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Quantifying Fault Rocks and Deformation: Advantages of combining Grain Size, Shape, and Mineral Phase Recognition Analyses

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Granular material from a fault and a clastic dike in granodiorite at the NW contact zone of the Hornelen basin has been compared by a new digital image analysis technique to extract size and shape characteristics for individual phases.

Particle size distributions measured in both samples are consistent with shear fracturing. However, the shape characteristics of the two samples are distinct. The granular material from the dike shows no clear shape-size correlation. In contrast, the granular material from the fault shows a systematic shape-size correlation (smaller grains being circular and smoother) suggesting a shift in deformation mechanism from fracturing to abrasion with decreasing grain size. Similarly, field observations, petrography, and the shape and texture of epidote indicate repeated faulting events. Field and textural observations combined with grain size and shape characteristics indicate that the dike sample has a mixed origin. Granulation in fractures connecting to the dike indicates mechanical deformation, while flow structures, texture, grain shape, and high content of epidote in the dike itself suggest that fluids from the basin have been present.

Our results show that combined size, shape and phase recognition analyses can reveal quantifiable differences in granular material associated with a fault and clastic dike. Hence a distinct origin of these materials is interpreted.