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Missing link between ultra-high pressure (UHP) and ultra-high temperature metamorphism (UHT): A case study in the Bohemi

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The Gfoehl unit in the Behemian Massif is a unique metamorphic belt, as both ultra-high pressure (UHP) and ultra-high temperature (UHT) metamorphic rocks are exposed together. The maximum P-T conditions of the Ky-bearing Gfoehl granulite are estimated as ? 1000C and 1.5?2.0 GPa (e.g., Carswell & OBrien, 1993), equivalent to UHT conditions (Harley, 2004) or high-P granulite-facies conditions (OBrien & Roetzler, 2003), while the most of UHP conditions (>_3.0 GPa) have been identified from lenticular bodies in the country rock with felsic compositions, i.e., Grt-peridotite and associated eclogitic rocks. Thus, a significant pressure gap is apparently existed between UHP lenses and surrounding (U)HT host. However, recent petrologic studies succeeded to identify the UHP conditions from some peculiar rocks/minerals mostly derived from crustal materials, such as Cpx with K-feldspar lamellae (Becker & Altherr, 1992), pyrope/Opx-bearing quartzite (Kotkova et al., 1997), and garnet with minor but significant amounts of Na2O (=0.18wt%) and TiO2 (=0.5 wt%) in migmatitic gneiss of the Gfoehl unit (Vrana & Fryda, 2003). These geological and petrologic lines remain the issue to be solved, how and where the UHP and (U)HT rocks were mixed with both together? What is the predominant mechanism to bring up these rocks from upper mantle to the earth surface?

This paper briefly introduces the present state of our research.

Re-evaluation of peak P-T conditions of a Ky-eclogite associated with Grt-peridotite hosted by migmatitic gneiss at Nove Dvory gave 1050?1150C and 4.5?4.9 GPa (Nakamura et al., 2004), which are well concordant to those of the host peridotites (Medaris et al., 1990). Some garnet porphyroblasts in the Ky-eclogite remain a chemical zoning suggesting P-increase during the garnet growth, which infers that the host peridotite and the associated eclogite experienced the subduction to ? 150 km depth. Any signs of UHP conditions had not been found from the country migmatitic gneiss at Nove Dvory. However, Raman spectra for SiO2 phases indicating the transformation from coesite to quartz were found from the migmatitic gneiss at relevant area (Kobayashi et al., 2008). These results suggest that at least a part of the Gfoehl migmatitic gneiss has been subducted to UHP depths and its P-T history is more complicated rather than the traditional idea of moderate-T/Low-P origin of the gneiss (Linner, 1994). The rareness of UHP evidence in the Bohemian Massif may owe to the higher-T overprinting of post-UHP metamorphism than those in the Dabie-Sulu belt, China.

Peak P-T conditions of a Grt-rich granulite at Rohy were estimated as ? 2.2 GPa and 1000C based on the association of omphacitic Cpx inclusions (XJd=30 and XTsch=15), Pl inclusions (XAn=30) and the host Grt (Prp18˜27Alm38˜41Grs34˜40). Similar peak-P values can be inferred from using GASP barometer for the composition of grossular-rich Grt core (Grs20) in the Ky-bearing granulite at Plesovice. However, Grt-peridotite hosted by the Ky-bearing granulite at Plesovice records UHP conditions (850?1030C and 2.3?3.5 GPa; Naemura et al., 2009) for Variscan HP metamorphism. An apparent peak-P gap among mantle- and crust-derived rocks still remains. The Plesovice Grt-peridotite records post-peak decompression conditions, represented by the development of kelyphites around UHP garnet, as 730?770C and 0.5?1.5GPa (Naemura et al., 2009). Although partial melting textures are also common but their P-T conditions is not well constrained in the at Plesovice, P-T values of the post-peak decompression stage for Grt-peridotite are almost over lap to those of partial melting in the nearby area, at Ktis (Kobayashi et al., 2010). These facts may infer the partial melting can give a buoyant force for the mixture of mantle materials and crustal rocks from lower crustal depth to the earths surface, but the exhumation mechanism from upper mantle to the lower crust for the UHP rocks is still under the veil.

キーワード: UHP metamorphism, UHT metasomatism, continetal collision, Bohemian Massif
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