Geophysical Research Abstracts,
Vol. 11, EGU2009-2217, 2009
EGU General Assembly 2009

Dilatant damage zones in faulted, poorly lithified low-porosity sandstones of the Barreiras Formation, NE Brazil

F. Balsamo (1), F. Storti (1), F. Salvini (1), A. T. Silva (2), and C. C. Lima (2)

(1) Università degli Studi Roma Tre, Dipartimento di Scienze Geologiche, Roma, Italy (balsamo@uniroma3.it, +39 06 57338201), (2) Cenpes, Petrobras, Rio de Janeiro, Brazil

We present results of structural and petrophysical investigations on eight extensional fault zones developed at shallow burial depth in low-porosity (<10%), quartz-dominated sandstones of the Barreiras Formation, NE Brazil. The studied fault zones generally show a broad spectrum of structures and deformation mechanisms which mainly encompass: (1) dilatant granular flow and intergranular tensile microcracks in fault damage zones with negligible development of cataclastic deformation bands; (2) non-destructive particulate flow up to cataclastic flow in fault cores. Compared to the undeformed host sandstone, shear-induced dilation in fault damage zones significantly increases bulk porosity, pore size and hence permeability, while cataclasis in fault cores progressively reduces the mean grain size, porosity and permeability.

Such a contrasting conduit/barrier behaviour is rather anomalous for faults developed in poorly lithified sandstones which are typically characterised by deformation band faulting. In particular, faulting in high-porosity (>10-15%) sandstones and loose sediments typically starts with progressive development of deformation bands, zones of deformation band and, with increasing offset, discrete slip surfaces. Extensive development of low permeability cataclastic deformation bands in fault damage zones significantly reduces fault transmissibility, thus providing an effective barrier to fluid flow.

Our data provide further supports to the importance of initial porosity in deforming granular material to determine the final hydraulic behaviour of fault zones, as well as the progressive changing of rheological conditions induced by diagenetic processes.