

Natural hydrogen exploration – State of knowledge and focus on the Intra-cratonic systems

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Abstract

Hydrogen directly coming from the Earth could represent an alternative source of decarbonized hydrogen and potentially provide the opportunity to rapidly scale up green hydrogen production for domestic use and export. Hydrogen can be naturally produced by various processes in the subsurface. We first propose to review the generation processes and elements of the hydrogen system through known case studies and focus on the intra-cratonic hydrogen occurrences that are not directly related to a mid-oceanic ridge system type. In this type of environment, the hydrogen is proposed to be mostly coming from water which is separated from oxygen by diagenetic process or by radiolysis. Since hydrogen is the most abundant element of the solar system, the degassing of large reserves of deep seated H₂ from the mantle or the Earth's core have been also proposed. The most well-known process is the oxidation reaction between water and ferrous sediments resulting in their transformation to the ferric state through the release of H₂. This process is the best candidate to explain high hydrogen flux measured above intra-cratonic surface depressions all over the world, such as in Brazil, Mali, United-States and Russia.

We will here provide an overview of natural hydrogen exploration in the world as well as the real rush toward natural Hydrogen exploration that is happening in Australia. In February 2021 the state of South Australia opened the doors to Hydrogen Exploration and as soon as September 2021 all the exploration licences have been applied to! Given that natural hydrogen exploration is quickly scaling up and has a potential to support energy transition for Australia and the global market, we need to unlock the natural hydrogen system with the best science, and we need to undertake a multidisciplinary approach, involving expertise from minerals, petroleum, groundwater systems and biology.