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East Asia: Seismotectonics, Volcanism and Mantle Dynamics

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We introduce the significant recent results of geophysical studies and discuss their implications on seismotectonics, magmatism, and mantle dynamics in East Asia. High-resolution geophysical imaging revealed structural heterogeneities in the source areas of large crustal earthquakes, which may reflect magma and fluids that affected the rupture nucleation of large earthquakes. In subduction zone regions, the crustal fluids originate from the dehydration of the subducting slab. Magmatism in arc and back-arc areas is caused by the corner flow in the mantle wedge and dehydration of the subducting slab. The intraplate magmatism has different origins. The continental volcanoes in Northeast Asia (such as Changbai and Wudalianchi) seem to be caused by the corner flow in the big mantle wedge (BMW) above the stagnant slab in the mantle transition zone and the deep dehydration of the stagnant slab as well. The Tengchong volcano in Southwest China is possibly caused by a similar process in BMW above the subducting Burma microplate (or Indian plate). The Hainan volcano in southernmost China seems to be a hotspot fed by a lower-mantle plume associated with the Pacific and Philippine Sea slabs' deep subduction in the east and the Indian slab's deep subduction in the west down to the lower mantle. The occurrence of deep earthquakes under the Japan Sea and the East Asia margin may be related to a metastable olivine wedge in the subducting Pacific slab. The stagnant slab finally collapses down to the bottom of the mantle, which may trigger upwelling of hot mantle materials from the lower mantle to the shallow mantle beneath the subducting slabs and cause the slab-plume interactions. Some of these issues, such as the origin of intraplate magmatism, are still controversial, and so further detailed studies are needed from now.

Keywords: East Asia, seismotectonics, intraplate volcanism, mantle dynamics, subducting slab