

Anomalous seismic activity beneath Kanto caused by the subduction of a cold fore-arc portion of the PHS slab

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Recent investigations based on seismic tomography, hypocenter determinations and focal mechanism analyses using nation-wide dense seismic network data have revealed precise configurations of the Pacific (PAC) and Philippine Sea (PHS) plates subducting beneath the Japanese Islands (Hirose et al., 2008; Nakajima et al., 2009; Kita et al., 2010). Estimated geometry shows a broad contact zone between the two plates located directly beneath the Kanto plain. It further shows anomalously deep intraslab activity within the PHS slab: earthquakes occur even near the bottom of the slab mantle about 60 km away from the upper surface of the slab. How far the slab mantle earthquake activity is formed from the slab upper surface depends on the age of the subducting plate (Yamasaki and Seno, 2003; Brudzinski et al., 2007). The distance from the upper surface to the lower plane of the double seismic zone in the PAC slab beneath NE Japan, where one of the oldest plates is subducting, is 40-50 km, and so the distance from the slab surface to the deepest slab mantle seismicity in the PHS slab beneath Kanto seems to be anomalously deep. The deepest interplate earthquake at the upper surface of the PHS slab reaches a depth near 60km, which is also anomalously deep compared with the case of NE Japan where the deepest depth is about 55 km. The forearc portion of the PHS plate, before its subduction beneath Kanto, had been cooled by the subduction of the PAC plate from the Izu-Bonin trench. We infer the lower temperatures by this cooling cause the anomalously deep seismic activity within the PHS slab and along its boundaries. Seismic tomography studies suggest that the bottom of the mantle of the PHS slab is serpentized, which probably causes a weak interplate coupling with the underlying PAC plate (Uchida et al., 2009). Seismic activity and seismic velocity structure thus obtained are considered to provide important information to constrain the temperature distribution of the subducting plates.

Keywords: Earthquake, Philippine Sea slab, Kanto, Fore-arc slab