S147-023 **Room: 303** **Time: May 26 16:30-16:45**

High velocity lower crust in rifted crusts of the Izu-Ogasawara arc-backarc system

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The Izu-Ogsawara arc is one of intra-oceanic island arcs with no collisions by the continental crusts, but has some types of crustal growth process and the crustal alteration. According to past petrologic and seismic studies, the growth processes in Eocene and after Oligocene are differences with each other (e.g., Tatsumi et al., in Press; Takahashi et al., in Prep). The crust and mantle structures of the Izu-Ogasawara arc-backarc system have the structural commonalities and variations, and the origin of the structural variations might be differences in process of the crustal growth and the stage of the rifting.

The Sumisu rift, which is in the first stage of the crustal rifting, has thick crust without crustal thinning, however, the southern Izu-Ogasawara arc-backarc system has many rifted areas with crustal thinning. The Ogasawara Trough and the Nishinoshima Trough are in the rifting stage with crustal thinning, but the rifting was stopped before spreading stage producing oceanic crusts, because the crustal thicknesses are still over 10 km. Markedly, much broader rifted area than above troughs is the western region of the Shichito sea mount chain, and the width along E-W is approximately 100 km. The rifting had not reached to the spreading stage because the crustal thickness is approximately 15 km. Large change of the crust along the volcanic front had been already reported despite of similar crustal composition (Kodaira et al., 2007), however, the crust of the region between the volcanic front and the rear arc has much dramatic change at the northern and southern parts of the arc.

Such rifted area has commonly lower crust with high P-wave velocity of over 7 km/s. In addition, the high velocity lower crust commonly accompanies the clear reflectors to the bottom. The high velocity lower crust distributes broadly beneath the rifted areas with crustal thinning and with thicker crust than typical oceanic crusts. Even if the thickness of the rifted crust is similar to that of the typical oceanic crust, the high velocity lower crust can be sometimes seen, for example, the boundaries between the Mariana Trough and Mariana arc, the Parece Vela Basin and West Mariana Ridge, and the Shikoku Basin and Nishi-shichito Ridge. On the other hand, the rifting seemed to be asymmetric because the high velocity lower crust is not seen at the region between the basin and the western arc, for example, the Parece Vela Basin and the Kyusyu Palau Ridge (Nishizawa et al., 2007).

It is suggested that the origin of the high velocity lower crust is underplating of the melts produced by the mantle decompression to the bottom of the crust or the serpentinization of the mantle rocks. When the underplating occurs there, the P-wave velocity and the thickness of the high velocity lower crust migh be reflect the temperature of the mantle during the rifting (Parkin and White, 2008). In this report, we summarize distribution of the high velocity lower crust and the mantle condition during the rifting if the origins are the underplating of igneous rocks due to mantle decompression.