DOLOMITE MARBLES AT CONTACT OF THE MOLDANUBICUM AND MORAVICUM IN THE AREA BETWEEN JASENICE AND OSLAVANY

DOLOMITICKÉ MRAMORY NA STYKU MOLDANUBIKA
A MORAVIKA V OBLASTI MEZI JASENICÍ A OSLAVANY

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Abstract

Houzar, S., Novák, M., 1991: Dolomite marbles at contact of the Moldanubicum and Moravicum in the area between Jasenice and Oslavany. *Acta Mus. Moraviae, Sci. nat.*, 76:83—94 (with Czech summary).

Dolomite marbles at the contact of the Moldanubicum and Moravicum in the area between Jasenice and Oslavany were studied. The observed mineral assemblages, metamorphic zonality, chemical composition of dolomite marbles and lithostratigraphy of the rock sequences containing marble bodies indicate: (1) The studied dolomite marbles of the Moldanubicum are nearly the same as the dolomite ones of the Strážek Moldanubicum, (2) The dolomite marble from Ketkovice-Chvojnice (the Olešnice Unit) is very similar to dolomite marbles in the northern part of the Olešnice Unit. (3) Tectonic movements along the Náměšť Fault are younger than metamorphism M 2 and the course of this fault is not always identical with the overthrust of the Moldanubicum over the Moravicum. (4) The metamorphism M 2 is not younger than the overthrust.

Key words: dolomite marbles, petrology, metamorphic evolution, Moldanubicum, Moravicum, western Moravia, Czechoslovakia.

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Introduction

Geology of the area between Jasenice and Oslavany has been discussed in many works (e.g. Suess 1898, 1906, 1912; Zapletal 1932; Němec 1936; Zoubek 1946; Dudek 1958, 1962; Kotásek and Weiss 1964; Patel 1972; Matějovská 1975; Weiss 1977; Rajlich 1988; Rejl et al. 1988; Urban 1988, 1990), nevertheless, great differences still exist in the regional division of this area, and in the views on the tectonic and metamorphic evolution.

Metamorphosed carbonate rocks were mentioned by Suess (1898, 1906), Květoň (1951), Němec (1960, 1961, 1971—72), Kotásek and Weiss (1964), Kalášek et al. (1952). Most of these works, however, were concentrated on calcite marbles, mineral relations were investigated only sporadically. This paper describes mineral assemblages and chemical composition of dolomite marbles. A comparison of the Strážek Moldanubicum with the northern part of the Olešnice Unit is given and some problems of the metamorphic evolution in this area are discussed.

Geological setting

The studied dolomite marbles are situated in a complicated region along the overthrust of the Moldanubicum over the Moravicum (Fig. 1). The Náměšť

