

# P-wave velocities of the Tanzawa tonalites under high pressure and high temperature conditions

# Yasuyuki Akutagawa[1]; Masahiro Ishikawa[2]; Makoto Arima[3]

[1] Environmental Sci, Education and Human Sci, Yokohama National Univ; [2] Graduate School of Environment and Information Sciences, Yokohama Nat. Univ.; [3] Geolo. Instit. Yokohama Natl. Univ.

Ultrasonic measurements of the velocities of the Tanzawa plutonic rocks at pressure and temperature conditions of the arc crust is very important for understanding the composition of the Izu-Bonin-Mariana arc. In this study, compressional wave velocity ( $V_p$ ) measurements on four specimens of the Tanzawa tonalites were conducted at simultaneous high pressure and high temperature to 1.0 GPa and 500 C using a piston-cylinder type apparatus. Rock samples used here are Kumakizawa type (SiO<sub>2</sub> 53.94 wt.%, quartz 7.2 vol.%, plagioclase 63.2 vol.%, hornblende 17.0 vol.%), Azegamaru type (Azegamaru type 1: SiO<sub>2</sub> 56.41 wt.%, quartz 17.5 vol.%, plagioclase 52.5 vol.%, hornblende 20.2 vol.%; Azegamaru type 2: SiO<sub>2</sub> 62.86 wt.%, quartz 30.9 vol.%, plagioclase 48.0 vol.%, and hornblende 10.7 vol.%), and Fujimi type (SiO<sub>2</sub> 71.13 wt.%, quartz 36.0 vol.%, plagioclase 55.0 vol.%) (Kawate, 1996). Our experiments show rapid increase in  $V_p$  from 0.1 to 0.3 GPa and linear increase from 0.3 to 1.0 GPa with pressurization in all experiments.  $V_p$  values at 0.6 GPa and 25 C are 6.50 km/s for the Kumakizawa type, 6.62 km/s for the Azegamaru type 1, 6.33 km/s for the Azegamaru type 2, and 6.11 km/s for the Fujimi type. Pressure derivative of  $V_p$  at 25 C is 0.37 km s<sup>-1</sup> GPa<sup>-1</sup> for the Kumakizawa type (0.3 - 1.0 GPa), 0.48 km s<sup>-1</sup> GPa<sup>-1</sup> for the Azegamaru type 1 (0.3 - 0.6 GPa), 0.31 km s<sup>-1</sup> GPa<sup>-1</sup> for the Azegamaru type 2 (0.3 - 1.0 GPa), and 0.45 km s<sup>-1</sup> GPa<sup>-1</sup> for the Fujimi type (0.3 - 0.6 GPa). The  $V_p$  and pressure derivative for the tonalites obtained in this study are generally consistent with that obtained in previous high pressure experiment at room temperature for the Tanzawa tonalite specimens (Kitamura et al., 2003). Temperature derivative of  $V_p$  for the Kumakizawa type is  $-0.9 - -2.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> (0.2 - 0.4 GPa, 25 - 300C),  $-0.9 - -1.6 \times 10^{-3}$  km s<sup>-1</sup> C<sup>-1</sup> (0.2 - 0.4 GPa, 300 - 500C), and  $-2.0 - -3.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> (0.5 - 1.0 GPa, 25 - 500C). Temperature derivative of  $V_p$  for the Azegamaru type 1 is  $-2.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> (0.4 and 0.6 GPa, 25-500 C, and almost  $0.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> at higher pressures. Temperature derivatives of  $V_p$  for Azegamaru type 2 is  $-3.0 - -6.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> (0.2 - 0.6 GPa, 25 - 500C),  $-2.0 \times 10^{-4}$  km s<sup>-1</sup> (0.7 GPa, 25 - 400C),  $-1.0 \times 10^{-4}$  km s<sup>-1</sup> (0.9 GPa, 25 - 400C),  $-3.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> (1.0 GPa, 25 - 400C), and almost  $0.0 \times 10^{-4}$  km s<sup>-1</sup> C<sup>-1</sup> at 0.8 GPa. We compare our results with  $V_p$  profile of the northern Izu-Bonin Arc (Suyehiro et al., 1996). P wave velocities of Tanzawa tonalites demonstrate that the middle crust ( $V_p$ : 6.1 - 6.2 km/s, depth: 7 - 12 km) is composed of tonalites.