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Seismic evidence for deep slab dehydration and big mantle wedge in East Asia

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We present new pieces of seismic evidence for the existence of low-velocity zones in the deep part of the upper mantle wedge and the mantle transition zone that are caused by fluids from the deep subduction and deep dehydration of the Pacific and Philippine Sea slabs under western Pacific and East Asia. The Pacific slab is subducting beneath the Japan Islands and Japan Sea with intermediate-depth and deep earthquakes down to 600 km depth under the East Asia margin, and the slab becomes stagnant in the mantle transition zone under East China. The western edge of the stagnant Pacific slab is roughly coincident with the NE-SW DaxingAnling-Taihangshan gravity lineament located west of Beijing, approximately 2000 km away from the Japan Trench. The upper mantle above the stagnant slab under East Asia forms a big mantle wedge (BMW). Corner flow in the BMW and deep slab dehydration may have caused asthenospheric upwelling, lithospheric thinning, continental rift systems, and intraplate volcanism in Northeast Asia. The Philippine Sea slab has subducted down to the mantle transition zone depth under Western Japan and Ryukyu back-arc, though the seismicity within the slab occurs only down to 200-300 km depths. Combining with the corner flow in the mantle wedge, deep dehydration of the subducting Pacific slab has affected the morphology of the subducting Philippine Sea slab and its seismicity under Southwest Japan. Slow anomalies are also found in the mantle under the subducting Pacific slab, which may represent small mantle plumes, or hot upwelling associated with the deep slab subduction. Slab dehydration may also take place after a continental plate subducts into the mantle.

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