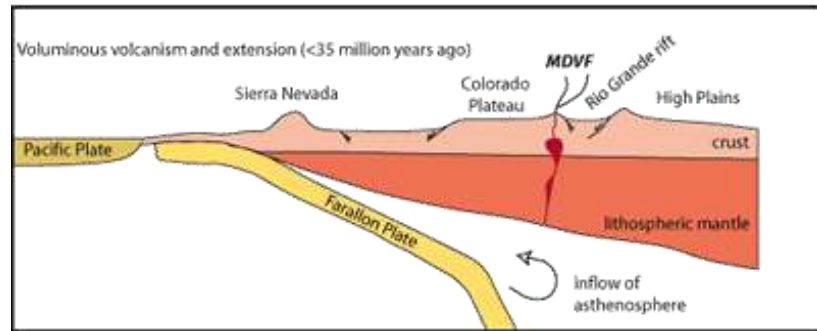


City of Rocks: Geology

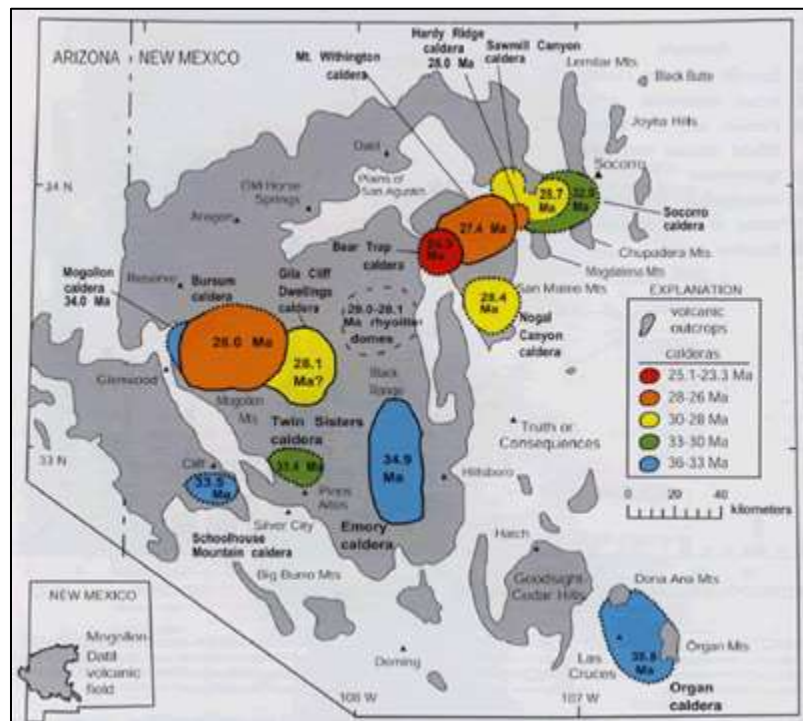
The landscape at the City of Rocks is the result of two geologic processes: Volcanism that formed the rocks and erosion that sculpted the rocks to create the present form.

Regional Setting: City of Rocks is at the south end of the Mogollon-Datil Volcanic Field (MDVF) that formed as a result of subduction along the west coast. The MDVF is characterized by a group of large calderas ranging in age from 36.2 to 24.3 million years old. Thick sequences of ash falls, pyroclastic flows and lava flows were erupted from these calderas.

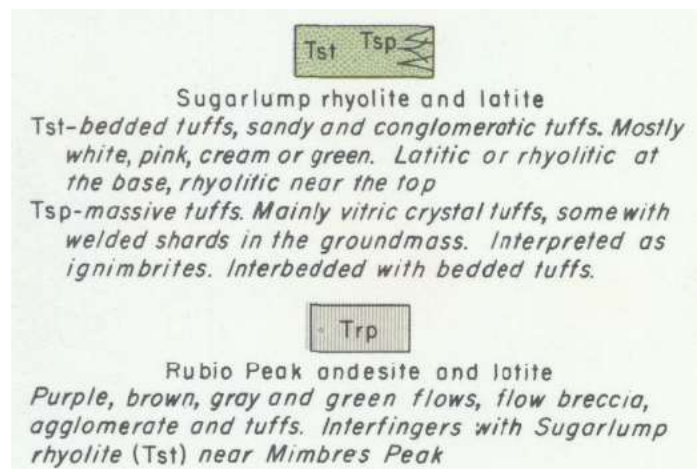


The City of Rocks is carved into a partially eroded layer of the Kneeling Nun Tuff that was deposited as pyroclastic flows and ash falls about 34.9 million years ago. The source was the Emory Caldera that is centered around Emory Pass on Highway 152. Elston in 1975 estimated that more than 215 mi³ of material was erupted from the Emory Caldera. This estimate is low because some of the Kneeling Nun Tuff has been eroded. By comparison the pyroclastic flows from the eruption of Mt. St. Helen's in 1980 had a volume of about .03 mi³.

Note: The ash layer at City of Rocks was originally mapped as the Sugarlump Tuff, but precise age-dating has shown that it is Kneeling Nun Tuff. The map below is from Elston (1957).



http://geoinfo.nmt.edu/tour/federal/monuments/gila_cliff_dwelling/home.html



City of Rocks: Geology

The rocks: The rocks are typical ash fall/flow 'tuffs' with 4 principle components:

- Phenocrysts (visible crystals) that crystallized from the magma as it cools. The phenocrysts here include: hornblende (black rectangles), biotite (black flakes), feldspar (white to clear rectangles) and quartz (grey equidimensional grains).
- Lithic fragments, broken bits of pre-existing rocks included in the magma.
- Pumice, formed as frothy, glassy magma that cooled quickly. In ash layers it is often seen as flattened grey streaks as the pumice collapses under the weight of the overlying ash.
- Ash, fine-grained material between all the other grains.

Rhyolites are rocks typically very rich in silica and dominated by feldspar and quartz. Latites do not have as much silica and quartz is less than 5%.

Some of these tuffs are welded. They were still hot when they settled and welded together.

Erosion: As the ash layers cooled they contracted and fractured. Additional fracturing may have occurred when the rocks overlying the layer at City of Rocks was eroded away. The fractures are visible as lines on the Google Earth image to the right. Water then was able to infiltrate the fractures. Through a long period of freeze and thaw cycles, the cracks became wider. Subsurface weathering by water and humic acid in the soils also contributed to the slow weathering at the City of Rocks. With time the overlying soil layers and debris in the cracks was washed away leaving the 'streets' of the City of Rocks.

More information:

http://geoinfo.nmt.edu/tour/state/city_of_rocks/home.html (and references on this page).

Elston, W.E., 1957, Geologic map and sections of Dwyer quadrangle, New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 38.

