Geophysical Research Abstracts
Vol. 14, EGU2012-6863-10, 2012
EGU General Assembly 2012

Lateral Structural Variation of the Downgoing Philippine Sea Plate beneath the SW Japan Arc

T. Iwasaki (1), E. Kurashimo (1), T. Iidaka (1), R. Arai (1), A. Kato (1), H. Sato (1), T. Ito (2), A. Nakanishi (3), S. Kodaira (3), Y. Kaneda (3), and K. Ito (4)

(1) The University of Tokyo, Earthquake Research Institute, Tokyo, Japan (iwasaki@eri.u-tokyo.ac.jp, +81-3-5689-7234), (2) Teikyo Heisei University, (3) IfREE, JAMSTEC, Yokohama, Japan, (4) Hanshin Consultants Co., Ltd., Osaka Japan

A well-known seismogenic zone along the Southwest Japan arc, where M8-class megathrust earthquakes repeatedly occur, is dominated by the northwestward subduction of the Philippine Sea (PHS) plate. This megathrust zone is separated into western and eastern parts by the Izu-Bonnin arc, which has collided to the Japan arc since middle Miocene. The western part, where a typical oceanic crust is being subducted, is known as fault areas of the 1946 Nankai (M8.0) and 1944 Tonankai (M7.9) earthquakes. An area just east of the Tonankai fault is considered to be a source region of the forthcoming Tokai Earthquake. The eastern part, characterized by the subduction of the forearc side of the Izu-Benin arc, is a fault area of the 1923 Kanto Earthquake of M7.9.

In the recent 10 years, intensive active and passive source seismic experiments were undertaken in the above megathrust fault areas. The most prominent and common feature of the seismic profiles west of the Izu collision zone is very strong reflection from the subducted PHS plate. This reflection, beginning at the deepest limit of the locked part of the plate boundary, extends downward to the wedge mantle. Amplitude analysis for the strong reflection indicates a very thin (200-500 m) low velocity (3-4 km/s) layer situated at the top of the plate boundary. A seismic profile crossing the 1944 Tonankai earthquake delineated detailed structural change along the downgoing plate. Namely, near the deepest limit of the locked part, a single low velocity layer as mentioned above exists at the top of the plate. But, in the deeper part, reflectors form more complicated distribution with a several kilometer thickness. It should be noted that very low frequency (VLF) earthquakes are concentrated within or beneath this reflective zone. The remarkable spatial correspondence between the cluster of VLF events and the reflective zone strongly indicates that dehydrated fluids are ascending from the oceanic lithosphere and trapped in the vicinity of the top of the oceanic crust to form strong reflective zone. Similar structure is also seen beneath the Tokai earthquake area. Dense array observation provided more direct evidence of the dehydrated fluids within the oceanic lithosphere. In this region, subducted ridge is recognized 15-20 km northwest of the deepest limit of the locked portion, where significant dehydration occurs and high pressure fluids are trapped to form a very low Vp/Vs zone. This area well corresponds to an area of slow slip which continued from 2000 to 2005.

The subducted PHS plate east of the Izu collision zone was well imaged from several seismic reflection profiling. Asperities of the Kanto Earthquake are characterized by less reflective portions of the plate boundary. Although the deeper part of the plate is identified from dipping reflectors, their intensities are significantly weaker as compared with the former cases west of the collision zone. Seismic tomography analysis provided little evidence on the existence of dehydrated fluids within the subducted lithosphere.