Thrust-type seismic zone in the subducting Philippine Sea plate beneath the southern Kanto district and the plate movement

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1. Introduction

In the NE-SW cross-section of seismicity along southern Boso peninsula, we can observe a noticeable seismic zone plunging steeply into the Philippine Sea slab (PH) from around the Sagami trough to the depth about 70 km. The maximum distance between the gently dipping upper surface of PH and the steeply subducting intraslab seismic zone exceeds more than 60 km. This extraordinarily slab thickening beneath southern Kanto has been examined from various viewpoints. In this study we find that the deeper intraslab seismic zone is characterized by the predominance of thrust-type events. As the most important factor associated with the thrust-type seismic zone, we point out the location of western deeper edge of the boundary between the Philippine Sea slab and Pacific slab (PA) which runs northwestward beneath Kanto.

2. Characteristics of the thrust type seismic zone in the Philippine Sea slab

The thrust-type seismic zone is characterized spatially as striking NNW-SSE along the Boso and Miura peninsulas and dipping steeply toward NE to ENE at a depth of approximately 30-70 km. The seismic zone locates in high-velocity structure in the slab deduced by the seismic tomography. Many fault plane solutions show reverse-type faulting and the gently northwestward-dipping nodal plane corresponds to the thrust-type with slip vector of PH movement. Seismic zones associated with PH are classified into three groups based on focal mechanisms [Hori,1997,2006]; i.e. 1) thrust-type at the upper boundary of PH, 2) down-dip compression (DC) type, and 3) down-dip extension (DE) type. The seismic zone described above does not correspond to any of these three groups.

3. Spatial relationship of the thrust-type seismic zone with the western deeper edge of the plate boundary between PH and PA

The western deeper edge of the boundary between PH and PA, i.e. the intersection of the lower base of PH and upper surface of PA (abbreviated as SB), runs and deepens northwestward along the upper surface of PA, which means SB crosses obliquely the iso-depth lines of PA. The southeastward extension of SB across Sagami trough runs toward the lower edge of the thrust boundary between the overriding PH and the subducting PA [Noguchi,2007]. The thrust-type seismic zone locates nearly above this western deeper edge SB beneath the Boso and Miura peninsulas.

4. Implications of intraslab thrust-type seismic zone beneath southern Kanto

Bounded by the western edge SB, the eastern part of PH slides over PA and unbends, which cause DE events in the lower PH mantle [Hori,1997]. Also the loading of PH distorts the underlying PA and causes concave up geometry of eastern PA. On the contrary, the western part of PH departs from the underlying PA and descends northwest downward by its gravitational force. But the buoyant Izu block in the western shallow part of PH prevents smooth subduction, which may produce intraplate fracture around northern Izu peninsula [Ishibashi,1988; Yoshida,1990]. Consequently we consider the middle part of PH around SB subducts most effectively due to the thrust-type events in the seismic zone with slip vector directing toward PH movement. This process may responsible for the slab thickening beneath southern Kanto. The intraplate fracture model around Izu could be combined with the thrust-type seismic zone beneath SB, which may cause new subduction within PH across western Sagami trough. The double subduction tectonics of PH slab is presented in another talk of this session [Yoshida et al.,2007].

5. Summary

The thrust-type seismic zone found in the subducting Philippine Sea plate in southern Kanto, which distribute above the western deeper edge of the boundary between PH and PA, is responsible for PH slab thickening. Further precise observation and investigation are necessary to clarify spatial distribution of seismicity, focal mechanisms, plate structure and temporal seismic activity.