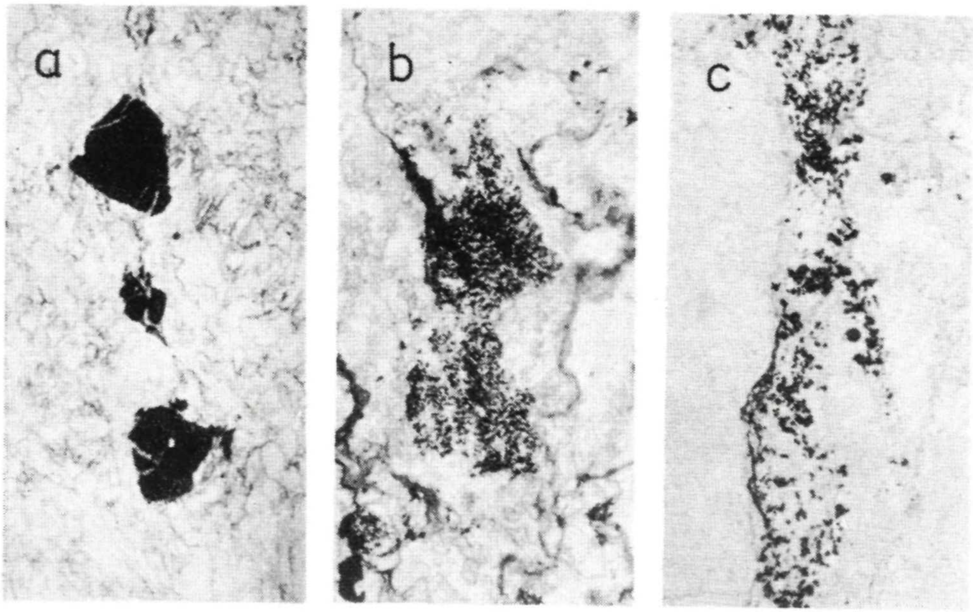

Fig. 4. Increase of chromspinelid cataclasis with increasing degree of metasomatic alteration. a — sample FKH-16, talc-carbonate listvenite. b — sample FKH-57, chlorite-quartz-carbonate (dolomite) listvenite, c — sample FKH-54, fuchsite-quartz-carbonate (dolomite) listvenite, magn. ×48, parallel nicols, photo by L. Oswald

Rocks of chlorite-quartz-carbonate composition are already products of more intense alteration originated at the expense of ultrabasics. This variety is genetically related to the previous one as proved by intermediate parageneses of chlorite + talc quartz + carbonate. Mostly talc underwent alterations being itself substitued by quartz-carbonate mass where usually quartz creates isolated domains of fine-grained development in panxenomorphous carbonate aggregate.

Quartz pseudomorphoses after chlorite are less frequent. Chromspinelid grains are strongly cataclased and together with chlorite rims rolled-out into planar surfaces yielding to the rock a preferredly oriented appearance and even slaty parting (fig. 4b). According to the species of the chlorite and carbonate present, several subtypes may be distinguished.

The most common subtype contains at most exclusively breunerite (up to 50 %) whereas Fe-dolomite is contained maximally in some per cents (tab. 1.).

The content of emerald-green Mg-chlorite is characteristic in this subtype; its Ni-content is higher (2,000 p. p. m.) and contains, as colouring element, chromium (over 1 p. c.). Macroscopically, the rocks have bright yellow colour and contain emerald-green chlorite stripes together with black disseminated chromspinelid grains (fig. 5). The variety composes the majority of listvenite bodies with the exception of the Slatvina locality.

