

Coexisting Omphacite-Diopside in Ab-CaCO₃ phases vein developed in Epidote-amphibolite olistolith in kamuikotan Metamorphic belt.

*Shusuke Kinoshita¹, Takao Hirajima¹

1. Department of Geology and Mineralogy, Graduate School of Science, Kyoto University

Ca-Na pyroxene is a common mineral in eclogite and blueschist facies metamorphic rocks. Omphacite with an intermediate composition between jadeite and augite is considered to be a clinopyroxene group with ordered $P2/n$ symmetry, because the cation partitioning and ordering in NaAl-CaMg substitution took place below the critical temperature. At further lower temperatures, two miscibility gaps were proposed between omphacite and $C2/c$ sodium-rich augite, and omphacite and $C2/c$ impure jadeite in the jadeite-augite binary system based on a thermodynamic theory and petrographic evidences (Carpenter, 1980). As natural Ca-Na pyroxenes generally incorporates Fe^{3+} as an aegirine component at various degrees, several phase diagrams of Ca-Na pyroxenes concerning with stability fields of $C2/c$ and $P2/n$ symmetries have been proposed in the jadeite-aegirine-augite ternary system based on a number of thermodynamic models (e.g. Carpenter, 1980; Holland, 1990; Green et al., 2007). As the low-temperature stability conditions of Ca-Na pyroxenes harm their synthetic study, thus it is necessary to justify the validity of proposed phase diagrams using natural samples. In this study, we report the petrology of omphacite and sodium-rich augite pair which was newly found from high-pressure mineral veins developed in an epidote amphibolite block collected from the Horokanai area in the Kamuikotan metamorphic belt, central Hokkaido. Shibakusa (1989) divided the metamorphic rocks in the Horokanai area into three zones, Zone I {lawsonite blueschist (BS) facies} to Zone III (epidote BS facies), based on the mineral assemblages of mafic rocks. Imaizumi (1984) reported the occurrence of epidote amphibolite blocks from the Horokanai pass area, which is located in Zone III of Shibakusa (1989), and he concluded that these blocks represent olistoliths within the Kamuikotan metamorphic rocks prior to the BS-facies metamorphism. We identified three kinds of metamorphic veins; 1) Pale green, 2) yellowish green and 3) white veins. The pale green vein is about 1 cm thick and its central part is mainly composed of Ca-Na pyroxenes, carbonate (aragonite and calcite) and albite, while apatite is partly developed in the outer part of the vein. Yellowish green veins and white veins are less than 1 mm thick and mainly composed of pumpellyite and albite, respectively. The composition of pumpellyite is identical to those of Zones II and III of Shibakusa (1989). Calcite is considered to have developed after the formation of aragonite, as aragonite is always surrounded by calcite. These observations suggest that the vein-forming conditions are about 250-350 °C and less than 7-10 kbar ($P-T$ estimation for Zone II/III of Shibakusa, 1989). Most of Ca-Na pyroxenes occur as anhedral grains, ca. 1mm in length, in the central part of the pale green vein. They are composed of two domains, 20-100 μ m in width, separated by straight boundary which can be easily identified by their different birefringence. The chemical composition of the two domains is omphacite ($Jd_{30-40}Ac_{15-25}Di_{38-55}$) and sodium-rich augite ($Jd_{4-8}Ac_{9-15}Di_{77-95}$), respectively, showing an obvious gap, probably between P lattice omphacite and C lattice sodium-rich augite. Tsujimori (1997) reported the coexistence of omphacite and sodium-rich augite in an omphacitite collected at the Osayama serpentinite mélange, Sangun-Renge belt. They are less Fe^{3+} contents compared with our data and are associated with pumpellyite. The results of our study and Tsujimori (1997) propose a miscibility gap between omphacite and sodium-rich augite at 250-350 °C, which is slightly wider than that proposed by Carpenter (1980) at 350 °C and there is a tendency that omphacite slightly prefers Fe^{3+} content rather than the coexisting sodium-rich augite.

Keywords: kamuikotan metamorphic belt, omphacite-diopside gao, aragonite