Deciphering a diverse garnet zoning pattern observed in a single eclogite lens in Nové Dvory, Moldanubian Zone of the Bohemian Massif

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There is an argument on the origins of the Nové Dvory eclogite which experienced over 4GPa and 1000 ^{o}C (Nakamura et al., 2004). It occurs as intercalated lenses in an ultrahigh-pressure (*UHP*) peridotite block surrounded by the country gneiss. Medaris et al. (1998) invoked the high-pressure melt origin of the eclogite based on a geochemical study. Nakamura et al. (2004), however, proposed the subduction origin of the eclogite inferred from a garnet which increases XGrs and decreases XMg toward the rim in a kyanite-SiO2 phase-bearing eclogite. Changes in XMg and XGrs of garnet are commonly utilized as indicators of temperature (*T*) and pressure (*P*), respectively. These assumptions are applicable to eclogites with low-variant and appropriate mineral assemblages. However, it is unlikely to be applied to eclogites with high variant systems. Recently, Faryad et al. (2013) and Nakamura et al. (2013) identified more variety of garnet zoning patterns in bi-mineralic eclogites in Nové Dvory. It made a new argument on the *P-T* history of the eclogite. This study reports further diverse zoning patterns of garnet identified in the Nové Dvory eclogite, and deciphers their formation process by taking into account of the above mentioned factors.
The study eclogites (ND120 and ND0207) are bi-mineralic type collected at one outcrop in Nové Dvory. They are dominated and modally layered by garnet and omphacite. Accessory rutile and apatite are observed. Garnet and omphacite are partially decomposed to amphibole, diopside, spinel, and plagioclase at the margin in various degrees. X-ray mappings show that garnets have individual core compositions and identical rim compositions among each modal layer. Omphacite inclusions are observed only in the inner rim of garnet. In ND120, three kinds of layers are identified, and they contain garnet with Fe-rich core (XMg = 0.30, XGrs = 0.22), Mg-rich-core (XMg = 0.65, XGrs = 0.22), and Ca-rich core (XMg = 0.55, XGrs = 0.25), respectively. The compositions of garnet rims are similar as XMg = 0.50 and XGrs = 0.22. In ND0207, two kinds of layers were identified, and they contain garnet with Mg-rich core (XMg = 0.69 XGrs = 0.21), and Ca-rich core (XMg = 0.52 XGrs = 0.37), respectively. The compositions of garnet rims are similar as XMg = ca. 0.60 and XGrs = ca. 0.30. In both samples, omphacites tend to be Mg-richer and Na-poorer when it appears near or in garnet with Mg-richer core. Because both increase and decrease in XMg (ND120) and XGrs (ND0207) of garnet are observed in hand specimen samples, these parameters cannot be utilized as *P-T* indicators.
The garnet rim contains omphacite, and is indicated to be developed under eclogite-facies. Yasumoto & Hirajima (2015) identified F-bearing pargasites in garnet from a Nové Dvory eclogite, which is stable up to ca. 3GPa at 800^{o}C. It also suggests the eclogite was formed through subduction. In the study samples, omphacite inclusions are not observed in the garnet core. This infers some cores formed under amphibolite-facies conditions. The chemical variation of garnet cores (i.e., Fe-rich, Mg-rich, and Ca-rich cores in ND120) and omphacites in the study samples are considered to be strongly controlled by local effective bulk compositions of their located layers. In contrast, similarity of the garnet rim compositions can be explained by the coincidence of effective bulk compositions of each layer. Drive force of changes in effective bulk compositions can be *T* increase along subduction or water liberated from decomposition of amphibole. Note garnet with Ca-rich core in ND120 has a Fe^{3+}-enriched omphacite-free mantle (XMg = 0.52, XGrs = 0.22, XAdr = 0.03) while the core and the rim are free from Fe^{3+}. This Fe^{3+} in the garnet mantle can be inherited from decomposed amphibole.

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