Hydrogen generation through banded iron formation (BIF) oxidation: a new resource for Australia?

Ugo Geymond[1] *Erick Ramanaidou*[2], *Dan Lévy*[1], *Isabelle Moretti*[1*]

UPPA, LFCR Rue de l'université, 64000 Pau, France
CSIRO Mineral Resources, Kensington, WA, 61512, Australia
ugo.geymond@gmail.com, *Isabelle.moretti@univ-pau.fr*

The oxidation of iron rich rock can generate H_2 in oceanic as well as in continental domains. Here we tested the potential for Banded Iron Formations (BIF), Precambrian iron-rich sedimentary rocks, to produce H_2 during weathering. The potential of these rocks for H_2 generation is very high, as they account for more than 60% of world global iron reserves with low Fe^{3+}/Fe-total before weathering. In addition, satellite imagery in Australia and Brazil revealed the presence of sub-circular depressions, that usually are the proxy of H_2-emitting features (Moretti et al., 2021), in the vicinity of iron mines hosted in BIF.
A petrological study conducted on fresh and weathered BIF samples from the Hamersley Province in Western Australia, shows that the weathering of the BIF has the potential to produce H_2 by oxidation under surface conditions. The mineralogical study shows transitions from stilpnomelane (a ferrous silicate) and ankerite (a ferrous carbonate) to goethite (FeOOH) and from magnetite (FeO Fe_2O_3) to maghemite (γFe_2O_3), hematite (αFe_2O_3) and goethite. The oxidation of ferrous iron from BIF by low temperature aqueous fluid is a promising mechanism for potential hydrogen production. The BIF weathering mineralogy suggests that low temperature aqueous fluids have the potential to generate H_2, challenging the idea that high temperature is always required to generate hydrogen as it is the case during serpentinisation. This new source of hydrogen could enhance Australia natural H_2 potential in addition to the radiolysis quantified by Boreham and al (2021) or to water reduction (Frery et al., 2021).

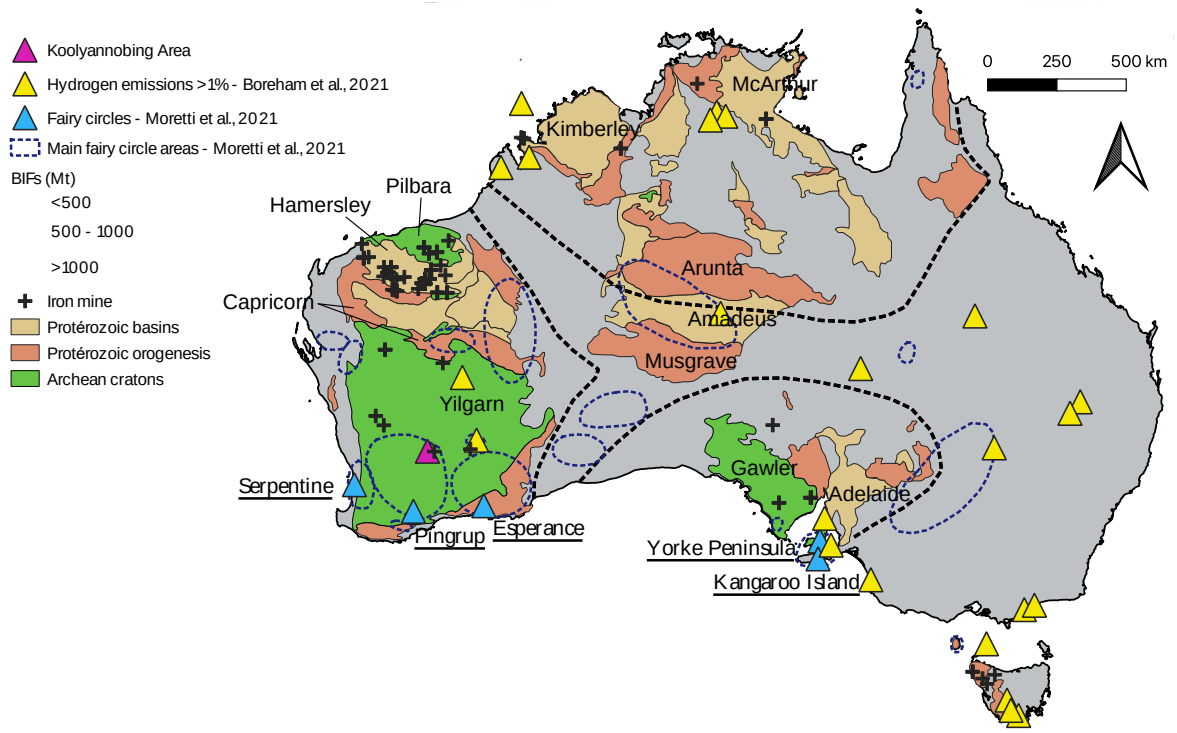

Figure 1: Simplified geological map of Australia and locations of the BIF and of the H2 emanations

References

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