Geochemical characterization of mineralized groundwaters in the Aquitaine Basin (SW France): lateral and vertical variability of the Eocene formations, hydrodynamic and geochemical processes of acquisition of the mineralization.

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Section Heading: 22a. Tracing groundwater variability

In the sedimentary Nord Aquitaine Basin (SW France), the large Eocene aquifer, mostly confined, is one of the main resources for drinking water. In this aquifer, a large saline area has been identified, where the groundwaters show high values of mineralization and anomalous levels of critical elements, such as sulfates and fluoride, leading to difficulties of resource exploitation for drinking water supply. Geochemical and isotopic characterization of withdrawn groundwaters shows a common origin of the mineralization.

The Eocene aquifer formations include several geological layers, which have different lithological, mineralogical and hydrodynamic properties. Since the beginning of the century, many boreholes in the area for drinking water supply have locally modified the natural water flows of the system. Our investigation shows the need for a precise and detailed knowledge of the vertical distribution of the hydrodynamic and geochemical properties of each layer. Indeed, the average concentration in the borehole water depends on the centimetre scale variation of water fluxes and concentrations. Geochemical models fully explain the composition of groundwaters across the study area and improve the understanding of geochemical processes taking place at the borehole scale.

To understand the acquisition of the groundwaters' geochemistry, it is necessary to consider the lateral and vertical variations in facies and mineralogy, geochemical processes (mineral dissolution and/or precipitation, phenomenon of diffusion in contact with low permeability and mineralized layers) and local fluid mixing processes within the borehole and its immediate surroundings.

Cu-isotope systematic of magmatic PGE-Cu-Ni sulfide ores from the Talnakh and Kharaelakh intrusions, Noril'sk Province (Russia)

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We have undertaken for the first time the examination of the Cu isotope composition of primary high temperature Cu-Ni sulfide ores from world-class PGE-Cu-Ni sulfide deposits associated with the economic Talnakh and Kharaelakh intrusions and native copper ores from the Noril'sk Province (Russia). Copper isotope ratios are reported as $\delta^{65}Cu‰=((^{65}Cu/^{63}Cu_{sample}/^{65}Cu/^{63}Cu_{NIST\ 976\ standard})-1)$ x 10^3. The isotope measurements were carried out with an MC ICP-MS (ThermoFinnigan Neptune) using sample-standard bracketing as outlined by Larson et al. [1].

Main set of samples of this study form three major $\delta^{65}Cu$ clusters that well match $\delta^{65}Cu$ signatures of two distinct reservoirs as defined for iron meteorites and carbonaceous chondrites, respectively [2-4]. The mean $\delta^{65}Cu$ value of massive sulfide ores at Talnakh forms the first cluster around zero ‰ (-0.1 ± 0.15 ‰, respectively), close to the $\delta^{65}Cu$ signatures of the Bulk Earth and iron meteorites. Similarly, the mean $\delta^{65}Cu$ value of disseminated sulfide ores at Talnakh forms the second cluster around –0.7 ‰ (–0.7 ± 0.4 ‰), matching that of the carbonaceous chondrites. The third cluster with the mean $\delta^{65}Cu$ values, represented by massive and disseminated ores of the Kharaelakh intrusion (-1.52 ± 0.24 ‰ and -1.6 ± 0.4 ‰, respectively) lie very close to the light-isotope end of the $\delta^{65}Cu$ range expressed by the carbonaceous chondrites. A $\delta^{65}Cu$ value measured in a sample and a replicate represented by native copper from the Arylakh deposit of the Noril'sk Province gave indistinguishable result of -1.9±0.15 ‰.

The determined $\delta^{65}Cu$ variability is interpreted to represent a primary signature of the ores, though a magmatic fractionation of copper isotopes and/or assimilation of the ore material from external source (in case of the Kharaelakh ores) can not be ruled out.

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[1] Larson *et al*. (2003) *Chemical Geology* **201**, 337-350.
[2] Luck *et al*. (2003) *GCA* **67**, 143-151.
[3] Luck *et al*. (2005) *GCA* **69**, 5351-5363.
[4] Wasson & Choi (2003) *GCA* **67,** 3079-3096.