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Petrology and geochemistry of eclogites from the Kechros Metamorphic Complex in eastern Rhodope (NE Greece)

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The Rhodope Metamorphic Province (RMP) is one of the major tectonic units in northern Greece. It consists of different tectonometamorphic complexes involved in the Alpine collisional history between the Eurasian and African plates. In eastern Rhodope a Jurassic UHP metamorphism is documented in the uppermost Kimi Complex by the presence of microdiamond inclusions in garnets from pelitic gneisses (Mposkos and Kostopoulos 2001). Partially or completely amphibolitized eclogites are common recording P-T conditions $>$1.8 GPa and 750^{0}C for the eclogitic stage and 1.5 GPa and 820^{0}C for an early stage of exhumation (Bauer et al. 2007).

In the underlying Kechros Complex lenses of kyanite eclogites in orthogneisses with Permian ages of their gabbroic protoliths and of common eclogites within metapelites associated with serpentinized peridotites occur.

The mineral assemblage of the kyanite eclogites is Grt+Omp(Jd_{35-55})+Ky+sodic-Tr+Hbl+Zo/Czo+Phg+Qtz+Rt. Garnet shows growth zoning with core composition $Grs_{0.19}Prp_{0.15}Alm_{0.63}Sps_{0.03}$ and rim composition $Grs_{0.20}Prp_{0.27}Alm_{0.52}Sps_{0.01}$. Matrix omphacite is in textural equilibrium with kyanite, but commonly it is replaced by Ca-amphibole. A decrease in jadeite component from the core to the rim indicates a re-equilibration tendency during exhumation. Temperatures of 550-600^{0}C and minimum pressure of 1.5 GPa are obtained with Grt-Cpx geothermometry and the jadeite component (Jd_{55}) in omphacite. However, the coexistence of matrix omphacite with kyanite constrains the minimum pressure to 2.1 GPa assuming H_2O activity equal to unity.

In the common eclogites the HP mineral assemblage is Grt+Omp+Czo+Gln+Ca-Amph. Glaucophane is present only as inclusions in garnet. In retrogressed samples Ca-amphibole replaces garnet and omphacite. It shows compositional zoning with increasing Al_2O_3 content from 5.0 wt% in the core up to 20.0 wt% in the rim. In the eclogites subjected to extensive retrogression, margarite associated with zoisite and albite/oligoclase (An_{22-28}) is formed during decompression, and with further decompression anorthite-rich plagioclase (An_{75-85}) is formed replacing margarite+zoisite, indicating isothermal decompression from the maximum pressure down to 0.5 GPa. Isothermal decompression is also documented from the mineral assemblage in associated metapelites (Mposkos, 1989).

Two protolith groups are distinguished with geochemical criteria: i) a low-Fe-Ti (LFT) and ii) a high-Fe-Ti (HFT) group. The LFT eclogites (kyanite eclogites) have low TiO_2 content ($<$0.67 wt%), negative Nb anomalies, positive Sr anomalies, small negative Zr and Hf anomalies and variable enrichments in LILE (e.g. Rb and Ba). The REE patterns are characterized by strong LREE enrichment (La_N/Yb_N=4.97-6.02), HREE depletion (Gd_N/Yb_N=1.51-1.89) and HREE abundance within the range of 8-12 $\times$ chondrite. The HFT eclogites (common eclogites) have variable Sr contents and small to moderate LILE enrichment, and lack Nb anomalies. The REE patterns of the common eclogites are characterized by LREE depletion and relatively flat MREE-HREE patterns at approximately 13-45 $\times$ chondrite concentrations. The protoliths of the LFT eclogites represent gabbros found in continental rifting environments with a strong subduction zone/crustal contamination influence, whereas the protoliths of the HFT eclogites indicate formation by partial melting in an extensional oceanic environment.

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