Morphology of the Philippine sea plate slab(s) just beneath the metropolitan area, Japan

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We present a new view of the morphology of slab(s) subducted just beneath the Metropolitan area of Japan. Previously, several different models of the surface geometry of the subducted Philippine sea plate slab (PH slab) have been published using mainly seismicity data (e.g., Nakamura and Shimazaki, 1981; Maki, 1984; Kasahara, 1985; Ishida, 1992; Noguchi, 1999). Recently, the actual depth of PH slab near Tokyo bay was constrained with a sophisticated artificial seismic profiling survey by Sato et al. (2005). As is important, the profiled depth of PH slab by Sato et al. (2005) beneath Tokyo bay is generally shallower than that in the previous models.

Our standpoint is, first, to discriminate unknown seismic slab (called slab SG, or seismic slab SG) above the downgoing Pacific plate slab (PC slab) and, second, to identify the morphology and detailed characteristics of slab SG. It is clear that the currently known surface contours of PH slab indicate the shallower-most part of slab SG as well.

We suggest three detailed morphology models of slab SG as follows. (Model 1) Slab SG consists of both PH slab at shallower depth and deeper underlain slab (slab SL). (Model 2) Bookshelf-like configuration of inclined multi-slabs on PC slab due to episodic accumulation of short-length slab(s) at a limited confined space between the base of the overriding plate and PC slab surface with repeated intermittent subduction initiations just south of the previously active paleo-Sagami trough(s). We emphasize that the above evolutional bookshelf model is, to some extent, similar to sediment layer accretion process near the deep trench system, but dynamic situation is not the same. (Model 3) The combined one of models 1 and 2.

Most of the previous studies assumed PH slab with constant thickness and paid little attention to the tectonic characteristics of the vertical extent and/or the bottom geometry of slab SG with variable thickness. However, we should take into account the tectonic implications such as the internal structure and evolution history as partly documented in the explanation of model 1, 2, and 3 above. The bottom extent of seismic slab SG beneath the Metropolitan area reaches 36.5N at least. The horizontal extent of seismic slab SG covers most of the Kanto Plain lowland. The bottom depth of slab SG is approximately 120km near 36.5N and 139.0E, being the same as of the surface depth of PC slab there. Below the Sagami trough axis near 34.5N and 140.0E, slab SG is located at 80 to 90km depth. The western bottom end zone of slab SG generally strikes the NNW-SSE direction, being approximately parallel to the volcanic front. The geometry of our model of Slab SG is different from that proposed by Ishikawa (2003, 2004).

To make clear the structure of SG slab in more detail, we should incorporate the effect of 3D mantle wedge circulation due to the subduction of both PC and PH slabs from different directions, as well as the space-time evolution history of accretion tectonics at the northern end zone of the Philippine sea plate, etc.