Recent tomographic studies show that the subducting Pacific slab is stagnant in the mantle transition zone under East Asia and a hot and wet big mantle wedge (BMW) forms above the stagnant slab, and the active Changbai intraplate volcano is caused by an upwelling flow in the BMW associated with deep slab dehydration and mantle-wedge corner flow (Zhao et al., 2004; Zhao, 2004, 2007; Lei and Zhao, 2005; Huang and Zhao, 2006). In this work, we have used global tomography to investigate if active volcanoes like Changbai exist in other regions on Earth. We improved our global tomography model (Zhao, 2004) by applying a flexible-grid approach to over 1,600,000 arrival times of P, pP, PP, PcP and Pdiff waves collected by the International Seismological Center (ISC). Our new global tomography is much improved over the previous model (Zhao, 2004) in the polar regions and has a spatial resolution of 200 to 500 km in the mantle. Using this new global tomography model, we examined the 3-D whole-mantle structure under all the intraplate volcanoes on Earth compiled by the Smithsonian’s Global Volcanism Program. We found that many Changbai-type active volcanoes exist in the back-arc regions in the North American plate and the Eurasian plate where the subducting Pacific plate is stagnating in the mantle transition zone. Such volcanoes are, e.g., (1) Imuruk, Michael, Ingakslugwat, Kookooligid, Nunivak, and St. Paul volcanoes in the Alaska and Aleutian regions, (2) Udokan, Sikhote-Alin, Vitim, Wudalianchi, Jingbo, and Dariganga volcanoes in NE Asia, and (3) Chuga-ryong, Ulreung and other volcanoes in and around Korea Peninsula. Studying the deep structure and origin of these volcanoes may greatly improve our understanding of the active volcanism and mantle dynamics of the Earth.

References