Origin of the Mesozoic magmatism in the north China craton: constraints from petrological and geochemical data

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Abstract

Voluminous plutonic and volcanic rocks were emplaced in the eastern part of North China craton (NCC) in the Mesozoic. The Mesozoic igneous rocks cover a variety of rock types ranging from monzogabbroic, through monzonitic to monzogranitic, and locally to syenitic. Monzonitic rocks are dominant, in which mafic enclaves (dioritic in composition) are frequently seen. Principal geochemical signatures of these Mesozoic rocks include high-K calc-alkaline to shoshonitic affinity, high Sr-Ba abundances and high Sr/Y, La/Yb, and highly enriched Sr-Nd isotopic compositions with $\varepsilon_{Nd}(t)$ ranging from -8 to -20 and I_{Sr} from 0.7053 to 0.710. Zircon SHRIMP dating reveals these Mesozoic rocks formed between 180 Ma and 120 Ma, but dominantly confined to a narrow range 135-127 Ma. The sudden surge of Mesozoic magmatism was genetically linked to the upwelling of asthenosphere in a back-arc extensional regime that was caused by subduction of the paleo-Pacific plate beneath eastern NCC. Upwelling of hot asthenospheric mantle material triggered partial melting of enriched subcontinental lithospheric mantle, generating voluminous mafic magmas. The mafic magmas underplated in the lower crust and sparked melting of the latter, producing granitic melts. We suggest that the Mesozoic rocks in the NCC probably originated from mixing between the coeval mafic and granitic melts, followed by fractionation of ferromagnesian phases and subordinate plagioclase, rather than from melting of mafic lower crust as previously suggested by many others.