

The mechanics of splay faulting

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First order splay faults, as defined here, are secondary faults that form at acute angles symmetrically on either side of a primary fault of the same sense of shear. This work is motivated by a systematic study of branching within the San Andreas fault system using a computer-based geometry quantification technique (Ando et al. 2009, BSSA). We show that these faults form when the primary fault becomes critically misaligned with the principal stresses such that splay fault formation, on the optimum plane for faulting, is favored. First order splay faults, in distinction from other splay faults, are secondary only in the temporal sense; they are not of lesser rank, in terms of slip or length, than primary faults. Such splay faults may form in any fault type: strike-slip, thrust, or normal. We show examples of each. Quantitative analyses are made on strike slip fault cases in California, New Zealand and Alaska with comparing the directions of the fault strikes and relative plate motion vectors. We also discuss and speculate on several outstanding problems with regard to first order splay faults: the placement of them in space, means by which primary faults become misoriented in the stress field, and the mechanics of first order splay fault-primary fault junctions, once formed.