TRAIL GUIDE

FREMONT INDIAN STATE PARK & MUSEUM

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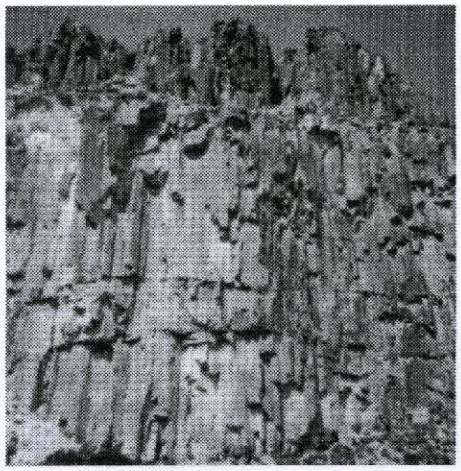
GEOLOGY

This vantage point is an ideal place to observe and learn about the geology of Clear Creek Canyon.

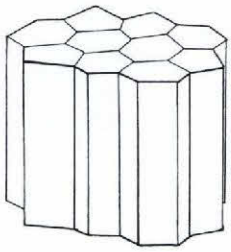
GEOLOGIC HISTORY

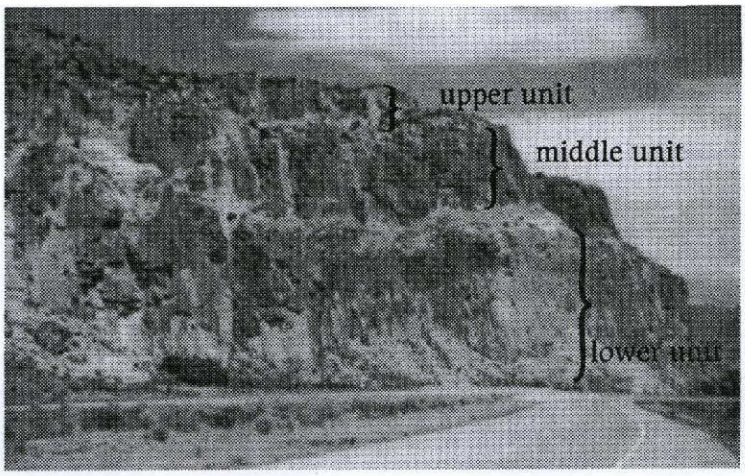
An ancestral valley has existed in the general location of Clear Creek Canyon for 27 million years (a down warp between the Pahvant and Tushar Mountains). Mount Belknap, a volcano 12 miles to the southwest in the Tushar Mountains, erupted a number of times between 22 and 14 million years ago. A succession of ash flows from Mount Belknap (the rock ledges surrounding you called the Joe Lott Tuff) partially filled this ancient valley 19 million years ago . Four million years of faulting and erosion established a new canyon with tributaries. These canyons were then filled over a period of 8 million years by deposition of eroded volcanic ash and rocks known as the Sevier River Formation. More faulting and erosion over the next 7 million years resulted in the Clear Creek Canyon you see today with remnants of the pink and tan layered Sevier River Formation sitting along side (where faulted) and on top of the older Joe Lott Tuff. The canyon has back filled again, somewhat, as indicated by holes drilled at the two bridges on I-70 near the visitor center. These drill holes confirm that the canyon floor was 40 to 60 m. below the present ground level.

COLUMNAR JOINTED IGNIMBRITES



The cliffs to the east on the north side of Clear Creek Canyon are an excellent example of columnar jointed ignimbrites. Ignimbrites are thick, massive, lava-like sheets of silicic volcanic rocks formed mainly of glass particles. These ignimbrites, part of the Joe Lott Tuff, formed as a result of explosive, hot, rhyolite ash-flows from a series of enormous volcanic eruptions 12 miles to the southwest in the Tushar Mountains 19 million years ago. When the ash-flow stopped here, it was hot enough that the ash welded together, creating the ignimbrites. As the fused flows cooled, cracks formed vertically from the top to bottom, creating the distinctive six sided columns. The columns each cooled from their center forming the geometric patterns that look like a honeycomb from the top. Clear Creek Canyon has cut down through the Joe Lott Tuff, so the view you are getting of the columnar joints is from the side and the full height of these spectacular pillars can be appreciated. Erosion and change continues and occasionally columns fall.





