THE STATUS OF NATIVE HYDROGEN WITHIN THE DISSOLVED GAS MIX OF THE LORRAINE CARBONIFEROUS BASIN AQUIFER.

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Résumé

The Regalor (Ressources Gazières de Lorraine) research project aims at the estimation of gas resources in the Lorraine Carboniferous basin. This basin with its Saar-Nahe extension is one of the largest Carboniferous basins of Europe. While outcropping in Germany, the sedimentary formations are seated beneath the Mesozoic cover and reach a depth estimated to a maximum of 8km. The basin developed during the Variscan orogeny. It accumulated coal rich detrital fluvio-lacustrine sediments from early Pennsylvanian to Permian (ca 315-270Ma) in a strict continental context. Basin burial and thermal reconstruction indicate a maximum thermal maturity of coal reached during the end of Cretaceous, leading to gas generation. Coal bed methane is recognized as major natural gas resource.
The innovative SysMoG™ GH2ASBUSTERS system was used to monitor dissolved gas species and concentrations in aquifers from surface to 1250m in FOLS1A. Methane was recognized as the major constituent of dissolved gases. While it was absent at the shallowest depth (< 100m), the hydrogen content of the dissolved gas mixture increased regularly to reach 18mol% at 1250m. Experimental organic geochemistry and methane isotopic measurements determines that the dissolved methane observed at 1250m originates from a coaly source located at 3200m. The compositional evolution profile of hydrogen and methane with depth are different, suggesting separate sources. This implies that the dissolved gas composition observed in Fols1A may originate from the addition of hydrogen to methane generated at 3200m. The origin of hydrogen is yet unknown.
The discovery of significant hydrogen occurrence in the Lorraine Carboniferous basin represents a major shift in concepts. To our knowledge, until now, coal bearing strata have not been considered as capable of hosting a native hydrogen resource. While methane resources occurs as CBM, hydrogen resource occurs as dissolved gas. On the contrary to methane for which the coal generative potential is nowadays exhausted at depth > 4000m, the reaction mechanism hypotheses for hydrogen suggest the possibility of generation still active.

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Also, the perspective of hydrogen extraction from the aquifers would need completely new technological developments. All these aspects are research topics in the ongoing Regalor II project.

Mots-Clés: Native Hydrogen, Methane, gas, Carboniferous, Lorraine