EBSD analysis on coexisting omphacite and diopside found in aragonite-calcite vein form the Horokanai area, Kamuikotan metamorphic belt, Hokkaido

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Ca-Na pyroxenes are common in high pressure metamorphic rocks. While most of them have C2/c space group, omphacite (Omp), the intermediate composition between jadeite (Jd) and diopside (Di), has P2/n space group, because of cation ordering in M1 sites (Mg, Fe and Al), and M2 sites (Ca and Na). Two miscibility gaps are reported between Jd and Omp, and Omp and Di, as a result of the ordering (Carpenter 1980b), which takes place below the critical temperature ~750˚C (Carpenter, 1980b). In addition, degree of the ordering in Omp decreases as the Fe (II) and Fe (III) contents increase, and finally, Fe-rich Omp has disordered C2/c space group (Carpenter, 1980b; Cámara et al., 1998). Matsumoto & Hirajima (2005) proposed a possible phase boundary between the P and C lattice in eclogite facies rocks (~700˚C) based on natural and synthetic data of Carpenter and Smith (1981), Cámara et al. (1998) and Boffa Ballaran et al. (1998), i.e., P lattice field for less Fe (III) (< 15%) Omp. However, Carpenter (1980a) reported P lattice space group for Fe (III)-rich (>20%) Omp in an epidote-blueschist collected from the Franciscan Complex. These data suggest the P lattice field also expands with the decrease of metamorphic temperature.
In this study, we report possible space group of coexisting Omp and Di found from a pale green vein in the Horokanai area of the Kamuikotan metamorphic belt. Shibakusa (1989) subdivided the relevant area into three zones, from zone I (Lawsonite-BS facies) to zone III (Epidote-BS facies) with the increase of grade. The host rock of the pale green vein is an epidote amphibolite, collected from the amphibolite block at the Horokanai Pass. The sample is mainly composed of epidote, Ca-amphibole and rutile which are partly replaced by muscovite + chlorite, Na-amphibole and titanite, respectively, suggesting the BS-facies overprinting on the epidote amphibolite as described by Imaizumi (1984). A pale green vein (~1 cm width), white veins (~1 mm width) and yellowish green veins (~1 mm width) are developed in the studied amphibolite. The pale green vein mainly consists of Omp, Di, calcite, aragonite, albite and apatite. White veins consist of calcite, aragonite and albite. Yellowish green veins consist of pumpellyite and chlorite. All aragonites are surrounded by calcites. Furthermore, the composition ranges of vein forming minerals are equivalent to those of zone II or zone III of Shibakusa (1989), thus the vein-forming conditions can be estimated as 250-350 ˚C and 7-10 kbar.
Ca-Na pyroxenes in the pale green vein show the wavy extinction and their grain sizes are of ~0.5 mm and growth faces dominantly lie parallel/perpendicular to the c axis. EBSD analysis suggests that Omp and Di constituting the hour-glass texture have the same orientation with the phase boundary parallel to the c axis. Three domains are recognized in Omp based on the contrast of back scatter electron (BSE) image, strongly correlated with Al/Ca contents. Their domain boundaries are curved and diffused and banding structures with ~1 μm width are observed in Omp domain in BSE image. The banding structures with ~1 μm width are also observed in Di. In spite of the existence of micron-scale zonings in Omp and Di, EPMA analysis gave Jd30-40Acm15-25Di38-55 for Omp and Jd4-8Acm9-15Di77-95 for Di. This compositional gap between Omp and Di is almost identical to those reported by Carpenter (1980a) and Tsujimori (1997) for BS facies (~300˚C) conditions.
Fe (III) component of Omp analyzed in this work is almost the same as the composition reported by Carpenter (1980a) pointed out P lattice space group for Omp with Fe (III) rich (~20 %) based on TEM study. However, Kikuchi patterns obtained from our Omp with similar Fe (III) content with the Omp of

Carpenter (1980a) are best fit to C2/c Di. Further study is needed to evaluate the ferric component effect on the space group of the Omp.

Keywords: omphacite, ordering state, Kamuikotan belt

