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Evolution of brittle deformation and fault growth in a high porosity sandstone analogue from the Cretaceous of the Bassin du Sud-Est, Provence, France

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Fluid circulation in the crust and in particular hydrocarbon migration in reservoirs is highly dependant on fault geometrical and hydromechanical properties. Understanding the evolution of these properties during fault growth and network development is of major importance in fluid flow prediction. This question is important for high porosity sandstone, where brittle deformation is expressed by cataclastic deformation bands (CDBs). CDBs which affected high porosity sandstone induce a significant permeability reduction, which poses problems for hydrocarbon production in faulted reservoirs.

This contribution is based on quantitative data of CDBs, obtained on a structural reservoir analogue in the Bassin du Sud Est (Provence, France). Very good quality outcrops of Cretaceous porous sands and sandstones allow us direct characterisation and quantification of deformation of these reservoir analogues. For each outcrop, the position of all visible CDBs was recorded along 1m wide scan-lines perpendicular to the main structures and through their damage zones. A total scan-line length of 717 metres has so far been recorded. All the data collected show the predominance of thin CDBs of small displacements, with 80% of the structures having thicknesses less than 2 cm. Larger faults (offsets $> \sim 1$ m) are also present, with different structural characteristics to the small CDBs. The larger faults contain very fine, ultracataclastic fault rock, have lower thickness / displacement ratios and seem to represent zones of much more extreme deformation localisation. The changing correlation between thickness and displacement from CDBs to larger ultracataclastic fault zones suggests a scale and/or time dependant transition in deformation mechanisms during fault growth. Although

the reason for the transition in growth mechanism is not yet clear, large faults form preferentially in contexts where a previous generation of CDBs already exists, suggesting the influence of previous structural heritage on further fault network growth.

Key words: Reservoirs, Porous sandstones, Cataclastic Deformation Bands (CDBs), Bassin du Sud-Est.