



Protoliths of the high-pressure tectonic blocks from the South Carpathians basement units

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Several high-pressure (HP) blocks (eclogites, metagabbronorites, garnet-chloritoid-bearing schists and garnet-kyanite mylonites) hosted in medium-pressure metamorphic complexes from the Lotru Metamorphic Suite (LMS), Leaota Massif (LM), and Făgăraș Massif (FM) were investigated in order to derive the nature of their protoliths based on geochemical data and relict fabrics.

The variation diagrams using Niggli values (Niggli, 1954) document a typical pelitic protolith for the HP garnet-chloritoid-bearing schists and garnet-kyanite mylonitic gneiss from the LM. Classification diagrams using major- and trace-element data show that most of the compositions of eclogite and metagabbronorite concentrate in and around the field of basalts. A few eclogites from the LM and LMS have compositions similar to picrites, rich in Cr and Ni. Thus, the classification diagrams confirm the assumed basaltic character of the studied eclogites and the fact that alterations did not significantly change the original composition. However, there is one notable exception of a very-high pressure (VHP) eclogite and its metasomatic envelope (Negulescu et al., 2009) from the LM. The tholeiitic and in many instances clear MORB character of the eclogites is also illustrated in the Mullen discriminant plot (Mullen, 1983), in contrast to the VHP-eclogite, as also REE-patterns indicate. The protoliths of the studied eclogites and metagabbronorites range from N-MORB to E-MORB. The VHP-eclogite and its rind display, despite metasomatic alterations, similar REE-patterns and other trace element concentrations, comparable with that of North American shale, thereby supporting the sedimentary origin of their protoliths (Negulescu et al., 2009). The most primitive sample is a Ca, Al-rich eclogite from the FM with an overall low REE concentration, displaying a slight Eu anomaly and a tea-spoon shaped LREE depletion indicative of a cumulate origin. The same origin is also probable for a few eclogites from the LMS with a similar kind of REE-patterns. Some E-MORB type eclogites and metagabbronorites from the LM are enriched in LILE and depleted in HFSE (Nb, Zr, Ti).

The consequences of the geochemical features are also supported by relict magmatic microtextures. Many eclogites contain microdomains indicating precursor phases replaced by eclogitic assemblages: (1) idiomorphic shapes of former Ti-rich clinopyroxene phenocrystals, replaced by garnet and omphacite, marked by cloudy areas containing rutile dust; (2) prismatic garnet pseudomorphs after plagioclase (3) sharply-delimited domains in composite garnet with abundant quartz inclusions outlining former plagioclase contours; and (4) omphacite replacing magmatic pyroxenes.

The geochemical, petrological and thermobaric data available for the South Carpathians HP/low-medium temperature complexes document geochemical and thermobaric contrasts among adjacent lithologies, as well as ocean-derived protoliths enclosed in upper crustal rocks, in apparent structural congruence. This structural setting indicates an intricate tectonometamorphic history involving collision-associated stacking, crustal imbrications, and amalgamation of units originating from distinct continental blocks.

Negulescu E. et al. (2009) Journal of Petrology 50/1, 103-125.

Niggli P. (1954) Rocks and mineral Deposits. San Francisco, Freeman, 559p.

Mullen E. D. (1983) Earth Planet. Sci. Lett. 62, 53-62.