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Water chemistry at Hontomín-Huermeces (Burgos, Spain): insights for a pre-, intra- and post-CO₂ injection geochemical monitoring.

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In this study, the very first geochemical and isotopic data related to surface and spring waters and dissolved gases in the area of Hontomín-Huermeces (Burgos, Spain) are presented and discussed. Hontomín-Huermeces was selected as a pilot site for the injection of pure (>99 %) CO₂. Injection and monitoring wells are planned to be drilled close to 6 oil wells completed in the 1980's. Stratigraphical logs indicate the presence of a confined saline aquifer at the depth of about 1,500 m into which less than 100,000 tons of liquid CO₂ will be injected, possibly starting in 2013. The chemical and isotopic features of the spring waters suggest the occurrence of a shallow aquifer having a Ca²⁺(Mg²⁺)-HCO₃⁻ composition, relatively low salinity (Total Dissolved Solids ≈800 mg/L) and a meteoric isotopic signature. Some spring waters close to the oil wells are characterized by relatively high concentrations of NO₃⁻ (up to 123 mg/L), unequivocally indicating anthropogenic contamination that adds to the main water-rock interaction processes. The latter can be referred to Ca-Mg-carbonate and, at a minor extent, Al-silicate dissolution, being the outcropping sedimentary rocks characterized by Palaeozoic to Quaternary rocks. Anomalous concentrations of Cl⁻, SO₄²⁻, As, B and Ba were measured in two springs discharging a few hundreds meters from the oil wells and in the Rio Ubierna, possibly indicative of mixing processes, although at very low extent, between deep and shallow aquifers. Gases dissolved in spring waters show relatively high concentrations of atmospheric species, such as N₂, O₂ and Ar, and isotopically negative CO₂ (<-17.7 ‰ V-PDB), likely related to a biogenic source, possibly masking any contribution related to a deep source. The geochemical and isotopic data of this study are of particular importance when a monitoring program will be established to verify whether CO₂ leakages, induced by the injection of this greenhouse gas, may affect the quality of the waters of the shallow Hontomín-Huermeces hydrological circuit. In this respect, carbonate chemistry, the isotopic carbon of dissolved CO₂ and TDIC (Total Dissolved Inorganic Carbon) and selected trace elements can be considered as useful parameters to trace the migration of the injected CO₂ into near-surface environments.