SCAPOLITE- AND ANHYDRITE-BEARING ROCKS FROM THE MOLDANUBIAN ZONE OF THE BOHEMIAN MASSIF: METAMORPHOSED EXHALITES AND EVAPORITES

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Scapolite- and anhydrite-bearing rocks have been studied in the Rožná ore district (the eastern part of the Moldanubian zone) and in the graphite deposits near Český Krumlov (the southern part of the Moldanubian zone).

In the Rožná uranium ore district, the scapolite- and anhydrite-bearing rocks occur in the host rocks of the metamorphosed barite–hyalophane–sulphidic ores of submarine-exhalative origin. They form stratiform bodies up to 1 m thick associated with up to 40 cm thick body of monomineral anhydrite. The amount of scapolite varies between 1 and 4 %, the amount of anhydrite between 1 and 8 %. Anhydrite is present as monomineral bands 0.1–0.2 mm thick or in the form of individual grains enclosed in amphibole or feldspar. Scapolite is present in xenoblasts and encloses corroded grains of plagioclase, carbonate and anhydrite. The structural formula of scapolite is $(Na_{1.23}Ca_{2.76}K_{0.01})(Al_{4.78}Si_{7.21})O_{24}(Cl_{0.04}(SO_4)_{0.41}(CO_3)_{0.55})$. The amount of meionite component (Me: 64.4–72.9 %) as well as the Al/Si ratio (0.66) are typical of scapolites originating at a temperature above 550 ^{o}C through metamorphic reactions between plagioclase, carbonate and anhydrite. The isotopic composition of sulphur in anhydrite is very homogeneous ($\delta^{34}S$ = +30 to +32 ‰) and indicates marine sulphate as the source of sulphate sulphur. The $\delta^{34}S$ values of pyrite range between +21.4 and +22.5 ‰. The origin of pyrite in scapolite- and anhydrite-bearing rocks can be explained by an inorganic reduction of anhydrite according to the reaction:

$$2\ CaSO_4 + Fe^{2+} + 4\ C = FeS_2 + 2\ Ca^{2+} + 4\ CO_2.$$

This is manifested in very low $\delta^{13}C$ values for calcite associated with pyrite-rich intervals (-18.7 to -19.5 ‰). The isotope composition of strontium in anhydrite ($^{87}Sr/^{86}Sr$ = 0.70797–0.70781) is close to that in strata-bound barite ores ($^{87}Sr/^{86}Sr$ = 0.7089–0.70766). Scapolite- and anhydrite-bearing rocks at the Rožná deposit are interpreted as an unusual type of metamorphosed exhalite. They probably originated through precipitation of fluids rich in Ca^{2+} (and SO_4^{2-}) on the floor of a sedimentary basin together with barite–hyalophane sulphidic ores.

In contrast, scapolite-rich rock (marbles and calc-silicates) studied in the graphite deposits near Český Krumlov are genuine meta-evaporites. The content of scapolite in marbles and calc-silicates varies from 2 to 10 %. The structural formula of scapolite is $(Na_{2.50}Ca_{1.42}\ K_{0.06})(Al_{4.10}Si_{7.90})O_{24}(Cl_{0.62}(CO_3)_{0.38})$. Scapolite is very rich in chlorine (2.4–2.6 % Cl) and the Al/Si ratio (0.5) is typical of scapolite which originated from sediments rich in halite. Scapolite-bearing rocks from the graphite deposits near Český Krumlov are interpreted as shallow-water evaporite metasediments deposited in a lagoonal environment. This is supported by the high amount of accumulated organic matter (up to 30 %) in graphite bodies and by the isotopic composition of pyritic sulphur ($\delta^{34}S$ = +8 to +28 ‰) in scapolite-bearing rocks, which indicate an aquatic environment with limited supply of marine sulphate.