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Spatial and dimensional variations of the faults and fractures attributes, and their influence on the permeability of the Cretaceous platform carbonates in Val D'Agri, southern Italy

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The structural architecture of fault zones in tight (e.g. cohesive, slightly porous) carbonate rocks includes highly fractured and fragmented sectors (damage zones) encompassing cataclastic bodies where most of the fault displacement is localized (fault cores). The typical dual component structural architecture of fault zones is replicated by the hydraulic one: both porosity and permeability significantly increase in the damage zone, while the fault core behaves as a fluid barrier. The control exerted by the structural fabric on the hydraulic behavior of fault zones is well evident in the directional permeability. For instance, in the case of normal fault, the permeability of the damage zone increases in the direction parallel to the fault core and decreases across the fault. The high-angle faults system that affects the Appeninic platform carbonates cropping out in the Val d'Agri area is composed of a main WNW trending, left-lateral, strike-slip fault set and several associated secondary faults: N20-30E trending right-lateral/transtensional, N90-110E trending left-lateral/transtensional and N130-150E trending left-lateral/transpressional. Even if these faults are characterized by different dimensional parameters (i.e. length and displacement) and architecture (i.e. fault core and damage zone thickness), qualitative classifications relative to the hydraulic properties of fault zones suggest that both types of faults (strike-slip and normal) could act as conduits for subsurface fluid flow. In order to compute the relative permeability between the host-rock and fault zones, as well as to evaluate the hydraulic properties of both strike-slip and normal faults, a Discrete Fracture Network (DFN) model was constructed using the software MOVE. The results are consistent with directional variations of the permeability, which is related to fracture orientation, interconnectivity and length.