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Lithosphere deformation of Nuomin River volcano in northeast China: Evidence from shear wave splitting

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Intraplate volcanos are different from interplate volcanos. Their origins have no direct causal connection with plate boundary condition or plate movement velocity, which have always been controversial. Northeast China widely develops Cenozoic intraplate volcanoes, such as Changbaishan volcano, Wudalianchi volcano, Aershan volcano, and Nuomin River volcano, making it a great place to study the mechanism of Intraplate volcanos. Among those volcanos, the Nuomin River volcano's causative mechanism is poorly understood due to the lack of detailed constraints on the upper mantle structure beneath this region. Previous studies show that there are obvious low-velocity anomalies in the upper mantle of Changbai Mountain and Aershan volcano and extend all the way to the top of mantle transition zone, while the low-velocity anomalies of the Nomin River volcano and the Wudalianchi volcano are much shallow. Similar to the adjacent Wudalianchi volcano, the Nomin River volcanic rock is potassic, however, it is quite different from the Aershan volcano which is sodic. The differences in the chemical composition and physical properties of these volcanoes suggest that they may underwent different asthenosphere and lithosphere deformation. Therefore, the deep structure study of the Nomin River volcano will provide necessary evidence for understanding the volcanic activity of the Cenozoic in the Northeast China.

Seismic anisotropy determined by the splitting of shear waves is one of the most effective conventional methods for studying mantle flow and lithospheric deformation. A total of 82 pairs of shear wave splitting measurements and 219 null measurements are obtained at 40 temporary seismic stations. Delay times vary from 0.4 s to 1.4 s with an average value of 0.78±0.21 s; while fast directions trending N77°W to N18°E with a mean value of N6.9°W±9.87° at most of stations. Fossil anisotropy within lithosphere is believed to be the main origin of anisotropy since the fast directions are in line with extensional orientation of the Late Mesozoic lithosphere in this area. Meanwhile, solely null measurements are measured at 19 stations, indicating lithospheric thermal erosion by hot mantle upwelling.