

APPLICATION OF CATHODOLUMINESCENCE MICROSCOPY TO THE STUDY OF METAMORPHIC REACTIONS IN MARBLES; EXAMPLES FROM THE MORAVIAN ZONE

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Only little attention has been paid to cathodoluminescence (CL) observations of metamorphosed carbonates related to the extensive works on sedimentary carbonates (MARSHALL 1988, YARDLEY & LLOYD, 1989). The studied marbles occur in the Moravian Zone of the Bohemian Massif, consisting of metapelites, metavolcanics and marbles ranging from amphibolite (Olešnice group) to greenschist facies (Lukov group). Tremolite marbles from the Olešnice Group exhibit polyphase metamorphism and several mineral reactions were found using transmitted light and CL. The mineral assemblage involving early tremolite (Tr I) is product of the reaction: $5 \text{Tlc} + 6 \text{Cal} + 4 \text{Qtz} = 3 \text{Tr} + 5 \text{CO}_2 + 2 \text{H}_2\text{O}$. It is supported by the textural relations of early calcite I (Cal I), with characteristic deep orange colour in CL image, associated with relics of quartz Qtz (blue CL) and grains of Tr I (black). Both Cal I and Tr I underwent brittle deformation. Their angular grains are rimmed and healed by younger Cal II with bright orange colour on CL. Formation of Cal II is very likely not related to the reaction producing Tr I, but represents the recrystallization of marble. Rare relics of dolomite (Dol) (dark red CL) and Qtz (blue CL) were found in large porphyroblasts of Tr I, indicating the mineral reaction: $8 \text{Qtz} + 5 \text{Dol} + \text{H}_2\text{O} = \text{Tr} + 3 \text{Cal} + 7 \text{CO}_2$ (e.g. Olešnice and Jobova Lhota localities). Rare equilibrium assemblage Tr I + Dol (red CL) suggests the mineral reaction: $2 \text{Tlc} + 3 \text{Cal} = \text{Tr} + \text{Dol} + \text{CO}_2 + \text{H}_2\text{O}$. Diopside (green CL) in rims around Tr I was observed in marbles near the contact with the higher grade Moldanubian Zone. It is formed by the reaction: $\text{Tr} + 3 \text{Cal} + 2 \text{Qtz} = 5 \text{Di} + 3 \text{CO}_2 + \text{H}_2\text{O}$. The latest Cal III (pale yellow CL) commonly fills cracks in some silicates, e.g. in retrograde Tlc. It may have originated during the latest metamorphic stage or in the zone of weathering.

Marbles with the mineral assemblage Cal + Qtz + Dol + Ab + Ms + Bt occur in the Lukov Group (Horní Dunajovice locality). The CL study revealed heteroblastic structure formed by angular grains of Fe-carbonates (Fe-calcite with $\text{FeO} \geq 1 \text{ wt\%}$ and Fe-dolomite; dull brown or without CL). These grains are located in the matrix consisting of Cal II (orange CL) grains. Minor micas and rare rutile appear black on CL, quartz and probably albite exhibit blue, apatite pale yellow CL. Late veins of Cal III (orange-yellow CL) cut early Fe-carbonates which were depleted in Fe and recrystallized on contact with Cal III, and exhibit orange CL.

This work is sponsored by Grant Agency Acad. Sc. ČR A3408902 for SH.

References

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