Chlorite-quartz-carbonate (Fe-dolomite) metasomatites containing lesser amounts of greyish-green Mg-chlorite, in thin section almost colourless, have been found as minor enclaves in the previous breuneritic metasomatite. Manometric analyses (tab. 1) point to but subordinated amounts of breunerite and overwhelming Fe-dolomite in the rock. This variety is remarkable by strongly varying colours (dark-grey to

Composition of the carbonate constituent in listvenites from the surroundings of Košické Hámre

Tab. 1

	Loc.	Sample	Type	Breunerite	Dolomite	NZ	Σ	Λ
1	3	FKH-36	$(Ch^1) + T + K$	50,71		47,52	98,33	1,77
2	2	FKH-17	$(Ch^1) + T + K$	46,23		52,20	99,43	0,57
3	6	FKH-2	$Ch^1 + T + Q + K$	44,08		54,25	98,33	1,67
4	6	FKH-4	$Ch^1 + T + Q + K$	26,28	3,14	56,25	85,67	14,33
5	1	FKH-68	$Ch^2 + Q + K$	64,87		32,33	97,60	2,40
6	6	FKH-5	$Ch^2 + Q + K$	42,84	4,42	44,70	91,96	8,04
7	2	FKH-15	$Ch^2 + Q + K$	61,71	2,51	34,95	99,17	0,83
8	4	FKH-62	$Ch^2 + Q + K$	39,34	3,56	53,37	96,27	3,73
9	10	FKH-9	$Ch^3 + Q + K$		49,68	49,32	99,00	1,00
10	10	FKH-12	$Ch^3 + Q + K$		53,86	45,57	99,43	0,57
11	4	FKH-60	$F + Q + K$		37,15	58,65	95,65	5,11
12	1	FKH-67	$Q + K$	17,61	32,15	49,45	99,21	0,79
13	2	FKH-27A	$(Ch^1) + Q + K$	4,58	54,44	38,12	97,14	2,86
14	2	FKH-27B	$(Ch^2) + Q + K$	36,47	25,05	33,37	94,87	5,11
15	10	FKH-28	$Se(?) + Q + K$	68,05		26,68	94,73	5,27

Analyses made by manometric method, analyzed by J. Turan, L. Turanová, Geological Institute, Comenius University, Bratislava. NZ — insoluble residue, Λ — soluble noncarbonatic constituent. Locality number as in fig. 3, metasomatite type as in tab. 3

greenish-white) and banded structure.

A peculiar subtype of chlorite-quartz-carbonate metasomatite has been found on the Slatvina locality being characterized by dark-green Fe, Mg-chlorite (strongly pleochroic in thin section) and rich disseminated hematite. By nacked eye, the rock reminds the previous subtype, it is of greyish-green colour and has well expressed banded structure.

Fuchsite-quartz-carbonate rocks are, when comparing with the other types, less frequent products of ultramafite alteration. Their largest occurrence is in the western part of the Teplý jarok locality where this type prevails. The variety creates only enclaves in chlorite-quartz-carbonate rock on the Zlatník and Rimasgrund localities. The rock is massive, greyish-green and has but slightly expressed banded structure. The fuchsite content is low, not concentrated into bands but mainly scattered. The microscopic composition is the same as in previous cases: carbonate mostly prevails in aggregates or single grains with authomorphic shapes towards quartz. The last mineral occurs as typical fine-grained aggregate (0.0X mm), fuchsite is present in minor flakes or short lense-like veinlets predominantly in quartz. Chromspinelid grains are strongly cataclased and scattered (fig. 4c). Peculiar feature is the locally rich tetrahedrite dissemination.

Listvenite bodies in the surroudings of Košické Hámre are rimmed by various metasomatic rock types originated synchronously with the listvenite through alteration of metabasites and their tectonites. Nevertheless, only anchimonomineral chlorite rocks are mentioned here because these represent the single variety related, from genetic point of view, to the ultrabasics. The last rocks originated by contact-metasomatic processes along the contacts of ultrabasite bodies with the surrounding rock still before the listvenization. The variety underwent but limited hydrothermal-metasomatic alterations so that creates relics inside and along the margins of listvenite bodies. The rock is massive and dark-green, consisting of, almost exclusively, Mg-chlorite and but subordinated apatite, carbonate, rutile and pyrite. Most common occurrences are on Zlatník and Ostrý harbek localities.

