Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG57-08 Room:A06 Time:May 27 16:45-17:00

Crust composition in the Hidaka Metamorphic Belt estimated from seismic velocity by laboratory measurements

YAMAUCHI, Koichi[1*] ; ISHIKAWA, Masahiro[2] ; SATO, Hiroshi[1] ; IWASAKI, Takaya[1] ; TOYOSHIMA, Tsuyoshi[3]

[1]Earthquake Research Institute, The university of Tokyo, [2]Yokohama National University, [3]Niigata University

The knowledge of rock composition is significant to understand the dynamics of the lithosphere in subduction systems. However, rock composition of the overriding plate is still poorly understood. To estimate rock composition of the lithosphere, it is an effective method to compare the elastic wave velocities measured under the high pressure and temperature condition with the seismic velocities obtained by active source experiment and earthquake observation.

Due to an arc-arc collision in central Hokkaido, middle to lower crust is exposed along the Hidaka Metamorphic Belt (HMB), providing exceptional opportunities to study crust composition of an island arc. Across the HMB, P-wave velocity model has been constructed by refraction/wide-angle reflection seismic profiling (Iwasaki et al., 2004). Furthermore, because of the interpretation of the crustal structure (Ito, 2000), we can follow a continuous pass from the surface to the middle-lower crust. We corrected representative rock samples from HMB and measured ultrasonic P-wave (Vp) and S-wave velocities (Vs) under the pressure up to 1.0 GPa in a temperature range from 25 to 400 ℃.

For example, the Vp values measured at 25 ℃ and 0.5 GPa are 5.88 km/s for the granite (74.29 wt.% SiO_2), 6.02-6.34 km/s for the tonalites (66.31-68.92 wt.% SiO_2), 6.34 km/s for the gneiss (64.69 wt.% SiO_2), 6.41-7.05 km/s for the amphibolites (50.06-51.13 wt.% SiO_2), and 7.42 km/s for the mafic granulite (50.94 wt.% SiO_2). And, Vp of tonalites showed a correlation with SiO_2 (wt.%). Comparing with the velocity profiles across the HMB (Iwasaki et al., 2004), we estimate that the lower to middle crust consists of amphibolite and tonalite, and the estimated acoustic impedance contrast between them suggests an existence of a clear reflective boundary, which accords well to the obtained seismic reflection profile (Iwasaki et al., 2014). And, we can obtain the same tendency from comparing measured Vp/Vs ratio and Vp/Vs ratio structure model (Matsubara and Obara, 2011).

Based on the velocity profile across the Kuril arc (Nakanishi et al., 2009) and measured ultra-sonic velocity of rock samples from HMB, we estimated rock composition of the Kuril arc. The Kuril arc has a thick middle to lower crust (6.5-7.3km/s), and shows more mafic lower crust than in HMB.

Keywords: elastic wave velocity, Hidaka Metamorphic Belt, acoustic impedance, tonalite, amphibolite