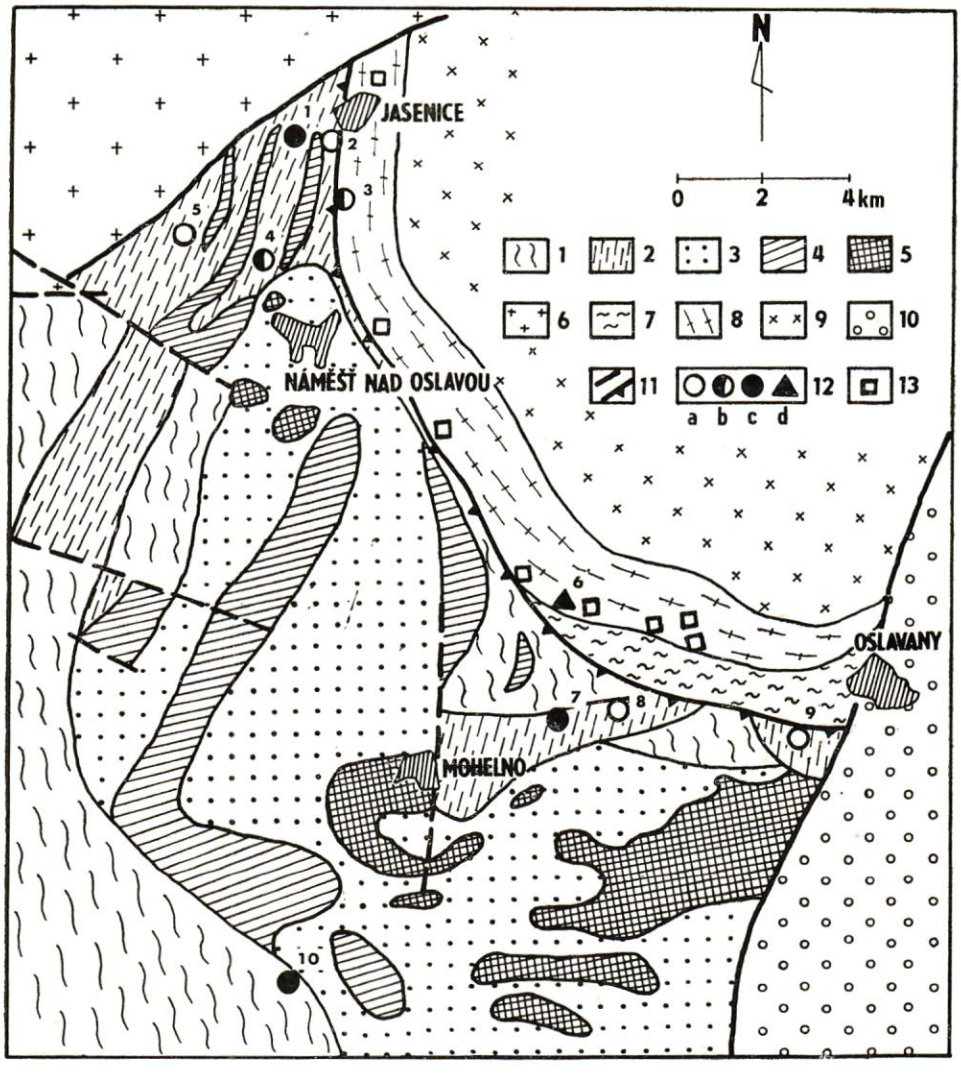

Fig. 1. Geological map of the studied area on the contact between the Moldanubicum and Moravicum.

Obr. 1. Geologická mapa studované oblasti na kontaktu mezi moldanubikem a moravikem.

Modified after Blížkovský et al. (1986) and Šouba and Scharmová (1984).

1 — Gföhl Gneiss, 2 — biotite gneiss, 3 — granulite, 4 — amphibolite, 5 — serpentinite, 6 — durbachite, 7 — Moravian Mica Schist Zone, 8 — Olešnice Unit, 9 — Bíteš Unit, 10 — Permian-Carboniferous, 11 — tectonic lines, 12 — dolomite marbles with the diagnostic mineral assemblages a — Fo+Chl+Spl+Cal (Zone C), b — Fo+Chl+Cal (Zone B), c — Fo+Spl+Cal (Zone D), d — Tr+Phl+Dol+Cal, 13 — calcite marbles; Numbers of localities: 1 — Naloučany, 2 — Jasenice, borehole JS-1, 3 — Pucov, 4 — Ocmanice E, 5 — Ocmanice W, 6 — Ketkovice-Chvojnice, 7 — Senorady W, 8 — Senorady E, 9 — Nová Ves near Oslavany, 10 — Kordula.

Podle Blížkovský et al. (1986) a Šouba a Scharmová (1984) — upraveno.

1 — gföhlské ruly, 2 — biotitická rula, 3 — granulit, 4 — amfibolit, 5 — serpentinit,

Fault represents the most important tectonic line in this region separating the Moravian Moldanubicum from the Olešnice Unit (Moravicum) and from the Moravian Mica Schist Zone (Mísař et al. 1983). The Moldanubicum is built by the Gföhl Gneiss and by the Náměšť granulite complex consisting of various types of granulites, metabasites and ultrabasite rocks. Subordinate biotite gneisses, locally migmatized to a different degree, in two isolated regions situated along the contact between the Moldanubicum and Moravicum (Fig. 1).

The Moravicum is formed by the varied complex of metamorphosed volcano-sedimentary rocks. The Olešnice Unit is characterized by biotite gneiss, mica schists, phyllite, quartzite, metabasite, graphitic rocks and marbles, the Bíteš Unit is formed predominately by the Bíteš gneiss and rare metabasites. Biotite-muscovite gneiss, mica schists and metabasites are typical of the Moravian Mica Schist Zone (Mísař et al. 1983).

Metamorphism of the studied part of the Moravian Moldanubicum is comparable with other Moldanubian regional units. The older regional metamorphism of the kyanite-staurolite type was overprinted by a low-pressure metamorphism of the sillimanite-cordierite type (Matějovská 1975). The Olešnice Unit and the Moravian Mica Schist Zone correspond to the kyanite-staurolite type with sillimanite, the contents of which decrease toward the E (Cháb and Suk 1977). Apparent differences in a metamorphic grade between these units, usually visible in rock hand specimens, were often overprinted by younger tectonic processes and mylonitization.

Marbles

The marbles occuring in the studied area can be divided into three individual groups:

1. dolomite marbles of the Moravian Moldanubicum
2. dolomite marbles of the Olešnice Unit
3. calcite marbles of the Olešnice Unit.

