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Structural architecture and petrophysical properties of the Rocca di Neto extensional fault zone developed in the shallow marine sediments of the Crotone Basin (Southern Apennines, Italy).

Mattia Pizzati (1), Fabrizio Balsamo (1), Paola Iacumin (2), Rudy Swennen (3), and Fabrizio Storti (1)

(1) NEXT, Natural and Experimental Tectonics Research Group, Department of Chemistry, Life Sciences, and Environmental Sustainability, University of Parma, Italy., (2) Department of Chemistry, Life Sciences, and Environmental Sustainability, University of Parma, Italy., (3) K.U.Leuven, Department of Earth and Environmental Science, Leuven, Belgium.

In this contribution we describe the architecture and petrophysical properties of the Rocca di Neto extensional fault zone in loose and poorly lithified sediments, located in the Crotone forearc basin (south Italy). To this end, we combined fieldwork with microstructural observations, grain size analysis, and in situ permeability measurements. The studied fault zone has an estimated maximum displacement of 80-90 m and separates early Pleistocene age (Gelasian) sands in the footwall from middle Pleistocene (Calabrian) silty clay in the hangingwall. The analysed outcrop consists of about 70 m section through the fault zone mostly developed in the footwall block. Fault zone consists of four different structural domains characterized by distinctive features: (1) <1 m-thick fault core (where the majority of the displacement is accommodated) in which bedding is transposed into foliation imparted by grain preferential orientation and some black gouges decorate the main slip surfaces; (2) zone of tectonic mixing characterized by a set of closely spaced and anastomosed deformation bands parallel to the main slip surface; (3) about 8 m-thick footwall damage zone characterized by synthetic and antithetic sets of deformation bands; (4) zone of background deformation with a few, widely-spaced conjugate minor faults and deformation bands. The boundary between the relatively undeformed sediments and the damage zone is not sharp and it is characterized by a progressive decrease in deformation intensity. The silty clay in the hangingwall damage zone is characterized by minor faults. Grain size and microstructural data indicate that particulate flow with little amount of cataclasis is the dominant deformation mechanism in both fault core rocks and deformation bands. Permeability of undeformed sediments is about 70000 mD, whereas the permeability in deformation bands ranges from 1000 to 18000 mD; within the fault core rocks permeability is reduced up to 3-4 orders of magnitude respect to the undeformed domains. Structural and petrophysical data suggest that the Rocca di Neto fault zone may compartmentalize the footwall block due to both juxtaposition of clay-rich lithology in the hangingwall and the development of low permeability fault core rocks.