U-Pb, Lu-Hf and Sm-Nd isotope systematics during polymetamorphism in the Ancient Gneiss Complex, Swaziland

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This study aims to resolve some of the potential complexity associated with Archaean polymetamorphic gneiss terranes, with specific application to high-grade paragneisses from the Ancient Gneiss Complex (AGC) in Swaziland. Archaean zircons and monazites which have experienced multiple growth and/or alteration episodes, typically display a complexity in their zonation and U-Pb ages which is near impossible to resolve. However, Gerdes & Zeh [2] showed that the radiogenic Hf content of zircon, for example, remains constant during alteration, and changes only during new zircon growth; providing a robust tool to constrain the exact number of metamorphic cycles a rock has been through. The Sm-Nd system could provide a similarly useful tool. Monazite, allanite, apatite, rutile and titanite are U, Th and light-REE bearing phases, making them highly amenable for Sm-Nd and U-Pb isotope analysis [1]. This study represents a first attempt at investigating the simultaneous behaviour of the U-Pb, Lu-Hf and Sm-Nd isotope systems in accessory phases during polymetamorphism, by in situ LA-MC-ICP-MS analysis.

We investigate metasedimentary granulites from two separate, spatially related areas of outcrop in south-central Swaziland, which were subjected to multiple high-grade events throughout the Mesoarchaean [3]. Zircons and monazites from these gneisses are particularly interesting in terms of the complexity in their zonation and U-Pb ages, with dominant age peaks at 3.51 Ga, 3.43 Ga, 3.40-3.39 Ga, 3.35 Ga, 3.33 Ga, 3.23-3.21 Ga, 3.18 Ga, 3.16 Ga, 3.11-3.07 Ga, and 2.99 Ga. The U-Pb, Lu-Hf and Sm-Nd isotope record in these grains may inform on: (1) the provenance of sediments from the south-eastern Kaapvaal Craton and the nature of the Archaean/Hadean hinterland; (2) the number of metamorphic episodes recorded; and (3) Archaean geodynamic processes during key events associated with early lithosphere assembly and crustal differentiation.

[1] Foster & Vance (2006) JAAS 21, 288-296. [2] Gerdes & Zeh (2009) ChemGeol 261, 230–243. [3] Taylor *et al.* (2012) GeolSocAmBull 124, 1191-1211.

Timing of ultra-high temperature (UHT) metamorphism and formation of incipient charnockites in the Kerala Khondalite Belt (KKB), southern India

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The Kerala Khondalite Belt, also known as The Trivandrum Block (TB), makes up the southernmost tectonic unit of the Indian Subcontinent and the southern extension of the microcontinent Azania. The TB is dominated by high-grade metasedimentary rocks typically either grt-bt felsic gneisses (locally referred to an leptynites) and graphite-bearing grt-crd-sill gneisses (khondalites). The leptynites and khondalites, together with a variety of igneous rocks, have been metamorphosed to granulite facies. Metamorphic conditions vary, with the lowest pressures and temperatures in the centre of the block (5 kbar, ~750°C), and a systematic increase to the north and south up to 8-9 kbar and <1000°C

Charnockites within the Trivandrum block typically form large-scale, orthopyroxene-bearing granitic bodies, such as those seen in the Nagercoil Block at India’s southernmost tip. However the appearance of incipient charnockites is more enigmatic, forming metre-scale “patches” within host leptynites, one classic locality being near Kottavattom [1]

Charnockitisation in these rocks is identified as a late stage process related to fluid migration through the host rocks, resulting in some of the youngest ages for accessory phases in the KKB. SHRIMP U-Pb data for both zircon and monazite in the host leptynite and incipient charnockite patches, combined with rare earth elements (REE) in zircon, monazite and garnet have been used to investigate the timing of charnockitisation in relation to the UHT metamorphism in the region.

[1] Raith & Srikantappa (1993). *JMG*. **11**. 815-832.

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