

Does a shallow magma reservoir exist in the Wudalianchi Volcanic Field?

Constraints from Magnetotelluric Imaging

Sun, X.¹, Zhan, Y.¹, Zhao, L.², Xu, J.³, Zhao, Y.³, Zhao, B.⁴, Yang, W.⁴

¹State Key Laboratory of Earthquake Dynamics, Institute of Geology, China Earthquake Administration, Beijing 100029, China

²Second Monitoring and Application Center, China Earthquake Administration, Xi'an 710054, China

³National Observation and Research Station of Jilin Changbaishan Volcano, Institute of Geology, China Earthquake Administration, Beijing, 100029, China

⁴Heilongjiang Seismological Bureau, Ha'erbin 150000, China

Using a new wide-band magnetotelluric survey consisting of 140 sites, we obtain new images of the 3D resistivity structure of the Wudalianchi volcanic field (WVF). We document a low-resistivity structure beneath Weishan volcano, which is consistent with previous studies. However, no low-resistivity structure is found beneath Laoheishan and Huoshaoshan volcanoes, which challenges the hypothesis of one or more magma reservoirs in the upper crust of the WVF. Due to the relatively low geothermal gradient and surface heat flow in the area, the high-temperature magma in the magma reservoir would cool rapidly and could not be sustained for a long time unless new high-temperature magma was regularly introduced into the system. However, estimated magma emplacement rates conflict with the observed volume of the low-resistivity body beneath Weishan volcano. We suggest that the magma in the WVF mainly originates from the mantle or the bottom of the crust with little crustal residence, and that the low-resistivity body in the upper crust is likely due to saline aqueous free fluids that are expected to be common in magmatic systems.