

Petrogenesis of the early Cretaceous intermediate and felsic intrusions at the southern margin of the North China Craton: Implications for crust-mantle interaction

XIN-YU GAO¹ AND TAI-PING ZHAO^{2*}

¹²Key Laboratory of Mineralogy and Metallogeny, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China

¹xygao@gig.ac.cn

²tpzhao@gig.ac.cn

New major and trace element, whole rock Sr and Nd isotopes and zircon U–Pb ages and Hf isotope data are presented for rocks from the early Cretaceous Tianqiaogou dioritic and Taishanmiao granitic plutons at the southern margin of the North China Craton (NCC), in order to investigate their petrogenesis and geological evolution. LA-ICP-MS U–Pb analyses for zircons from these two plutons yield similar $^{206}\text{Pb}/^{238}\text{U}$ ages of 122 Ma and 115–125 Ma, respectively. Monzodiorites from the Tianqiaogou pluton have whole rock $\varepsilon_{\text{Nd}}(t)$ values ranging from –6.2 to –1.3 and zircon $\varepsilon_{\text{Hf}}(t)$ values from +2.9 to +6.2. They are variably enriched in Ra, Ba, and Sr, and depleted in Nb, Ta, Zr, Hf and Ti, indicating that they were derived from a depleted mantle and underwent subsequent magma differentiation and crustal contamination. The Taishanmiao pluton is composed of metaluminous to peraluminous highly fractionated I-type granites that have high SiO_2 , Na_2O , K_2O , Rb, Th, and U, and low P, Ba, Sr, Ti and Eu contents. The granites have strong negative whole rock $\varepsilon_{\text{Nd}}(t)$ values (–16.1 to –7.5) and zircon $\varepsilon_{\text{Hf}}(t)$ values (–20.9 to –6.1). Their Nd T_{DM} ages (1.19 to 2.01 Ga) and zircon Hf T_{DM}^{C} ages (1565 to 2490 Ma) are much younger than the basement rocks beneath the southern margin of the NCC, suggesting derivation from an ancient crustal source with minor involvement of mantle-derived components. Therefore, rocks from the Tianqiaogou dioritic pluton were partial melts of the mantle source. Underplating of the mafic magmas initiated partial melting of the ancient continental crust, resulting in the formation of the Taishanmiao granitic pluton. Their complex petrogenesis reflects a strong crust–mantle interaction process related to lithospheric thinning beneath the southern margin of the NCC in early Cretaceous.