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Concurrent Apatite U-Pb Geochronology and Trace Element Constraints on Neoarchean–Paleoproterozoic Cratonization in the North China Craton

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Apatite, an accessory mineral in igneous, metamorphic and clastic sediments, is widely used in geochemical analysis and U-Pb chronology research due to its stable chemical properties and high distribution coefficient of rare earth elements (REEs). This study employs laser ablation quadrupole inductively coupled plasma mass spectrometry (LA-Q-ICP-MS) to conduct concurrent U-Pb geochronological and trace element analyses on apatite from the granite in Jidong Block, North China Craton. 15 groups of apatite with crystallization ages of 1.7 to 2.6Ga were selected to elucidate the petrogenetic characteristics and tectonic significance of Neoarchean–Paleoproterozoic magmatism in North China Craton.

Geochemical indicators reveal that Neoarchean apatite crystals (2.5–2.6 Ga) exhibit signatures consistent with a less differentiated magmatic source, enhanced crustal contributions, and more reduced magmatic conditions compared to their younger counterparts. These findings provide critical evidence for mantle plume-driven thermo-tectonic activity during the 2.55-2.50 Ga cratonization episode, significantly advancing our understanding of lithospheric evolution mechanisms at the Neoarchean-Paleoproterozoic transition in the North China Craton.