

Zircon Hf–O isotopic evidence for crust–mantle interaction in the 1.87–1.86 Ga Sancheong-Hadong-Gaya AMCG suite, Yeongnam Massif, Korea

YUYOUNG LEE¹, MOONSUP CHO², JEONGMIN KIM¹
AND YOUN-JOONG JEONG¹

¹Korea Basic Science Institute

²Seoul National University

The geochemical and isotopic characteristics of Proterozoic anorthosite–mangerite–charnockite–granite (AMCG) suites provide important constraints on crust–mantle interaction and magmatic evolution. We present *in situ* Hf–O isotopic analyses of zircon from the 1.87–1.86 Ga Sancheong–Hadong–Gaya AMCG complex in the Yeongnam Massif, Korea, to determine the sources and evolution of parental magmas associated with Paleoproterozoic AMCG magmatism along the eastern margin of the North China Craton. In addition to our previous studies of the Sancheong–Hadong area, we report new geochronological and Hf–O isotopic data from the Gaya anorthosite body. Zircon grains from the Gaya anorthosite show distinct magmatic cores and thin dark-CL overgrowth rims, with Th/U ratios ranging from 0.21 to 0.72. The rims contain higher U contents (727–1246 ppm) than the cores (127–389 ppm). SHRIMP U–Pb dating of zircon cores and rims yielded weighted mean ²⁰⁷Pb/²⁰⁶Pb ages of 1862 ± 14 Ma ($n = 11$) and 1848 ± 18 Ma ($n = 6$), respectively. The former age is consistent with our previous result for the crystallization of the Sancheong-Hadong anorthosites (1862 ± 2 Ma), suggesting a regionally synchronous emplacement; on the other hand, the latter is attributed to the subsequent crystallization of residual melt. Zircons from the anorthositic rocks yielded initial $\epsilon_{\text{Hf}}(t)$ values ranging from +2.0 to –6.2 and $\delta^{18}\text{O}$ values of 5.26–6.85 ‰, whereas those from felsic gneisses have $\epsilon_{\text{Hf}}(t)$ and $\delta^{18}\text{O}$ values of –2.0 to –5.4 and 8.21–9.01 ‰, respectively. These isotopic data suggest that anorthositic parental magmas were primarily mantle-derived but underwent approximately 10–30% crustal contamination. Such a crustal signature is also recorded in the charnockitic-granitic magma, which has probably formed by melting of the lower crust. Our combined $\epsilon_{\text{Hf}}(t)$ – $\delta^{18}\text{O}$ data support a hybrid-source model for the AMCG petrogenesis, typified by a predominance of mantle-derived components in the anorthositic rocks and a reworking of older crustal sources in the granitoids. The AMCG magmatism at 1.87–1.86 Ga in the Yeongnam Massif represents a late-orogenic product of Paleoproterozoic amalgamation associated with the assembly of the Columbia supercontinent.