

GJGS Abstract

Neogene Rotational Rifting of the Colorado Plateau Microplate: A model for the distribution of divergent stress and strain in the Uinta Basin and uplift of the Uinta Mountains (and possibly the San Juan Mountains)

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ABSTRACT

The rotation of a Colorado Plateau microplate was proposed in the 1970s. A variety of studies and data in the ensuing decades support the concept. We define the Colorado Plateau Microplate (CPM) as a block of lithosphere that is rifting away from the North American craton in a clockwise fashion during the Neogene and Quaternary. The CPM includes the Physiographic Colorado Plateau but extends farther east and northeast. Deformation accompanying the rotational rifting is generally restricted to a 75 km “damage zone” that extends outward from the nine, linear rifts bounding the CPM. Within these damage zones, stress and strain parallel the principal rift boundaries. The damage zones extend into both the rotating CPM and the craton. Model experiments provide insights into what is observed in nature.

Borehole-image logs in numerous oil and gas wells in the Piceance and Uinta basins reveal variable patterns of the state of stress. A consistent WNW trend for Neogene faults, gilsonite dikes, and horizontal principal stress directions characterize the Piceance and eastern Uinta basins. This pattern abruptly changes to dominantly N-S with a minor E-W trend in the central Uinta basin. Left lateral displacements on the E-W features are interpreted as Neogene, rather than Laramide. The N-S pattern continues through the western Uinta basin.

Both basins fall within the 75 km damage zone for the three northern rifts bounding the CPM. The stress and strain patterns in both basins appear to reflect the kinematics of the clockwise rifting of the CPM.

The rotational rifting of the CPM generated the Neogene uplift of the Uinta mountains and speculatively the San Juan mountains.