

**Évaluation de la production précoce de d'oxygène dans le premier écosystème côtier de la Terre
(3,2 Ga Moodies Group, Barberton Greenstone Belt, Afrique du Sud)
via les isotopes stables non-traditionnels**

**Probing early oxygen production in Earth's first coastal ecosystem
(3.2 Ga Moodies Group, Barberton Greenstone Belt, S. Africa)
using non-traditional stable isotopes**

This thesis request is being made in support of the ANR PRC project “MOODIESLIFE” that has been resubmitted in 2021-2022. Should the ANR project not be funded, we seek to launch the associated PhD project in 2022 or early 2023 all the same to correspond with the availability of the newly available drill cores currently being produced in the context of the ICDP-funded drilling project (1.8M USD) that is currently drilling in S. Africa in which porteur Lalonde is co-PI. **The following text describes the ANR project MOODIESLIFE and the role of the requested PhD allocation within this context of this ANR project.**

The ANR PRC project “MOODIESLIFE” represents a request for French national funding to support exciting new science in association with the ICDP project “Barberton Archean Surface Environments (BASE), Moodies Group, Barberton Greenstone Belt” that is currently drilling in S. Africa from late 2021 to mid-2022. The MOODIESLIFE project represents a collaboration between coordinator Stefan Lalonde (CNRS-LGO, Brest, FR), who is one of ten international co-PIs that co-wrote the ICDP BASE project, in partnership with Pierre Sansjofre (MNHN, FR) and BASE primary PI Christoph Heubeck (Friedrich Schiller Universität, Jena, DE). Additional collaboration with specialists Pierre Bonnand (UBO-GO, Brest, FR) and Martin Homann (University College London, UK), a team of sedimentology and geochemistry engineers in Brest and in Paris, and a new PhD student and a postdoctoral researcher to be hired, completes the bulk of the MOODIESLIFE team. The primary goal of MOODIESLIFE is to use elemental and stable isotope signatures to examine weathering processes, paleoredox conditions, microbial colonization, and microbial diversity in Earth’s most ancient terrestrial and coastal ecosystems preserved in the 3.2 Ga Moodies Group.

The PRC project MOODIESLIFE is designed to push the limits of both traditional (C,N) and non-traditional (Ce, Mo, U, Cr) stable isotope geochemistry, to train highly qualified researchers in advanced geochemical techniques examining life’s origins (3 year PhD, 2 yr postdoc, and two 5-month MSc projects; 210k€), and to ensure strong French participation in this exciting early Earth ICDP drilling project (missions to S. Africa and the ICDP Spandau Core Storage facility near Berlin to participate in drilling, core characterization, and sampling; 35k€; organisation of ICDP post-drilling workshop and sampling party; 20k€). The MOODIESLIFE project will benefit from early access to the ICDP core materials during their embargo period, ensuring access to the most promising horizons that record surface weathering processes, ocean nutrient and redox status, and microbial community evolution. Scientific risks (e.g. depth of weathering) are leveraged by the availability of multiple drill holes (9 planned), and logistical risk is near-zero as the BASE ICDP project achieved its revised drilling funding goal in 2021 (\$1.6M€), drilling commenced in late Oct 2021, and all sampling and analytical work planned in the MOODIESLIFE project will occur in low COVID-risk countries (France and Germany). Accordingly, an ambitious analytical campaign (85k€) comprised of XRF corescanner, major element, trace element, stable isotope redox tracers (Ce, Mo, U, and Cr), and C + N stable isotope analyses of some of the most promising core sections will guarantee the opportunity for high-impact discovery and ensure that France remains at the forefront of early Earth and primitive biosphere studies. A diverse set of complementary projects currently being mounted by BASE PIs spanning 10 countries† provides exciting opportunities for international collaboration.

† The BASE ICDP project co-PIs include Christoph Heubeck (BASE lead PI, U. Jena, DE), Stefan Lalonde (CNRS/LGO, FR), Nic Beukes (U. Johannesburg, S. Africa), Martin Homann (University College London, UK), Emmanuelle Javaux (U. Liege, BE), Takeshi Kakegawa (Tohoku U., JP), Martin van Kranendonk (U. of New South Wales, AU), Johanna Marin-Carbonne (U. Lausanne, CH), Paul Mason (Utrecht U., NL), and Mike Tice (Texas A&M, US).