Geochemistry of Pyroxenites from selected Areas of the Sudetes

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Occurrences of pyroxenites are not frequent in the Sudetes and the Fore-Sudetic Block as the northeastern flank of the Bohemian Massif. Most often they form thin, layered intercalations in the lower parts of the ophiolite suites (ultramafic cumulates) and commonly occur as tectonic enclaves, small stocks or veins within crystalline complexes. Pyroxenites were also ascertained in the mantle-derived xenoliths from the Lower Silesian Tertiary basalts.

The studied samples of pyroxenites and primary hornblende-bearing ultrabasic rocks from Sudetes included: pegmatoidal clinopyroxenites from ophiolite suites (Ślęża and Braszowice Ophiolite suites), garnet-bearing orthopyroxenites and clinopyroxenites (from a shear zone in the northern part of Sowie Góry), websterites (from central part of Góry Sowie Block near Sudetic Marginal Fault). Additionally, coarse-grained hornblendites, biotite-bearing clinopyroxenites occurring in the cover of Kłodzko-Złoty Stok Granite Intrusion and olivine-bearing hornblendites exposed near Bielice (Stare Mesto Unit) were also analysed.

The determinations of trace element and REE contents were carried out using XRF, INAA and ICP methods in the Activation Laboratory Ltd. (Canada) with the valuable assistance of the "GEOANALIZA" Enterprise from Cracow (Poland). The obtained results indicate that most samples have low L.O.I (below 2 wt. %), reflecting small degree of secondary hydration, which is commonly caused by strong metamorphism. For this reason, the geochemical discrimination of pyroxenites was established using major, trace and rare earth elements.

On the basis of geochemistry, three groups of pyroxenites can be distinguished among the studied samples. The MORB-normalized multielement patterns exhibit also three kinds of profiles characteristic of: 1) island arc-related ultramafic cumulates (Ślęża and Braszowice Ophiolites, Kłodzko – Złoty Stok Area, Staré Město Unit), 2) high-temperature subcrustal intrusive dykes (Góry Sowie I) and 3) recycled primary peridotites? (Sowie Góry II).

The first group, highly enriched in LIL and moderately depleted in HFSE, probably originate by small degree of melting of less depleted peridotite mantle source, which may have taken place in the later stages of the oceanic crust development. Secondly, the high-temperature intrusive dykes display "humped" profile characterized by a slight selective enrichment in LIL, and strong depletion in HFSE. This may reflect their derivation from sub-continental lithosphere during partial melting, caused by convection of underlying upper mantle. Third type of pattern shows selective enrichment in LIL and strong negative Ba anomaly, moderate depletion in Sr, K and HFSE. It can be distinctive of mantle-derived, ultrabasic components, which were re-equilibrated and contaminated during their upwelling from the asthenosphere.

The REE chondrite-normalized patterns exclude both an intra-oceanic and intracontinental nature of primary melts. The significant LREE-enrichment can be considered a characteristic feature of continentalrift-related enviroment. However, some HFSE- and HREE-depleted samples can be also regarded as products of deep-seated crystallization of tholeiitic melt derived from the garnet-bearing source.

Summing up, it can be generally accepted that Sudetic pyroxenites contain mixed population that comprises mantle and crustal lithologies. Their geochemistry most probably reflects both partial melting and silicate melt separation during diapiric upwelling of mantle fragments from the asthenosphere and high-level fractionation processes. The most plausible genetic explanation for the third group of pyroxenites (recycled) is shearing-involved re-equilibration and chemical modification resulting from asthenosphere-litosphere interaction.