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Variation in 142Nd/144Nd of Archean rocks from southwest Greenland : Implications for early Earth mantle dynamics

H. Rizo (1), M. Boyet (1), J. Blichert-Toft (2), M. Rosing (3), and J.L. Paquette (1)

(1) Université Blaise Pascal, Laboratoire Magmas et Volcans, CNRS 6524, F-63000 Clermont-Ferrand, France (H.Rizo@opgc.univ-bpclermont.fr) , (2) Laboratoire de Géologie de Lyon, CNRS UMR 5276, Ecole Normale Supérieure de Lyon, 69364 Lyon, France, (3) Natural History Museum of Denmark and Nordic Center for Earth Evolution, University of Copenhagen, DK-1350 København, Denmark

The short-lived 146Sm–142Nd chronometer (half-life = 103 Ma) has proven successful in bringing constraints on the dynamics of the early Earth mantle. Since the parent isotope, 146Sm, was extant only during the first 300 Ma of the history of the Solar System, the positive 142Nd anomalies measured in southwest Greenland Archean rocks imply that their incompatible element-depleted mantle source formed during the Hadean. Interestingly, the magnitude of these anomalies seems to decrease over time. 3.7-3.8 Ga old rocks from the Amitsoq Complex have revealed +10 to +20 ppm 142Nd anomalies [1, 2, 3, 4, 5, 6, 7], whereas younger 3.0 Ga old samples from the Ivisaartoq greenstone belt yield smaller positive anomalies, ranging from +5.5 to +8.5 ppm [8]. Thus, the chemical heterogeneities detected in the southwest Greenland mantle were formed during the first 150 Ma of Earth's history, and seem to have resisted re-mixing by mantle convection until 3.0 Ga. In this study, we investigate the evolution of the southwest Greenland mantle during the time period of 3.3-3.4 Ga. The samples analyzed come from both the $\sim$3.3 Ga amphibolite unit and the $\sim$3.4 Ga Ameralik basic dyke swarm from the Amitsoq Complex. Coupled Sm-Nd and Lu-Hf bulk-rock ages obtained for seven amphibolites are in good agreement (3351 $\pm$ 210 Ma and 3302 $\pm$ 260 Ma, respectively) and consistent with the minimum age found by Nutman and Friend (2009) [9] for this formation. We further obtained coherent bulk-rock 147Sm–143Nd and zircon+baddeleyite 207Pb/206Pb ages for the Ameralik dykes (3428 $\pm$ 250 Ma and 3421 $\pm$ 34 Ma, respectively), in line with ages suggested by Nielsen at al., (2002) [10] and Nutman et al., (2004) [11]. We are currently in the process of analyzing these samples for 142Nd isotopic compositions and the results will be compared with the existing southwest Greenland data in order to shed new light on the evolution and destruction of heterogeneities in the early Earth mantle.

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