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## The Geochemistry of Pure Minerals with Pure Hydrogen in Aqueous Solutions

Aliakbar Hassanpouryouzband, **Eike Marie Thaysen**, Mark Wilkinson, and Katriona Edlmann  
School of Geosciences, University of Edinburgh, Grant Institute, West Main Road, Edinburgh, EH9 3JW, UK  
(hssnpr@ed.ac.uk)

In alignment with the Paris Agreement, more than 120 countries have now committed to reaching net zero by mid-century. Among the future energy storage technologies required for limiting global warming to well below 2 °C, geological storage of hydrogen is considered as a strong candidate to support increased renewable electrification. It is therefore crucial to understand the impact of injected hydrogen on geochemical equilibrium in these geological storage settings. Here, we investigate the potential for hydrogen reactions with different pure minerals using our custom high pressure/temperature batch reactors. Minerals examined include Gypsum, Calcite, Dolomite, and two types of Pyrite. We conducted the experiments at high pressure and temperature conditions with simulated reservoir brine, representing real geological conditions. Moreover, we conducted control experiments with inert nitrogen to ensure confidence that any identified geochemical reactions are induced by hydrogen, rather than elevated, temperature, pressure or brine chemistry. Our results suggest that abiotic geochemical reactions are not likely to result in hydrogen loss within the time scales of geological hydrogen storage.