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沈み込み帯の脱水作用と非火山性群発地震の発生
Fluids dehydrated from the subducting oceanic crust and non-volcanic seismic swarms

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A non-volcanic seismic swarm is often assumed to be tied to fluid movements, based on earthquake mi-grations obeying a diffusion equation. However, seismological observations that relate to the presence and driving force of fluids are not well documented. One of the most intensive non-volcanic seismic swarms in Japan is located in the Wakayama district, SW Japan, and quite distant from the present volcanic front.

It is important to fully describe the crustal heterogeneity originating in crustal fluids. We have deployed a very dense seismic array with a length of about 100 km at the western edge of the Kii Peninsula. The dense seismic observations were conducted from December in 2010 to June in 2011. The linear array consists of 86 seismometers with 1 Hz natural fre-quency, those continuously recorded three-component signals. Both P- and S-wave arrival times from local earthquakes including some low-frequency earth-quakes (LFEs) were manually picked from waveforms observed by both dense temporary stations and per-manent stations. The dense and well-covered ray-paths from local and teleseismic events afford us precious opportunities to investigate the fine-scale seismic structures.

The most striking feature of the fine seismic image is low-velocities with low Poisson ratios beneath the seismic swarm region. This low-velocity feature is also supported by the receiver functions. In addition, the corner of mantle wedge is characterized as low veloci-ty, leading to an inverted inland Moho at depth of about 30 km. This low velocity mantle seems to ex-tend to deeper depths.

At depths shallower than 40 km, a depth-section of receiver functions shows that the oceanic crust, of which the top and bottom (plate interface and oceanic Moho) are outlined by strong negative and positive amplitudes, respectively, is subducting at a dip angle of approximately 15-degree. In contrast, the polarity of the plate interface changes from negative to positive at depths greater than 50 km. The dip-angle of the oceanic crust increases with depth. We interpret the transitions of the polarity as indicating the onset of eclogitization of the oceanic crust. The subducting oceanic crust beneath LFEs is characterized by low-velocities and high Poisson ratios, which are commonly observed at Tokai or Shikoku regions.

We propose that fluids dehydrated from the sub-ducting oceanic crust could infiltrate into the mantle wedge and crust, leading up to the intensive non-volcanic seismic swarms in Wakayama and high-helium isotopes widely observed in the Kii Pen-insula.

Keywords: seismic swarm, crustal fluid, non-volcanic, velocity structure, receiver function, dehydration