

tinct element of the Cordillera. During the Phanerozoic Era, areas surrounding the Colorado Plateau have been subjected to repeated tectonism, including contraction, extension, and magmatism while the plateau has been little affected by these processes. Deformation and magmatism mostly wrap around the Colorado Plateau, suggesting the plateau is a rigid body that has often transmitted forces across itself. Compiled geophysical and petrologic evidence indicates that the lithosphere of the Colorado Plateau has a higher strength than regions to the east, south and west. Strength differences may be attributed to a mafic crustal composition and long-term lower crust and mantle geothermal gradients, especially relative to the Basin and Range Province. Estimates of crustal and lithospheric thickness indicate that the ratio of the thickness of mantle to crust in the northern Basin and Range Province ranges from 0.8 to 1, whereas the same value in the Colorado Plateau is about 1.2. Given that mantle rocks are stronger on average than crustal rocks, the ratio of crust to mantle and the greater total thickness of the Colorado Plateau lithosphere also make it inherently strong.

Some evidence suggests that fertile or hydrated mantle may exist beneath the Colorado Plateau. Rock strength data show that mafic rocks in the crust and high pyroxene and amphibole contents in the upper mantle may enhance lithospheric strength, or, at a minimum, provide no reason to presuppose that a fertile, hydrated mantle should be weak.

The Colorado Plateau, although inferred to be stronger than regions to the west, south, and east, may not be as strong as the Archean Wyoming Province to the north. Higher seismic velocities in the lower crust and upper mantle north of the Cheyenne belt imply a higher strength in the middle Rocky Mountains. In this context, the Uinta aulacogen, which separates the Wyoming Province and the Colorado Plateau, developed as a "pop up" structure during Mesozoic to early Tertiary contraction. Thus, in understanding the tectonic history of the western U.S., or any region for that matter, it is important to assess the relative compositional and thermal structure of the lower crust and upper mantle. These factors have exerted considerable control over the partitioning of strain and magmatism throughout the Cordillera in the Colorado Plateau region during the last 1 Ga. Similar factors play an important role in the architecture of mountain systems throughout the world.

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Tectonic inheritance at the Colorado Plateau - Basin and Range margin - Miocene uplift of the Virgin Mountain anticline influenced by reactivation of Proterozoic and Laramide structures

The Virgin Mountain anticline (VMA) is a NE-trending basement-cored uplift that straddles the Colorado Plateau - Basin and Range margin in southeast Nevada and northwest Arizona, approximately 15 km south of the Utah border. Our hypothesis is that this region has been an important zone of weakness from the Paleoproterozoic through to the present, and that Miocene extension and uplift was signifi-

cantly influenced by inherited structures and tectonic boundaries. Two processes: 1) reactivation of basement structures, and 2) utilization of lower Paleozoic rheologic heterogeneities, influenced were the Colorado Plateau margin was originally defined and how Miocene extension was made manifest at this margin from ~20 to 5 Ma. Intense 1.7 Ga fabrics and the presence of exotic lithologies (ultramafics, pillow volcanics, chert) suggest that this structure may have been part of a Paleoproterozoic province boundary. NE-trending upper greenschist grade dextral-transpressional mylonites are ubiquitous throughout the VMA, suggesting that this area was a high strain zone during Mesoproterozoic (~1.4 Ga) transpressive deformation. N to NW-trending "monoclinical-type" geometries in the Paleozoic and Mesozoic sections, and the position of the VMA between the thin-skinned Sevier thrust belt and thick-skinned monoclines of the Colorado Plateau, suggest a Laramide (~65 Ma) component of deformation. Miocene extension was generally exhibited by brittle oblique dip-slip fault reactivations of strongly fissile mylonitic foliations in the basement, steep and shallow normal faulting in the Tapeats sandstone, basal-glide and westward tectonic thinning in the Bright Angel shale, and steep to moderate normal and antithetic normal faulting in the overlying Paleozoic carbonates. Highly angular (>60°) relationships are observed in the Lower Paleozoic section on the west limb of the VMA. This structural-rheological partitioning and deflection of strain may give insights into the complex Miocene strain field observed at the Colorado Plateau - Basin and Range margin.

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Tectonic Evolution of the Arizona Transition Zone

The Transition Zone (TZ) of Arizona lies between the Colorado Plateau (CP) and Basin and Range (BR) Provinces, and shares some physiographic, stratigraphic, and structural aspects with each. The oldest rocks in all three provinces are Proterozoic metavolcanic and metasedimentary rocks, which record the evolution from oceanic to continental environments from >1.75 to 1.65 Ga. These rocks were strongly deformed, mostly between 1.7 and 1.6 Ga, and structurally are dominated by north- to northeast-trending folds, cleavage, high-strain zones, and shear zones. The rocks were intruded by Proterozoic granites before, during, and after deformation, and subsequently overlain in places by sedimentary and volcanic rocks of the mid- to late Proterozoic Grand Canyon Supergroup and Apache Group. All three provinces then received a similar, ~1 km-thick cover of platformal Paleozoic clastic and carbonate rocks.

With the onset of subduction beneath the southwestern edge of North America in the Triassic, the stratigraphic and structural histories of the three provinces began to diverge. Triassic and Jurassic rocks are not preserved in the TZ, but sequences of these rocks in the BR and CP have stratigraphic ties and some commonalities, indicating that the TZ originally contained similar Lower Mesozoic sequences and did not block sediment transfer between neighboring provinces at this time. In the Early to Middle Jurassic, for example, the TZ evidently contained the facies change between volcanic-dominated sequences of the BR and sediment-dominated ones of the CP.