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TTG and potassic granitoids in the eastern North China Craton: Making a Neoarchean upper continental crust during micro-continental collision and post-collisional extension

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When and how the continental crust began to form on the Earth is key to understanding the formation and growth of the continental crust [1]. As the major component, Archean granitoids provide us with an insight into the forming process of the early continental crust [2].

In this contribution, we report the study of a series of Neoarchean granitoids, including TTG (tonalite, trondhjemite and granodiorite) and potassic granitoids, in the Xingcheng region of the eastern North China Craton. Zircon U-Pb dating shows that the TTG granitoids were emplaced in the Neoarchean, with the coeval mafic magmatic enclaves, followed by intrusion of potassic granitoids, in a 75 Myr period (2595-2520 Ma). The geochemistry of the TTG granitoids is consistent with the rock derivation from partial melting of K-rich mafic crust at different depth levels (up to 10-12 kbar) during a continental collision event. Some potassic granitoids are consistent with derivation from low-degree melting of mafic crust [3], while other peraluminous potassic granitoids are best interpreted as resulting from partial melting of prior potassic TTG granitoids in response to post-collisional extension [4].

The TTG and potassic granitoids in the Xingcheng region record the evolution from collision of micro-continental blocks to post-collisional extension, suggesting that the amalgamation of micro-continental blocks gave rise to the cratonization of the North China Craton at the end of the Archean. The rock assemblage of these granitoids resembles the syn- and post-collisional magmatism in the Phanerozoic orogenic belt [5], and the estimated average composition of the studied rock assemblages is similar to that of the present-day upper continental crust, suggesting that a proto-type upper continental crust might have been developed at the end of the Archean by mixing of TTG and potassic granitoids. We thus conclude that collisional orogenesis is responsible for the continental cratonization at the end of Archean.

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