European Mineralogical Conference
Vol. 1, EMC2012-171-1, 2012
European Mineralogical Conference 2012

Mineral inclusions and compositional zoning in garnet from felsic granulite from Kutná Hora Complex (Moldanubian zone, Bohemian Massif)

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Felsic granulites with lenses of garnet peridotites and garnet pyroxenites are common in high-grade units in the Moldanubian and Saxothuringian zones, including Sudetes in the Bohemian Massif. Most of the estimated P-T paths show decompression part of their metamorphic history. This was the reason for their lower crust origin that together with fragments of upper mantle rocks were exhumed during continental collisions. However, this interpretation was doubted due to their relict eclogite facies stage and by the presence of eclogites and garnet peridotites, which show UHP conditions. We present major element chemistry and inclusion patterns preserved in garnets from felsic granulites in the Kutná Hora Complex in the Moldanubian zone. It is aimed to develop pre-granulite facies stage and possibly reconstruct their P-T paths and to clear their relations to fragments of UHP metamorphism of mafic and ultramafic lithologies.
The felsic granulites are mostly composed of quartz, ternary feldspar, garnet, kyanite, biotite and accessory rutile, ilmenite and zircon. Perthitic K-feldspar is common, but antiperthitic plagioclase can be found as inclusions in garnet. Garnet forms porphyroblasts up to 1.5 cm in size, well-rounded and with fractures after deformation. Garnet (Alm35, Prp34, Grs24, Sps7) is fairly homogenous in the core with a decrease of Mg and Ca and increase of Fe at the rim. However, some grossular-rich garnet (Alm50-56, Prp31-35 Grs10-17, Sps0-1), show complex zoning. In addition to decrease of Mn towards the rims, Ca exhibits first increase and then decrease to the rim. The Mg and XMg content show first decrease followed by increase towards the rim and at the most rim parts they show decrease again. The following inclusions were found in garnet from felsic granulite: quartz, feldspars, kyanite, rutile, phengite, graphite, carbonates and sulphides. Graphite is present also in the matrix. Well-preserved inclusions of phengite have high (up to 3 wt %) TiO_2. If it is replaced by biotite, the Ti content decrease in relict phengite, but the biotite may have up to 5 wt % of TiO_2.
Preservation of prograde zoning in garnet and the presence of phengite inclusions suggest that the rocks underwent prograde metamorphism. The occurrence of graphite both in the inclusions as well as in the matrix suggest that part of granulites were derived from sedimentary material. Preservation of phengite in felsic granulites that based on ternary feldspar thermometry reached temperature at least 900 °C is due to high Ti content, which stabilize phengite at very high-temperature conditions.