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Geology of ophiolite and serpentinite melange around Mitsuishi Horai-san, Kamuikotan Zone, Hokkaido

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Serpentinites containing high-P/T metamorphic rocks are expected to provide information on structure, physical properties, and dynamics inside subduction zone of upper mantle depths. Comparing with structural evolution of concurrent accretionary and subduction complexes and forearc basin, it could be a key to comprehensively understand the entire subduction zone dynamics. Based on this aspect of view, we have thus surveyed geology of serpentinite melange and related rocks exposed around Mitsuishi Horai-san in the Kamuikotan high-P/T zone in Hokkaido. This area is known to yield blocks of the most high-grade metamorphic rocks (garnet- and/or epidote amphibolite) in the Kamuikotan zone. However, isolated occurrence of serpentinite melange among Neogene deposits and poor exposure has obstructed to evaluate its significance on subduction zone evolution. To date, we have made a geological map of eastern half of the area, and obtained two new insights (A and B below) on geological components and structures, which will be here presented.

A: Constituent rock units

A geological body that has been wholly regarded as a ”serpentinite melange” is composed of at least three components.

The first is a dismembered ophiolite (here named as ”the Gunkan-yama ophiolite”) as a pile of tectonic slices of ultramafic and mafic rocks without any signs of high-P/T metamorphism. The ultramafic rocks comprise a partly serpentinized harzburgite body and extensively serpentinized cumulate bodies (clinopyroxenite-wehrlite and dunite with trace gabbro). Mafic rocks are composites of gabbro (-diorite) and diabase, whose grain sizes considerably vary in each single body. Based on occasional intrusive boundaries, they probably comprise dike complexes intruded into cumulates.

The second component is a serpentinite melange (here named as ”the Horai-san serpentinite melange”) with severely sheared matrices of foliated serpentinite. It lies on the southwest of the Gunkan-yama ophiolite, and contain blocks of amphibolites, antigorite serpentinite, minor metapelites, and of rocks common with the ophiolite such as massive serpentinite, ultramafic cumulate, gabbro and diabase.

The third component is a low-grade (blueschist facies) metabasite occurring on the northeast of the ophiolite. Based on lithological similarity, it is inferably an extension of a coherent metabasites in the main exposure of the Kamuikotan Zone to the northeast of the study area.

Rocks of the study area are therefore regarded as a full set of the fundamental elements of the Kamuikotan zone: an ophiolite, a serpentinite melange, and a low-grade metamorphic body. They seem to be arranged more regularly than previous view of entire mixed-up structure.

B: Relationships with surrounding sediments

It has been considered that the ”basement rocks” now consisting of ophiolite, serpentinite melange, and metabasites were emplaced along with a fault crosscutting the surrounding Neogene deposits. However, our mapping revealed that they are unconformably overlain by the basal conglomerate of the Neogene deposits both on their NE and SW margins, with several observations of the contact on outcrops. The basement exposure is thus regarded as an inlier at the core of an anticline. This suggests that the basement rocks had been emplaced before the timing of the unconformity. Clasts of epidote-amphibolite and chromian spinel are contained in the Cretaceous forearc basin deposits to the northeast of the study area, and therefore, the emplacement might have basically completed until late Early Cretaceous (Albian).

Keywords: ophiolite, serpentinite melange, high-P/T metamorphic rocks, subduction zone