1. These marbles form lenticular bodies from 1 to 40 m thick, enclosed in biotite gneiss (Ocmanice-W, Senorady-E) or in migmatites (Nová Ves near Oslavany, Naloučany). The contact with adjacent rocks is usually sharp, even though rare narrow reaction rims have been observed. Tectonic breccias accompanied by serpentinization and chloritization are known from the contact of marble and migmatite in Nová Ves near Oslavany. Dolomite marbles are very similar to dolomite marbles from the Strážek Moldanubicum (Novák 1989) and to those from other parts of the Moravian Moldanubicum (Houzar 1984). They are medium- to fine-grained, massive, white to pale grey in colour, usually poor in silicates which form irregular nests and bands. Layered silicate-rich marbles were found in Senorady-W and Ocmanice-E. Mineral assemblages (Table 1) are similar to those of the Strážek Moldanubicum (Novák 1989), however, forsterite is nearly always far more intensively serpentinized. Spinel, clinohumite, pyrhotite and galena are rare. The diopside grains associated with forsterite have been found in some localities. Zonal reaction veins composed

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6 — durbachit, 7 — moravská svorová zóna, 8 — olešnická jednotka, 9 — bítešská rula, 10 — permokarbon, 11 — tektonické linie, 12 — dolomitické mramory s diagnostickými minerálními asociacemi; a — Fo+Chl+Spl+Cal (zóna C), b — Fo+Chl+Cal (zóna B), c — Fo+Spl+Cal (zóna D), d — Tr+Phl+Dol+Cal, 13 — kalcitické mramory. Čísla lokalit: 1 — Naloučany, 2 — Jasenice, vrt JS-1, 3 — Pucov, 4 — Ocmanice V, 5 — Ocmanice Z, 6 — Ketkovice-Chvojnice, 7 — Senorady Z, 8 — Senorady V, 9 — Nová Ves u Oslavan, 10 — Kordula.

of diopside and serpentinized forsterite + calcite zones and comparable with reaction veins from the Strážek Moldanubicum (see Novák 1986) were found in Nová Ves near Oslavany and in Ocmanice-W.

2. Marbles of this group are known only from two localities; Ketkovice-Chvojnice and Pucov (Fig. 1). In the Chvojnice river valley about 1.5 km SW from Ketkovice, a lenticular body of dolomite marble about 10 m thick occurs.

Tab. 1. Mineral assemblages of dolomite marbles from the Moldanubicum.
Tab. 1. Minerální asociace dolomitických mramorů z moldanubika.

Locality Lokalita	Metamorphism M 1 Metamorfóza M 1	Metamorphism M 2 Metamorfóza M 2	Metamorphism M 3 Metamorfóza M 3
Ocmanice E	Phl+Tr+Dol+Cal	Fo+Cal	Atg
Ocmanice W	Phl+Dol+Cal	Fo+Cal	Atg
Jasenice	Phl+Dol+Cal	Fo+Chl+Cal	Atg
Jasenice	Phl+Dol+Cal	Fo+Chl+Spl+Cal	Atg
Jasenice	Phl+Dol+Cal	Fo+Chl+Spl+Cal	Atg
Nová Ves	Phl+Tr+Dol+Cal	Fo+Chl+Spl+Cal	Atg
Nová Ves	Phl+Tr+Dol+Cal	Fo+Chl+Spl+Cal	Atg
Senorady E	Phl+Dol+Cal	Fo+Chl+Spl+Di+Cal	Atg
Senorady E	Phl+Dol+Cal	Fo+Chl+Spl+Cal	Atg
Senorady E	Phl+Dol+Cal	Fo+Chl+Spl+Chu+Cal	Atg
Senorady E		Fo+Chl+Spl+Di+Cal	Atg
Senorady W	Phl+Tr+Dol+Cal	Fo+Spl+Cal	Atg
Senorady W	Phl+Dol+Cal	Fo+Spl+Cal	Atg
Senorady W		Fo+Spl+Cal	Atg
Naloučany		Fo+Chl+Spl+Cal	Atg
Naloučany	Phl+Tr+Dol+Cal	Fo+Spl+Cal	Atg
Naloučany		Fo+Spl+Cal	Atg
Kordula (Němec 1960)	Phl+Cal	Fo+Spl+Cal	Atg

Abbreviations: Phl — phlogopite, Tr — tremolite, Dol — dolomite, Cal — calcite, Fo — forsterite, Atg — antigorite, Chl — chlorite, Spl — spinel, Di — diopside, Chu — clinohumite, Gr — graphite, Kfs — K-feldspar, Qtz — quartz, Tlc — talc.
Vysvětlivky: Phl — flogopit, Tr — tremolit, Dol — dolomit, Cal — kalcit, Fo — forsterit, Atg — antigorit, Chl — chlorit, Spl — spinel, Di — diopsid, Chu — klinohumit, Gr — grafit, Kfs — K-živec, Qtz — křemen, Tlc — mastek.

Tab. 2. Mineral assemblages of dolomite marbles from the Olešnice Unit and from Pucov.
Tab. 2. Minerální asociace dolomitických mramorů z olešnické jednotky a z Pucova.

