

Genetic relationship of greenschists and amphibolites in Veporicum of the Nízke Tatry Mts.

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Abstract. Within the Nízke Tatry Mts. metabasites we have distinguished: (1) typical greenschists, and (2) diaphorites of the greenschists facies appearance. Majority of their bodies is located on tectonic zone between the Hron complex and the Jánov Grúň complex. From realized field as well as laboratory studies it follows that a part of the Jánov Grúň metabasites ranked till now among greenschists represents diaphorites of amphibolites. In the past they have been ranked to the Hron complex; at present we consider them to be member of the leptyno-amphibolite complex of the Western Carpathians.

Key words: amphibolites, greenschists, diaphorites, Veporic Unit, Western Carpathians

Introduction

In the Nízke Tatry Mts. Veporicum complex there are isolated bodies of greenschists and amphibolites. However, gradual transition between the amphibolites and greenschists may be observed frequently as well. This is the reason of different opinions on their genesis.

Some authors suggest common genesis of both meta-basic rock types and they classify these rocks within the Hron Complex (KLINEC, 1966), the metamorphism of which reached PT conditions of the amphibolite facies. The authors explained the different character of metamorphism as the result of progressive metamorphism of basic rocks, and they considered the greenschist to be diaphorites of amphibolites.

Another opinion assumes different genesis of amphibolites and greenschists. The criteria for this are based on the different grade of metamorphism and geological position. The amphibolites are included into the Hron Complex and the greenschist into the low-metamorphic Janov grúň Formation. This opinion was accepted also by the authors of the latest geological map of this area (BIELY et al., 1992).

During a preliminary study of greenschists from the Janov grúň Fm. we obtained results which are not entirely consistent with the last mentioned conclusion.

Geology

The Janov grúň Formation (MIKO, 1981; MIKO & IVANIČKA, 1993) consists of chlorite-sericite phyllite, sericite-chlorite-albite phyllites, sericite-quartz phyllites, metamorphosed effusive rocks and volcanoclastics of rhyodacite to dacite composition, metadiabases and greenschists. Paleovolcanic rocks of the Janov grúň Fm. belong, according to MIKO (l.c.), into the spilite-diorite-keratophyre formation. The rocks of the Janov grúň Fm. were metamorphosed in the greenschist facies conditions ($T = 340 - 370^{\circ}\text{C}$, $P = 340-400\text{ MPa}$, MIKO & KORIČOVSKÝ, 1994).

The presence of metamorphosed products of basic volcanism - greenschists - is typical for the lower part of the Janov grúň Fm. (MIKO, l.c., MIKO & IVANIČKA, l.c.). One of the largest bodies is lying 2.5 - 3 km ENE of Mýto pod Ďumbierom, on the western slopes of Priebyka (Fig. 1). This body and greenschist bodies in the Ždiarska Valley, NNW of Polomka and N of Závadka nad Hronom and Heľpa (marked in the geological map of BIELY et al., 1992) were the subject of our study.

Petrography

By a detailed field and thin section study, the following rocks may be distinguished among the meta-basic rocks of the studied bodies:

a) **Typical greenschists.** They are represented by fine-grained rocks of dark green colour, as a rule with well pronounced metamorphic foliation. Fine-augene structure is formed of characteristic tabular albite porphyroblasts. The rock matrix is formed predominantly of sub-microscopic chlorite aggregate. In the greenschists there are fine-grained titanite clusters, irregular grains of minerals of the clinozoisite-epidote group, carbonate nests, idioblastic ore minerals (magnetite, pyrite). Equigranular greenschists are sometimes characterised by a sub-microscopic grain-size. The locally present quartz is concentrated predominantly in small lenses. Such greenschist types are usually described as progressively metamorphosed volcanics/volcanoclastic material of basic volcanites.

