Coupled ^{146,147}Sm-^{142,143}Nd systematics of Nulliak ultramafics (3.76 Ga, Labrador) push back time of early mantle differentiation

PRECILLIA MORINO[1], GUILLAUME CARO[1] AND LAURIE REISBERG[1]

[1]CRPG-CNRS, Université de Lorraine, Nancy, France

The coupled ^{146,147}Sm-^{142,143}Nd system is a powerful tool for constraining the timing of earliest mantle differentiation. However, due to the scarcity of Eoarchean mantle-derived rocks with undisturbed ^{147}Sm-^{143}Nd systematics, its application has remained limited to a few evolved lithologies (Akilia TTGs, Isua metasediments). This study attempts to provide a coherent ^{142,143}Nd dataset for the Eoarchean mantle using well-preserved ultramafic rocks from the Nulliak assemblage. Samples include meta-dunites, -pyroxenites and -lherzolites exhibiting only minor serpentinization and limited element mobility. From a geochemical perspective, Nulliak ultramafics include "Barberton type" komatiitic compositions (low Al/Ti, HREE depletion), suggestive of a deep mantle source. ^{147}Sm-^{143}Nd analyses yield a crystallization age of 3.756±0.068 Ga with $\varepsilon^{143}Nd_i$=1.4±0.1 and μ^{142}Nd=8.6±2.5 ppm. This ^{142,143}Nd signature corresponds to a model age of mantle differentiation of 4.42-4.49 Ga (assuming a BSE with chondritic Sm/Nd and μ^{142}Nd=0). Superchondritic compositions for the BSE would translate into older model ages. Irrespective of the choice of primitive mantle composition, Nulliak ultramafics provide differentiation ages 50-100 Ma older than those estimated from Isua metasediments and Akilia tonalites. This may indicate that these crustal rocks and the Nulliak ultramafics sample distinct mantle reservoirs. If the latter originated from deep melting of a hot plume, their model age could reflect the early onset of magma ocean crystallization in the lowermost mantle.