

Application of Zr-in-rutile thermometry to a Moldanubian garnet-clinopyroxene granulite

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The purpose of this work is to re-examine the decompression P-T path of a garnet-clinopyroxene (Grt-Cpx) intermediate granulite in the Moldanubian Zone of the Bohemian Massif using the Zr-in-rutile thermometer and Grt-Cpx and jadeite-quartz-albite geobarometers. Early high-pressure (HP) metamorphic stage of rutile and omphacite occur as inclusions in high-Ca garnet core. By contrast, later medium-pressure rutile occurs in the matrix composed of augite, plagioclase, mesoperthite, quartz and ilmenite. The Zr contents of the most rutile inclusions are in a limited range of 1100-1500 ppm, regardless of inclusion size. This may suggest that rutile inclusions have preserved original Zr compositions without much modification by later diffusional re-equilibration. Using the Zr-in-rutile thermometry, we obtained ~830 °C at 18 kbar for the early HP stage. Rutilites in clinopyroxene-plagioclase domains of the matrix generally occur as small euhedral crystals and have higher Zr contents (mostly 8000-10000 ppm), corresponding to 1000-1020 °C at 11 kbar. Those in quartz-feldspar domains of the matrix occur as coarser and elongated grains with lower Zr contents (3000-5000 ppm), yielding slightly lower temperatures. An intensive Si and Zr X-ray mapping of the matrix suggests that rutilites in both domains of the matrix were formed in quartz-bearing but zircon-absent conditions. Thus, the obtained Zr-in-rutile temperatures indicate the minimum estimates. Based on these new results, we revealed that a Moldanubian Grt-Cpx granulite has undergone a significant heating of about 200 °C during decompression from the peak pressure condition. This heating was caused by incorporation of a HP rock into an exhuming higher-temperature felsic granulite as a result of continental collision.