Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37075

U-Pb Dating of Iron Oxide in Banded Iron Formation: What event(s) are we dating?

CHARLOTTE DA PONTE[1], ANTOINE TRIANTAFYLLOU[2], EMMA CALASSOU[3], VÉRONIQUE GARDIEN[4], DELPHINE BOSCH[5], OLIVIER BRUGUIER[6], CLAUDIO GAUCHER[7] AND PROF. FABRICIO CAXITO[8]

[1]Lyon Geology laboratory - Earth, Planets and Environment (LGL-TPE), Université de Lyon
[2]Lyon Geology Laboratory: Earth, Planets, Environment
[3]Lyon Geology Laboratory: Earth Planet Environment
[4]Laboratoire de Géologie de Lyon : Terre, Planète et Environnement, CNRS UMR 5276 - UCB Lyon1 - ENS Lyon 8 Campus de la Doua, Bâtiment Géode, 2 rue Raphaël Dubois, 69622 Villeurbanne, FRANCE
[5]CNRS-UMR5243, Géosciences Montpellier, Université de Montpellier
[6]Géosciences Montpellier, Université de Montpellier, CNRS
[7]Facultad de Ciencias
[8]Universidade Federal de Minas Gerais

Banded Iron Formations (BIFs) are distinctive marine sedimentary deposits that offer crucial information about ancient ocean chemistry and paleoclimate spanning the Archean to the end of Neoproterozoic era. They are defined by a rhythmic layering of silica-rich bands alternating with iron oxide rich bands. A key challenge in BIF research is the lack of an in-situ absolute dating technique, which makes it difficult to assign these deposits to an exact timescale and hinders detailed reconstruction of their depositional settings. Currently, most BIFs are dated indirectly through interbedded metavolcanic rocks or by constraining maximum depositional ages using detrital zircons from related sedimentary sequences, and more directly via whole-rock Sm-Nd or Lu-Hf geochronology on apatite.

Our work focuses on the optimization of the in-situ U-Pb dating method on iron oxide by LA-HR-ICP-MS. This approach comes with some limitations as there is no reliable and certified U-Pb iron oxide reference material and as iron oxides only incorporates a few ppm of U and lots of common Pb. Statistical tests were performed to determine which non-matrix match standard has the closest ablation behavior (between zircon 91500, rutile R10 and hematite MRHFO) to that of our samples. Data was reduced using Iolite v4 and lower intercept age calculated using IsoplotR.

Our method was tested on four different BIFs: Yerbal BIF (Uruguay), Aït Ahmane BIF (Morocco), Wanimzi BIF (Morocco), and Cauê BIF (Brazil). We obtained respectively an age of 604 ± 47 Ma, 729 ± 33 Ma, 676 ± 20 Ma and 550 ± 30 Ma. Aït Ahmane and Yerbal oxides ages are close to the expected age of deposition (753-640 Ma and 664-610 Ma). As for Wanimzi and Cauê BIFs, yielded ages are probably related to a medium-grade metamorphic event. These results establish iron oxide as a potential direct geochronometer of depositional age in BIFs if combined with a detailed petrographical characterization of the oxides.