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Reconstitution of the local tectonic and geodynamic history to study the fluid transfers in a carbo-gaseous aquifer (Quezac-Southern Massif Central France)

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A multidisciplinary approach taking into account remote sensing, geological, and hydrogeological analyses was developed to reveal the water percolations history through time in the Quezac aquifer (Southern Massif Central - France). Detailed field measurements of the various tectonic joints, water and gas transfers were done in the study site. Microtectonic measurements confirmed the local tectonic history and the structural map was completed by a morphostructural approach, using detailed photointerpretation of both Digital Elevation Model and aerial photographs. The past fluid transfers were discussed from mineralization, the sediment deposits and the deduced tectonic history. To resume, the present fluid transfers observed in the field were related to four main tectonic joints groups, noticed by the tectonic and morphostructural approach. The history of tectonic constraints, geodynamical context and fluid transfers was finally reconstituted. It shows the major role of the N-S tectonic joints for water flows, followed by E-W ones, due to their longest karstification history. The NW-SE and NE-SW orientations, more recently karstified, appeared to have less influence on water transfers. The weak gas production at the surface of N-S faults is probably due to its dispersion linked to their intense karstification. This innovative multidisciplinary approach leads to propose a model for the present water and gas preferential flow paths, taking precisely the local tectonic and geodynamic context into account.