

Towards the depositional age and Archean seawater signature for the Nuvvuagittuq (Canada) and Cauê (Brazil) Banded Iron Formations using Nd-Hf isotopic systematics

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Banded iron formations (BIFs) from the Nuvvuagittuq greenstone belt in Canada and the Cauê Banded Iron Formation in the Iron Quadrangle in Brazil are Archean sedimentary, chemical rocks. While the Nuvvuagittuq BIFs have experienced the amphibolite metamorphic facies, they might represent the oldest sedimentary, chemical rocks found on Earth as their deposition is estimated to be Hadean to Eoarchean in age (4.3–3.8 Ga). Cauê BIFs are thought to be deposited leading to the Great Oxidation Episode, at ca. 2.42 Ga, but it remains unclear how they relate to this event. So far, neither of these two BIFs has been precisely dated as datable minerals in the bracketing stratigraphic units were not yet found.

Major and trace elements concentrations together with Sm-Nd and Lu-Hf isotopic compositions were analyzed for the Nuvvuagittuq and Cauê BIFs to constrain their depositional ages and Archean seawater signature. The study focused on nine outcrop samples from the Nuvvuagittuq greenstone belt and twelve samples from the exploration drill-cores of the Cauê BIFs. Results show that most of the studied BIFs have the typical trace element signature of seawater-derived precipitates. Low Al and Zr concentrations suggest minor siliciclastic contamination for most samples. Principal component analysis performed on trace and major element compositions identified the most altered and detritally contaminated samples in the two studied datasets. The Lu-Hf and Sm-Nd isochrons did not yield geologically meaningful dates for the Nuvvuagittuq and Cauê BIFs due to a large dispersion of datapoints. This suggests that isotopic systematics were significantly perturbed by post-depositional, metamorphic events. The study however raises a question on the meaning of MSWD values for a supposedly Archean dataset with small analytical errors and three orders of magnitude scatter in parent-daughter ratios. The application of percentage-based systematic errors to parent-daughter ratios highlights the limit of using weighted linear regression model to estimate depositional ages by isochron methods in metasedimentary rocks. We herein propose a potentially alternative way to use analytical errors (and