

Development of a downhole sampler and an integrated analysis system for gas content determination in an aquifer fluid (major, noble gas and isotopic measurement). Application in situ on a geothermal well

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Considering the growing need of characterization and monitoring of deep fluids in several areas (geological storage of CO₂, geothermal energy, pollutants in groundwater), IFPEN has developed a downhole sampler and an integrated analysis system for in situ measurements of dissolved gas in fluid, representative of reservoirs conditions. This project has been conducted in the framework of the European SECURE project.

The field apparatus is composed of three main parts. A downhole sampler has been designed to sample aquifer fluids at reservoirs conditions, down to 3500 meter. A system transfer function with a specific pump allows to collect the dissolved gas and measure the Gas to Water Ratio (GWR). Then, the gas collected is analyzed on site with a portative micro gas chromatograph. These experimental results are used as inputs for the calculation of the dissolved gas at the aquifer conditions with a thermodynamic model based on Soreide Witson equation. Furthermore, additional measurements as isotopic or noble gases analysis can be conducted at the lab.

The entire device has been tested and validated on a geothermal well operated by the Swiss company SIG, in the Geneva basin. 5 samplings have been done from 800 m to 1361 m : field measurements showed an excellent repeatability of very low gas to water ratio (lower than 0,2) and of gas composition, mainly constituted of CH₄ and CO₂, with significant proportions of He, Ar and traces of H₂S, C₂H₆ and C₃H₈.

Hence, the first encouraging data results acquired and associated calculations are key results at this stage for a better understanding of the hydrogeology of the well. This set of data shows a gas arrival or gas accumulation at 800 m depth. The isotopic composition of methane done on the sample indicates a bacterial origin.