Metamorphic overprint of the Kamuikotan metamorphic rocks around Asahikawa City, central Hokkaido, Japan: Implications for fluid infiltration in subduction zone during exhumation

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Regional metamorphic fluid flow is associated with both prograde and retrograde metamorphisms of high-pressure and low-temperature metamorphic rocks in subduction zone where is a field of widespread fluid cycling. The Kamuikotan metamorphic rocks distributed in northern Japan are typical subduction-related high-*P/T* metamorphic rocks in the world. The Kamuikotan metamorphic rocks around Asahikawa City have evidence implying thermal overprint which might have been caused by fluid infiltration. These metamorphic rocks show relatively high geothermal gradient (Sakakibara and Ota, 1994), spatially heterogeneous distribution of K-Ar ages (Iwasaki *et al.*, 1995; Ota *et al.*, 1993; Ota, 1999) and overgrowth of alkali amphibole by actinolite in metabasites (Gouchi, 1983). Furthermore, pervasive development of quartz veins and locally preserved high-*P/T* mineral assemblages indicate heterogenous fluid migration controlled by structural components (Breeding and Ague, 2002). Therefore, this study reexamined the tectonics of the Kamuikotan metamorphic rocks in respect of metamorphic overprint by fluid migration during exhumation .

The Kamuikotan metamorphic rocks in the studied area can be divided into three distinct metamorphic zones from north to south based on metamorphic minerals from basic rocks. Zone I is characterized by the presence of lawsonite and alkali amphibole (Gouchi, 1983; Ota, 1997). Zone III is characterized by the presence of epidote, actinolite and chlorite. Zone II is characterized by compound assemblages of Zone I and Zone III. The metamorphic temperature applying the Raman carbonaceous material geothermometer (Kouketsu *et al.*, 2014) is approximately 313, 308, 302, 294℃ from Zone II and 351, 325℃ from Zone III. At least two stages of metamorphism are discriminated based on textural features and chemical compositions of alkali amphiboles and associated minerals from Zone II. The first stage is identified by alkali amphiboles grown on pressure shadow and pull-apart region of relict pyroxene and rimmed by actinolite and chlorite. These alkali amphiboles are optically and chemically homogeneous, and range in chemical composition from crossite to glaucophane. The second stage is characterized by the occurrence of pumpellyite, chlorite and titanite. Amphiboles coexisting with these minerals are actinolite and magnesioriebeckite. These mineral assemblages and chemical compositions of sodic amphiboles suggest that basic rocks of Zone II primarily had been metamorphosed under relatively high-P/T condition and were subsequently converted to assemblages of the late stage corresponding to the pumpellyite-actinolite facies. Occurrence of metamorphic minerals from three points of a pelitic rock of Zone III shows a series of changes according to the distance from the serpentinite which had intruded along faults. The pelitic rock directly adjacent from the serpentinite is characterized by the presence of biotite while two pelitic rocks contain phengite. It is inferred that the Kamuikotan metamorphic rocks experienced blueschist-facies metamorphism at maximum depth of subduction stage and partially underwent greenschist-facies metamorphic overprint during exhumation stage and this metamorphic overprint was caused by fluid migration along structural components.

Keywords: Kamuikotan metamorphic rocks, metamorphic overprint, fluid infiltration, Raman spectroscopy