JOE LOTT TUFF

The rock ledges before you on the north side of the canyon and much of the rest of lower Clear Creek Canyon, is part of a series of rhyolite ash-flows called the Joe Lott Tuff Member of the Mount Belknap Volcanics. Approximately 150 cubic kilometers of rhyolite were extruded from the Belknap volcano to form the Joe Lott Tuff, then the volcano collapsed forming the Belknap

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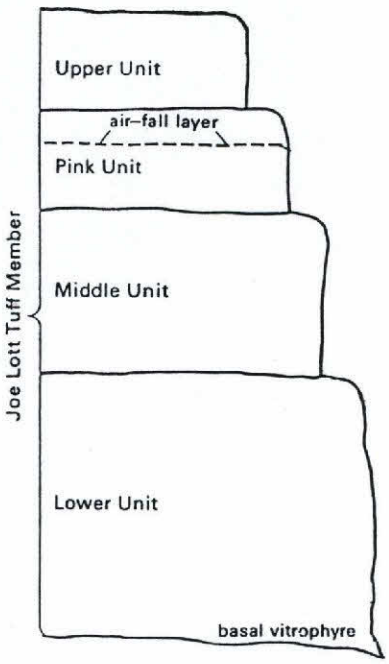
Caldera which is 13 by 17 kilometers in size. The ash-flows followed an ancient valley that underlies the present Mill Creek and Clear Creek Canyons. Joe Lott Tuff is separated into distinct cooling units:



Lower- this unit extends upward from the canyon floor and is 64 m. thick. The tuff composition varies from being purplish-gray and full of pumice near the bottom to being chalky in the top. Columnar joints are in the middle of the unit. The weld quality of the tuff is poor towards the top and bottom and moderate in the middle. The entire ash-flow that resulted in the lower unit was deposited as part of a single flow that had different consistencies and is thought to have occurred in a matter of days to weeks. The unit dried most likely, for a number of years before the middle unit covered it.

Middle- columnar jointing is also exhibited in this unit but it is distinguishable from the lower one because the tuff color is light gray. The welding of the ash is of poor quality and the unit is 43 m. thick. This unit seems to be the result of one volcanic flow with between 20 and 100 years until it was covered by the next ash-flow.

Upper- this unit is 31 m. thick and is best seen at the highest visible point. The color is light gray but it differs from other units in that the fusion is better and rock particles are larger.

Pink- although it can not be seen from this vantage point, throughout most of Clear Creek Canyon there is a fourth unit of Joe Lott Tuff that is between the middle and upper units and is 26 m. thick. The unit is rich in pumice and is poorly welded and easily erodible. The pervasively pink color is a result of iron oxidation. The unit consists of two ash-flow layers (the lower is 17 m. and the upper is 9 m. thick) divided by a layer of ash .5 m. thick that was air-fall from Mount Belknap. A good place the see the pink unit is on the north side of the road near the west park entrance sign.

Pink Cooling Unit of the Joe Lott Tuff Member

SEVIER RIVER FORMATION

From 14 to 7 million years ago eruptions continued on the Tushar Mountains. These eruptions differed from the earlier eruptions that formed the Joe Lott Tuff. They were much more sporadic over a longer period of time, and produced ash that was distributed by air-fall and did not fuse when in hit the ground. The ash was spread, probably many meters deep, over the flanks of Mount Belknap, including the eroded upper tributaries of Clear Creek Canyon. This ash and some underlying rocks were easily eroded and carried by streams to the lower valleys of the mountain. This changed Clear Creek from an erosive environment to one of deposition, filling the canyon with conglomerate, sandstone and siltstone now known as the Sevier River Formation. Subsequent faulting and uplift rejuvenated streams in the area including Clear Creek and its tributaries. Most of the Sevier River Formation has eroded away with only remnants seen along the sides of the canyon. An excellent exposure of the Sevier River Formation can be seen in the Castle Rock Campground.

INFORMATION SOURCES:

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