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Sulphur isotopes: a tool to understand the variations of chemical composition of deep waters
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Chemical composition of waters from deep aquifers reflects the interactions between waters and reservoir rocks. The determination of an accurate chemical composition of waters is thus necessary to identify the origin of this mineralisation. The water chemistry of the Infra-Molassic Eocene aquifer (Aquitaine Basin - France) has been investigated through different studies highlighting various origins for water mineralization. Isotopic analyses helped, in agreement with hydrogeology, to identify geochemical basins whose properties modify the chemical water composition (André et al., 2002; Douez, 2007).

However, if the chemical composition of waters from this deep aquifer (about 500 to 1000 m depth) does usually not change with time, seasonal variations of sulphate concentrations occur in a specific area. About 200 analyses of sulphate collected during more than 10 years show variations between 10 and 110 mg SO₄/L. These variations of sulphate concentrations are correlated with the water conductivity but they are anti-correlated with piezometric variations (reaching about 80 m per year) which are due to the seasonal storage of natural gas in the aquifer and are recorded about 30 km around the storage area. Several hypotheses are considered in order to explain these sulphate variations: mixing of waters from different aquifers, vertical transfers by advection or dispersion from the molasse aquitard, local biological processes...

This study uses both isotopic tracers (¹⁸O and ³⁴S of sulphates, ¹³C and ¹⁴C) and composition of trace elements (F, B, Ba, Sr...) in order to determine the origin of these variations. It will be based on existing chemical data but also on the acquisition of new ones. This chemical approach will be secondly coupled with a hydrological modelling of the specific area in order to understand the local behaviour of the aquifer (residence time, recharge processes, interaction with adjacent reservoirs/aquitards).