Locality Lokalita	
Ketkovice-Chvojnice	Phl+Tr+Dol+Cal
Ketkovice-Chvojnice	Phl+Tr+Dol+Cal
Prosetín	Tr+Chl+Tlc+Dol+Cal
Prosetín	Phl+Tr+Dol+Cal
Prosetín	Tr+Dol+Cal
Velké Tresné	Phl+Tr+Dol+Cal
Pucov	Phl+Tr+Di+Cal+Gr+Dol
Pucov	Phl+Fo+Cal+Dol+Atg
Pucov	Phl+Tr+Fo+Di+Cal+Dol+Atg
Pucov	Phl+Fo+Di+Cal+Dol+Atg

Table 3. Chemical analyses of dolomite marbles. Tabulka 3. Chemické analýzy dolomitických mramorů.

	1	2	3	4	5	6	7	8	9	10	11	12
						wt %						
SiO_2	0.65	1.12	2.91	5.89	1.36	7.78	5.39	1.43	5.33	9.80	7.13	5.21
TiO_2	0.013	0.035	0.019	0.042	0.010	0.020	0.020	0.020	0.020	0.020	0.034	0.010
Al_2O_3	0.19	0.61	0.37	0.80	0.39	0.82	0.79	0.31	0.28	0.49	0.76	0.37
Fe_2O_3	0.07	0.19	0.12	0.16	0.13	0.33	0.18	0.29	0.28	0.25	0.54	0.09
FeO	0.06	0.06	0.06	0.14	0.14	0.29	0.07	0.06	0.14	0.17	0.26	0.16
MnO	0.021	0.030	0.091	0.030	0.058	0.041	0.019	0.091	0.048	0.035	0.047	0.034
MgO	20.98	20.46	20.06	17.81	20.64	12.28	18.06	16.74	20.45	19.12	20.17	20.65
CaO	31.34	31.05	31.38	32.82	30.91	38.73	32.61	35.37	31.00	30.80	29.38	30.00
Na_2O	0.15	0.08	0.12	0.13	0.03	0.06	0.03	0.11	0.03	0.05	0.13	0.03
K_2O	0.03	0.11	0.15	0.12	0.04	0.26	0.10	0.11	0.16	0.06	0.07	0.05
P_2O_5	0.01	0.02	0.01	0.04	0.005	0.01	0.03	0.04	0.06	0.05	0.03	0.005
H_2O^+	1.25	1.40	1.29	2.01	1.77	—	—	1.77	2.14	1.51	0.26	1.64
H_2O^-	0.05	0.05	0.13	0.19	0.11	—	—	0.06	0.12	0.10	0.14	0.12
CO_2	45.03	44.49	43.22	39.57	44.60	39.19	42.48	43.44	39.93	37.52	41.16	41.72
Total	99.84	99.71	99.93	99.75	100.19	99.81	99.78	99.83	99.99	99.98	100.11	100.09
						ppm						
Zn	419	404	228	556	61	30	26	31	72	7	37	45
Cu	12	5	<5	<5	<5	—	5	<5	19	6	21	<5
Pb	—	—	—	—	9	12	—	—	—	—	—	9
Ba	<50	<50	350	63	<50	38	16	<50	<50	<50	<50	<50
Sr	49	57	82	117	88	198	170	117	63	101	43	86

1 — Naloučany, small quarry NE — Naloučany, malý lomek sv. od obce
2 — Ocmanice-E, outcrop in Oslava valley — Ocmanice-V, výchoz v údolí Oslavy
3 — Jasenice, borehole JS-1, — Jasenice, vrt UP JS-1
4 — Jasenice, borehole JS-1, — Jasenice, vrt UP JS-1
5 — Senorady-E, outcrops 1 km E — Senorady-V, výchozy 1 km východně od obce
6 — Nová Ves near Oslavany, small quarry in Oslava valley — Nová Ves u Oslavan, malý lomek v údolí Oslavy
7 — Nová Ves near Oslavany, small quarry in Oslava valley — Nová Ves u Oslavan, malý lomek v údolí Oslavy
8 — Pucov, borehole NW — Pucov, vrt sz. od obce
9 — Pucov, small quarry W — Pucov, malý lomek západně od obce
10 — Ketkovice, small quarry in Chvojnice valley — Ketkovice, malý lomek v údolí Chvojnice
11 — Prosetín
12 — Velké Tresné near Olešnice

It is enclosed in muscovite-biotite gneiss with intercalations of graphitic rocks and metabasites. White to pale grey medium-grained marble contains thin layers rich in white needle-like tremolite associated with rare phlogopite (Table 2). Talc, chlorite and palygorskite represent late fissure minerals. The mineral assemblage (Table 2) and textural relations are nearly the same as in Prosetín and Velké Tresné near Olešnice in the northern part of the Olešnice Unit (Novák 1988). Dolomite marble from Pucov appears to be strongly heterogeneous and rich in silicates. Prevailing massive medium-grained marble contains common grains of serpentinized forsterite and flakes of phlogopite. Silicate-rich bands are characterized by common tremolite and diopside. Dark grey, fine-grained marble is more calcitic; diopside, tremolite, phlogopite and graphite have been found in thin sections (Table 2). Rare metasomatic reaction veins similar to those of the Strážek Moldanubicum and Nová Ves near Oslavany occur in this dolomite marble.

