東アジア下の太平洋スラブとフィリピン海スラブの深部構造

Imaging the subducting Pacific and Philippine Sea slabs under East Asia

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New findings on the deep structure and morphology of the subducting Pacific and Philippine Sea slabs under East Asia are obtained recently by using high-resolution regional tomography. The 3-D P-wave velocity structure down to 700 km depth under the Japan Islands is determined by simultaneously inverting a large number of arrival time data from local and teleseismic events. We used 207,000 arrival times from 7743 shallow and deep earthquakes under the Japan Islands, and 34,148 arrivals from 333 teleseismic events which were collected by using a multi-channel cross correlation technique. Our tomographic images clearly show the subducting Pacific and Philippine Sea slabs under Japan. Three new features are revealed. (1) The Philippine Sea slab is subducting aseismically down to 500 km depth under Kyushu. (2) Significant low-velocity anomalies exist at depths of 300-500 km in the mantle wedge above the Pacific slab, which may reflect the deep dehydration process of the Pacific slab. (3) Low-velocity anomalies are visible in the mantle below the Pacific slab, which may be caused by hot mantle upwelling. We also used regional and global tomography to study high-resolution P-wave velocity structure of the mantle beneath the entire East Asia. The results show that the Pacific slab is stagnant in the mantle transition zone under East China, which may have contributed to the lithospheric thinning and the formation of intraplate volcanoes (e.g., Changbai, Wudalianchi) in East China. The Philippine Sea slab is also found to subduct down to the mantle transition zone and merge with the Pacific slab there. Our tomographic images show that the active Tengchong volcano in Southwest China is not a plume-related hotspot but is caused by the subduction of the Burma microplate under the Eurasian plate. These results suggest that the subduction of lithospheric plates has profound effects on the seismic and volcanic activities and mantle dynamics in not only the plate boundary regions but also the intraplate regions far from the plate boundaries.