Correlation between high-temperature geothermal energy andnatural hydrogen generation in the Asal Rift, Republic of Djibouti and in Iceland

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Hydrogen is an important energy source and could be an interesting alternative in the future. However, at present, this hydrogen is mainly produced by methane reforming, a process that emits CO2. Different alternatives exist: the use of a methane plasma torch, the electrolysis of green electricity and the production of natural hydrogen. The geological contexts suitable to produce natural hydrogen are ophiolites, Proterozoic intracratonic basins and oceanic ridges. Indeed, high H2 concentrations have been measured in the hydrothermal vents of oceanic ridges. This gas is, in part, the product of the serpentinization of ultrabasic or basic rocks. This reaction involves the oxidation of ferromagnesian minerals associated with a reduction of water, optimally between 250 and 300°C. Through this reaction the coupling of high temperature geothermal energy and hydrogen production could be significant. However, the conditions in deep oceanic environment seem to preclude a profitable economic production. Nevertheless, there are geographical areas where the coexistence with a mantle plume allows these ridges to emerge, like in Iceland or in the East African rift. In Iceland, geothermal energy is a major energy source. In the case of the East African Rift, the geothermal gradient is quite high too. In addition, in Iceland, the climate involves a regular meteoric water recharge while for the East African Rift and especially the Asal Rift (Republic of Djibouti) the climate is dryer, the recharge is made by the ocean. A high geothermal gradient at shallow depths, sufficient water recharge and a crustal production rich in ferromagnesian minerals could allow an interesting production of H2. Thus, the objective of this study is to discuss the origin of this gas in the Asal Rift and in Iceland. Then to illustrate the interactions between geothermal energy and the production of natural dihydrogen in the two previous cases.

Keywords: Hydrogen, Geothermy, East-African rift, Iceland

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