Effect of metamorphic overprint on early Earth isotopic ages: the case study of Saglek block (Labrador, Canada)

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For the last 60 years, whole-rock isotope geochemistry has provided benchmark results that have shed light on Earth's evolution. With improvements in analytical resolution, those results have been complemented by spatially resolved information extracted from accessory mineral phases, predominantly zircon. Many of the results recovered from the two approaches on early Earth materials are hard to reconcile. While isotope signatures (e.g. Sm/Nd or Lu/Hf) obtained from whole-rock protocols indicate extensive chemical differentiation of the mantle before 3.6 Ga, those from spatially resolved analysis of individual minerals point toward much less dramatic differentiation, with the majority of crystal domains having sub-chondritic compositions.

To investigate likely reasons for the observed discrepancies between whole-rock and mineral data, here we present a coupled trace element and U–Pb/Hf/O isotope dataset for ca. 3.86 zircon from an early TTG component of the Saglek Block (North Atlantic Craton), for which whole-rock isotopic data have been published.

Lead isotope show 3 distinct zircon crystallization events: (1) an Eoarchean event at ca 3.86 Ga; (2) an early Paleoarchean metamorphic event at ca. 3.5 Ga, and (3) a Neoarchean event (ca. 2.75 Ga) with zircon domains showing complex zoned overgrowths.

Oldest domains display mantle-like $\delta^{18}O$ (+4.9±0.2‰ to +6.8.0 ± 0.2 ‰, n=30), while Paleoarchean metamorphic domains have sub-chondritic εHfi and δ18O values up to +9 ‰, clearly related to a mature supracrustal precursors involved in the reworking of 3.86 Ga crust at ca. 3.5 Ga.

Youngest domains (ca. 2.8-2.7 Ga) display heterogeneous Hf-signature from -23 to -5 ε-units with homogeneous $\delta^{18}O$ of +6.7±0.1‰ (n=7).

These results show that large isotopic heterogeneities are preserved at the grain scale. In the light of these intra-sample heterogeneities we will discuss the potential consequences for whole-rock isochrones interpretation.

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.