Fracture Patterns within the Tensleep Formation over a Spectrum of Laramide-age Thrust Structures, Wyoming

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Analysis of outcrop and core fracture data over a spectrum of Laramide thrust structures (broad low-angle arches to tight high-angle folds) in Wyoming shows the Tensleep Formation is cut by numerous intersecting fractures, including 1) inherited F_0 fracture patterns unrelated to folding are present in some structures 2) fold-related extension fractures trend approximately normal (F_1) and parallel (F_2) to the axis of folding. Hinge-normal F_1 extension fractures typically formed in response to horizontal stress prior to uplift and prior to the hinge-parallel F_2 fractures that formed during folding. Areas on broad anticlines that were not significantly folded, i.e., relatively planar backlimbs, contain only the early, F_1 fractures. Shear fractures (F_S) in tightly folded structures can have strike-slip, thrust, and/or bed-parallel motions of slip. Fractures of all sets (F_0, F_1, F_2, and F_S) were locally reactivated in both shear and extension as folding intensified.

Lithology also influences fracturing with limestones accommodating much of the larger-scale bed-parallel shear through brecciation, although it is not always obvious due to weathering and secondary re-cementation. From a distance, many of the limestone beds in fact appear to be unfractured. The eolian sandstone facies accommodated strain by extension fractures, and by shear both parallel and oblique to the large-scale cross bed fore sets and bedding. Fracture intensity is dependent upon fold-style and degree of folding. Idealized fracture models can be constructed but significant variations in structural style and lithology must be taken into consideration.