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Geochronological and geochemical constraints on the position of the Sør Rondane Mountains within East Antarctica

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The western Sør Rondane Mountains (Antarctica) can be divided into a southern part, which consists dominantly of metatrondhjemites (and minor mafic lithologies), and a northern part dominated by amphibolite- to granulite-grade gneisses and granitoids, with minor amphibolites and marbles. The two parts are separated by a shear zone.
U-Pb LA-MC-ICPMS ages of igneous zircon from metatrondhjemites in the southern area range between 986 $\pm$ 5 and 1010 $\pm$ 12 Ma, while initial epsilon Hf values for the zircons vary between +6.7 and +8.0. Whole rock analyses show low concentrations of incompatible trace elements, including immobile elements such as Nb and Zr, indicating that this is unrelated to the amphibolite-facies overprint. Primitive mantle-normalised trace element diagrams show a negative Nb-Ta anomaly and positive K and Pb anomalies, typical for arc magmas. Rare earth element (REE) patterns vary from flat to REE-enriched, with both negative and positive Eu-anomalies, reflecting crystal fractionation and accumulation processes. This southern area likely represents the infracrustal section of an intra-oceanic arc.
The grey gneisses north of the shear zone yield U-Pb zircon ages of approximately 630-670 Ma. Initial epsilon Hf values lie between 0 and +5, and could be interpreted as purely intracrustal reworking of material similar to the southern metatrondhjemites; the whole rock geochemistry of the grey gneisses is, however, significantly more enriched in incompatible trace elements. An interpretation as a supracrustal section of a mature arc seems to fit most evidence.
Three late- to post-tectonic granitoids north of the shear zone yield igneous ages of 575 $\pm$ 7, 553 $\pm$ 10 and 537 $\pm$ 3 Ma. The older sample analysed shows Hf isotopic evidence for the input of a component more juvenile than that of the southern metatrondhjemites, and Hf isotopic values decrease with age for the other two samples. The intermediate-age sample (Vengen Granite) has been affected by movement on the shear zone. It is the only sample containing inherited zircons, with ages up to appr. 960 Ma. The youngest sample (Utsteinen Granite) is undeformed, and classifies as an A2-type granite. The U-Pb and Lu-Hf zircon data do not suggest involvement of crustal material older than the metatrondhjemites.
The ages of the metatrondhjemites are younger than the Mesoproterozoic ages from central Dronning Maud Land (appr. 1050-1150 Ma; Satish-Kumar et al., 2008), and show more resemblance to Mesoproterozoic ages of the easterly Lutzow-Holm area. The latter, however, show isotopic evidence of the involvement of Archean material, which is not seen in Sør Rondane. Post-tectonic A-type granitoid magmatism, on the other hand, appears to be slightly older than in central Dronning Maud Land (Jacobs et al., 2008), where it is more often charnockitic in character, with indications of the involvement of pre-Mesoproterozoic crustal material.
Sør Rondane therefore appears to hold a special position within East Antarctica in terms of igneous ages and relatively juvenile mantle extraction ages.

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