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New geochronological evidence for a c. 3.1-3.2 Ga old cratonic core in the Fiskenæsset area, South-West Greenland

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The Archaean basement of southern West Greenland from the Nuuk region, and down to the Fiskenæsset area (c. 63-64N), has been well studied since it was first mapped out in the late 1960's and early 1970's by geologists from GGU (later GEUS). Much of the later work in the region has centred on resolving the tectonothermal evolution by establishing crustal 'terranes' (Friend et al. 1996); and central to this work has remained detailed geochronology, essentially U/Pb zircon dating by TIMS, SIMS or LA-ICPMS. With an ever-growing mass of geochronology data, progressively more elaborate models for the tectonometamorphic histories have been proposed, particularly for the Nuuk region.

The Fiskenæsset area belongs to the 'Tasiusarsuaq terrane' that extends from the Buksefjorden area, down to Fredrikshåb Isblink; it is dominated by 2.92–2.84 Ga tonalite and granodiorite gneisses (Friend & Nutman 2001; Crowley 2002). Peak granulite facies conditions have been dated at 2.81–2.79 Ga and were associated with the intrusion of the charnokitic 'Ilivertalik Augen Granite', just north of the central Fiskenæsset area. Also hosted within the 'Tasiusarsuaq terrane' is the mafic layered intrusion, the Fiskenæsset complex (Meyers, 1985).

Our field investigations in the Fiskenæsset area (2008-2009) included boat based reconnaissance and sampling along well-exposed shorelines of the fjords, including an E-W transect along the Fiskenæsset fjord and sampling around Qeqertasuatsiaq island. The samples targeted for zircon U/Pb dating included TTG gneisses (felsic granulites) and syn- and post-kinematic leucocratic sheets and dykes (pegmatites). A sample of the Ilivertalik granite from the Ilivertalik mountain was also included, along with a gneiss xenolith within the Ilivertalik granite.

The felsic granulites from the Fiskenæsset fjord all show multi-component age distributions; in addition to ages typical for the Tasiusarsuaq terrane elsewhere, these rocks also contain zircons with ages between $\sim$3.0 and $\sim$3.2 Ga, mostly in the range 3.13-3.20 Ga. At Qeqertasuatsiaq, samples mainly of felsic sheets all give consistent ages of $\sim$2.80 Ga (within error; 2.795-2.803 Ga). The xenolith sample within the Ilivertalik granite also contains a pronounced peak at 3.172 $\pm$ 0.003 Ga, whereas the granite itself is dated to 2.798 $\pm$ 0.003 Ga, consistent with previously reported ages for this intrusive complex.

The new zircon U/Pb age data reveal new insights into the early development of the crust in the Fiskenæsset region. The area containing the felsic granulites with the 3.1-3.2 Ga old zircons extends $\sim$15 km along the east-west trending Fiskenæsset fjord. Noteworthy, the main foliation in the rocks in this area runs roughly parallel to the fjord, raising the questions as to the actual lateral extent of this old component. However, similar old aged zircons both in the Ilivertalik xenolith ($\sim$10 km further to the NW), in gneisses near Ameralik fiord (Næraa et al., unpublished data) and in a few regional stream sediments suggest a more widespread distribution of this 3.1-3.2 Ga component, although apparently not preserved equally well throughout the region.

The occurrence of an older zircon component within the Tasiusarsuaq terrane indicates that felsic crust existed prior to 2.92 Ga, which otherwise hitherto defined the oldest crust forming TTG event within the terrane. It also implies that the 2.97 Ga Fiskenæsset complex might have intruded into, or proximal to a continental crust. Future investigations of Hf-isotope composition of the 3.1-3.2 Ga zircons will help to constrain the relationship between the early and late crustal components, and the extent to which these represent pristine mantle derived material or reworked older crust.

Crowley, J.L. 2002: Precamb. Res. 116, 57–79.
Friend, C.R.L., Nutman, et al. 1996: EPSL 142, 353–365.
Myers, J.S. 1985: Bull. G.G.U. 150, 72 pp.