

Seismicity in the mantle wedge around Ogasawara Islands and Lesser Antilles

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Nakata et al. (2018) deployed ocean bottom seismometers around Ogasawara Islands from July to October in 2015, and observed seismicity of the area. Double seismic zone and seismicity in the mantle wedge (green circles in the figure) were identified. Some hypocenters were distributed in the 20-50 km depth range inside the mantle wedge. These earthquakes are located beneath the Ogasawara Trough without forming any clusters. Ogasawara Trough is a forearc basin between the current volcanic arc and the Ogasawara ridge.

Seismic activity is usually low in the mantle wedge in areas without complex plate interactions. However, seismicities in the mantle wedge have been reported for other regions. Uchida et al. (2010) found supraslab seismicity off Sanriku coast. Davey and Ristau (2011) reported seismicity observed in the mantle wedge beneath northeast New Zealand. Laigle et al. (2013) reported seismicity in the mantle wedge along the Lesser Antilles subduction zone. The seismicity in the mantle wedge beneath Lesser Antilles is distributed over trench-normal distance more than 50 km, which is wider than that seen in the figure.

Supraslab earthquakes offshore Sanriku (Uchida et al. 2010) are distributed mainly near the toe of the mantle wedge, and form clusters. Earthquakes in the mantle wedge beneath northeast New Zealand form clusters near the boundary of subducting slab. The seismicity around Ogasawara Islands looks like that of Lesser Antilles rather than those offshore Sanriku and beneath northeast New Zealand.

The tectonic features of the forearc basins in the Lesser Antilles and Ogasawara Island regions are similar. Ogasawara ridge was formed with volcanic activities in 41-48 Ma related to beginning of the Pacific plate subduction in this area (Ishizuka et al. 2006). The backarc and forearc basins of the Lesser Antilles were formed as a single structure, and the Lesser Antilles were formed by volcanic activities with dividing the single basin into the two (Aitken et al. 2011). The volcanic activity started at about 40 Ma (Briden et al. 1979) due to the rollback of the Atlantic oceanic slab subduction (Aitken et al. 2011). Both forearc basins around Ogasawara Islands and Lesser Antilles are related to beginning of oceanic slab subduction. The seismic activity in mantle wedge may be related to dehydration of minerals which were formed at the time of subduction onset.

Keywords: Ogasawara Islands, the Lesser Antilles, seismicity in the mantle wedge, onset of oceanic slab subduction

