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# Rutile petrochronology of Eo-Archaean metasediments from the southern Inukjuak domain, Québec (Canada) and Akila island (SW Greenland)

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The world's oldest rocks of demonstrable volcano-sedimentary origin comprise the Archean "supracrustal belts", in which they occur as variably deformed enclaves within ancient metamorphosed granite-granitoid gneiss terranes. The Inukjuak Domain in northern Québec is part of the Archean Minto Block in the northwestern Superior Province of Canada. Eoarchean (ca. 3800-3780 Ma) rocks of the Nuvvuagittuq supracrustal belt (NSB) and the Ukaliq supracrustal belt (USB) are the best known of numerous supracrustal enclaves within this domain. Sample IN14032 represents a quartzite, interpreted as a quartz-pebble metaconglomerate from the USB. The main mineral assemblage is anthophyllite + muscovite + quartz + rutile + zircon. Owing to the pervasive greenschist-facies retrogression of the sample it was not possible to constrain P-T conditions using phase equilibrium calculations; however, the Zr-in-rutile geothermometer provides a tight constraint on T. A total of 41 rutile analyses were done by electron microprobe at the University of Innsbruck. Zr contents of rutile range from 407 ppm to 914 ppm and yielded T of 660-730°C at an assumed pressure of 0.6 GPa and the calculated mean T is 670°C ± 40°C (2s). U-Pb dating of rutile from this sample using the ion microprobe at Heidelberg University following Schmitt & Zack (2012) yielded ages of 2500-2600 Ma, which correlate well with the youngest zircon ages from this sample, consistent with the lower closure T for Zr diffusion in rutile (<600°C).

Similarly, supracrustal rocks from the Nuuk region of West Greenland preserve a record of surficial processes in the early Archean (>3600 Ma). Within the lithologies of the enclave a minor anthophyllite-garnet rock (sample GR114) with chemical characteristics suggesting a sedimentary protolith was identified. The main mineral assemblage of this sample is garnet + anthophyllite + hornblende + biotite + plagioclase + K-feldspar + quartz. Evidence for a later metamorphic overprint is given by the growth of a second generation of biotite and plagioclase as well as diffusive modification of the garnet composition along fractures. Phase equilibrium calculations of the main matrix assemblage yielded average P-T conditions of 580 ± 40°C and 0.6 ± 0.1 GPa. Zr-in-rutile geothermometry of rutile inclusions in garnet yielded increasing T from 610 ± 30°C in the core to 670 ± 30°C in the rims. U-Pb dating of rutile from this sample yielded discordant ages of

2400-1400 Ma. The upper intercept yields an age of ca. 2500 Ma, which again correlates again well with previous U-Pb zircon ages around 2700 Ma whereas the lower intercept at ca. 1000 Ma is indicative of a Grenville-age overprint.

The rutile U-Pb ages combined with Zr-in-rutile geothermometry show that Neoarchean metamorphism reached upper amphibolite-facies conditions (580-670°C) in both supracrustal localities in accordance with previous P-T estimates and U-Pb zircon ages. In addition, the sample from Akilia island yields hitherto unknown evidence of a later-stage Grenville metamorphic (high-greenschist-lower amphibolite-facies) overprint.

Schmitt, A. K., & Zack, T. (2012). High-sensitivity U–Pb rutile dating by secondary ion mass spectrometry (SIMS) with an $O_2^+$ primary beam. Chemical Geology, 332, 65-73.