Geometric configuration of the subducting Philippine Sea plate beneath Kanto and seismotectonics

Shin-ichi Noguchi[1]; Akio Yoshida[2]; Kohji Hosono[3]

[1] NIED; [2] Magnetic Observatory; [3] Earthq.Info.Predict.Div.,JMA

It has been an important subject to clarify precisely the geometric configuration of the subducting Philippine Sea plate beneath the Kanto District, in terms of various fields. Based on the data observed by a high-quality seismic network, several plate geometry models have been proposed and reconstructed in 1980s and early 1990s (Okada,1990; Ishida,1992). It is a difficult task to determine a unique configuration geometry of the subducting Philippine Sea slab, not only because of the complicated seismicity but also because of some equally possible interpretations. This implies that the hot and young Philippine Sea slab has a heterogeneous and easily deformable structure with less flexural rigidity compared with the old and cold Pacific slab. From about mid 1990s, with increases of both the quality and quantity of observation data and with developments of analysis methods, various information and views have been obtained about the hypocenter distributions, stress fields and physical states in and around the subducting slabs. Some examples are as follows: (1) the three-layer structure of hypocenters and corresponding stress fields composed partly in the subducting Philippine Sea slab(Hori, 1997). (2) the estimate of the extending interface between the Philippine Sea and Pacific slabs and the deformation of the Pacific slab near the interface (Noguchi, 2002). (3) the various and interesting structures of both elastic velocity and Pisson's ratio distributions beneath central and eastern Kanto in and around the subducting slab revealed by seismic tomography (e.g., Ohmi & Hurukawa, 1996; Kamiya & Kobayashi, 2000; Sekiguchi, 2001; Noguchi & Sekiguchi, 2001). (4) the peculiar structure of hypocenter distributions in and above the subducting slab beneath central Kanto observed by the recent unified data by JMA (Hosono & Yoshida, 2001). Associated with observations, the hypothesis of dehydration embrittlement has been proposed as the most viable mechanism to explain the intraslab seismic activity (Seno et al., 2001). The mechanism has applied to the double seismic zone in the mantle part of the Philippine Sea slab as the dehydration of the serpentinized mantle wedge of the Izu-Ogasawara fore-arc which is subducting beneath Kanto. Furthermore the existence of a chain of serpentine seamounts exposed at the fore-arc parallel to and west of the Izu-Ogasawara Trench axis (kamimura et al., 2003) can be closely associated with earthquake clusters distributed discontinuously along the upper part of the most northeastern Philippine Sea slab subducting beneath eastern Kato.

In this study, based on these observations and information, we examine a wealth of hypocenters and focal mechanism solutions to construct a reasonable geometric configuration of the subducting Philippine Sea slab, by classifying earthquakes of the three plates converging in the Kanto area into intraplate and interplate events. Because of the complex distributions of hypocenters and focal mechanism solutions, in particular, in and around the subducting Philippine Sea slab, we first separate earthquake in the deeper part of the Pacific and Philippine Sea slabs, where hypocenters and focal mechanism solutions distribute almost continuously. Then we separate the earthquakes in the upper crust of the continental plate. Finally we focus on the complex earthquakes in the lower crust of the continental plate and along the Philippine Sea slab beneath southern and central Kanto to see closely the subducting plate boundaries. Associated with this we examine the seismicity in and around the presently locked interface of the 1923 type and the 1703 type Kanto earthquake fault zones.