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Pan-African syenites and A-type granites in the Sør Rondane Mountains, Antarctica

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The Sør Rondane Mountains (eastern Dronning Maud Land, Antarctica) experienced a prolonged period of magmatism during the amalgamation of Gondwana. Our LA-MC-ICPMS zircon U-Pb data show that the large Lunkeryggen Syenite Complex was emplaced around 560 Ma, while A-type granites were emplaced between 575 and 500 Ma; inherited zircon is scarce. The syenites are close to silica saturation, and contain very high levels of incompatible trace elements such as Sr and Ba. They display negative Nb-Ta and Ti anomalies in normalised trace element diagrams, and thereby show resemblances to silica-undersaturated minette dykes of a similar age [1]. Their zircon Hf isotopic composition has an epsilon value around 0 [2], while their initial whole rock epsilon Nd values vary between 0 and +3, and initial Sr isotopic ratios are 0.7043-0.7046. A-type granitoids with ages between 550 and 575 Ma have similar Nd isotopic signatures. Although their level of trace element enrichment is less pronounced than for the syenites, their normalised trace element pattern is similar. Younger granitoids (530-500 Ma) extend to more negative epsilon Hf (> -6) and Nd (> -5) values, with the lowest values measured in more easterly localities.

Quartz $\delta^{18}O$ values (n= 13) of the granitoids and syenite vary between 9.3 and 10.8 ‰ (average 9.9‰), and do not display any correlation with Hf and Nd isotopes. Country rocks (gneiss, migmatite and Tonian metatonalite) have quartz oxygen isotope values of 7.7 to 12.2 ‰ (n= 9). Our own data in combination with literature values shows that epsilon Nd values at 550 Ma of the host rocks vary from ca. -5 to +5; the higher values are for the metatonalites, and the lower ones for migmatites and schists.

Although the isotopic data for the granitoids can therefore be explained by reworking of inhomogeneous crustal materials, similar to those of the country rocks, this does not fit their major and trace element characteristics: No obvious crustal source for the syenites has been identified, and some of the intrusions with the more negative epsilon Nd values are dioritic in composition.

Therefore, the geochemical signature of Pan-African magmatism in the Sør Rondane Mountains appears to represent a combination of mantle and crustal sources, and would be more difficult to explain as a result of intracrustal melting only. The apparent east-west trend of decreasing epsilon Nd and Hf values could help to define the boundary between different crustal terranes.

References:

[1] Owada M et al. (2013) Prec Res 234: 63-84.

[2] Elburg MA et al. (2016) J Geol in press