TRACE ELEMENT ABUNDANCES IN RUTILE AND ZR-IN-RUTILE GEOTHERMOMETER APPLIED TO THE SUDETIC ECLOGITES

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The Sudetic eclogites outcrop in the eastern termination of the West Sudetes in the Orlica-Snieznik Dome (OSD) and in the Fore-Sudetic Block (FSB) within the Kamieniec Zabkowicki metamorphic complex. Most of the OSD eclogites can either display the MORB provenance and belong to the Mg-Al-Cr eclogite sub-type (OSD1) or show calc-alkaline affinity (OSD2). The OSD eclogites from eclogite-granulite series (OSD3) originated at the expense of bimodal volcanics. The FSB eclogites belong to Fe-Ti sub-type (BAKUN-CZUBAROW, 1998). The OSD eclogites underwent UHPM during continental collisional event (BAKUN-CZUBAROW & KUSY, 2001), whereas the FSB eclogites are subduction related ophiolitic rocks. In rutiles from OSD & FSB eclogites, abundances of high field strength (Zr, Nb), 3d type transition (Cr, Fe) and other trace elements (Al, Si, Ca) were determined by means of CAMECA SX 100 electron microprobe, with the use of the TR-type software. Rutile grains from different eclogites show large variations (1 2 orders of magnitude) for compatible – Cr (60 - 6400 ppm), Nb (100 - 4700 ppm), Zr (70 - 1750 ppm), Fe (500 - 6000 ppm), and for incompatible elements Ca (< 25 - 14000 ppm), Si (< 12 - 6500 ppm), Al (< 12 - 600 ppm). Most analysed rutile grains are homogenous on single grain scale, and less so between the grains in the same rock sample. The element order of decreasing preference for rutile Nb > Ti >> Cr > Zr, established by ZACK et al. (2002) for Trescolmen eclogites, has been confirmed for the Sudetic eclogites. From among the analyzed grains, rutiles from the OSD1 eclogites are the Cr-richest, from the OSD3 eclogites are the Zr-richest, while rutiles from FSB eclogites are richest in Nb. Thus the analyzed trace compatible elements (HFS and transition) are significant for the rutile provenance study. A new Cr-Zr-Nb discrimination diagram for rutile, with distinguished fields for rutile from OSD1, OSD3 and FSB eclogites, has been constructed and tentatively verified. For the estimation of the rutile-quartz-zircon equilibration temperature in the Sudetic eclogites, the newly formulated Zr-in-rutile geothermometer: $T(in\ ^{o}C) = 127.8 \times ln(Zr\ in\ ppm)\ \ 10$ (ZACK et al., 2004), was applied. The obtained results plot close to the upper limits of the previous geothermobarometric estimates: 740 °C for OSD1, 780 °C for OSD2 and 930 °C for OSD3, but are ca 50 °C higher than earlier results for the FSB eclogites (660 °C).

References

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