



EARLY AND LATE ARCHAEOAN METAMORPHISM AND METASOMATISM OF THE EARTH'S EARLIEST SUPRACRUSTAL SEQUENCE AT ISUA, WEST GREENLAND

D. Ulfbeck (1), J. Baker (1), M. Rosing (1,2), T. Waight (1)

(1) Danish Lithosphere Centre, Øster Voldgade 10, 1350 Copenhagen, Denmark, (2)
Geological Museum, University of Copenhagen, Øster Voldgade 5-7, 1350 Copenhagen,
Denmark. (dgu@dlc.ku.dk / Fax: +45-33110878)

The Isua Supracrustal Belt (ISB) in southern West Greenland constitutes the single largest sequence of Early Archaean supracrustal rocks on Earth and comprises large volumes of metamorphosed pillow basalts. Considerable portions of these basalts were converted to garnet-biotite-carbonate schists during multiple episodes of metamorphism and metasomatism causing de-silification, carbonation and alkali exchange (Rosing et al., 1996). Field evidence indicates that these events occurred under amphibolite facies conditions and were largely coeval with the main stages of deformation in the Early Archaean, but no sample scale isotopic age determination has demonstrated this to date.

We have carried out combined Lu-Hf and Sm-Nd MC-ICPMS analyses on whole rock samples of garnet-biotite-carbonate schists and mineral separates (garnet and biotite), and obtain a 3776 ± 66 Ma Sm-Nd isochron (initial $\epsilon_{Nd} = +2.0 \pm 1.6$, MSWD = 0.95) and a 3484 ± 120 Ma Lu-Hf reference line (initial $\epsilon_{Hf} = -1 \pm 3$, MSWD = 28) for the whole rock samples. All garnet mineral separates were analysed both leached and unleached in order to assess the effects of sub-20 μm inclusions of allanite, apatite and sub-2 μm zircons, identified by SEM imaging, on garnet REE and Hf budgets. Short (24 hr) leaches with concentrated HNO_3 efficiently removed allanite and apatite inclusions as illustrated by garnet REE patterns which show dramatic increases in Sm/Nd ratios (on average from 0.6 to 3.0) in leached relative to unleached aliquots. Sm-Nd and Lu-Hf regressions of all minerals and mineral and whole-rock pairs systemati-

cally yield Late Archaean (~2600–2800 Ma) ages for both leached and unleached aliquots of garnet indicating a complete resetting of the REE and Hf budgets on mineral scale at this time, but only partial resetting (Lu-Hf) on a whole rock scale. This demonstrates the presence of a Late Archaean metamorphic event which affected both the Sm-Nd and Lu-Hf systems on mineral scales and apparently only left the Early Archaean whole-rock Sm-Nd systematics intact.

Rosing, M., Rose, N., Bridgwater, D. & Thomsen, H. 1996 Earliest part of Earth's stratigraphic record: A reappraisal of the >3.7 Ga Isua (Greenland) supracrustal sequence. *Geology*, 24, 43–46.