Geophysical Research Abstracts
Vol. 13, EGU2011-11114-1, 2011
EGU General Assembly 2011

Linking the Ravns Storø and Bjørnesund supracrustal belts (SW Greenland) using Lu-Hf and Sm-Nd isotopic data and whole-rock geochemistry

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The Ravns Storø and Bjørnesund supracrustal belts are located less than 10 km apart and a link between the two have been speculated since the area north of Frederikshåbs Isblink was mapped in the 1970's.
The Ravns Storø belt (also referred to as Ikkattup Nunaa) contains well-preserved lithic tuffs and pillow lavas indicating that these metavolcanic rocks formed in a shallow subaqueous environment. Variably evolved amphibolites make up the majority of the supracrustal belt, but in the SE there are ultramafic rocks and unusual aluminous schists that contain cordierite, staurolite, garnet and anthophyllite. A cross-cutting tonalitic sheet has a zircon LA-ICP-MS U-Pb age of 2905.3 +/- 4.9 Ma, which provides a minimum age for the Ravns Storø supracrustal sequence.
The Bjørnesund belt is characterised by amphibolites, calc-silicate amphibolites and intrusive sheets of granitic and tonalitic composition. The main lithologies and structural relations are very similar to those of the Ravns Storø supracrustal belt, but higher degree of deformation has obscured many primary features in the Bjørnesund belt. The volcanic rocks of the Bjørnesund belt are in direct structural contact with a layer of anorthosite and leucogabbro, which is similar to the anorthositic Fiskenæsset complex further to the north. A link between those rocks and the Bjørnesund supracrustal belt has previously been suggested (Myers 1985). A gneiss sheets that intruded the Bjørnesund volcanic rocks has LA-ICP-MS zircon age of 2893.6 +/- 7.8 Ma.
The whole-rock geochemistry for the two supracrustal belts is similar. They both contain amphibolites with tholeiitic basaltic compositions (dominantly pillow lavas at Ravns Storø) and calc-alkaline amphibolites (dominantly subaerial tuffs). There is considerable overlap in both major and trace elements within each of the two groups regardless of which of the two supracrustal belts the samples are from.
The tholeiitic rocks (6-10 wt.% MgO and SiO2 around 48 wt.%) have primitive mantle-normalised LaN/SmN $\sim$1.2 and NbN/LaN around 0.6 whereas the calc-alkaline amphibolites (MgO around 4 wt.% and 50-58 wt.% SiO2) have LaN/SmN from 2.1-3.2 and NbN/LaN around 0.3. In various tectonic discrimination diagrams the tholeiitic rocks plot in the island arc tholeiite (IAT) or mid-ocean ridge basalt (MORB) fields and the calc-alkaline amphibolites plot in the calc-alkaline basalt (CAB) field. Our preferred interpretation of the geochemical data is that both volcanic belts developed in an island arc setting where early IAT gave way to CAB in a maturing arc system.
Five amphibolite samples from each of the two supracrustal belts were analysed for Lu-Hf and Sm-Nd isotopes by MC-ICP-MS. They define a Lu-Hf-isochron age of 2993 +/- 69 Ma and a Sm-Nd-isochron age of 2947 +/- 47 Ma supporting the idea that the two metavolcanic sequences were contemporaneous within analytical resolution and possibly co-magmatic. These ages overlap with the $\sim$ 2970 Ma age of the Fiskenæsset complex (Polat et al. 2010). Accepting the age for the Fiskenæsset complex, the epsilon-Hf(2970Ma) range from 3.8-5.4 +/-0.4 and epsilon-Nd(2970Ma) range from 1.4-3.0 +/-0.3 suggesting derivation from a mildly depleted mantle source.
We propose that the common isotopic and whole-rock data combined with the comparable field relations, lithologies and ages for the Ravns Storø and Bjørnesund supracrustal belt are best explained by a single co-magmatic volcanic sequence that formed in an island arc setting at about 2970 Ma.

References

Myers, J.S. 1985. Stratigraphy and structure of the Fiskenæsset Complex, southern West Greenland. Grønlands

Geologiske Undersøgelser Bulletin 150, 72.

Polat, A., Frei, R., Scherstén, A. and Appel, P.W.U. 2010. New age (ca. 2970 Ma), mantle source composition and geodynamic constraints on the Archean Fiskenæsset anorthosite complex, SW Greenland. Chemical Geology, 277, 1-20.