Dynamic of groundwater circulation and source of salinity in large sedimentary aquifers (Adour-Garonne district, SW France): Sulfate and Strontium isotopes constraints

EMMANUELLE PETELET-GIRAUD[1], PHILIPPE NEGREL[2], AGNES BRENOT[3], EILINE MALCUIT[4] AND ROMAIN MILLOT[5]

[1]BRGM, 45060 Orléans, France, e.petelet@brgm.fr
[2]BRGM, 45060 Orléans, France, p.negrel@brgm.fr
[3]BRGM Rhône-Alpes, 69626 Villeurbanne France, a.brenot@brgm.fr
[4]CFG Services, 45060 Orléans, France, e.malcuit@cfg.brgm.fr
[5]BRGM, 45060 Orléans, France, r.millot@brgm.fr

This study provides further characterization of the groundwater in a large sedimentary aquifer system that have been identified as being of primary importance and/or at risk in the Adour-Garonne district. As large water abstractions for human activities can induce complete modification of the natural functioning of such aquifer systems, e.g. with leakage between aquifer layers that can lead to water quality degradation, the characterization of such large system constitutes a key point to evaluate further deterioration and protect and enhance aquatic ecosystems. For that purpose, combined geochemical analysis, and two isotope systematics ($^{87}Sr/^{86}Sr$ and $\delta^{34}S$-SO4, $\delta^{18}O$-SO4) have been applied to one demonstrative aquifer systems: Eocene aquifer. The Eocene aquifer is made up of five aquifer systems: Paleocene, Eocene Infra-Molassic Sand, Early Eocene, Middle Eocene and Late Eocene with a mineralized area, north of the Aquitaine basin where the groundwaters show strong mineralization and anomalous levels of critical elements (SO_4, F…), leading to difficulties of resource exploitation. Extreme heterogeneity of geochemical composition and sulfate and Sr isotopic signatures of groundwater between the aquifers but also within a single aquifer are discussed in terms of lithological control induced by lateral variation of facies and interconnections between aquifers. Strong control of evaporite dissolution (both sulfate and halite) was evidenced in three domains in the Adour-Garonne district. Weathering of silicate and carbonate rocks has also been demonstrated to be partly responsible of the spatial variability of groundwater geochemistry within an aquifer. In addition to this strong lithological control, different relations between the Eocene Infra-Molassic sand aquifer and the other aquifers, depending on the part of the district, have been demonstrated.