Geophysical Research Abstracts
Vol. 19, EGU2017-3528-5, 2017
EGU General Assembly 2017

Seismological structures of the subducted Philippine Sea plate and the overriding SW Japan arc, - Reinterpretation of the wide-angle reflection data in the Kii Peninsula, SW Japan -

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Our recent reinterpretation for seismic refraction/wide-angle reflection data in eastern Kii Peninsula, SW Japan, provided new structural information on the uppermost part of the subducted Philippine Sea (PHS) plate and overriding the SW Japan arc, including the landward reflectivity variation in the vicinity of the plate boundary and the large scale structural change within the SW Japan arc.

The Kii peninsula is located in the eastern part of the well-known subduction zone along the Nankai trough where offshore M8-class megathrust earthquakes repeatedly occur. The plate boundary beneath this Peninsula is in the stable or conditionally stable regime except for its southernmost tip, which corresponds to the northwestern end of the rupture area at the last event (1944 Tonankai earthquake (M7.9)). The surface geology of the overriding SW Japan arc is divided to two parts by the E-W trending Median Tectonic Line (MTL), the most prominent tectonic boundary in SW Japan. South of the MTL, Cretaceous-Jurassic accretionary complexes are exposed, whose northernmost unit consists of high P-T metamorphic rocks (the Sanbagawa metamorphic belt (SMB)). The region north of the MTL is occupied by older accretionary complexes, partly suffered from the Cretaceous magmatic intrusions.

Our seismic data from five dynamite shots were acquired in 2006 along 80-km line almost perpendicular to the Nankai trough. The structure of the SW Japan arc was obtained both from intensive wide-angle reflection analysis and advanced reflection processing by seismic interferometry technique. The former analysis delineated clear structural change in the uppermost crust across the MTL. In the latter processing, we retrieved virtual shot records at 512 receiver points from free-surface backscattered waves by the deconvolution interferometry. The subsequent CRS (Common Reflection Surface)/MDRS (Multi-Dip Reflection Surfaces) methods provided an enhanced image within the island arc, including a northward dipping reflector band just south of the MTL. This reflection band, about 10-15 km thick, includes the SMB, extending from 2-10 km to 25-35 km depth. The MTL itself is recognized as the uppermost part of this band inclining northward to a depth of nearly 25 km.

In the reflection processing, the PHS plate is well imaged as northward dipping reflectors in a depth range of 20-35 km beneath the southern half of our profile. According to the wide-angle reflection analysis, a thin (less than 1 km) low velocity (3.5∼5km/s) layer is situated at the top of the PHS plate under the southernmost part of the profile, which corresponds to the trenchward half of the conditionally stable zone. In the central part of the profile (the landward half of the conditionally stable zone), strong reflectors with 2-3 km/s velocity contrast are distributed in a diffused manner at 30-35 km depths, around which low frequency earthquakes are occurring. Such reflective signature fades out further north in the region of stable regime. The obtained lateral structural change are clearly correlated with the frictional properties of the plate boundary, probably controlled by dehydrated fluids from the subducted PHS plate.