Isotope studies and chemical investigations of hot springs from North-Eastern Algeria; Fluid-mineral interaction

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To improve our understanding of the origin of thermal water from North-Eastern Algeria, hydrochemical facies, isotopic characteristics to identify the major geochemical processes that affect water composition, for this purpose, a multidisciplinary approach was adopted, including hydrogeochemistry, isotope hydrology and principal component analysis (PCA).

Eleven samples collected from thermal springs in 2015 vary in temperature between 38 and 96 ◦C, a near neutral pH and very high values of electrical conductivity. Two groundwater types were identified: highly mineralized Na-Cl type representing the deep thermal waters and Ca-SO4 type determined the presence of evaporite deposits (Triassic) along the circuit of upwelling.

The application of IIRG method illustrates three rectangular configurations which the first corresponds perfectly to the standard diagram γ, indicating a deep circulation of fluids, second corresponding to water circulation through the evaporate sequences, and the last belongs to intermediate between the standard α and γ, due to possible mixing in thermal waters with surrounding groundwater.

The isotopic results (δ O18, δD) (respectively −9.95 to −7.72 ‰ and from −61.99 to −38.20 ‰) fall on the Global Meteoric Water Line (GMWL) indicate a meteoric origin of the thermal water (rains at higher altitude).

In order to know the state of fluid-mineral equilibrium, saturation index (SI) was used; the most of the thermal waters have Chalcedony and quartz near or slightly above the saturation limit for equilibrium. In present study, multivariate statistical method - Principal

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component analysis PCA - is used; PC1 (41%) explains the minerality, (ionic composition), for which temperature is of secondary importance PC2 (18%).