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# Contrasting petrogenesis of Mg–K and Fe–K granitoids and implications for post-collisional magmatism: case study from the late-Archaean Matok pluton (South Africa)

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Post-collisional, metaluminous high-K calc-alkaline granitoids emplaced throughout the last 3.0 Ga are compositionally diverse, ranging from Mg-rich (e.g. sanukitoids) to Fe-rich compositions, both being intimately associated locally. While the origin of Mg–K suites is fairly well understood, that of Fe–K magmas is much less constrained. In addition, no model accounts for the post-collisional nature of both granitoid types, in one hand, and their geochemical differences, on the other hand. This work addresses these issues investigating the petrography and geochemistry (major-, trace elements and Sm–Nd isotope data on whole rocks, trace element and in situ Sr–Hf–Nd isotopes on accessory phases) of the 2.69 Ga-old Matok pluton, emplaced in the northern Kaapvaal Craton (South Africa). It consists of diorites, granodiorites and monzogranites, which show clear petrographic and compositional affinities with other post-collisional Fe–K suites.

In spite of unradionegic Hf–Nd isotope compositions ($\varepsilon$Nd(WR) = –2.7 to –4.6; $\varepsilon$Hf(Zrn) = –3.2 to –3.6) and radiogneic Sr ones (Sr(i) > 0.702), most of the Matok pluton derives from neither reworking of local continental crust, nor crustal contamination of basaltic melt. Whole-rock as well as accessory mineral geochemistry indicate that the whole suite fractionated from a common mafic parent, either by partial melting or crystallization. Geochemical modelling shows that this parent magma or source rock derives itself from the involvement of two distinct mantle sources: (1) enriched, subcontinental lithospheric mantle, which was metasomatized by sedimentary (or sediment-derived) material derived from local crust of the Pietersburg block; and (2) asthenospheric mantle. Mantle enrichment took place less than 0.3 Ga prior to the pluton emplacement, and explains the 'crustal' isotope signature of the Matok pluton.

Involvement of both sources is the only relevant way to explain the differences between Fe–K suites, such as the Matok pluton, and Mg–K suites, such as sanukitoids, the petrogenesis of which only requires metasomatized mantle. We propose that the most adequate geodynamic setting for the involvement of these two mantle sources is a postsubduction, collision-related slab breakoff event. Such a model accounts for (1) the postcollisional nature of both Mg–K (sanukitoids) and Fe–K magmas; (2) their close spatial and temporal relationships in several late-Archaean to Phanerozoic terranes; and (3) their differences in petrography and geochemistry. In addition, such a model also accounts for many other typical features of the late-collisional context, such as high-T metamorphism and large-scale melting of the orogenic crust, in response to thermal stabilization of the lithosphere and intrusion of mafic melts at shallow levels.