High P-T measurements of P-wave velocity for ultrabasic Ichino-megata xenoliths, NE Japan

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Calc-alkaline andesite erupted at the Ichino-megata volcano in the Honshu arc, northeastern Japan, contain xenoliths of various mafic and ultramafic rocks and these xenoliths provide a unique opportunity to examine petrological characteristics of the Honshu arc (Aoki, 1971; Takahashi, 1978; Takahashi, 1980; Zashu et al., 1980; Fukuyama, 1985; Aoki and Yoshida, 1986; Takahashi, 1986; Kushiro, 1987). Recent extensive seismic experiments across the NE Honshu arc (Iwasaki et al., 2001) suggest that the arc crust is composed of highly deformed Tertiary sedimentary upper crust layer, a middle crustal layer with relatively lower Vp of 5.75-5.9 km/s, and a 15 km thick lower crust with Vp of 6.6-7.0 km/s. In this study, we developed new experimental technique to measure Vp of Ichino-megata xenoliths at lower crustal P-T conditions (up to 800 degrees C and 1.0 GPa), and combined the measured Vp of the xenoliths with the velocity structure of the arc. The measured rocks include hornblende gabbro, pyroxene-hornblende gabbro, hornblendite and spinel lherzolite . It is widely accepted that Vp value of the rocks considerably decreases with elevating temperature (e.g. Kern and Richter, 1981). At constant pressure of 1.0 GPa, the Vp of hornblende gabbro gradually decreased from 7.21 km/s at 25 degrees C to 6.91 km/s at 700 degrees C. Similarly the Vp values of the pyroxene-hornblende gabbros reduces from 7.06 km/s at 25 degrees C to 6.73 km/s 800 degrees C. Also the Vp value of the hornblendite and spinel lherzolite lowers from 7.11 km/s (25 degrees C) to 6.45 km/s (800 degrees C) and 8.00 km/s (25 degrees C) to 7.46 km/s (800 degrees C). Vp-temperature correlation for all rock samples in this study show non-linear. Vp values decrease slightly at lower temperature conditions, while Vp values decrease rapidly at higher temperature conditions. Cusp locates at various temperatures (300-500 degrees C) depending on the rock sample measured. Compared measured Vp with Vp perturbations of Zhao et al. (1992), the temperature of lower crust zone beneath Ou back-bone range is estimated 300-400 degrees C higher than that beneath back-arc side of NE Japan and it suggests existence of the partial melting of lower crust zone beneath Ou back-bone range.