

## Tendencies and lacunae in the research of natural hydrogen

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In a review article published in *Earth-Science Reviews* I combined data and ideas on natural hydrogen from almost five hundred scientific publications and books (Zgonnik 2020). It presents for the first time perspectives on hydrogen from the literature of the former Eastern bloc with that of the West, including data from rare hardcopies and recent studies.

Despite the fact that natural hydrogen has mostly been studied in a fragmentary way, there are numerous examples of detections of hydrogen in nature. The review paper summarized and classified discoveries of hydrogen as a free gas in different environments, as inclusions in various rock types, and as dissolved gas in ground water. It has been detected in high concentrations, often as a major gas, in all types of geologic setting: sediments, metamorphic and igneous rocks, basement, orebodies and coal mines, oil and gas reservoirs and aquifers. This conclusively shows that hydrogen is much more abundant in nature than it was previously thought.

Possible mechanisms of hydrogen generation are critically reviewed, and hydrogen flux estimates are given for each mechanism when they were available. By adding up all the geological sources, the review article provides an updated estimate of the annual flow rate of geologic hydrogen of 23 Tg/year. This value is an order of magnitude greater than previous estimate, but most likely still not large enough to account for recently discovered worldwide diffusive seepages present on all continents.

The serpentinization is well studied mechanism of hydrogen generation and many articles are available on the subject. Until now, this mechanism was considered the main source of natural hydrogen. On the other hand, by doing the review it became clear that the deep-seated hydrogen (originating from the mantle and core of the Earth) is potentially much greater source of hydrogen in nature. It is very likely that large amounts of hydrogen have been stored inside the Earth since its formation, but the research is still limited.

Natural hydrogen takes part in a variety of natural processes. Testing for hydrogen can be used for the surveying of natural environments, for the monitoring and prediction of earthquakes, for mapping of faults and the search for minerals. However, this powerful tool is still not used for all its potential.

Hydrogen of geologic origin has the potential to become the renewable energy of the future, with exploratory projects ongoing at the present time.

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