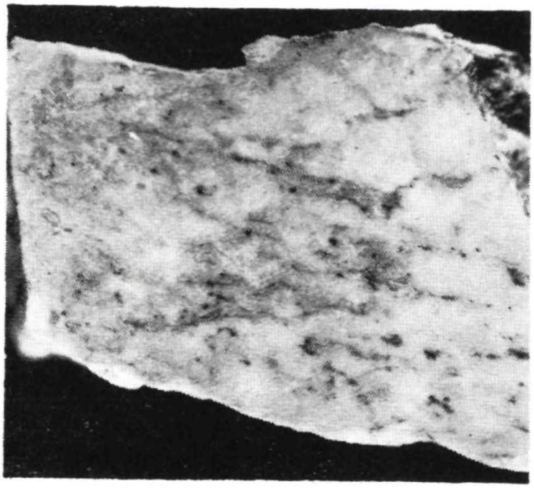

Fig. 5. Chlorite-quartz-carbonate (breunerite) listvenite. Black grains are chromspinelids, greyish stripes composed of emerald-green chlorite, sample FKH-15, magn. ×1.5, photo by L. Oswald

Chemical characteristics

The chemical composition of metasomatic rocks resulted from two antagonistic tendencies: one tending to maintain the pecularities of composition of the educt and another expressed by the tendency of alterating hydroterms to modify the original composition. The rate of the second tendency grows by the alteration degree. The rules indicated influence also the composition of investigated samples. Listvenites originating at the expense of ultrabasites from the surroundings of Košické Hámre preserved the pattern of their origin in contents of petrogenous as well as trace elements. The characteristic traits of ultrabasics, the high MgO and Al_2O_3 content, remain namely in products of initial alteration stages i. e. in talc-carbonate and chlorite-quartz-carbonate (breunerite) rocks (tab. 2, fig. 6). Later metasomatite types, namely the final fuchsite-quartz-carbonate rocks reflect the introduction of calcium by the development of dolomitic carbonate with simultaneous decrease of their magnesium content. Even alkalies then appear owing to the development of fuchsite. From trace elements, high concentrations of chrome characterize all metasomatite types (tab. 3). Certain cases of low chromium concentrations result from the partial destruction of its main carrier, the chromspinelids. Early stages of metasomatic alteration are characterized also by the preservation of original high nickel concentrations. In final products, the fuchsite-quartz-carbonate rocks, the amount of nickel is considerably lower (tab. 3). Similar behaviour characterizes even cobalt contents. Low concentrations of titanium and vanadium are sensible indicators of the original ultrabasic nature of listvenites. In anchimonomineral chlorite rocks confined to the rims of listvenite bodies, concentrations of Ti and V are higher what points to enrichment at the expense of enclosing metabasites.

The comparison of listvenite composition with Uralian listvenites *(locus typicus)* revealed almost perfect similarity (tabs. 2 and 3, fig. 6). Owing to the same original rocks (serpentinized alpinotype ultrabasite), this similarity is proof for a generally valid geochemical nature of listvenization processes.

Chemical composition of metasomatites after ultrabasite from the surroundings of Košické Hámre

