Natural Hydrogen systems in continental environment: Redox conditions and carbon interaction

A. PRINZHOFER[1] , J.B. FRANÇOLIN[2], AND I. MORETTI[3]

[1]GEO4U, R.J., Brazil (alain.prinzhofer@geo4u.com.br)
[2]GEORISK, Rio de Janeiro, Brazil (jfrancolin@gmail.com)
[3]ENGIE, Paris, France (isabelle.moretti@engie.com)

The occurrence of hydrogen has been known in oceanic environments (mid-oceanic ridges and slices of oceanic crust preserved in mountain chains), and more recently in the middle of continents in larger and easily producible amounts. Drilling success of four natural hydrogen exploration wells in Mali in 2017 around the initial discovery has drawn attention to future world industrial potential. The H_2 accumulations found originally looking for water in 1987 and was at shallow depths (100m) that means low drilling costs. The H2 is now burn to produce electricity. It seems that the most promising geological areas in continents are neo-Proterozoic rocks, with very low organic carbon content and reducing sedimentation conditions. It could be demonstrated that the presence of organic carbon reduces the time life of H_2, as it is almost immediately reacting with carbon to generate hydrocarbon compounds, mainly methane.

This paper will also discuss the production mechanisms that are likely involved in the process of hydrogen generation. The feasibility of hydrogen generation in geological settings involves two major sources of natural H_2: water reduction with ferrous iron as the reducing agent, and ammonium ions decomposition in metapelites, generating H_2 and N_2 in reducing environments. The proportion of N_2 (between 1 to 100%), correlated with high helium concentrations (up to 3%) would indicate the relative importance of ammonium decomposition as well as the Redox conditions in the kitchen of generation.