# Linking velocity to lithology: Arc crustal lithology beneath NE Honshu

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The NE Honshu has been known as a typical and mature volcanic island arc along convergent plate boundary. Subduction of Pacific Plate plays critical roles in the water cycles and magmatism beneath NE Honshu Arc because slab dehydration is believed to contribute to partial melting in the mantle wedge. The island arc magmatism is a fundamental process in the recent crustal evolution of the NE Honshu Arc. The NE Honshu Arc was primarily located at the eastern margin of the Asian Continent as a part of Eurasian Plate, and it was rotated counterclockwise to the present location by the Miocene back arc spreading (the opening of the Japan Sea). According to previous petrological studies, the Cenozoic volcanic activity of the NE Honshu arc can divide into three major stages: from continental margin volcanism (66-21 Ma), through back-arc basin volcanism (21-13 Ma), and finally island-arc volcanism (13-0 Ma) (Ohguchi et al., 1989; Yoshida et al., 1995). Therefore, constructing the petrological model for the crustal structure of the NE Honshu Arc is important for understanding the crustal evolution of the NE Honshu Arc which has been formed by continental arc, backarc opening and island arc processes (e.g., Yoshida et al., 1995; Yoshida, 2001; Yoshida et al., 2005).

In 1997, a seismic experiment was carried out in the NE Honshu to investigate crustal and upper mantle structure across NE Honshu Arc (Iwasaki et al., 2001). The results showed that the crust is composed of Tertiary sediments, a relatively low velocity (Vp = 5.75-5.9 km/s) crystalline basement and a 15-km thick lower crust with Vp of 6.6-7.0 km/s. The Vp of lower crust of the NE Honshu Arc is 0.2-0.4 km/s lower than that inferred for the lower crustal layer of the northern Izu-Bonin-Mariana (IBM) Arc (Suyehiro et al., 1996; Takahashi et al., 1998) and the Aleutian Arc (Fliedner and Klemperer, 1999; Holbrook et al., 1999). The prominent low velocity (low-Vp) lower crust beneath NE Honshu Arc extends horizontally at least 150 km east-west. Generally, lower velocity represents relatively higher SiO2 composition in deep crustal rocks. However, recent ultrasonic velocity experiments of Ichinomegata xenoliths showed that the low-Vp lower crust is mainly composed of hornblende gabbros with ultrabasic composition (Nishimoto et al. 2005).

In order to interpret the observed seismic heterogeneity of the lower crust of the Northeast Japan arc, Nishimoto et al. (2008) measured compressional- (Vp) and shear-wave velocities (Vs) of xenoliths simultaneously at higher temperatures. They obtained the velocity deviations (dVp and dVs) using the average reference Vp (6.61 km/s) and Vs (3.76 km/s). They compared seismic tomography with dVp and dVs of the xenoliths using Vp-Vs-Vp/Vs deviation diagrams and interpreted the seismic heterogeneity of the lower crust of the Northeast Japan arc as follows; (1) the high-Vp and Vs regions beneath the Tobishima Basin consist of hornblende-pyroxene gabbro, (2) hornblende gabbro is a predominant rock type beneath the Dewa Hills and Ou Backbone Range, (3) the low-velocity anomalies beneath the active volcano areas may be caused by the existence of partial melts of hornblende gabbro, and (4) the low-Vp and high-Vs regions beneath the Kitakami Mountains consist of quartz-plagioclase-bearing rocks. The ultrasonic velocity data show that the seismic heterogeneity in the lower crust of the Northeast Japan arc reflects variations in rock composition. Petrological features of lower crusts, in general, reflect crust-mantle differentiation process. Hence, the lower crustal lithology of the NE Honshu Arc is an important key to resolve an issue of crust-mantle differentiation and its role on crustal evolution of the island arc that are related to the tectonic history.