Tab. 2

	1	2	3	4	5	6	7	8
SiO_2	34,22	24,94	43,77	55,03	30,92	32,73	40,81	33,25
TiO_2	0,03	0,03	0,02	0,02	0,22	1,46	0,01	0,01
Al_2O_3	1,19	1,61	1,62	1,41	17,50	19,38	1,84	0,45
Cr_2O_3	0,20	0,23	0,17	0,11	0,13	0,03	0,32	0,24
Fe_2O_3	0,65	0,52	2,39	0,38	0,52	0,10	4,17	1,72
FeO	5,31	6,06	3,55	3,50	6,06	6,55	4,16	3,67
MnO	0,12	0,16	0,30	0,16	0,04	0,01	0,06	0,09
NiO	0,20	0,20	0,12	0,00	0,31	0,35	0,23	0,17
MgO	32,15	29,90	10,84	7,59	28,23	25,40	36,00	29,18
CaO	0,18	0,30	14,51	12,84	0,10	0,28	0,61	0,40
Na_2O	>0,01	0,04	0,10	0,08	0,10	0,08	<0,1	0,07
K_2O	>0,01	0,05	0,09	0,28	0,03	0,04	<0,1	0,05
H_2O^-	0,23	0,24	0,41	0,36	0,24	0,32	0,34	0,03
H_2O^+ CO_2	23,29	35,56	20,60	18,26	15,06	13,12	11,40	1,00 29,46
P_2O_5	0,01	>0,01	0,01	>0,01	>0,01	0,26	>0,1	0,02
S	0,01	>0,01	0,05	0,03	>0,01	0,01	—	0,01
Σ	97,79	99,84	98,55	100,05	99,46	100,21	99,93	99,83

Analyses made in laboratories of Geologický prieskum Spišská Nová Ves, 1 — FKH-17, 2 — FKH-15, 3 — FKH-12, 4 — FKH-60, 5 — FKH-3, 6 — FKH-18, 7 — A, 8 — B, other data in tab. 3

The origin of listvenites

To the contrary to classical Uralian localities, a well expressed metasomatic zonality lacks in listvenites from the eastern part of the Gemeric Paleozoic. This is due to small size of single bodies as well as to the high intensity of hydrothermal activity. The development sequence of single mineral types of listvenites in the area investigated, and by that also the general trend of chemical changes, may be stated only on the base of rarely observable

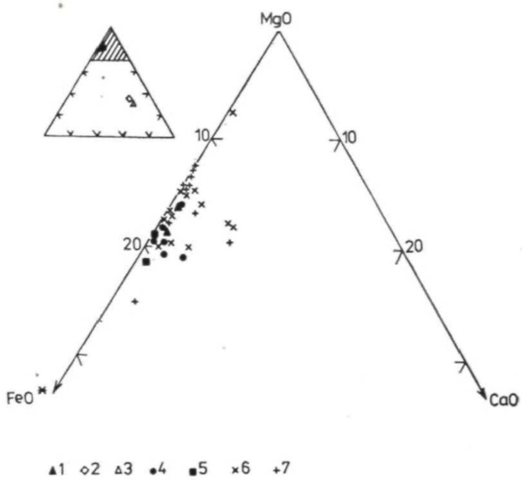

Fig. 6. Variations of FeO* contents (total Fe as FeO), MgO and CaO in various types of metasomatite after ultrabasite (listvenite) and in their educts from the surroundings of Košické Hámre and Ural Mts. (latter data from Sazonov, 1978). 1 — breunerite-bearing listvenite (talc-carbonate and chlorite-quartz-carbonate rock), 2 — chlorite-quartz-carbonate (dolomite) listvenite, 3 — fuchsite-quartz-carbonate (dolomite) listvenite, 4 — serpentinite from the Paleozoic of the Gemeric unit, 5 — anchimonomineral chlorite rock, 6 — listvenites from the Ural Mts. (breunerite-bearing types), 7 — serpentinites from the Ural Mts.

Contents of some typomorphic elements in listvenites from the surroundings of Košické Hámre

Tab. 3

	Loc.	Sample	Type	Ni	Co	Cr	V	Zn	Ni/Co
1	2	FKH-69	T + K	1250	90	2170	30	111	13,89
2	2	FKH-17	Ch^1 + T + Q + K	2020	84	2025	32	100	24,05
3	2	FKH-15	Ch^2 + Q + K	1590	74	1560	39	50	21,49
4	1	FKH-68	Ch^2 + Q + K	1100	60	1250	30	52	18,33
5	2	FKH-14	Ch^2 + Q + K	940	26	1485	35	100	36,15
6	6	FKH-65	Ch^2 + Q + K	935	41	1320	35	109	22,80
7	10	FKH-12	Ch^3 + Q + K	30	40	1140	35	23	19,36
8	4	FKH-35	(Ch^1) + Q + K	8	910	1730	47	405	11,41
9	4	FKH-58	F + Ch^1 + Q + K	46	194	1220	17	39	17,00
10	4	FKH-60	F + Q + K	153	9	750	25	87	6,00
11	6	FKH-3	a. Ch^1	2460	82	870	156	600	30,00
12	2	FKH-18	a. Ch^1	2780	150	211	259	200	18,53
13		A	Serp	1806	80	2190	54		22,58
14		B	F + Q + K	1200	70	1450	30		17,14

