

Geology of the Arkansas Headwaters Recreation Area

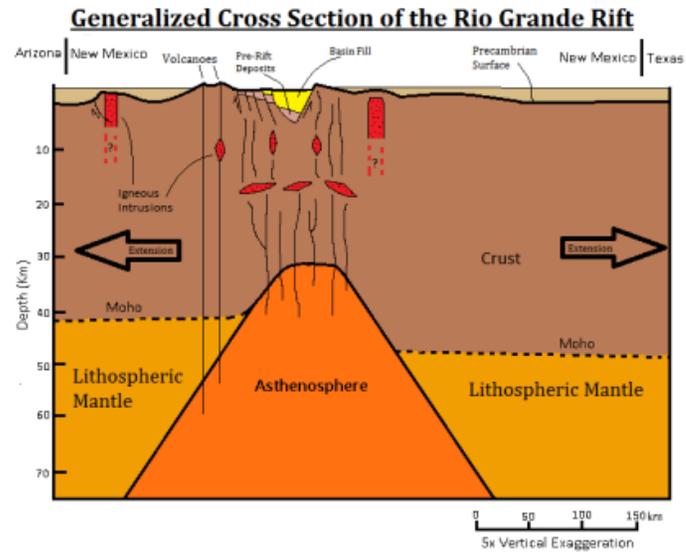
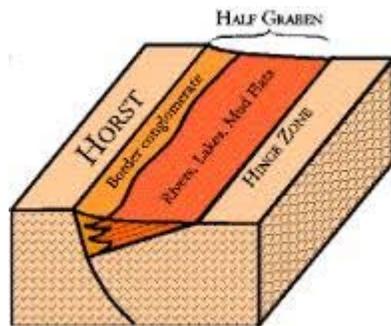
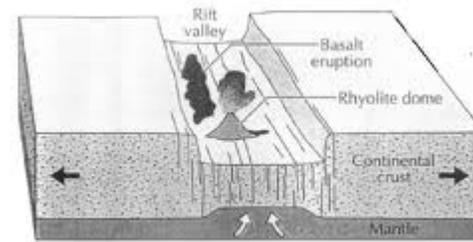
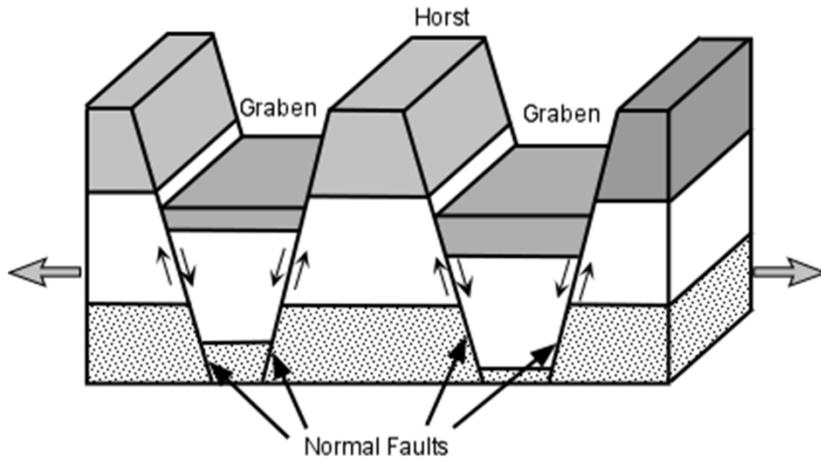
Geological Sections of AHRA

- Upper Arkansas River Valley
 - Leadville to Salida
 - Segment of the Rio Grande Rift
- Upper Big Horn Sheep Canyon
 - Salida to Coaldale
 - Canyon through the east horst of the Rio Grande Rift
- Lower Big Horn Sheep Canyon / Royal Gorge
 - Coaldale to Canon City
 - Canyons through the Front Range uplift of the southern Rocky Mountains

Upper Arkansas River Valley

- A portion of the Rio Grande Rift running from southern Wyoming into Mexico
 - **Rift** – a portion of Earth's crust where spreading has occurred
 - Caused by tensional forces from the flat-subducting Farallon Tectonic Oceanic Plate activity below the crust
 - Elongated blocks of crust (**horsts**) parallel to and on both sides of a rift rotate and uplift, here now to over 7K feet above the graben, while spreading apart
 - The area between the spreading blocks (**graben**) drops along the uplifting fault-bounded blocks forming a valley, here now 15K thick with post-rift fill
 - The uplifting exposes rocks lower in the rift's horst walls from thousands of feet deep within the crust
 - The spreading allows hydrothermal and volcanic activities from deep within the earth to rise to the surface
 - Causing hot spring activity on the west from Cottonwood Creek south to Poncha Pass and Salida
 - Causing related volcanic activity on the east from Buffalo Peaks south to Salida and on the west from Independence Pass to Monarch Pass

