

REACTIVATION OF A PROTEROZOIC CONTINENTAL MARGIN, BRIDGER RANGE, SOUTHWESTERN MONTANA

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The Bridger Range is a relatively small (25 mi. long; 40 km), north-trending uplift of Archean metamorphic rocks and Proterozoic through Mesozoic sedimentary rocks. The Bridger Range is unique in that it overlaps the boundaries of four major tectonic provinces that have combined to produce the overall structure of the Northern Rocky Mountains. These tectonic provinces are: 1) the Middle Proterozoic Belt Basin; 2) the Sevier fold and thrust belt, which mimics the shape of the former Belt Basin; 3) the Laramide foreland province of basement-involved deformation; and 4) the Basin and Range province. These provinces span the Middle Proterozoic rifting of western North America through the culmination of compressional mountain building during the Sevier and Laramide orogenies, to the present phase of crustal extension. In a broad sense, the Bridger Range records a “mega-Wilson cycle” of continental margin evolution. As a result of having so many different styles of deformation superimposed at one locality, the Bridger Range contains numerous examples of reactivated faults, folded thrust sheets, and overlapping structural families.

The Pass fault in the central Bridger Range marks the structural juxtaposition of Proterozoic sedimentary rocks, the LaHood Formation, against Archean basement rocks to the south. This fault was active as a normal fault along the south margin of the Belt Basin between 1.45 Ga. - 850 Ma. ago, and was the site of further movement during the Paleozoic as evidenced by sedimentary facies changes adjacent to the fault. During the Paleocene the Pass fault and other northwest-trending faults in the Bridger Range were reactivated as high-angle, oblique-slip, lateral thrust ramps along the transverse fault zone of the Helena salient. Subsequently, the basement-cored ancestral Bridger anticline developed during the Laramide orogeny in latest Paleocene to earliest Eocene time and was thrust about 1.8 mi. (3 km) eastward over the western flank of the Crazy Mountains Basin. Finite strain analysis helps to distinguish between the thin-skinned (Sevier) and thick-skinned (Laramide) compressional events. Finally, the modern valley and range landscape began to form through crustal extension perhaps as early as the mid-Oligocene (base of the Renova Formation), but certainly by the Late Miocene (base of the Sixmile Creek Formation). The west limb and crest of the ancestral Bridger anticline was down-dropped to form the Gallatin Valley, which filled with up to 6500 ft. (2000 m) of Late Cenozoic clastic detritus, leaving the east limb standing high as the modern Bridger Range. Thus, the Bridger Range is a “perched basement wedge” of Archean and Proterozoic rocks overlain by steeply east-dipping Paleozoic-Mesozoic strata.