^{142}Nd evidence for recycling of Earth's primordial crust at the Hadean-Eoarchean transition

G.CARO[1], P. MORINO[1], S.J. MOJZSIS[2], N. L. CATES[2], W. BLEEKER[3]

[1]CRPG-CNRS, Université de Lorraine, Vandoeuvre-les-Nancy, France
[2] Collaborative for Research in Origins (CRiO), University of Colorado, Boulder, USA
[3] Geological Survey of Canada, Ottawa, Canada

The question of the rise (and demise) of the terrestrial protocrust remains highly controversial, mainly due the paucity of reworked Hadean components in the Archean rock record. In this context, the presence of ^{142}Nd deficits in magmatic rocks of the Archean Innuksuac gneiss complex and Nuvvuagittuq supracrustal belt (northern Quebec), has major implications for our understanding of Hadean geodynamics. In this study, we investigated the ^{146,147}Sm-^{142,143}Nd systematics of the Ukaliq belt, a recently discovered volcano-sedimentary enclave of the Innuksuac complex. Despite a rough correlation between the ^{142}Nd/^{144}Nd and Sm/Nd ratios, the fine structure of the ^{146}Sm-^{142}Nd signal in Ukaliq rocks cannot be easily reconciled with a Hadean emplacement age. Coupled ^{146,147}Sm-^{142,143}Nd chronometry indicates that the negative ^{142}Nd anomalies were inherited from a Hadean crustal precursor extracted from the mantle ca. 4.4 Gyr ago, possibly as a result of magma ocean crystallization. We propose that foundering of this primordial crust after a long period of quiescence at the surface produced felsic melts and/or fluids carrying unradiogenic ^{142,143}Nd which imprinted the overlying mantle with a chemically and isotopically enriched signature. Metasomatically triggered melting of this modified mantle then generated a variety of boninitic and tholeiitic magmas, the combination of which resulted in the ^{146}Sm-^{142}Nd pseudo-isochrons observed in Ukaliq/Nuvvuagittuq lavas. While remnants of this ancient crust have yet to be found, the preservation of its isotopic signature offers a unique opportunity to better constrain the composition and evolution of the Hadean lithosphere.