Sm-Nd isotopic compositions of the mantle-derived rocks of the Saglek-Hebron Gneiss Complex, Labrador

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The study of Archean terranes is crucial to understanding the early evolution of the Earth's crust and mantle. The Saglek-Hebron Complex (SHC) in Northern Labrador hosts several generations of metavolcanic rocks and granitoids as old as 3.9 Ga. It has recorded multiple mafic magmatic events over more than 1 billion years, making it ideal to study the evolution of mantle-derived rocks over time. The SHC supracrustal rocks have been divided into the Nulliak and Upernavik units originally based on the fact that only the former appears to be intruded by the Saglek mafic dykes. The exact age of the Saglek dykes is however poorly constrained. Recent Sm-Nd work, mainly on ultramafic rocks, has suggested an age of ~3.8 Ga and ~3.4 Ga for the Nulliak and Upernavik rocks, respectively [1]. Here we present a Sm-Nd isotopic study focussing on the different generations of mafic rocks in the SHC, including the supracrustal rocks and two generations of mafic dykes. Preliminary Sm-Nd data for the Nulliak samples yield an isochron age of 3068 ±440 Ma (MSWD=28, n=12) with an initial εNd value of +1.5. Mafic rocks from the Upernavik unit give an identical age of 3045 ±380 Ma (MSWD=27, n=10) and initial εNd= +1.3. The high scatter and the discrepancy with ages previously obtained for ultramafic rocks suggest that the Sm-Nd system was opened during the high-grade metamorphism of the SHC and that the initial εNd values may not be representative of their mantle source(s). The Sm-Nd data for both generations of mafic dykes exhibit much less scatter suggesting that they were not as affected by post-crystallization processes. Excluding samples that show evidence for crustal contamination, the Saglek dykes yield an isochron age of 3385 ±88 Ma (MSWD=3.5, n=7) and initial εNd value of +1.6. A younger generation of undeformed mafic dykes yield a Sm-Nd isochron age of 2696 ±85 (MSWD=3.6, n=16) with an initial εNd value of +1.7. Despite ~700 Ma of age difference between both generations of mafic dykes, they exhibit similar εNd values suggesting that they are either derived from distinct mantle sources or that their source had a chondritic Sm/Nd ratio.

[1] Morino et al. (2017)