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Particle size distribution of fault core rocks: the role of pre-existing flaws and cleavage during ultrasonic treatment in laser-aided analytical procedures

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Fault core rocks (i.e. breccia, gouge, cataclasites) form by progressive fragmentation, crushing, chipping, sliding, rotation and grinding of rock particles during faulting. Their occurrence and spatial distribution exerts a primary control on the mechanical strength and permeability properties of fault zones. Particle size distributions provide fundamental information for studying deformational mechanisms during brittle faulting because they can be related to specific fragmentation processes and to the intensity of comminution. The use of laser-aided analytical techniques provides the possibility to easily broaden the size range of poorly coherent fault core materials and to increase the sampling detail because of the small quantity of analysed material. Ultrasonic mobilisation of disaggregated particles is commonly included in the analytical method of laser-aided particle size analysis, to facilitate and optimise laser activity. However, ultrasonic treatment may influence the resulting particle size distribution because of collision-induced particle fragmentation. Such fragmentation is facilitated by the presence of intragranular flaws and cleavages that can be exploited as preferential micromechanical discontinuities during particle collisions. To investigate the sensitivity of particle size data to the use and timing of ultrasonic particle mobilisation, we performed specific test analyses by systematic varying the duration of ultrasonic particle mobilisation preceding laser activation. These test analyses were carried out on fault core rocks developed in both carbonate platform rocks and quartz-rich clastic rocks faulted in soft-sediment conditions. Results of these tests indicate a

significant sensitivity of particle size distribution data to ultrasonic mobilisation, thus questioning the meaning of many published datasets obtained by laser-aided analyses.