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On the genesis and evolution of serpentinite melange in the Mitsuishi-Horaisan area of the Kamuikotan Zone, Hokkaido.

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The Mitsuishi-Horaisan area is one of the typical localities of serpentinite melange with high-grade metamorphic rocks in the Kamuikotan high-P/T metamorphic zone. It is thus expected that the serpentinite melange records condition and evolution of deep subduction zone. Here we discuss genesis and evolution of the serpentinite melange.

Pre-Tertiary in this area comprises an array of high-P/T accretionary complex, ophiolite, and serpentinite melange from NE to SW. These together are overlain by Miocene sediments, and tightly folded to form an anticline. Foliation of serpentinite melange matrix does not show any structure of the fold axis, and thus are probably formed during or after the folding.

Amphibolite blocks consist of garnet-epidote amphibolite and epidote amphibolite. The latter also occasionally contain pseudomorphs and trace relics of garnet. Amphiboles commonly show a compositional zoning from (I) actinolite core via (II) hornblende or barroisite mantle and (III) actinolite rim 1, to (IV) sodic amphibole rim 2. Stage I amphiboles contain relic inclusions of titanite. Stage II amphiboles co-occur with rutile +- ilmenite, garnet or its pseudomorphs, oligoclase or albite and muscovite +- biotite. Stages III and IV amphiboles are associated with titanite, albite, phengite, and chlorite. Sodic pyroxene also occurs in the stage IV. This zoning suggest heating from the greenschist (I) to amphibolite (II) facies and subsequent cooling via the greenschist facies again (III) to the blueschist facies(IV). Geothermobarometry on garnet amphibolites suggested conditions of 560-670 degC, ~1.1 GPa for the stage II.

The amphibolite blocks are commonly mantled by actinolite or tremolite rocks with chlorite or talc, regarded as reaction rind in contact with serpentinites. Sodic amphiboles rimming tremolite suggest that the contact reaction (i.e. fragmentation of amphibolites and juxtaposition with ultramafic rocks) precedes the stage IV.

Ultramafic rocks are primarily classified into (a) antigorite rock, (b) peridotite and massive serpentinites with mesh texture of low-temperature serpentines, and (c) foliated serpentinite mainly of chrysotile. Some massive serpentinite contains antigorite, which generated prior to low-temperature serpentinization, implying that olivine co-existed with antigorite in early stages. Antigorite rocks occasionally contain diopside in addition to common occurrences of carbonates. These occurrences suggest that peridotite first heterogeneously hydrated to produce antigorite peridotite and antigorite rocks. This stage is compared to the amphibolite stages II-III. Low-temperature serpentinization may have occurred in or after the amphibolite stage IV.

Metamorphic sequence of the amphibolites is characterized by early heating under high geothermal gradient from the greenschist (I) to amphibolite (II) facies, juxtaposition with serpentinite (II-III), and subsequent cooling without significant decompression (III-IV) to the blueschist facies. The stage IV condition is common with the major Kamuikotan schists. Contemporaneously, peridotite first experienced a high-temperature hydration mixing with amphibolite fragments at depths of 30-40 km. Later, olivine was extensively hydrated to be mesh textures of low-temperature serpentines during or after the stage IV.

In Hokkaido, subduction zone jumped from the Oshima Belt in the west to the Kamuikotan Zone in the earliest Cretaceous as the Horokanai Ophiolite was emplaced. Amphibolites in serpentinite melanges are the first products since the new subduction zone initiated. It is difficult to explain high thermal gradients and subsequent near-isobaric cooling for amphiboltes in the scheme of thermally stable subduction zone. Whereas subduction initiation and transition to more matured low subduction geotherm potentially explain them. If so, serpentinite blocks in the study area could be fragments of the very juvenile wedge mantle being hydrated for the first time.