Thrust Faults in the Alcova Limestone at Beer Mug Anticline, Wyoming

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The two-meter thick Triassic Alcova Limestone, a heterogeneous, thin-bedded carbonate, forms a stiff strut within a thicker ductile shale sequence. Small, complex thrust faults in the Alcova Limestone near Beer Mug Anticline in southeastern Wyoming record a horizontal compressive stress that was concentrated in the strut and that exceeded the weight of the overburden.

Structures characteristic of the Alcova thrust system include standard thrust planes, back-thrusts, bedding-parallel decollement zones, bed-parallel shear in the folds, folds, and fold-core voids. Local stylolites suggest that dissolution also played a role. The main thrusts in the Alcova Limestone form meter-scale en echelon planes that step back at each offset when traced up section and that have offsets of 1-20 centimeters. The thrusts cut ductile carbonates, where the beds thickened plastically, and brittle carbonates, where the beds are faulted. These thrust planes can be traced from down-dip initiation up-dip to where they steepen and terminate blindly in folded duplex structures. Smaller, centimeter-scale synthetic and antithetic thrusts are also pervasive in the formation. Most of the main thrusts are relatively small, and none seem to have developed into a larger structure that localized meters or tens of meters of offset, suggesting a selflimiting feedback mechanism that locked each fault up after at most a few tens of centimeters of displacement.

These thrusts allow a unique interpretation of the local stress system that produced the kilometer-scale thrust faults in the area. Horizontal compressive stresses in excess of the overburden produced this system, and those stresses rather than drape over a basement fault produced the associated, large-scale, tightly folded Beer Mug Anticline. The small Alcova thrusts mimic the geometry of kilometer-scale thrusts seen in seismic lines in thinskinned fold and thrust belts, and can be used as analogs to study the characteristics of deformation in these systems.