

A new 1.32 Ga Tianshui mafic sill of the Yanliao large igneous province in the northern North China Craton

XINPING WANG¹, PENG PENG² AND CHONG WANG²

¹Shanxi Normal University

²Institute of Geology and Geophysics, Chinese Academy of Sciences

A new 1.32 Ga Tianshui mafic sill was identified in the Liaodong area, which enlarges the scale of the Yanliao large igneous province (LIP, extending >600 km) in the North China Craton (Fig. 1). It intrudes concordantly into limestone layers and is overlain by Neoproterozoic strata. SIMS baddeleyite Pb-Pb dating on two coarse-grained gabbros yields weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ages of 1324 ± 2 Ma ($n = 20$, MSDW = 1.5) and 1326 ± 5 Ma ($n = 9$, MSDW = 1.3) (Fig. 2), similar to those of mafic sills in the Yanliao LIP. The Tianshui mafic sill shows a similar E-MORB geochemical character as the mafic sills in the Yanliao LIP, including tholeiitic composition, enriched light rare earth elements ($\text{La}/\text{Yb}_N = 2.45\text{--}3.77$), and large ion lithophile elements (e.g., Rb, Th, U, and K), but depleted high field strength elements (e.g., Nb, Ta, Zr, P, and Ti), positive baddeleyite $\varepsilon_{\text{Hf}}^t$ values of 3.59–10.96, with a peak of 6.07, and negative whole-rock $\varepsilon_{\text{Nd}}^t$ values of -1.8 to -0.6 , with an average of -1.3 , indicative of an enriched mantle source. The 1.32 Ga Yanliao mafic sills underwent extensive crystallization differentiation controlled by olivine, clinopyroxene, and plagioclase. They were generated at a high primary temperature of ~ 1550 °C and crystallized at ~ 1140 °C at 0.24 kbar, which could be related to the mantle plume magmatism.

References

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