Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24490

Enhancing Low-Temperature Hydrogen Production from Peridotites Using Electrical Reservoir Stimulation

JACOB NEWMARK[1], **VIKAS AGRAWAL**[1], ALEXIS S. TEMPLETON[1,2], JONAS TOUPAL[1], ALI TAROKH[1], LUCAS MEJIA[1] AND RAFAEL VILLAMOR-LORA[1]

[1]Eden GeoPower Inc.

[2]University of Colorado, Boulder

Presenting Author: vikas.agrawal@edengeopower.com

With increasing demand for hydrogen (H_2) in the industrial and clean energy sectors, geologic H_2 has become a source of interest for its potential as an untapped carbon-free energy resource. Much of this current effort focuses on recovery of natural H_2 produced through processes that include mafic and ultramafic serpentinization reactions, Fe(II)-bearing mineral oxidation, and water radiolysis [1-3]. Stimulating geological formations to generate H_2 by promoting serpentinization reactions of FeO-rich minerals by increasing the reactive surface area of these minerals provides a new avenue for accelerating geologic H_2 generation. A primary target for stimulated H_2 includes peridotites such as those of the Samail Ophiolite in Oman where analyses of deep hyperalkaline Ca^{+2}–OH^- groundwaters have detected µmol to mmol L^{-1} concentrations of dissolved H_2 [4]. Estimates suggest that peridotite rocks have the potential to produce 2-4 kg H_2 m^{-3} when completely oxidized, indiciating a significant potential for H_2 production and orders of magnitude above stimulation of other mafic rock types, such as basalt [5]. However, subsurface reservoirs are limited by existing permeability for promoting serpentinization processes. Eden's Electrical Reservoir Stimulation (ERS) technology provides a unique solution to enhance stimulated H_2 potential by increasing the permeability, surface area, and temperature of water/rock reactions.

In this study, we are conducting core scale experiments on peridotite from the Samail Ophiolite, replicating *in-situ* geologic conditions as well as different P-T conditions, to demonstrate the impact of ERS on the rates and extents of rock hydration and H_2 generation. Water/rock reactions are analyzed by characterizing the changes in rock properties, pore fluid chemistry, pH, conductivity, and amount of H_2 generated for optimized stimulation methods. Our research holds promise for unlocking the vast potential of geologic H_2 as a significant contributor to the transition toward a cleaner and more sustainable energy future.

[1] Truche *et al.*, (2018) *Earth Planet. Sci. Lett.* 493, 186-197. **[2]** Geymond *et al.*, (2023) *Front. Earth Sci.* 11. **[3]** Templeton *et al.*, (2024) *Front. Geochem.* 2. **[4]** Nothaft *et al.*, (2021) *J. Geophys. Res.: Biogeosci.* 126. **[5]** Osselin *et al.* (2021) *Nat. Geosci.* 15, 765-769.