Analyses made in Laboratories of Geologický prieskum Spišská Nová Ves, locality number as in fig. 3. Single metasomatite types are characterized by typical mineral assemblages: K — carbonate, Q — quartz, Ch^1 — greyish-green Mg-chlorite, Ch^2 — emerald-green Mg-chlorite, Ch^3 — black-green Fe, Mg-chlorite, (Ch) — chlorite in subordinated amounts, F — fuchsite, Se — sericite, Serp — serpentine, a. Ch — anchimonomineral chlorite rock, A — serpentinite from the Paleozoic of the Gemeric unit (average of 16 analyses), B — fuchsite-quartz-carbonate (breunerite) listvenite from the Ural Mts. (average of 9 analyses, data from Sazonov, 1978) structural and textural relations between different metasomatite types.

Basic data allow to assume four stages of alterations of original ultrabasites. The first stage is explained by the generation of talc-carbonate rocks at the expense of serpentinite. This stage of alteration has been completed in the whole volume of single bodies therefore serpentinite did not preserve neither as relics and the newly generated carbonate was breunerite. The development of chlorite-quartz-carbonate (dolomite) metasomatites may be assigned as the second stage of alteration. The rate of its development on localities investigated is various being the dominant one on Slatvina locality. This stage was peculiar for high activity of calcium and is reflected by the generation of exclusively dolomitic carbonate. During the third stage, the alteration acquired regressive character and the development of chlorite-quartz-carbonate (breunerite) metasomatites resulted in enrichment of magnesium. The accumulation of such metasomatites occurred at the expense of both older products reflecting, according to the view of the author, the bound of calcium into dolomitic carbonate due to the continuing alterations in deeper portions of original ultrabasite bodies. This led to sharp decrease of calcium activity in hydrothermal solutions when, simultaneously, considerable amounts of magnesium have been released and mobilized.

In the majority of bodies, alteration processes accomplished by the development of chlorite-quartz-carbonate (breunerite) metasomatite. Only to a certain degree and in some cases, fuchsite-quartz-carbonate (dolomite) metasomatites originated in the final progressive stage of alteration. The variety occurs, as a rule, in veinlets or irregular nodule-like chambers. More continuous partions of fuchsite-quartz-carbonate (dolomite) metasomatite occur only on Teplý potok locality.

The alteration stages indicated may not be understood as independent phases limited in time but as products of more or less continuous development when the whole alteration process was governed by a unique hydrothermal system. Such deduction is unambiguously proved by very near carbon and oxygen isotopic compositions in chlorite-quartz-carbonate (breunerite) and fuchsite-quartz-carbonate metasomatites (sample FKH-15: $\delta^{13}C$ —5.25 per milles PDB, $\delta^{18}O$ +19.15 per milles SMOW; sample FKH-60: $\delta^{13}C$ —4.45 per milles PDB, $\delta^{18}O$ +20.07 per miles SMOW). The hydrothermal water responsible for metasomatite generation was obviously of magmatic or metamorphic origin. A more exact evaluation, due to incertainities in the assessment of temperatures responsible for metasomatite generation and in the determination of the fractionation coefficient for the carbonate/water system, is impossible.

