Seismic tomography of the crust and mantle under East Asia

Dapeng Zhao[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.

http://www.jpgu.org/meeting/

We determined high-resolution 3-D P-wave velocity structure of the crust and mantle under the Western Pacific to East Asia using multi-scale seismic tomography methods (Zhao, 2004, 2007; Huang and Zhao, 2006; Zhao et al., 2009). A large number of arrival times of P, pP, PP and PcP waves recorded by many seismic stations in East Asia are used in the tomographic inversions. The subducting Pacific slab is imaged clearly as a high-velocity zone from the oceanic trenches down to 670-km depth, and intermediate-depth and deep earthquakes are located within the slab. The Pacific slab becomes stagnant in the mantle transition zone under eastern China. The western edge of the stagnant slab is generally parallel with the Japan Trench and the Ryukyu Trench and roughly coincides with a prominent surface topographic boundary in East China (the so-called Daxinganling-Taihangshan Gravity Lineament). Although there are some discrepancies between the topographic boundary and the western edge of the stagnant slab, both of them are located approximately 1800 km west of the trenches. The entire Pacific slab is stagnant in the mantle transition zone under Northeast China (53-37 degree North latitude). Under 37-28 degree North latitude, however, some of the slab materials are visible below the 670-km discontinuity, though most of the slab materials are still in the transition zone, suggesting that part of the slab materials have started to drop down to the lower mantle. Under the Mariana arc, the Pacific slab penetrates directly down to the lower mantle. It is also visible that the Philippine Sea slab has subducted down to the mantle transition zone depth under western Japan and the Ryukyu back-arc region (Abdelwahed and Zhao, 2007). There are three active intraplate volcanoes in China. The Changbai and Wudalianchi volcanoes in Northeast China are underlain by significant slow anomalies in the upper mantle, above the stagnant Pacific slab, suggesting that the two active volcanoes are not hot spots but a kind of back-arc volcanoes associated with the deep subduction of the Pacific slab and its stagnancy in the transition zone as well as corner flow in the big mantle wedge (BMW) above the stagnant slab. The active Tengchong volcano in Southwest China is related to the eastward subduction of the Burma microplate.

References

D. Zhao (2004) Phys. Earth Planet. Inter. 146, 3-34.

D. Zhao (2007) Gondwana Research 12, 335-355.

D. Zhao et al. (2009) Phys. Earth Planet. Inter. (in press).

J. Huang, D. Zhao (2006) J. Geophys. Res. 111, B09305.

M. Abdelwahed, D. Zhao (2007) Phys. Earth Planet. Inter. 162, 32-52.