SCG10-02 Room:101B Time:May 22 14:30-14:45

Pattern of fluid release from the subducting slab at the IBM margin

Ikuko Wada[1*]

[1]International Research Institute of Disaster Science, Tohoku University

Aqueous fluids released from the subducting slab play an important role in the creation and the evolution of arc crust by altering the physical properties of the overlying mantle material via hydration and by triggering hydrous melting, which is in large part responsible for arc magmatism. In this study, we investigate the pattern of fluid release from the subducting Pacific slab at the Izu-Bonin-Mariana (IBM) margin, using steady-state thermal models and the thermodynamic calculation code Perple_X, and explore its role in the formation of arc crust at the IBM margin. Geological and geophysical observations and thermo-mechanical models indicate that the distribution of hydrous phases in the lower crust and upper mantle of oceanic lithosphere can be highly localized due to fault-controlled fluid migration and hydration. However, to date, most studies of fluid flux in subduction zones have assumed a uniform distribution of mineralogically bound H_2O within given lithologies in the incoming oceanic plate. Fluid flux calculations by Wada et al. (2012) for a range of generic subduction systems show that for a given bulk H_2O content, localized hydration results in shallower H_2O release compared to uniform hydration, and that the H_2O flux off the subducting slab beneath the forearc and arc regions can be almost twice as large from a locally hydrated slab as from a uniformly hydrated slab. In this study, we will apply the approach developed by Wada et al. (2012) to the IBM subduction system and quantify the effect of localized hydration in the incoming Pacific plate on the pattern of fluid release. The hydration of the overlying mantle by the released aqueous fluids and the subsequent downdip flow of the hydrated mantle driven by the motion of the slab delay the liberation of H_2O and affect the depth distribution of fluid flux. At the IBM margin, the subducting Pacific slab is old and cold. The mantle material at the base of the mantle wedge may be altered by mechanical mixing with subducted sediments and crust and/or by the addition of Si- and Al-rich aqueous fluids. In such cases with a relatively cold condition along the interface, hydrous phases, particularly chlorite, may be stable in a thin layer along the base of the wedge to the sub-arc depth (Wada et al., 2012). In the fluid flux calculations for the IBM system, we will quantify the effect of the hydration of the overlying mantle on the pattern of fluid release. The modeling results will be compared with the location and the degree of hydrous melting in the mantle wedge inferred from geophysical and geochemical observations.

Keywords: Subduction zones, Thermo-petrologic model, Fluid flux, Subducting slab, Mantle wedge, Arc volcanism