An outline of Bend-Fault Hydrology in the Old Incoming Plate (H-ODIN) project and its perspective

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Crustal hydration at the mid-ocean ridge by hydrothermal circulation has been considered to be the first-order control on the degree of the oceanic plate hydration. Previous ocean drilling projects have revealed hydration processes and their extent of oceanic crust at spreading centers. Recently, hydration due to plate bending-induced normal faults (bend-fault hereafter) in incoming plate just prior to subduction has drawn considerable attention (e.g., Ranero et al., 2003 Nature). In the last decade, a number of geophysical structure studies have been conducted to test the hypothesis that significant hydration is due to plate bending-induced normal faults just prior to subduction (e.g., Fujie et al., 2013 Geophys. Res. Lett.). However, we really do not know what is the bending-induced fault zone. Bend-fault hydration processes depend on various conditions, such as thermal conditions and stress state. Ideally, comparing subduction zones with several different basic states (e.g. Old cold plate vs Young hot plate) will be the most effective approach to expand our knowledge of bend-fault hydration processes. Two new IODP proposals on hydration in incoming plate of middle America site (Morgan et al., 2014, Pre-876: Bend-Fault Serpentinization (BFS): Oceanic Crust and Mantle Evolution from Ridge through Trench) and northwest pacific site (Morishita et al., 2015 Pre-886: Bend-Fault Hydrology in the Old Incoming Plate) have been submitted. The world's largest dense onland seismic observation network is in NE Japan. In addition, a large number of onland/offshore reflection and refraction seismic surveys have been conducted here, both before and after the 2011 Tohoku earthquake. This network and surveys provides an invaluable data set to study how various subduction zone processes shape subduction inputs, tectonics, and volcanism. The northwestern Pacific is one of the best targets because here horst-and-graben bend-fault structures are the best developed in the world (Nakanishi, 2011, Springer), and this is also one of the world oldest, thus coldest, subducting oceanic plates, hence likely to be associated with the deepest extent of bend-fault serpentinization. The maximum penetration depth of seawater, and thus degree of serpentinization is thought to be inversely proportional to the temperature of the incoming plate, i.e., deeper in cold plate than in hot plate. In the presentation, I introduce the contents and perspective of the new IODP proposals using CHIKYU on hydration of incoming plate prior to subduction.

Keywords: Incoming oceanic plate, Bending fault, Hydrology

