



## **Characterisation of the geochemical baseline of French groundwaters : isotopic constraints (Sr, N, S, O,...). Application to the large Jurassic aquifer (SW France).**

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One of the basic requirements of the European Water Framework Directive is the evaluation of the patrimonial state of groundwater quality. This task involves knowledge of the natural geochemical background of groundwater in order to detect chemical variations due to human activities, and to predict short-term and long-term water quality evolution. In this way, a methodology applicable to the French geological context, able to characterise the natural baseline of water chemistry, has been developed.

The proposed methodology therefore adopts a step by step strategy that takes into account the definition of groundwater bodies, the need to identify human pressure on the groundwater resources as well as the long-term quality objectives, fixed by the Water Framework Directive for groundwater bodies.

The methodology presented, allows to evaluate the geochemical background through three levels of application: (1) the *predictive* level, the aim is to assess the geochemical background of a region where water quality data are scarce, (2) the *subtractive* level, with the correction of the atmospheric and human inputs in order to estimate the geochemical baseline of an anthropised aquifer, and (3) the *prospective* level, the methodology assist in the optimal design of observation and monitoring networks.

The first step is collection of all available data (taking into account their representativity and their quality) , the methodology is based on the successive analyse of major, trace elements (available or new data) and the identification of the processes which may affect the initial geochemical signature of the aquifer (salinisation, leakage from over- and underlying aquifers, redox reactions at the limit of confinement and acid

mine drainage) which can be highlighted with the combined use of isotopic tracers (Sr, N and O of NO<sub>3</sub>, S, O, H, B, C, ...).

This approach has been applied to the middle and upper Jurassic aquifer in the south-west of France. These formations progressively sink from the surface up to 1000m deep. This multi-layer aquifer, mainly calcareous, can be divided in 3 compartments : unconfined groundwaters, confined ones, and confined groundwaters in a mineralised zone. Each compartment has been characterised, and a geochemical baseline for the groundwater is proposed according to the hydrogeological context. Strontium and sulphate isotopes have allowed to point out the leakage from two different compartments of the underlying Triassic aquifer (marl and carbonate). Nitrogen isotopes have identified the nitrate to be of agricultural origin. Oxygen, Tritium and 14-carbone have estimated the recharge to be very recent in the unconfined part of the aquifer and from late Pleistocene in the confined zone of the aquifer.