Seismic structure of the Changbai intraplate volcano from joint inversion of ambient noise and receiver functions

Hongxiang Zhu[1], You Tian[1], Dapeng Zhao[2], Honghao Li[1], Cai Liu[1]

[1]College of Geoexploration Science and Technology, Jilin University, Changchun 130026, China, zhuhx14@mails.jiu.edu.cn
[2]Department of Geophysics, Tohoku University, Sendai 980-8578, Japan

The Changbai volcano is located at the border between China and North Korea and is the largest intraplate volcano in NE Asia (Liu, 1999; Liu, 2000). We studied the detailed crustal and upper mantle structure beneath the active Changbai intraplate volcano in northeastern China by conducting a trans-dimensional Bayesian inversion of teleseismic receiver functions and Rayleigh-wave group velocity dispersion from ambient noise. We used a total of 79 broadband seismic stations, including 27 Jilin University (JLU) stations, 40 CEA permanent stations and 12 NECESSArray portable stations. More than 12,000 teleseismic receiver functions recorded at 79 seismic stations and 1645 noise correlation functions were used in this study. Receiver-function H-κ stacking measurements reveal a thick crust (~40 km) with a high Vp/Vs ratio (>1.8) beneath the Changbai volcano. A 3-D Vs model was constructed by interpolating the 1-D profiles obtained by a joint inversion of receiver functions and ambient-noise Rayleigh-wave group velocity dispersions. Our joint inversion results show a heterogeneous crustal structure in the study region. A low-velocity body at a depths of 8-15 km is revealed directly beneath the Changbai volcano, which has a lateral extension of over 100 km in a south-north direction and may reflect a large magma chamber in the mid-crust. Our results also reveal a 5~10 km depressed Moho and a low-velocity anomaly in the uppermost mantle beneath the Changbai volcano. These features may indicate an upwelling channel of asthenospheric material with a high mafic composition, and the mafic intrusion is attached to the bottom of the crust and so deepens the Moho beneath the volcano. Our present results support the notion that Changbai volcanism is caused by hot and wet mantle upwelling associated with subduction-driven corner flow in the big mantle wedge above the stagnant Pacific slab in the mantle transition zone (Zhao et al., 2004, 2009; Zhao and Tian, 2013).

Reference

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