3. Grey calcite marbles with common dark grey tremolite, graphite, phlogopite and pyrite are widespread in the Olešnice Unit. They are located in muscovite-biotite gneiss, mica schist and phyllite and often contain intercalations of graphite or graphitic rocks, which were even exploited in some localities (Čučice, Ketkovice). These marbles have not been studied in detail in this work.

Chemical composition of dolomite marbles (the types low in silicates were analysed only) is given in Table 3 and the MgO/MnO ratio is shown in Fig. 2. Only very small differences appear between the Moldanubicum s. l. and the Olešnice Unit. The Moldanubian dolomite marbles show lower SiO_2/Al_2O_3 ratios

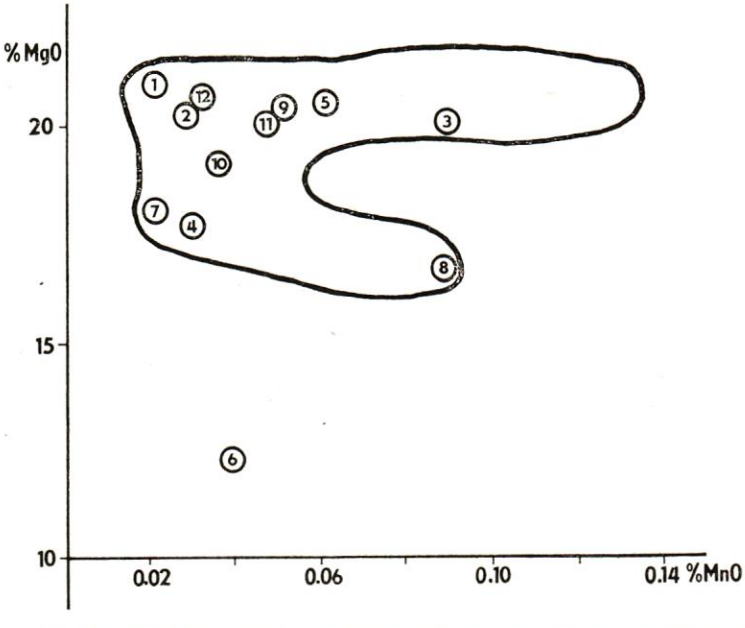

Fig. 2. MnO/MgO ratio of the studied dolomite marbles in the field of dolomite marbles from the Strážek and Moravian Moldanubicum.

Obr. 2. Poměr MnO/MgO ve studovaných dolomitických mramorech v poli dolomitických mramorů strážeckého a moravského moldanubika.

The field is based on the data from Novák (1987) and unpublished data of the authors. Numbers correspond to Table 3.

Pole je založeno na datech Nováka (1987) a nepublikovaných datech obou autorů.

and higher Zn contents, especially from the Náměšť surroundings. The MgO content in the marble from Nová Ves near Oslavany (anal. no. 6) corresponds to the calcite-dolomite layered marble.

Metamorphic evolution of dolomite marbles

The observed mineral assemblages (Tables 1 and 2) and textural relations among minerals show apparent differences in the metamorphic evolution between dolomite marbles relating to the Moldanubicum and the Olešnice Unit. The studied Moldanubian marbles were found to be polymetamorphites very similar to dolomite marbles of the Strážek Moldanubicum (comp. Novák 1989), therefore, the individual metamorphic zones were designated by the same marks.

The oldest metamorphism M 1 is characterized by the equilibrium mineral assemblage Phl+Tr+Cal+Dol, which has been observed as relicts in most localities. In the course of the younger metamorphism M 2 phlogopite and presumably tremolite were replaced, to a different degree, by forsterite, chlorite, spinel and clinohumite, respectively, and metamorphic zones similar to the Strážek Moldanubicum were formed. The mineral assemblages corresponding to the Zone A developed in the dolomite marbles of the Svratka Crystalline Complex only (Novák 1989) and have not been observed within the studied area. The Zone B with the diagnostic mineral assemblage Fo+Chl+Cal has been detected in locality Ocmanice-E. This occurence situated in the field is very poor and small in quantity of the studied samples, therefore, it did not allow a more detailed study. The mineral assemblage of Zone C Fo+Chl+Spl+ +Cal is common in localities Nová Ves and Senorady-E. It occurs also in dolomites from the borehole Jasenice JS-1, however, typomorphic assemblage for this zone chlorite+spinel is very rare. The mineral assemblage Fo+Spl+Cal corresponding to the Zone D has been found in Naloučany, Senorady-W and according to the data of Němec (1960), it is also present in Kordula near Rouchovany. Diopside has been found rarely in some thin sections from Zone C, however, its textural relations to forsterite are not clear. Clinohumite in equilibrium with forsterite occurs in one thin section from Senorady-E and it indicates presence of the Zone K.

