Hydrogen Emanations in Intracratonic Areas: New Guide Lines for Early Exploration Basin Screening

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Offshore the emission of dihydrogen is highlighted by the smokers along the oceanic ridges. On shore in situ measurements in ophiolitic contexts and in old cratons have also proven the existence of numerous H_2 emissive areas. When H_2 emanations affect the soils, small depressions and vegetation gaps are observed. These depressions, called *fairy circles*, have similarities with the pockmack and vent structures recognized for long time in the sea floor when natural gas escapes but also differences. In this paper we present a statistic approach of the density, size and shape of the *fairy circles* in various basins. New data from Brazil and Australia are compared to the existing database already gathered in Russia, USA and again Brazil. The comparison suggests that Australia could be one of the most promising areas for H_2 exploration, de facto a couple of wells already found H_2 whereas they were drilled to look for hydrocarbons. The sum of areas from where H_2 is seeping overpasses 45 km² in Kangaroo Island as in the York Peninsula. The size of the emitting structures, expressed in average diameter, varies from few meters to kilometers and the footprint expressed in % of the ground within the structures varies from 1 to 17%. However, globally the sets of *fairy circles* in the various basins are rather similar and one may consider that their characteristics are homogeneous and may help to characterize these H_2 emitting zones. Two kinds of size repartitions are observed, one with two maxima (25m and between 220m ± 25%) one with a simple Gaussian shape with a single maximum around 175 m ± 20%. Various geomorphological characteristics allow us to differentiate depressions of the ground due to gas emissions from karstic dolines. The more relevant ones are their slope and the ratio diameter vs depth. At the opposite of the pockmark structures observed on the seafloor for which exclusion zones have been described, the H_2 emitting structures may intersect and they often growth by coalescence. These H_2 emitting structures are always observed, up to now, above Archean or Neoproterozoic cratons; it suggests that anoxia at the time the sedimentation and iron content play a key role in the H_2 sourcing.

Mots-Clés : Natural hydrogen; Brazil; Australia; Russia, Gas escape

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