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New mantle tomography of East Asia: Insight into slab subduction and intraplate volcanism

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Recently we determined a new, high-resolution, P-wave tomography of the crust and mantle down to 1000 km depth under East Asia by inverting 1,401,797 P-wave arrival times from 17,180 local and regional earthquakes recorded by 2247 seismic stations of local and regional seismic networks in East Asia and temporary seismic stations deployed in the Tibetan plateau (Wei et al., 2012). Our new tomography model has improved the previous tomography model of Huang and Zhao (2006) who used 1012 seismic stations in East Asia, whereas the overall pattern of the new model is nearly the same as those of our previous results (Zhao et al., 2004, 2009; Lei and Zhao, 2005; Huang and Zhao, 2006). Our new tomography shows that the subducted Pacific slab is revealed clearly as a high-velocity (high-V) zone and it becomes stagnant in the mantle transition zone (MTZ) beneath Korean Peninsula and eastern China. The Indian lithosphere is characterized by a high-V anomaly and it is subducting nearly horizontally beneath the entire or most parts of western Tibet and with a small dipping angle to the southernmost part of eastern Tibet. The intraplate magmatism in different parts of East Asia has different origins. The active Tengchong volcano in Southwest China is underlain by a prominent low-velocity (low-V) anomaly in the upper mantle and a dipping high-V zone down to MTZ, which may be caused by the deep subduction and dehydration of the Burma microplate plate (or Indian plate). The Hainan volcano is underlain by a plume-like low-V anomaly that extends down to at least 1000 km depth, whereas the plume seems to be caused by the deep subductions of the Burma microplate (or Indian plate) in the west and the Philippine Sea plate in the east. Beneath the active intraplate volcanoes in and around Korean Peninsula and East China (e.g., Changbai, Ulleung, and Jeju), prominent low-V anomalies are revealed in the upper mantle down to 410 km depth, while a significant high-V zone is imaged clearly in MTZ, indicating that these intraplate volcanoes are caused by the hot and wet upwelling flow(s) in the big mantle wedge (BMW) above the stagnant Pacific slab in MTZ. The origin of the Wudalianchi volcanism in NE China seems to be also affected by lithospheric delamination in addition to the BMW processes.

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