The retrograde phase of the metamorphism M 2 represented by younger chlorite II, forming in the junction between spinel and forsterite or clinohumite, is very weak in this region. Serpentinization of forsterite, the typical mark of the youngest metamorphism M 3 is far more intensive than in the Strážek Moldanubicum.

Metamorphic evolution of dolomite marbles relating to the Moldanubicum in the studied region is nearly the same as in the Strážek Moldanubicum. The metamorphism M 1 producing phlogopite and tremolite, mostly with visible preferential orientation, seems to be syntectonic. The younger metamorphism M 2 is posttectonic and polyphase. During the first phase metasomatic reaction veins with diopside, forsterite and calcite were formed. The main, second phase caused a distinct metamorphic zoning. Formation of diagnostic mineral equilibrium assemblages could be expressed by the following reactions described already by Novák (1989) from the Strážek Moldanubicum:

(1) $Tr + 11\,Dol = 8\,Fo + 13\,Cal + 9\,CO_2 + H_2O$
(2) $2\,Phl + 5\,Dol + 2\,H_2O = Chl + 3\,Fo + 5\,Cal + 5\,CO_2 + K_2O$
(3) $4\,Phl + 12\,Dol = 9\,Fo + Chl + Spl + 12\,Cal + 12\,CO_2 + 2\,K_2O$
(4) $2\,Phl + 7\,Dol = 6\,Fo + Spl + 7\,Cal + 2\,H_2O + K_2O + 7\,CO_2$
(5) $4\,Phl + 15\,Dol + H_2O = 5\,Fo + Chl + Spl + Chu + 13\,Cal + 13\,CO_2 + 2\,K_2O$

Dolomite marbles from the Olešnice Unit show different metamorphic evolution. The mineral assemblages and relations from Ketkovice-Chvojnice are similar to those from Prosetín and Velké Tresné in northern part of the Olešnice Unit (see Table 2), nevertheless, the equilibrium mineral assemblage tremolite + dolomite, common in Prosetín (Novák 1988), was found only sporadically. A prograde metamorphic event of a syntectonic character producing tremolite and phlogopite, and a retrograde event characterized by formation of talc, chlorite and palygorskite have been observed. The equilibrium assemblages including tremolite, phlogopite, calcite and dolomite indicate the existence of the following mineral reactions:

(6) $3\ Dol + Kfs + H_2O = Phl + 3\ Cal + 3\ CO_2$

(7) $8\ Qtz + 5\ Dol + H_2O = Tr + 3\ Cal + 7\ CO_2$

however, further mineral reaction (8) could appear in Prosetín.

(8) $2\ Tlc + 3\ Cal = Tr + Dol + CO_2 + H_2O$

Retrograde minerals — talc, chlorite and palygorskite — often occur in fissures, which do not allow to determine exact mineral reactions of their origin.

The mineral assemblages from Pucov (Table 2) resemble those from the metamorphic zone B in the Moldanubicum, however, there are some differences — the absence of chlorite and presence of common diopside. This mineral occurs mostly in silicate-rich bands, nevertheless, it seems to be in the equilibrium with tremolite and phlogopite. Forsterite is not associated with diopside, therefore, relations between these minerals are not clear. Whether diopside represents older mineral formed together with tremolite during metamorphism M 1, or whether it is formed together with forsterite during metamorphism M 2, or all silicates — forsterite, tremolite, diopside represent the invariant equilibrium assemblage, as described by Högelsberger (1989) in Waldviertel, is not possible to decide. A detailed study of textural relations in the assemblage forsterite + tremolite + diopside + calcite + dolomite + phlogopite is required.

Discussion

Dolomite marbles from the Moravian Moldanubicum and from Olešnice Unit show very similar chemical characters (see Table 3 and Fig. 2). Nevertheless, there were found some significant differences in the lithostratigraphy and in the metamorphic evolution.

The Moldanubian dolomite marbles are situated in biotite gneisses, sometimes migmatized to a different degree. They are often associated with metabasites and pyroxene gneisses. The dolomite marble from Pucov is enclosed in fine-grained biotite gneiss and no other rocks were found in this locality and its close proximity. The dolomite marble from Ketkovice-Chvojnice is located in muscovite-biotite gneiss with common intercalations of quartzite, metabasite and graphitic rocks. Graphite-rich bands are deposited in a close overlying of the dolomite body.

