

DEHYDRATED FLUID AND SEISMIC DEFORMATION IN DEEP SUBDUCTION ZONE ?constraints from lawsonite eclogite and olivine-opx sp

OKAMOTO, Kazuaki^{1*}

¹Saitama University, ²Joint Graduate school, Tokyo Gakugei University

Introduction: 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 the lawsonite-amphibole eclogite facies and few earthquakes in the lawsonite eclogite facies. It was considered that the dry eclogite is distributed in the area where there is few earthquake [1]. However, ultrahigh pressure experiments and thermodynamic calculation are both demonstrating that the lawsonite eclogite is stable [2] in the area. In order to unravel relation between dehydration and seismic deformation, we have investigated dehydration process of natural metamorphic rocks recording very cold geo-thermal history in the crust and lithosphere in the slab.

Lawsonite eclogite (Alpine Corsica): Alpine Corsica is the best representative field area exhibiting lawsonite eclogite and blueschist as a coherent high pressure, low temperature metamorphic belt. Ophiolite sequence (oceanic plate structure) is also well-preserved, and the pillow structure is clearly recognized in the lawsonite eclogite. Recent petrological researches have revealed that both blueschist (rims of the pillow) and lawsonite eclogite (core of the pillow) are stable in the same pressure and temperature condition [3] because chemical variation including water content creates both lawsonite-amphibole eclogite and lawsonite eclogite in different portion of subducted crust. We carefully observed microtexture of the lawsonite eclogite and blueschist and have found that omphacite vein and lawsonite vein in mylonitized blueschist matrix.

Olivine-opx spinifex in serpentinite (Cerro del Almirez, Nevado complex): Metamorphic olivine after antigorite has been described in Italian Alps and also from the Mt. Shiraga, Japan. However, the olivine was formed with talc and fluid by antigorite breakdown reaction in pressures lower than 1.5 GPa. Spinifex olivine with opx in the Cerro del Almirez, is the product at pressures ($P > 1.5$ GPa) relevant to the lower seismic plane beneath Northeast Japan. In Cerro del Almirez, olivine-opx rocks underlie antigorite schist by a contact [4]. In the olivine-opx rocks, the blade-like, elongated olivine and opx were grown, representing spinifex texture. It clearly indicates the presence of large amount of water facilitate crystallization of elongated olivine with opx.

Discussion and conclusion: In the lawsonite eclogite in the Alpine Corsica, blueschist and lawsonite coexist together reflecting chemical difference in pillowed structure or lithology. Omphacite and lawsonite veins are observed along the shear band in mylonitized blueschist. It suggests that decomposition of glaucophene caused hydro-fracturing and precipitate omphacite and lawsonite vein. Garnet was grown statically close to the vein.

Olivine-opx spinifex in the serpentinite, Cerro del Almirez, were probably recrystallized in the presence of large amount of water. The estimated dehydration reaction has a negative P-T slope at pressures higher than 1.5 GPa. The reaction is volume reducing reaction and the olivine-opx spinifex texture was formed under volume reducing reaction.

References: [1] S. Kita et al., *Geophys. Res. Lett.*, 33, doi:10.1029/2006GL028239. (2006). [2] K. Okamoto et al., *Geochemistry*, 46 205-215 (2013). [3] A. Vitale Brovarone et al., *J. Met. Geol.*, 29, 583-600, (2011). [4] V. Trommsdorff et al., *CMP*, 132, 139-148 (1998).

Keywords: double-seismic zone, upper seismic plane, Lawsonite eclogite, lower seismic plane, olivine-opx spinifex, dehydrated vein