The metasomatic paragenesis found in listvenites in the area investigated corresponds to the development sequence of classical Uralian listvenites. Moreover, also the regression stage, producing chlorite-quartz-carbonate (breunerite) listvenites has its analogies in so called "yellow listvenites" (comp. Sazonov, 1975, 1978). However, it is to be mentioned that not all rocks in the area and composed, as the main constituent, of breunerite and/or dolomite represent in fact altered ultrabasite. Several cases have been found (Slatviny and Košická Belá localities) where the metasomatic alterations occur in sedimentogeneous carbonate situated near to structures carrying the ultrabasites. Besides mineral and chemical characteristics, there are also pronounced differences in carbon isotopic composition (e. g. the breunerite rock from Slatviny, sample

FKH-28 has the $\delta^{13}C$ value equal to —1.8 per mille PDB).

Metallogenic importance of listvenites

The metallogenic meaning of listvenites lies (i) in their collector properties for specific mineralization types and (ii) in their function as mobilization environment for primary ore element concentrations accumulated, as a rule, already in their educts (Ivan, in print).

Listvenite bodies in the eastern part of the North-Gemeric Paleozoic belt are remarkable mainly for their collector properties containing locally small amounts of disseminated mercury ore and a stockwork to disseminated copper-antimony mineralization. The mercury mineralization is very irregular bound mainly to dolomitic metasomatite and disseminatons of cinnabar are only rarely observable. The copper-antimony mineralization is represented by tetraedrite impregnations in metasomatites or as chambers or quartz veinlets (Ďuďa 1976) being related to final stage of listvenite development as deduced by its occurrence only in fuchsite-quartz-carbonate rock. In breuneritic metasomatite, tetrahedrite is concentrated into younger quartz veinlets.

Indications of ores which could represent mobilization products from listvenites or from their educts (serpentinite) have hitherto not been found in the area. Mainly ores of cobalt-nickel arsenides known near Dobšiná have to be taken in consideration (Hovorka — Ivan, 1981b, Ivan, in print) or, eventually, also mineralizations of gold (Clark, 1979, Zhelobov, 1979). Up to present, none of indicated ores related otherwise to listvenites in the area have economic value. Nevertheless, these may indicate considerable accumulations related to tectonic surfaces in the depth.

The meaning of listvenites for stratigraphy and tectonics

The assessment of ultrabasite origin of listvenites (serpentinite) motivated the reevaluation of stratigraphic and tectonic schemes used formerly for the area. Ultrabasites occur in Paleozoic complexes of the Gemeric unit in two different forms: (i) as constituent of a higher metamorphosed unit composed mainly of gneiss and amphibolite as well (ii) as tectonic implantate from this unit into the stratigraphically higher complex of the Dobšiná group (Hovorka — Ivan, in print). From this aspect, it is highly probable that the epimetamorphic volcano-sedimentary sequence in the area investigated does not belong to the Rakovec group but, from lithological point of view, corresponds to the very similar constituent of the Dobšiná group, the Zlatník member *sensu* Š. Bajaník et al. (1981). Also the presence of graphiteous shales, otherwise unknown from the Rakovec group, speaks in favour of such interpretation. Therefore, in tectonic respect, the area considered does not belong to the Rakovec partial nappe *sensu* P. Grecula — I. Varga (1979) but to the newly defined Klátov partial nappe (Hovorka et al., in print) including rocks of the so called gneiss-amphibolite complex (Rakovec group up to recently) and also part of the Dobšiná group (Rudná and Zlatník members).

Conclusions

Geological and mineralogical investigations of metasomatic rocks from wider surroundings of Košické Hámre known hitherto as metasomatic ankerite bodies proved that

1) the majority of rocks represents hydrothermally altered ultrabasite,

2) by composition, both mineralogical and

geochemical, the metasomatites correspond to listvenites and are very similar to their Uralian analogies,

3) listvenites in the area carry poor disseminated mercury mineralization and stockwork to disseminated tetrahedrite ore,

4) the presence of ultrabasites altered to listvenite within the Paleozoic epimetamorphosed volcano-sedimentary complex casts doubts on its hitherto used ranging into the Rakovec group and, obviously, the complex participates on the Zlatník member of the Dobšiná group creating, the newly defined, Klátov partial nappe.

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