Origin of Moho

*Yoshihiko Tamura[1], Eiichi TAKAZAWA[1,2], Georges Ceuleneer[3], Katsuyoshi Michibayashi[4], Tomoki Sato[1], Shuichi Kodaira[5], Seiichi Miura[5]

1. ODS, JAMSTEC, 2. Niigata University, 3. Universite de Toulouse, 4. Shizuoka University, 5. CEAT, JAMSTEC

The origin of Moho has been debated since its discovery at the beginning of 20[th] century (Prodehl et al., 2013, *Tectonophysics* **609**). Moho is, however, absent in many oceanic regions (as much as 40 %). (Mutter & Carton, 2013, *Tectonophysics* **609**). Ohira et al. (2017, *EPSL* **476**) conducted an active-source reflection and refraction survey to investigate crustal structure and Moho characteristics along a > 1000 km profile in a Pacific Ocean basin. Clear oceanic Moho reflections had been observed only at the southwestern end of the profile (~50 km) and Moho reflections were diffused, weak, or absent along most parts of the profile (~1000 km). Ohira et al suggest that the unclear Moho reflection events may correspond to a thick intermediate lithology between mafic and ultramafic. As a matter of fact, the contact between mantle peridotite and layered gabbro from the lower oceanic crust in the Oman ophiolite is ultramafic, usually underlined by a dunitic transition zone (DTZ), mostly made of olivine + scattered Cr-spine with few mafic intervals (less than 10 % and mostly gabbros and troctolitic sills). The thickness of DTZ ranges from a few meters to a few hundred meters (Abily & Ceuleneer, 2013 *Geology* **41**). When the DTZ is >150m thick, it could be thick enough to be detected as the clear reflection events by seismologists (Sheriff & Geldart, Exploration Seismology), and thus, Moho could be an unusually thick dunite.

The DTZ is considered either as a pile of cumulates or as residual peridotite leached by melts (e.g., Abily & Ceuleneer, 2012). However, we present here the third hypothesis, which should be examined by the Oman Drilling Project and ChikyuOman campaign that describe the cores on board RV Chikyu, that is, the unusually thick dunite is produced by hydrous melting of mantle peridotite at low pressures in the divergent plate boundaries. At lower pressure and in hydrous conditions, the liquidus field of forsterite expands relative to that of enstatite and enstatite melts incongruently to produce dunites. The in-situ melt should be magnesian andesitic in composition, which will mix with dominant high pressure basaltic melts coming below before reaching to the seafloor. Rospabe et al. (2017, *Geology* **45**) suggested involvement of a hydrous melt in the genesis of the DTZ, and synmagmatic faults (Abily, Ceuleneer, & Launeau, 2011, *Geology* **39**) could be main avenues for seawater penetration down to the Moho. Koepke et al. (2005, *Terra Nova,* **17**; 2007, *CMP,* **153**) suggested that seawater caused H_2O-saturated melting of lower crustal gabbro. Koepke & Feig (2006, abstract of 11[th] EMPG, Bristol) showed that chromitites could be also produced by a fluid-induced partial melting of harzburgite at MOHO level. The availability of water should be variable along the mid-ocean ridges, resulting in the variable thickness of the DTZ.

Shallow melting of hydrous mantle could be responsible for both the advent of continents in the subduction zones (Tamura et al., 2016, *Scientific Reports* **6**) and the genesis of Moho in the oceans.

Keywords: Moho, ophiolite, dunite, hydrous melting of mantle, mid ocean ridge, subduction zone