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Fabric evolution and permeability characterisation of extensional fault zones developed in the poorly lithified sandstones of the Barreiras Formation, Icapui area (NE Brazil)

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The final fabric in fault core rocks is the result of particle comminution and granulation, rolling, and grinding. In the surrounding damage zones, deformation is dominated by fracturing dictated by dynamic and kinematically-induced stresses. As a result of such a structural architecture, a fault zone is typically characterised by a double contrasting zoning in fluid circulation. Commonly, the fault core is characterised by a significant permeability decrease across the fault. On the other hand, an increase of permeability parallel to the fault plane characterises damage zones. In clastic sequences, large scale faults can compartmentalise reservoirs by juxtaposing units with different permeability properties and/or by the development of fault rocks. We studied the internal structure, particle size properties and permeability evolution of extensional faults developed in poorly to unconsolidated sandstones located in the Northeast Brazilian coast (Icapuí area). Particle size distribution analyses show that faulting produced a decrease of the average particle size in the fault core rocks with increasing fault displacement. This caused an increment in silt and residual clay-size fractions. Accordingly, the increase of fault displacement causes a corresponding increase of the fractal dimension in the fault core rocks. Permeability measurements in damaged and undamaged rocks showed that permeability increases in the damage zones and decreases in the fault cores of extensional faults.