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Deformation bands in poorly cemented clastic sediments: Effects of grain size and diagenesis on band fabric

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Deformation bands were analyzed in poorly cemented silt, sand, and gravel from localities in Austria and California to assess depositional and diagenetic controls on their mode of deformation. Shear deformation bands in poorly cemented, high-porosity sediments are generally characterized by the rotation of elongate grains parallel to the band orientation. On macroscopic and microscopic scale, grain breakage is restricted to softer lithologies or may be totally absent.

In sand-sized samples, we determined a higher proportion of silt-sized grains within deformation bands, resulting in positive outcrop relief of bands. Shear deformation bands in gravels do not show a positive relief, but are recognizable by the rotation of elongate pebbles. In silts, deformation bands appear as darker bands that are about 1-3 mm wide forming anastomosing arrays. Relations of band thickness to grain size indicate that band thickness scales linearly with grain size over three orders of magnitude.

The observations indicate that shear deformation bands in poorly cemented clastic sediments under shallow burial conditions (<300-500 m) involve grain translation, reduction in porosity, and grain rotation, with only minor or no grain fracturing, distinguishing these particulate deformation bands from cataclastic deformation bands in cemented rocks deformed under greater burial depth.