Elastic wave velocity measurements of Tanzawa hornblende gabbro up to 800 degrees C and 1.0GPa

go katsune[1]; Masahiro Ishikawa[2]; Makoto Arima[3]

[1] Envi. & Info. Sci., Yokohama Nat. Univ.; [2] Graduate School of Environment and Information Sciences, Yokohama Nat. Univ.; [3] Geolo. Instit. Yokohama Natl. Univ.

We present a new experimental data of elastic properties of hornblende gabbro from the Tanzawa mountain. We use these data to interpret seismic structures of Izu-Bonin-Mariana island arc. Ultrasonic measurement of elastic velocities of deep crustal rocks under lower crustal P-T conditions is a fundamental approach for interpretation of seismic structures of lower crust of island arcs. Kitamura et al. (2003) measured elastic wave velocity of the Tanzawa plutonic rocks up to 1GPa and 400 C. However, there is no report that shows elastic properties of the Tanzawa plutonic rocks under lower crustal P-T conditions of island arcs. Here, we measured compressional wave velocities(Vp) and shear wave velocities(Vs) of hornblende gabbro of Tanzawa plutonic complex, central Japan, which has been interpreted as an exposed upper lower crust of the northern IBM arc. The experiments were carried out using ultrasonic technique in a piston cylinder type high-pressure apparatus and the experimental conditions were up to 1.0GPa in a tempreture range from 25 to 800 degrees C.

The Vp and Vs at 1.0 GPa in hornblende gabbro from Otanazawa(OOT-22a) yield 7.07 km/s to 6.72 km/s and 3.81 km/s to 3.56 km/s, respectively, with increasing temperature from 25 degrees C to 800 degrees C. Vp and Vs determined for hornblende gabbro from Doushi (DOU-19) are 7.12-6.77 km/s (Vp) and 3.79-3.42km/s (Vs), respectively at 1.0GPa and 25-800 degrees C. The Poisson's ratio increases significantly from 500 to 600 degrees C. The Poisson's ratios for OOT-22a and DOU-19 increase significantly at temperature of ˜500-600 degrees C. Furthermore, these specimens after experiment contain garnet. The results suggest that altered specimens are dehydrated at temperature of ˜500-600 degrees C.

In contrast, Vp determined for hornblende gabbro from Doushi (2505) are 6.97-6.74 km/s with increasing tempreture from 25 to 800 degrees C at 1.0GPa. Reversible and discontinuous change in tempreture derivative of Vp(dVp/dT) at 450 degrees C are observed for this sample. It changes from 1.27 $*$10-4 km/s degrees C-1 to 4.13 $*$10-4 km/s degrees C-1 during heating.

Seismic experiments carried out at the northern Izu-Bonin-Mariana arc (Suyehiro et al., 1996; Takahashi et al., 1998; Kodaira et al., 2007) provide important constraints to understand the structure and composition of intraoceanic arc crusts. The seismic studies of the northern IBM arc revealed that Vp of the top layer of the lower crust is 6.7-6.8 km/s. Our experimental results shows that the Vp in the hornblende gabbro (6.76-6.70km/s) at 0.6GPa and 400-600 degrees C, which conditions are applicable for the lower crust of IBM arc, and suggest that the top layer of the lower crust consists of hornblende gabbro.