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Study of cataclastic deformation in compressive tectonic regime of a sandstone from south central Pyrenees, Spain: Timing of deformation bands occurrence during burial history and comparison with geomechanical models.

Romain Robert (1), Philippe Robion (1), Christian David (1), Pauline Souloumiac (1), and Elodie SAILLET (2)

(1) University of Cergy-Pontoise, 1 rue Descartes, Neuville-sur-Oise, France , (2) Institut Polytechnique Lasalle Beauvais, 19 rue Pierre Wagué, Beauvais, France

In high porosity sandstone lithologies, deformation bands (DBs) are characterized by changes in micro-structural characteristics inducing a localized change in the petrophysical properties of the rock. These DBs, which are generally tabular structures from millimeters to few centimeters thick, can be used at the field scale to decipher extensional or compactional tectonic regime. However, numerous parameters in addition to the tectonic regime may affect development of DBs, and particularly the evolution of porosity during burial history. The aim of this work is to understand the relationship between the DBs occurrence in tectonic shortening regime and the timing of grain cementation that occurs during burial for an analogue to siliciclastic reservoir.

For that purpose, we have focused our analysis on the Aren syn-tectonic sandstone formation, Maastrichtian in age, localized on the front of the Boixols thrust, on the southern side of the Sant Corneli anticline, in the south central Pyrenees (Spain). The outcrops are localized in the Tremp-Graus basin, all along a 30 km East-West trend where 10 different sites, in which deformation bands are observable, have been investigated and sampled. The structural geometry of the basin is constrained with 3 serial N-S oriented cross sections showing an increase of the shortening from West to East.

Our field work strategy was to, 1) measure the orientation of the DBs in each site, 2) take cores both within the DBs and the host rock to conduct systematic thin section investigations, and 3) take oriented cores in order to study the magnetic fabric giving informations on the internal deformation linked to a set of deformation band and regional N-S shortening.

Field data show a minimum of two sets of DBs on each site with variation of orientations and densities. These DBs are perpendicular to the strata which prove their early occurrence, recording the initial stages of local deformation and evolution of the Boixols fold and thrust.

At the microstructures scale, DBs are characterized by grain crushing with hertzian fractures associated with pore collapse. All these evidences allow us to define these structures as compaction bands. Further microscopical investigation, grain size distribution and initial porosity are determined by image analysis. These data are confronted to geomechanical models in order to investigate the relationship between the occurrences of DBs in the burial history and the diagenesis of the rock during the compressive event.