The mineral assemblages in studied dolomite marbles of the Moravian Moldanubicum show three independent metamorphic cycles similar to those in the Strážek Moldanubicum (Novák 1989). The mineral assemblage in dolomite marble from Pucov is nearly the same as in the Moldanubian dolomites (see Tables 1 and 2). Simpler metamorphic evolution has been observed in dolomite marble from Ketkovice-Chvojnice. Only prograde metamorphism of syntectonic character producing tremolite and phlogopite was found. Retrograde metamorphism in the Olešnice Unit is not so strong as in the Moldanubian marbles, nevertheless, this difference may be caused by high sensibility of

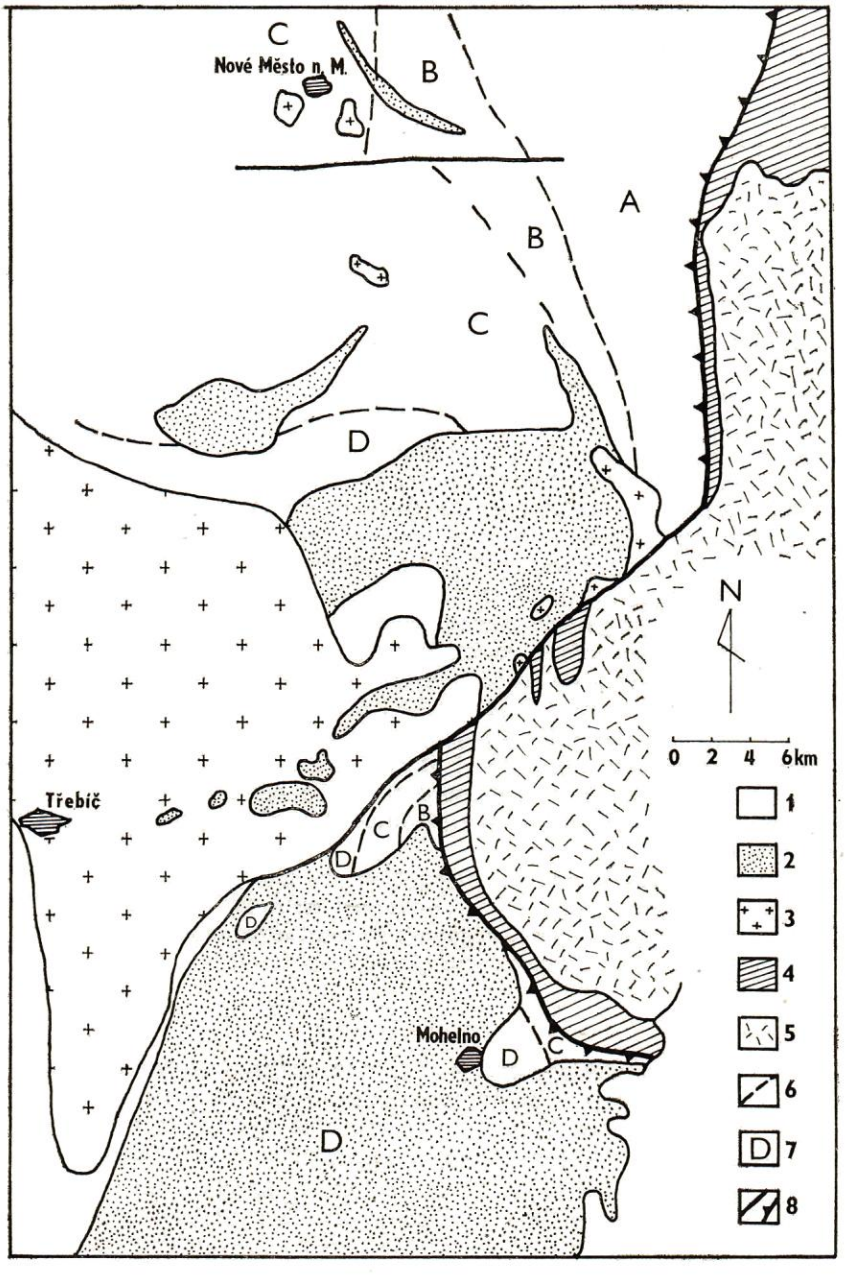

Fig. 3. Geological map of the eastern margin of the Moldanubicum.
Obr. 3. Geologická mapa východního okraje moldanubika.
1 — gneisses and migmatites of the Moldanubicum and of the Svratka Crystalline Complex, 2 — Gföhl Gneiss, granulites, 3 — durbachites, 4 — Olešnice Unit and Moravian Mica Schist Zone, 5 — Bíteš Unit, 6 — metamorphic isograds, 7 — designation of metamorphic zones in dolomite marbles, 8 — tectonic lines.
1 — ruly a migmatity moldanubika a svrateckého krystalinika, 2 — gföhlské ruly, granulity, 3 — durbachity, 4 — olešnická jednotka a moravská svorová zóna, 5 — bítešská jednotka, 6 — metamorfní izogrády, 7 — označení metamorfních zón v dolomitických mramorech, 8 — tektonické linie.

forsterite which is to be replaced by serpentine in the metamorphism characterized by high H_2O activity.

