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Growth history of syn-sedimentary extensional faults in poorly lithified sediments of the Tarquinia basin, Italy

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Outcrop scale extensional faults affecting poorly lithified Pliocene sandstones are well exposed in the Tarquinia basin, north of Rome. Syn-sedimentary faulting is indicated by along- and across-strike sediment thickness variations in the fault hanging walls. The major fault segments in the study area are 30-40 m in length, with an average spacing of 5-15 meters. They strike NW-SE to E-W and are partially overlapped both along and across strike. In some cases, major fault segments are connected by breached relay ramps, indicating a transition from soft- to hard-linkage. Estimated displacements never exceed 15-20 m. Slikenlines on fault planes shows pure dip-slip sense of motions. Fault damage zones are few meters wide and include subsidiary synthetic and antithetic extensional faults, deformation bands and joints. At lateral fault tips most displacement is accommodated by subsidiary faults and deformation bands, while well cemented slip surfaces accommodate most displacement in the central sectors of the fault zones. Sub-vertical joints systematically occur in the footwall damage zones. The anisotropy of magnetic susceptibility (AMS) shows that K_1 orientations along transects perpendicular to a major fault zone are consistent with the stretching directions inferred from faults data.

Based on structural and AMS data we propose a evolutionary model for normal fault growth developed in poorly lithified sediments which involves the occurrence of fault parallel stretching during lateral fault propagation and consequent jointing near perpendicular to the fault strike. The proposed evolutionary pathway has been validated by numerical-analytical modelling (FRAPtre). The occurrence and timing of fault-parallel stretching and related deformation has a considerable impact on the perme-

ability properties of normal fault zones and on the evolution of permeability anisotropy through time.