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Interactions between deformation bands, stylolites and sheared stylolites in fault development in carbonate grainstones: a case study from the Maiella mountain, central Italy

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In this study we show, through detailed mapping integrating with microstructural and textural analyses, the role of deformation bands, stylolites and sheared stylolites in faults development in the porous carbonate grainstones of Cretaceous age cropping out in the Majella Mountain.

In this area, we have identified three major processes which played a role in fault development: (i) strain localization; (ii) pressure solution and (iii) shearing of pressure solution products, that is, shearing of stylolites. The structures related to the first process include narrow bed-parallel compaction bands, and five sets of compactive shear bands which are characterized by a particulate flow mechanism involving grain rotation, translation and pore collapse. The products of the pressure solution process include one set of bed-parallel stylolites, and five major sets of stylolites, each overprinting the earlier individual sets of compactive shear bands. The shearing of these stylolites produces secondary and tertiary sets of stylolites oblique to the compactive shear bands. The sheared stylolites contribute to reduce the grain size and to form a cataclastic narrow zone within the band. A plot of slip vs. thickness, for the exposed faults, shows that larger slip values correspond to faults with associated sheared stylolites and cataclastic fault rocks.

Our study also show, however, that the transition from one deformation process to the others poses some intriguing, still unanswered, questions about: (i) material prop-

erties variations within the bands, (ii) structural anisotropy, resulting from the above changes, and (iii) possible variations in the orientation and magnitude of local stress conditions.