Correlation of single metamorphic events between the Moravian Moldanubicum and the Olešnice Unit (Moravicum) is complicated. The metamorphic processes producting tremolite and phlogopite in dolomites in both regional units show some similarities. Textural relations in the mineral assemblages including tremolite and phlogopite indicate the same mineral reactions (6), (7), however, in the Olešnice Unit, especially in Prosetín, the reaction (8) may have taken part too. The metamorphic processes have rather syntectonic features. It seems that the metamorphism producing phlogopite and tremolite in the Moldanubicum and in the Olešnice Unit is identical, nevertheless, a detailed petrological study of whole rock sequence containing the studied marbles is required to confirm this assumption.

Low-pressure metamorphism M 2 produced distinct zonation, nearly the same as in the Strážek Moldanubicum (Novák 1989), but with the steeper metamorphic gradient (Fig. 3). The sequence of metamorphic zones is the same, the Zone A has not been observed only. The mineral assemblage of dolomite marble from Ketkovice-Chvojnice (the Olešnice Unit) is similar to the Zone A in the Svratka Crystalline Complex, however, no younger recrystallization of phlogopite typical of this zone (Novák 1989) was not found. The course of metamorphic isograds is cut by the Náměšť Fault (see Fig. 3). In the Náměšť nad Oslavou surroundings this course seems to be close to the course of metamorphic isograds in granulitic rocks (Matějovská in Mísař 1983). The first phase of the metamorphism M 2 represented by metasomatic reaction veins with diopside and forsterite + calcite (Novák 1986) has been observed in some localities (Nová Ves near Oslavany, Ocmanice, Pucov). The third retrograde phase producing younger chlorite II at the contact of forsterite and spinel is very weak in this area. No manifestation of the metamorphism M 2 has been found in the dolomite marble of the Olešnice Unit (Ketkovice-Chvojnice, Prosetín, Velké Tresné).

The youngest retrograde metamorphism is clearly identical in both regional units. It is very likely to be connected with the overthrust of the Moldanubicum over the Moravicum, although serpentinization of forsterite is common also in the Strážek Moldanubicum but is not so strong.

Conclusions

1. The rock sequence consisting of biotite gneisses migmatized to a different degree, metabasites and dolomite marbles occurs between the Gföhl gneiss and rocks of the Olešnice Unit. It is comparable with rock sequences in the Strážek and Moravian Moldanubicum corresponding to the Varied Group.

2. The mineral assemblages in the dolomite marble from Pucov and the lithostratigraphy of surrounding rocks show that this locality corresponds more likely to the Moldanubicum than to the Olešnice Unit, even though it is situated on the E from the Náměšť Fault (Fig. 1).

3. The course of the Náměšť Fault is not always identical with the boundary between the Moldanubian rocks and the rocks of the Olešnice Unit. This fault seems to be younger than the overthrust of the Moldanubicum over the Moravicum. Tectonic movements along this fault strongly complicated the geological development of this area.

4. The sequence of the metamorphic zones in the studied dolomite marbles is nearly the same as in the Strážek Moldanubicum, but with a steeper metamorphic gradient (Fig. 3). The isograds are cut by the Náměšť Fault, therefore,

tectonic movements along this fault must be younger than metamorphism M 2 (comp. Suess 1898).

5. Temporal relations between the metamorphism M 2 and the overthrust of the Moldanubicum over the Moracivum are not clear. Differences in the metamorphic evolution of dolomite marbles between the Moldanubicum and the Olešnice Unit indicate that the metamorphism M 2 is not younger than the overthrust. Nevertheless, these conclusions are based only on the study of dolomite marbles, therefore, a detailed study of the whole rock sequence in this area is required.

SOUHRN

Studium minerálních asociací, metamorfní zonálnosti a chemického složení dolomitických mramorů, jakož i litostratigrafie horninových komplexů obsahujících tělesa karbonátových hornin na styku moldanubika a moravika v oblasti mezi Jasenicí a Oslavany ukazuje:

(1) Biotitické ruly, někdy více či méně migmatitizované, s polohami metabazitů a dolomitických mramorů, vyskytující se ve dvou oblastech mezi komplexem gföhlských rul s granulity a olešnickou jednotkou (obr. 1), jsou srovnatelné s horninami pestré skupiny strážeckého a moravského moldanubika.

(2) Minerální asociace a metamorfní zonálnost dolomitických mramorů řazených k moldanubiku jsou velmi podobné oblasti strážeckého moldanubika, metamorfní zonálnost má však mnohem výraznější gradient a metamorfní izogrády jsou utínány náměšťským zlomem (obr. 3).

(3) Průběh náměšťského zlomu není vždy totožný s hranicí moldanubika a moravika a vlastní zlom i pohyby na něm jsou mladší než předpokládané nasunutí moldanubika na moravikum.

(4) Časové vztahy mezi metamorfózou M 2 produkující zřetelnou metamorfní zonálnost a nasunutím moldanubika na moravikum nejsou zcela jasné. Značné rozdíly v metamorfním vývoji dolomitů moldanubika a olešnické skupiny ve studované oblasti naznačují, že metamorfóza M 2 není mladší než nasunutí moldanubika na moravikum.

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