EXPERIMENTAL EVIDENCE FOR UNIVERSALITY OF THE LOCALIZATION PROCESS LEADING TO ROCK FRACTURE, UNDERSTOOD AS A CRITICAL PHENOMENA.

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Some features of the localization process that leads a rock under compression to macroscopic failure are reminiscent of critical phenomena: localized microcracking creates geometrical structures up to a certain length scale above which there is no more local order. The length scale and geometry of these structures evolve during loading, up to peak stress, where one of those structures forms a band through the rock sample, inclined relative to the major stress axis, and along which the sample will ultimately fail. Such bands diverge at peak stress, and break the rotational and translational symmetry of the imposed stress. This encourages attempts to explain the band formation as a continuous phase transition with major stress τ_1 as a control parameter. One expects the physical properties sensitive to these structures to scale in the neighborhood of the peak stress τ_{1c} as a power-law of the control parameter. One can show that the compressibility of rock exhibits such a scaling law $(\tau_1 - \tau_{1c})^{-\gamma}$ over at least a decade. Using laboratory data from a wide variety of rocks, with inter or intragranular microscopic breaking, we show that universality of the γ exponent is reasonable up to experimental resolution with $\gamma = 0.36 \pm 0.08$.