Multiple prograde metamorphic history of UHP granulites from the Moldanubian Zone - revelation by Y+REEs compositional zoning in garnets

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Preservation of compositional zoning in metamorphic garnet is a powerful tool to reconstruct P-T paths in metamorphic rocks. This is due to the slow diffusion rates of some major and trace elements, including Y and HREEs, which show strong partitioning into garnet. In this investigation, we utilize compositional zoning patterns of major, trace and REEs in garnet crystals from felsic granulites of the Kutná Hora Complex (Bohemian Massif) to reconstruct their prograde metamorphic evolution. The granulites contain lenses and boudins of mantle garnet peridotites and eclogites. Compositional zoning in garnet provides the evidence of pre-granulite facies metamorphic history of the rocks. This is documented by high Y and HREEs contents in the core with annuli in the mantle part of garnet grains that are interpreted as the result of two distinct metamorphic events. The core of large garnet with relatively high Ca and bell-shaped manganese contents suggest its formation during a prograde low- to medium- temperature metamorphic event which was coeval with HP-UHP metamorphism. Based on pseudosection modeling by Perple_X thermodynamic software in combination with compositional isopleths of major elements from garnet tried to reconstruct prograde metamorphic path of felsic granulites. Grs content in combination to Prp and X_{Fe} revealed LT-HP conditions of garnet formation. After that, grossular is slightly decreasing and X_{Fe} rapidly decreasing, which leads to increase of pressure and temperature to coesite and even diamond stability field. UHP conditions of these rocks were confirmed by inclusions of coesite and micro-diamond in garnet and zircon. Decompression and cooling during exhumation of the rocks led to partial resorption of garnet and release of trace and REEs into the matrix. The new garnet with high Y + HREEs in the annuli was formed during the granulite facies event at crustal levels. The annuli usually show higher Y + HREE contents compared to the core of prograde garnet.