Rift Diagrams



Upper Arkansas River Valley

- Geology of the Upper Arkansas Rift Valley
 - The Mosquito Range is the east horst and the Sawatch Range is the west horst of the rift valley
 - A significant amount of uplifted Precambrian metamorphic basement rock (gneiss and schist) is exposed at the base of both horst walls
 - Un-metamorphosed Precambrian basement granites and granite intrusions in the metamorphosed rock are also exposed in the horst walls below the sedimentary rock layers high on the horst walls
 - Significant glaciations have occurred to both horst walls to the north end of the valley and in the Sawatch alone to the south end
 - Where Lake Creek, Clear Creek, and Pine Creek end at the Arkansas River, banks of glacial till are present as remains of glacial moraines
 - Just south of the Granite town site, one or more ice dams that formed during the glacial melt period, creating a 500 foot deep lake, burst to scour out and form the deeper portion of the Granite Canyon area and carry large boulders way downstream (as far as the Spikebuck recreation site)
 - The glacial outwash has forced the Arkansas River tightly against the east horst through much of the Upper Arkansas River Valley
 - Large deposits of volcanic rhyolite and some andesite remain along the east horst from Bald Mt., Sugarloaf and Ruby Mountains and Rainbow rock south to Salida and predominate from Hecla Junction to the lava flow east of Salida from “S” Mountain
 - Along the base of the Sawatch Range south of Mesa Antero, large alluvial fan deposits contain sorted glacial outwash from streams draining glaciers in the Sawatch
 - Mixed with the basement granite and volcanic deposits, the Precambrian basement metamorphics make a significant appearance near Hecla Junction and east of Salida at the base of the east horst

Upper Big Horn Sheep Canyon

- A fault system in the east horst of the Rio Grande Rift
 - Formed by tensional spreading steeply uplifting huge blocks of crust, forming faults and fractures that the Arkansas River follows
 - The uplift and faults slope downward easterly to Coaldale
 - Later crustal shifting and volcanism possibly diverted the Arkansas River from a southward flow through Poncha Pass to a southeastward flow following faults through the east horst
- Uplifting exposed deep Precambrian rocks up through successive layers of the lower Paleozoic sedimentary rock layers
 - Deep Precambrian Basement metamorphics are exposed just east of Salida
 - Rocks traversed just to the east change abruptly to Cambrian/Ordovician white Sawatch sandstone/brownish Manitou limestone/red-yellow Harding quartzite/gray Fremont dolomite
 - The massive gray cliffs then encountered are Ordovician Fremont Dolomite/Limestone
 - Beyond the dolomite are successive pink Parting Shale/purplish Parting Quartzite/red-yellow Dyer Chert/white-yellow Dyer Dolomite/yellow-green Dyer Shale/grayish Leadville Limestone layers in the Devonian and Mississippian formations severely twisted, faulted, and bent behind Wellsville by crustal east horst uplift
 - From Swissvale to Vallie Bridge, the uppermost sedimentary layer for this region, the purple sandstone/green-brown-black shales/red-white Pennsylvanian/Permian redbeds, are passed
 - The redbeds consist of red and white sandstone/shale/mudstone/conglomerate layers
 - Up to approximately 22,000 feet in thickness
 - Some areas on the tops of the ridges to the north and across the river east of Rincon and west of Howard are capped with Salida Volcano Field andesite flows
 - To the northeast of Howard, beds of white to reddish rhyolite ash cap the Permian redbeds
- Just west of Coaldale (at Vallie Bridge), the sediment layers traversed near Wellsville were caught and bent up nearly vertical by the west edge of the Front Range uplift
- Steeply dipping sedimentary layers to the southwest of Coaldale on the top of the east horst contain coal and gypsum

Lower Big Horn Sheep Canyon / Royal Gorge

- Canyons through the massive Front Range uplift
 - Major tectonic crustal uplift of deep Precambrian basement granites and metamorphics
 - The crust here is deeply faulted and fractured by the 10K+ feet of uplift
 - The Arkansas River follows faults and fractures through the uplifted mountains
 - The abrupt west end of the uplift at Coaldale marks the east extent of the east Rio Grande horst and the river enters the Front Range Uplift through a water gap
- Geology of the canyons
 - The west most ridge of the uplift visible approaching Coaldale from the northwest is made up of tan Precambrian granites with a some dark metamorphic rock
 - From Coaldale to Texas Creek, the uplift consists of tan/pink/orange Precambrian granites and black gabbro with metamorphic gneiss and schist
 - To the north, the ridges are capped with 39-mile Volcano Field basalt lava flows
 - Deep in the canyon east of Texas Creek to Parkdale, rocks are primarily Precambrian metamorphics uplifted from deep within the crust
 - Gneiss, schist, and Proterozoic/Archean metasediments persist, especially around Texas Creek
 - The walls contain few original basement granite masses but many granite intrusions introduced after the metamorphosing of this portion of the crust
 - At Parkdale, a tilted and severely faulted outlier of Mesozoic Morrison, Dakota, etc. sedimentary rock layers are visible trapped by the uplift of the basement rock
 - East and south of Parkdale, the southward continuation of the Front Range uplift from Pikes Peak is visible
 - Royal Gorge rock consists of granites, gneiss, and schist with huge granite masses and black intrusions of gabbro contained in the gneiss

References

- Chesterman, Charles W. *National Audubon Society Field Guide to Rocks and Minerals*. New York, NY: Chanticleer Press, 1979, 1988
- Chronic, Halka and Williams, Felicie. *Roadside Geology of Colorado*, Second Edition. Missoula, MT: Mountain Press, 2002, 2010
- Lutgens, Frederick K. and Edward J. Tarbuck. *Essentials of Geology, Eighth Edition*. Upper Saddle River, NJ: Prentice Hall, 2003, 2000, 1998, 1995
- Matthews, Vincent, Katie KellerLynn and Betty Fox. *Messages in Stone: Colorado's Colorful Geography*. Denver: Colorado Geological Survey, 2003
- Meldahl, Keith Heyer. *Rough-Hewn Land*, Berkeley and Los Angeles, CA: University of California Press, 2011, 2013
- Reed, Jack and Ellis, Gene. *Rocks Above the Clouds*. Golden, Colorado: Colorado Mountain Club Press, 2009