A geochemical profile through the Mesoarchaean Nigerlikasik tholeiitic to calc-alkaline metavolcanic sequence, South-West Greenland

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We present a detailed stratigraphical log and a dense sampling profile for geochemical and geochronological characterisation of the Nigerlikasik supracrustal belt. This sequence is relatively well-preserved and coherent, and describes a compositional evolution from ultramafic serpentinites near the base (~30 m), to mafic amphibolites through mid-section (~220 m), to felsic biotite-hornblende (bio-hbl) schists in the top-section (~300 m).

Relict volcanic structures, such as possible fiamme-textured ignimbrites, pyroclastic breccia-flows and rare pillow-basalts are present in this sequence. Obliquely cross-cutting aplite sheets (<2 m wide) dominate at the base (closer to the contact to the surrounding TTGs), but are found up through the entire sequence (decreasing in abundance upwards).

A total of 99 rock samples were collected from the ~550 m thick metavolcanic section, including 6 samples from the TTG 'basement' and aplite sheets of similar compositions. Four of these aplite sheets were dated by LA-ICPMS zircon U/Pb dating at GEUS, yielding fairly consistent igneous ages of (1) 2929 ± 5, (2) 2931 ± 4, (3) 2913 ± 5 and (4) 2922 ± 5 Ma, and providing a minimum age of the metavolcanic succession at ~ 2930 Ma.

It is uncertain whether the lower (ultra)mafic part of the Nigerlikasik metavolcanic section is made up of tholeiitic island arc basalts, derived from a hydrated juvenile mantle wedge, OIBs, or "hot" Archaean MORBs. The overlying andesites-dacites represent a more diagnostic calc-alkaline volcanic island arc suite, which (together with the ≤2930 Ma intrusive TTG?) could have been derived either from decreased proportions of partial melts from a garnet-bearing crustal source (e.g. a subducted oceanic slab) or through extensive high-P garnet-amphibole fractionation within a subcrustal magma reservoir.