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Split of the Philippine Sea plate and non-volcanic seismic swarm in Wakayama district, SW Japan

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To understand the driving force of an intensive non-volcanic seismic swarm in Wakayama district of the Kii Peninsula, Japan, we used a series of dense seismic linear arrays to measure fine-scale variations of seismic structures beneath the seismic swarm area. Kato et al. (2014, EPS) revealed that a low-velocity anomaly confined to just beneath the seismic swarm area is clearly imaged, which correlates spatially with an uplifted surface area and a highly conductive and strong attenuative body, implying the presence of fluids therein. In addition, they suggested that dehydration conversion from oceanic basalt to eclogite within the subducting Philippine Sea Plate takes place at depths greater than 50 km. Fluids released from the subducting oceanic crust could cause serpentinization of the mantle wedge.

In 2013, we conducted a new seismic experiment (deployment of 40 portable seismic stations) to investigate the structure between Wakayama district and Awaji Island at the western extension of the seismic swarm area, where the Philippine Sea Plate has been proposed to split (Ide et al., 2010). From a new receiver function image with high spatial resolution, we found that the dehydrated oceanic crust (high-velocity without intra-slab seismicity) steeply gets to be shallow toward offshore from Wakayama district and close to the bottom of the overlying crust beneath Awaji Island. Interestingly, we found out a split or gap of the oceanic crust beneath the center of Awaji Island. However, the gap width appears to be significantly smaller than one proposed by Ide et al. (2010). Due to this split of the oceanic crust, hot mantle is easily leaking into the mantle wedge beneath Wakayama district, resulting to warm thermal condition. These anomalous structures of the oceanic crust and mantle wedge may locally promotes dehydration reactions of the subducting oceanic crust, leading to local increase in fluid flux to the shallow seismic swarm area.