Thrusts, Back-thrusts, and Detachment of Rocky Mountain Foreland Arches

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ABSTRACT

The basement geometry of the central Rocky Mountains provides a critical test for Laramide tectonic models. On a large scale, Laramide structural highs are better described as anastomosing, connected arches than as individual "uplifts." Thrust and reverse faults on the margins of Laramide arches dip both under and away from the ranges. Structural modeling shows that faults dipping toward the basins are commonly backthrusts off master thrusts which underlie and bring up the arches. These master thrusts alternate between emergent thrusts with major basement overhangs and blind thrusts below imbricate back thrusts.

The northwest-trending average orientations of Laramide faults, folds, and arches suggest northeast-southwest-directed slip over the entire province. The continuity of Laramide arches suggests direct linkages between underlying northeast- and southwest-directed master thrusts. Basement rotations and geophysical evidence for a continuous crust-mantle interface in Wyoming indicate that these master faults are listric, and merge in a subhorizontal detachment in the lower crust. Southwest-directed faults like the Wind River thrust are probably backthrusts off the northeast-directed detachment. West- and north-trending sections of basement arches probably form by oblique slip on lateral ramps connecting the northwest-trending arch culminations.

The minimal penetrative strain and the variety of fault styles at the surface in the Laramide foreland indicate that horizontal compression on a mid-crustal stress guide drives Laramide crustal shortening and detachment. Unlike shortening in the coeval Cordilleran thrust belt, Laramide shortening parallels the plate convergence vector and may reflect increased interaction between the North American and Farallon plates during low-angle oblique subduction.