

Elastic wave velocity measurement under high pressure and temperature conditions for lower crust rocks in the Kohistan arc

Daisuke Tsutsumi[1]; Masahiro Ishikawa[2]; Makoto Arima[3]

[1] Geological Inst, Yokohama National Univ; [2] Graduate School of Environment and Information Sciences, Yokohama Nat. Univ.; [3] Geolo. Instit. Yokohama Natl. Univ.

Determining elastic properties of deep crustal rocks is a fundamental approach for interpretation of seismic structures of island arcs. However, there are only a few reports that show elastic properties under lower crustal P-T conditions of island arcs (e.g., Kono et al., 2006, Nishimoto et al., 2008). The Kohistan terrain is one of the examples of oceanic island arc exposing full crustal section from upper crustal volcanics to upper mantle peridotite. In this study, we measured ultrasonic velocities of the gabbro collected from Jijal Complex which is believed to be the lowest part of the lower crust of the Kohistan arc. Modal mineral compositions of gabbro are plagioclase ($Ca\# = Ca / (Ca + Na + K) = 0.58 - 0.65$) (64.1 vol.%), clinopyroxene ($Mg\# = Mg / (Mg + Fe^{2+}) = 0.58 - 0.59$) (15.3 vol.%), orthopyroxene ($Mg\# = 0.53 - 0.56$) (14.6 vol.%), hornblende (4.1 vol.%), ilmenite (2.0 vol.%), and quartz (0.1 vol.%). Measurements of elastic wave velocities were carried out on a core sample by using the pulse reflection technique with a piston-cylinder apparatus up to 1.0 GPa and 800 degrees C.

The P- and S-wave velocities (V_p and V_s) for the gabbro at the conditions of 1.0 GPa and 25-800 degrees C are 7.14-6.82 km/s and 3.93-3.67 km/s, respectively. The gabbro shows a sudden decrease in V_p/T (temperature derivative of V_p) at around 400 degrees C. V_s/T (temperature derivative of V_s) also shows sudden decrease at around 400 degrees C. These changes in V_p/T and V_s/T show reversibility during heating and cooling. These elastic velocities can be compared with the seismic velocity profiles of the Izu-Bonin-Mariana arc without any correction. Our result indicates that the gabbro is one of the candidates for the high V_p lower crustal rocks of the Izu-Bonin-Mariana arc. According to this study and Katsune et al. (this meeting), the high V_p lower crustal rocks are not exposed in the Izu collision zone (the Tanzawa Mountain). This concludes that the gabbroic lower crust subducts as the Philippine Sea slab at the Izu collision zone while the hornblende gabbroic top layer of the mafic lower crust is exposed by arc-arc collision.