Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SCG07-11 会場:106 時間:5 月 21 日 12:00-12:15

ボヘミア山塊 Moldanubian 帯 Nove Dvory 産エクロジャイト中のざくろ石組成累帯構造の多様性とその意義
Variation and significance of chemical zoning pattern of garnet in Nove Dvory eclogoite, Moldanubian Zone of the Bohemia

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Nove Dvory eclogite recorded extremely high-P/T conditions, 4.5-4.9 GPa/1100oC (Nakamura et al., 2004). In spite of such high-T conditions, various zoning patterns of garnet are identified from the eclogite, i.e., homogeneous, pyrope-increasing with constant grossular content, pyrope-decreasing with constant grossular content, and grossular-increasing with constant almandine content (Nakamura et al., 2004). The preservation of such zonings infers the short duration of UHP metamorphism and subsequent granulite facies overprinting (Nakamura et al., 2011). The present study found a new type of garnet zoning from a Nove Dvory eclogite, i.e., grossular increasing and almandine decreasing type. Studied samples, collected from an outcrop with 1.5 x 3.0 m in a vertical cliff, can be classified into kyanite-bearing and kyanite-free eclogite. kyanite-free eclogites are characterized by higher modal amount of garnet, ca. $>$ 60 vol %. Another main UHP phase is omphacite along with minor apatite. Pargasitic amphiboles are commonly identified as primary inclusions in several garnet grains. Garnet and omphacite were decomposed to kelyphite and symplectite, mainly composed of plagioclase, biotite, amphibole, spinel, corundum and K-feldspar, with various degrees. Main UHP minerals in kyanite-bearing eclogites are also garnet and omphacite with subordinate amount of kyanite and apatite with or without SiO2 phase. Break-down products of garnet and omphacite are plagioclase, biotite, spinel amphibole, clinopyroxene, and orthopyroxene suggesting that the host eclogite experienced a granulite facies overprinting during the exhumation. The both types of eclogites contain garnets showing the new zoning type, but they show following distinct chemical characters, i.e., garnet is almandine-richer and omphacite is jadeite-richer in the kyanite-free eclogite than those in the kyanite-bearing eclogite. The new type garnet grains in the kyanite-free eclogite vary their compositions from Alm35-43Prp30-35Grs30 in the core to Alm35Prp30Grs35 in the rim, instead those in the Ky-bearing eclogite vary their compositions from Alm30Prp40-45Grs25-30 in the core to Alm20-25Prp30-33Grs45-50 in the rim. These zoning patterns are generally identified in coarse-grains with $>$ 2 mm in diameter. The core composition of fine-grained garnet ($<$2mm in diameter) is almost identical with the rim composition of coarse-grains. Most of garnet grains decrease their grossular content to partially developed outer most rim, to Alm33Prp33Grs33 in the kyanite-free eclogite and to Alm25-32Prp30-33Grs35-45 in the kyanite-bearing eclogite. Jadeite and Ca-tschermakite content of omphacite inclusions in garnet of the kyanite-free eclogite are 0.43-0.48 an d 0.02-0.04, respectively, and those of the kyanite-bearing eclogite are 0.25-0.38 and 0.04-0.05, respectively. There was a controversy on the origin of eclogite, high-P cumulate (Medaris et al., 1995) or low-P gabbro (Obata et al., 2006). These chemical characters obtained by this study also suggest that the studied eclogite has experienced the subduction as pointed out by Nakamura et al. (2004), and that compositions of garnet and omphacite in both types of the eclogite reflect differences in bulk compositions of the protolith. Thus, the protolith of kyanite-bearing eclogite should be derived from more primitive rock and that of the kyanite-free eclogite should be more differentiated one. The peak P-T conditions of the studied kyanite-bearing eclogite was estimated to be 4.1-4.3 GPa and 900-940oC by garnet-clinpyroxene-kyanite-SiO2 phase geobarometer of Nakamura and Banno (1997) and garnet-clinopyroxene geothermometer of Nakamura (2009), and the equilibrium temperature of kyanite-free eclogite was estimated to be 1070-1080oC assuming the pressure within 4.1?4.3GPa. These estimates are lower than those of Nakamura et al., (2004), i.e., 4.5-4.9 GPa and 1050-1150oC, probably caused by the serious comoisition modification of omphacite.

キーワード: UHP エクロジャイト, ボヘミア山塊, ざくろ石, 組成累帯構造
Keywords: UHP eclogite, Bohemian Massif, Garnet, Compositional zoning