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Pattern and Development of Deformation Bands Near Strike-Slip Fault Junctions

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Deformation bands (DBs) are an important class of strain localization in porous granular materials. Here we report observations of cataclastic DBs formed in Navajo Sandstone from the Sheets Gulch area of the San Rafael swell of southeastern Utah. Two mutually cross-cutting orientations of DBs located between the junctions of four faults (of similar orientations to the DBs) consistently lack slip surfaces, unlike the bounding faults that have them. The DB array defines an intermediate principal strain axis rotated 20° to the southeast from bedding normal, consistent with early strike-slip deformation banding, faulting, and bedding rotation within the thrust fault stepover beneath the Waterpocket monocline. Subequal and synchronous development of both orientations (S68°W, 63° and S18°W, 62°) of DBs in the area suggest that neither set is older and dominant, which is inconsistent with DB formation at a strike-slip stepover. Further, the bounding faults define a nearly orthogonal network instead of an echelon array. Instead, the DB array may represent an exposure of broad-scale strain-hardening between larger-displacement strike-slip faults consistent with block rotations and macroscopic (regional-scale) flow as the monocline grew.