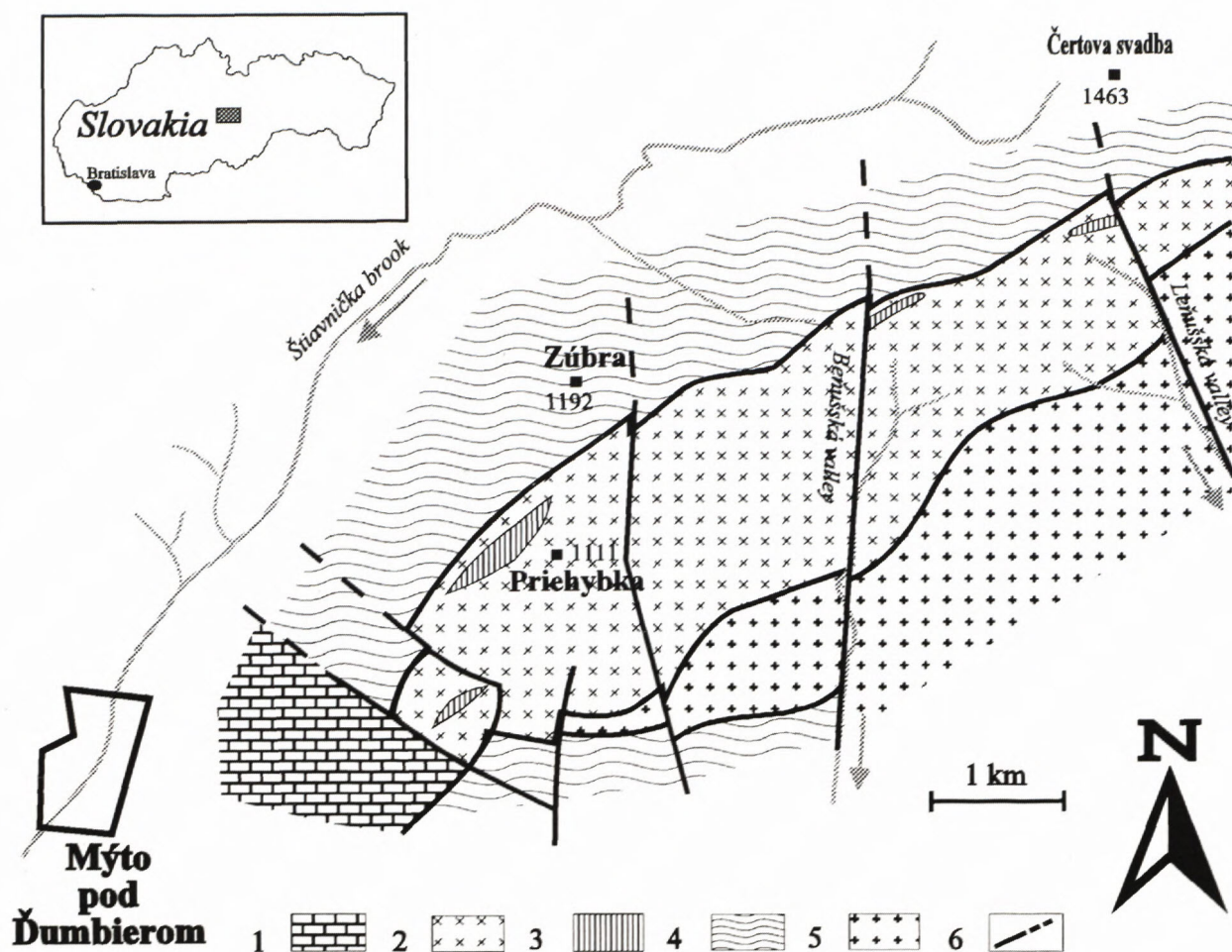


Fig. 1: Geological map of the western part of the Janov grúň Formation (simplified from MIKO and IVANIČKA 1993). 1 = Mesozoic; 2 = Janov grúň Formation (phyllites, rhyodacites, dacites and their volcanoclastics); 3 = metadiabases and greenschists; 4 = Hron Complex (micaschists, amphibolites); 5 = biotite granitoids; 6 = tectonic boundaries

b) **Diaphorised amphibolites.** They are fine-grained rocks, in which the predominant phase is green to greenish-brown amphibole with plan-parallel orientation. A characteristic feature are wholly or partly preserved (pseudomorphed by chlorite) porphyroblastic garnets. Plagioclases are strongly recrystallised into a fine-grained aggregate of white mica, albite, quartz, chlorite and clinozoisite. A characteristic metamorphic newly-formed mineral is chlorite. Rocks of this group bear frequently signs of faint banded texture, with alternating lighter and darker bands. This type of meta-basic rocks occurs usually in the central part of the studied bodies.

