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Dehydrated fluid and seismic deformation in deep subduction zone

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Dehydrated fluid in deep subduction zone causes various geological phenomena such as earthquake, and arc volcanism. It has been considered that there is a correlation between the double seismic zone and metamorphic dehydration reaction in deep slab. The location of the upper limits of the upper seismic plane correspond to metamorphic facies boundary where H2O contents change in subducting crust; numerous earthquakes from 60 to 110 km depths in the lawsonite-blueschist facies, many earthquakes in the lower crust of the slab from 110 to 150 km depths in thelawsonite-amphibole eclogite facies and few earthquakes in the lawsonite eclogite facies. Recent petrological researchs have revealed that both blueschist and lawsonite eclogite are stable in the same pressure and temperature condition because chemical variation including water content creates both lawsonite-amphibole eclogite and lawsonite eclogite in different portion of subducted crust. Partial melting would occurred in eclogite in deep subduction zone if warm slab is subducted. In descending slab, the eclogite would reach wet solidus defined as phengite-, through zoisite-, and amphibole-decomposition reactions with increasing temperatures. The lowerplane of the double seismic zone, is considered to be related to dehydration reaction in the slab. Metamorphic olivine has been described in vein from serpentinite mylonite. The vein was created by dehydration reaction to decompose antigorite under shear deformation. In the cold slab beneath Tohoku arc, the reaction has a negative slope in P-T space and forms olivine+orthopyroxene+fluid. In the warm slab beneath SW Japan, the reaction has a positive slope in P-T space and forms olivine+talc+fluid. The above these dehydration reactions are well-described in the serpentinite from high P/T metamorphic belt from Spain, and Italy, respectively.

Keywords: Subduction zone, Blueschist, Lawsonite eclogite, Dehydrated fluid, Earthquake faulting, Metamorphic olivine