Geophysical Research Abstracts
Vol. 16, EGU2014-6263, 2014
EGU General Assembly 2014

Brittle structures in porous sandstones, south central Pyrenees, Spain: field characterization and impact for fluid flow.

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In order to better constrain fluids flow circulations in the continental crust, understanding evolution of fault geometry and hydromecanical properties is essential. The knowledge of faulting in analogous reservoirs is particularly important in silicoclastic context. Indeed the high value of natural porosity and the impact of faulting on porosity and permeability will generate potential reservoirs. Depending on the type of faults, deformation in sands and sandstones reservoirs can produces barriers or conduits for fluids.

This study focused on an silicoclastic analogous reservoir localised in south central Pyrenees (Spain), named the Aren group, where deformation is recorded by different type of faults. The Aren group is located on the front of the Boixol thrust, on the southern side of the San Corneli anticline. The outcrops are localised in 3 different area, comprised between the towns of Aren, Tremp and Isona. Depending of the outcrop, we identify presence of veins, joints, deformation bands (DBs) and some few sites where both of them are recorded in the same unit. We present a complete field study, based on two different field mapping methods : (i) field photomosaiques and associated detail 2D mapping ; (ii) linear scanlines along deformed outcrops. These two different methods, applied around ten outcrops allow us to obtain : (1) 30 meters squares of 2D detailed maps of fractures and linkage information ; (2) 90 linear meters of fracture density vs. distance all along the outcrop for each type of fracture. Field measurements and quantification was completed by a systematic sampling, in order to give an access to (i) microtectonic elements and fine characterisation of the different fault types by SEM observations ; (ii) a porosity quantification of host rock and fault zones based on the SEM pictures.

Field data shows a strong relationship between the different types of brittle structures. On the Aren outcrop, fine DBs (wich act as barriers) are located in clusters or patches. Later joints or veins (wich act as conduits) are located only on the sides of the DBs patches, due to a difference of rock mechanical properties between host rock and deformed rocks.

These detailed analytical methods demonstrate the evidence of different type of deformations and can allow us to determine the corresponding controlling factors and evidence of thes factors on localisation processes. These geological factors are essential for determine the bulk permeability of the reservoir, by understanding the growing process for obtain conduits or barriers. In addition, a future work could show some evidence for a transition in growth mechanisms from the deformation bands to the joints, and especially to the mode I cracking process.