

EVIDENCE OF RIFTING IN MONTANA

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Large scale Early Proterozoic doming occurred over a 175 km diameter area centered near Butte, Montana about 1600 million years ago. Vertical uplift of approximately 10 km is indicated as amphibolite grade gneiss and schist retrograded to greenschist facies. Perhaps a mantle plume developed from heat buildup beneath the stalled mega-continent and bulged the crust. Trigonal rifting followed, and the mega-continent began to split apart. The Belt basin, a rifted three-armed Middle Proterozoic depocenter, formed and began to fill with sediments from both east and west.

The failed arm, an aulacogen, stretches eastward across central Montana from Missoula to Glendive. It is 100 km wide by 700 km long, and it strongly influenced post-Lower Proterozoic Montana geologic history. Major stratigraphic units thicken or thin within the rift, often in harmony with the Williston basin.

In Cretaceous time, subduction of the Pacific plate and Laramide heat flow cooked and stressed western Montana. Late Cretaceous folding, metamorphism and igneous activity dominated the rift. By Paleocene time, accretion of the micro-continent Wrangellia in western Idaho and eastern Washington caused intense compression, shoving the thrust belt eastward and torquing the rift along its boundaries, resulting in extensive left lateral movement. The intense Laramide energy surge caused punctuated diagenesis, resulting in expulsion and transport of both metals and petroleum to traps near and within rift boundaries.