Magmatic rocks of the Dinaric evaporite mélange: evidence from the Adriatic carbonate platform

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Magmatic rocks of the Kosovo, Sinjsko and Vrličko polje in External Dinarides associated with evaporites, carbonates and clastic rocks represent a part of the Dinaric evaporite mélange. Magmatic rocks of Dinaric evaporite melange in selected fields have been classified as amphibole-bearing dolerite according to IUGS classification, based on primary mineral assemblage of these rocks. The rocks have been divided in four main types according to ratio of the primary amphibole/pyroxene amount in the sample from 10/90 to 90/10, which shows evolution of magma. The microstructure of the samples is mostly subophitic to intergranular.

Primary magmatic association is composed predominantly of plagioclase, clinopyroxene (Cpx), brown amphibole, and minor amount of opaque minerals, zircon and titanite. It is overprinted by medium-grade secondary hornblende after Cpx or brown amphibole. Low-grade secondary mineral assemblage is predominantly composed of sericite, chlorite, actinolite, tremolite and minor amounts of prehnite, clinozoisite, secondary quartz, cristobalite, and pumpellyite.

Electron microprobe analysis of selected minerals allow the following conclusions: Feldspar grains show mostly the composition of albite and rarely orthoclase. Amphibole shows various composition according to careful examination of BSE images. Edenite/pargasite found as primary amphibole in the cores rimmed by edenite, and magnesiohornblende. The last overprint on amphibole is actinolite, which is classified as low-grade mineral association. Most of the chlorite grains show the composition of Fe-Mg chlorites, with a bit more pycnochlorite than diabantite. Mg-chlorite is scarce and there is more penninite than clinochlore. According to results from the microprobe it was possible to calculate the formulas for chlorite, prehnite, clinozoisite and ilmenite.

$^{40}Ar/^{39}Ar$ analysis of primary amphiboles revealed an age of 215–220 Ma variably overprinted by secondary amphibole at ca. 125 Ma or even younger amphiboles.

Temperature and pressure conditions of the selected rocks were estimated using plagioclase-hornblende thermobarometry. The estimated temperatures then were compared with temperature values obtained by the geothermometer based on Ti contents in amphibole. The following model of crystallization is proposed.

Edenite and pargasite are primary minerals in studied magmatic rocks of the Dinaric evaporite melange, which crystallized at temperatures of 800 °C±30 °C and depths of ~9–14 km. The rims of the primary amphibole that crystallized at depth of 9 km, still have edenite compostion. With the slight decrease of temperature, pressure and of (Na+K), the conditions for magnesiohornbende are established, which formed at 700±30 °C and pressure of 2–3 Kbar at depth of 5–9 km. The conditions for crystallization of actinolite occured at depth of 2–5 km and under temperatures of 600–650±30 °C. The last detected temperature is the low-temperature formation of chlorite (210–270 °C). The span of temperatures in-between actinolite and chlorite crystallization was suitable for formation of most of described secondary minerals, whereas some, like prehnite-pumpellyite, were formed most likely even below these temperature conditions.

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