

GEOLOGY 25 - LECTURE 3B
COLORADO PLATEAU: Canyonlands NP
(Textbook: Ch 8)

Canyonlands NP

Very rough park with few services, little water, just a few paved roads and rugged but spectacular trails.

- dirt roads crossing remote sections of the park are remnants of the uranium mining days in the 50s & 60s
- most visitors to the park never actually enter it, preferring to gaze into it from nearby Dead Horse Point State Park.
- Canyonlands was once the domain of ancient early Americans like the ancestral Pueblo and Fremont peoples who left behind petroglyphs etched into rock faces – lots of places to explore
- national park split into three zones by the deep canyons of the Colorado and Green rivers that meet in the park (Island in the Sky where most visitors go, The Needles, The Maze)

Canyonlands composed of red **late Paleozoic & Mesozoic** rocks comprising a broad plateau bisected by deep, narrow canyons carved by downcutting rivers - similar to other Colorado Plateau parks

Erosional features of the Canyonlands landscape

As in other parks on the Colorado Plateau, intersecting joint sets determine patterns of weathering and erosion

- erosion dominates the landscape - as time rolls by and erosion proceeds, canyons widen and large **plateaus** reduce to **mesas**, then to **buttes**, then to **pinnacles** until they collapse and nothing remains but a pile of rubble.
- a mesa is an elevated feature with dimensions like a tabletop.
- the term “butte” is commonly mis-used in the American West, but by definition it refers to an elevated feature with roughly equal dimensions across its upper caprock.
- the tops of plateaus, mesas, and buttes are commonly composed of a resistant caprock (like sandstone or limestone or volcanic rock)

How do larger plateaus progressively decrease in size to smaller landscape features?

The drainage system of gullies and streams cut canyons into the edges of plateaus by *headward erosion*. Shallow gullies draining the plateaus focus erosion at narrow slots weathered along joint planes near the tip of the canyon along the edge of a plateau, causing the canyon to grow in a headward direction into the margins of the plateau through time.

How do rivers erode down into solid rock to carve deep canyons with incised meanders?

Canyonlands NP is marked by the confluence of the Green River and Colorado River that have eroded canyons about 2000' deep into the plateau.

The rivers in Canyonlands have created tight curves within deeply entrenched canyons - called **incised meanders** (informally known as "goosenecks")

- “incised” simply means that the river is located at the bottom of a narrow canyon composed of rock. There is no real floodplain surrounding an incised river due to the steep rock walls on either side.
- meandering river patterns are common on very low **gradient** rivers that cross flatlands covered by soft soils or unconsolidated sediments – like the Sacramento River in northern California
- “gradient” is the slope from the headwaters of a river to its downstream mouth, either where it meets another river or where it empties into the ocean
- typically, where rivers flow down high gradients from highlands to lowlands, the river shape tends to be straighter, but that’s not the case with rivers on the Colorado Plateau
- meandering rivers can become ‘incised’ into hard rock if the region is uplifted by geologic forces

Incised meanders in deep canyons are very common throughout the Colorado Plateau and indicate vertical downcutting by rivers that meandered across a flat landscape prior to regional uplift of the Plateau.

- the original streams meandered because the original topography of the region before ~5 to 6 million years ago was low gradient, with streams forming meandering patterns. The Colorado Plateau didn’t yet exist and the region was a lowland.
- around 5-6 million years ago, the Colorado Plateau was broadly and unevenly raised upward by large-scale geologic forces (tectonics – more on this later). (This was a second episode of uplift that occurred after the first episode during the late Mesozoic / early Cenozoic.)
- the higher elevations increased the gradients of existing rivers, speeding their flow and enhancing their potential to erode downward.
(i.e., the plateau rose upward beneath the level of the older river systems)
- as the rivers incised into the underlying rock, they maintained their meandering pattern as the region was raised upward. Once the rivers carved their meandering patterns into solid rock it was hard for them to change orientation – they became “entrenched” within the rock and incised downward. Canyon widening only occurred where incised tributary streams entered the main river canyon.
- the actual erosion within deep river canyons is done by the abundant sand, gravel and boulders that collide with the rock walls during flood flows (erosion is fairly minimal during normal stages when the water simply carries along clay and silt)

Virtually all the rivers of the Colorado River system run through deeply entrenched canyons along most of their lengths: Green River, Dolores River, San Juan River, Paria River, Colorado River (through the Grand Canyon, of course) and many others

- Many of the smaller tributary streams cut narrow **slot canyons**, no more than a few feet wide, that only have running water during violent **flash floods** generated by heavy rains that scour the plateau. The water doesn’t penetrate the slickrock landscape easily, so it runs off downslope into canyons, often dropping off plateau edges in spectacular waterfalls.
- many slot canyons have relatively straight profiles because they inherited their shape by eroding downward along joint planes
 - given enough time, countless flash floods carrying countless boulders and debris can carve a deep slot canyon.

To see a list of the top hikes in Canyonlands NP, go to: <https://www.visitutah.com/Places-To-Go/Parks-Outdoors/Canyonlands/Adventure-Guide>

These websites provide supplementary information if you've decided to not use the textbook.

National Park Service – Geology of Arches NP

<https://www.nps.gov/arch/learn/nature/geologicformations.htm>

National Park Service – Geology of Canyonlands NP

<https://www.nps.gov/cany/learn/nature/geologicformations.htm>

Wikipedia – Geology of Arches and Canyonlands NPs

http://en.wikipedia.org/wiki/Arches_National_Park

http://en.wikipedia.org/wiki/Canyonlands_National_Park

http://en.wikipedia.org/wiki/Geology_of_the_Canyonlands_area

Capitol Reef NP – if you'd like to visit, read this article first for tips and hints:

<https://www.nps.gov/care/planyourvisit/index.htm>

It is illegal to collect rocks, fossils or Indian relics in a national park.

Natural sounds and natural quiet comprise part of a park's **soundscape**. The term 'soundscape' refers to the total acoustic environment in a particular area, including sounds people experience. This consists of both natural and human-caused sounds. The natural soundscape is managed as a park resource with a unique and inherent value and as an important element of the National Park experience.

We'll return to the Colorado Plateau and finish the story in a few weeks after I introduce a few other concepts like tectonics and metamorphism. We'll go back and talk about the basement rocks of the Grand Canyon and formation of the Canyon as well as the cause of "uplift."