Fault block rotation and strain in transtension

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Transtension generates noncoaxial constriction and poses difficult problems of wrench/normal fault-combination block rotation in the brittle regime. Normal faults rotate around vertical and horizontal axes and wrench faults around vertical axes.. All faults, except those that are vertical and parallel with the zone boundary (line of no infinitesimal strain) or the transport direction, rotate either with or against vorticity.,. Kinematic problems arise because blocks of varying size and shape bounded by normal and wrench faults rotate at different rates about vertical and horizontal axes while shortening or lengthening. This causes serious compatibility problems between adjacent blocks that may be solved by block margin deformation, by bulk block strain, by buckling of faults, by volume increase with holes opening at block intersections, by alternating periods of normal and wrench faulting, by discrete arrays of normal and wrench faults, or by a combination of some or all of these If domains of conjugate wrench faults form on surfaces of maximum shear stress, and rotate in opposite senses to minimum shear/normal stress ratios, fault slip and block rotation cease, and new faults must form if bulk deformation continues. Three major compatibility problems arise, the zone shortens parallel with its boundary, widens by different amounts for each domain, and, if the normal fault blocks remain rigid the zone lengthens then shortens. Alternatively, if the conjugate wrench faults are rotated as "passive" markers to maintain complete compatibility of zone length and width, the blocks change shape, involving substantial internal deformation. Although the bulk instantaneous strain/stress field determines the wrench/normal fault regime at infinitesimal or very small strains, compatibility dictates their rotation, slip-sense, buckling and intersection relationships. Therefore, slip directions and senses and stress patterns are dictated by block rotation and, as faults lock at unfavorable intersections and orientations, new fault systems increase fracture penetration to decrease block size. This implies an increase in fracture porosity and fluid flow in contrast to simple, orthogonal extension