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The discovery of deep tremor and low-frequency earthquakes in Kyushu, Japan The discovery of deep tremor and low-frequency earthquakes in Kyushu, Japan

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Kyushu is a part of the Nankai-Kyushu-Ryukyu subduction zone where the Philippine Sea plate is subducting beneath the Eurasian plate. In this area, tectonic tremors and low-frequency earthquakes (LFEs) have not been discovered yet, though they are well-studied in Tokai, Kii, and Shikoku Regions along the Nankai subduction zone. The subducting plate beneath Kyushu is a little older, but there is a high V_p/V_s zone at around 30 km depth, which is considered as an essential structural feature for tremor generation (Matsubara et al., 2009).

The envelope correlation method of Ide et al. (2010) detected many tremor activities including LFEs beneath Kyushu, in northern and southern Miyazaki prefecture. The waveforms have the characteristics of LFEs, such as dominant frequency range (1-10 Hz), detectable S-wave arrivals and obscure P-waves, and successive occurrence, similarly to those observed in the Nankai subduction zone. We relocated these LFEs, using manually identified S-waves in band-passed waveforms between 2-8 Hz, and S-P times measured by cross-correlating waveform envelopes between vertical and horizontal components. For each LFE, S-waves constrain the epicenter and S-P times at stations near the epicenter constrain the depth.

The depths of LFEs are distributed between 30 and 50 km, which are shallower than the depths of intraslab earthquakes in this area, which are between 50 and 60 km. The locations of LFEs suggest that they occur on the interface between Eurasian plate and Philippine Sea plate, and also at the depth of known high V_p/V_s area, which suggests the presence of fluid. The two areas of active LFEs are located on the northern and southern edges of the subducting Kusu-Palau Ridge. Although the distribution is not continuous like LFEs in the Nankai subduction zone, the above findings suggest that similar phenomena are occurring beneath Kyushu. The existence of slow-slip events may be predicted.

キーワード: 深部微動, 低周波地震, 九州, エンベロープ相関

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