Geochemistry

The aim of the preliminary geochemical study was to test on a limited number of samples the possibility of obtaining exact geochemical data necessary for the

study of genesis of the problematic meta-basic rocks. Therefore, we focused on the determination of REE contents. Analytical determination of REE (carried out by the INAA method in the laboratories of MEGA, a.s., Stráž pod Ralskem, Czech Republic) is listed in Table 1.

From a comparison of REE contents in both end types it is obvious that there are no (or only negligible) differences between them (Tab. 1, Fig. 2). Both samples have low Σ REE, normalised REE curves are flat, similar to primitive basalt types.

Discussion and conclusions

If we would include all greenschists of the Nizke Tatry Mts. Veporicum unit into the Janov grúň Formation, we would be confronted with the following problems:

- the majority of larger bodies is situated in a tectonic zone between the Hron Complex and the Janov grúň Formation,

Tab. 1 REE contents (in ppm values) in the studied meta-basic rocks of the Nízke Tatry Mts. Veporicum.

	La	Ce	Nd	Sm	Eu	Gd	Tb	Tm	Yb	Lu	ΣREE
G-3	5.80	14.80	11.00	4.30	1.40	5.00	1.05	0.54	4.30	0.75	48.94
G-4	5.80	14.90	12.50	4.10	1.25	5.10	0.99	0.60	3.80	0.55	49.59

Sample G-3 is a typical greenschist with augen structure. Predominant minerals are albite and chlorite, less abundant is quartz and carbonate.

Sample G-4 is diaphthorised garnet amphibolite. From minerals corresponding to PT conditions of the amphibolite facies, predominant are amphibole and plagioclase. Less abundant is garnet. The metamorphic assemblage of the amphibolite facies comprises 70% of the rock, the rest is a younger assemblage corresponding to PT conditions of the greenschist facies (albite, quartz, chlorite, sericite, epidote and carbonate).

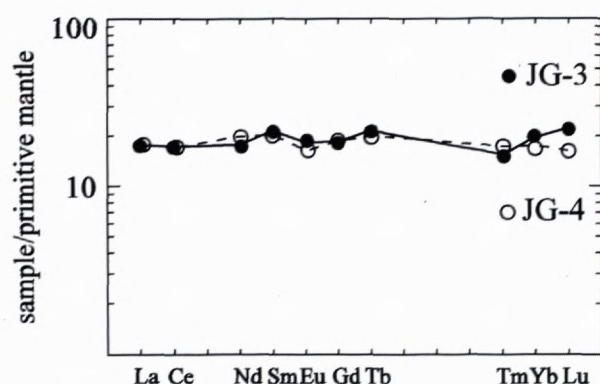


Fig. 2: REE contents in the studied metabasites, primitive-mantle normalised (SUN 1982)

■ greenschist bodies, as indicated in the geological map (BIELY et al. 1992) north of Heľpa, alternate with amphibolites of the Hron Complex. Such geological position is in our opinion not very probable. This is supported also by mutual transitions of greenschists and amphibolites, which may be observed in field outcrops. A younger mineral assemblage occurs in the amphibolites, corresponding to their recrystallisation in the same conditions as the metamorphism of greenschists.

REE contents in two samples of the studied meta-basic rocks suggests the following preliminary conclusions:

- the practically identical REE contents in the greenschist and diaphthorised garnet amphibolite indicate that the greenschists represents a totally diaphthorised amphibolite,
- the protolith of both greenschist and the diaphthorised garnet amphibolite were very probably the same rocks,
- REE appear to have been immobile during the diaphthoresis, which shows the suitability of their application in the detailed study of the genesis of greenschists and amphibolites,

d) low ΣREE and primitive character of REE distribution in both cases is practically identical with REE characteristics determined in amphibolites of the leptyno-amphibolite complex in the Western Carpathians (LAC - HOVORKA et al. 1992, 1994, HOVORKA & MÉRES 1993, or "banded amphibolites" in the terminology of SPIŠIAK and PITOŇÁK 1992, JANÁK et al. 1993, or amphibolites of the Hron Complex, KLINEC 1966).

From the above facts it follows that a part of the meta-basic rocks marked in the 1 : 50 000 geological map (BIELY et al., 1992) as greenschists of the Janov grúň Formation are diaphthorites of amphibolites. They were formerly assigned to the Hron Complex (KLINEC 1966), at present we classify them with the leptyno-amphibolite complex. These are most probably especially the greenschist bodies situated near the tectonic contact of the Hron Complex (LAC) and the Janov grúň Formation.

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