Fluid circulations and iron oxides associated on cataclastic deformation Bands in porous sandstones, Bassin du Sud-Est, Provence, France: New insights from rare earth elements geochemistry

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Present day mining exploration readdresses the old problem about the control of cataclastic deformation bands (CDBs) on fluid flow, which is still debated in petroleum research. CDBs are common structures in porous sandstones [1]. These structures are tabular zones of finite width that have experienced grain rotation, crushing, cataclasis or cementation and they correspond to the localization of strain in porous rocks.

Field and laboratory measurements exhibit evidence of porosity reduction in the CDBs (ratio of ½ to ¼ of the host rock porosity) and that the CDBs permeability is significantly reduced by one to six orders of magnitude relative to the host rock [2].

In fluid saturated rocks, CDBs seem to behave like transient barriers, whereas in unsaturated rocks, their effect on fluid flow is not clear. In the vadose zone, a barrier effect was observed for paleofluids [3] whereas laboratory tests suggest that CDBs could be capillarity conduits [4]. In this work, we try to further understand and find field, mineralogical and geochemical evidences for CDBs behavior.For that, we examine the spatial distribution of oxidation fronts and CDBs in the porous sandstones of Bedoin (SE France) to discuss interaction between fluid flow and CDBs in the vadose zone. It appears that the oxidation fronts underline preferential pathways for the ground water, and CDBs seems to constitute a trap where the oxides contained in the fluid accumulate. The rare earth element (REE) patterns show a decreasing slope from light REE to heavy REE, and europium or cerium anomalies, which provides information about the oxidating fluids.

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