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Fracture patterns and controlling factors in porous sandstones, south central Pyrenees, Spain

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

In this contribution, we 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 areas, comprised between the towns of Aren, Tresp and Isona. Depending of the outcrop, we identify presence of joints, deformation bands 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 photomosaics 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.

These detailed analytical methods demonstrate the evidence of two different type of deformation and can allow us to determine the corresponding controlling factors. 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.