

Geol 104 Geology of National Parks  
Lecture 13: Canyonlands, Arches and Mesa Verde

I. Location

A. Canyonlands NP – SE Utah:

1. Confluence of Co and Green Rivers with Island of the Sky plateau between them.
2. ~110 mi E-NE of Bryce
3. Arches is few miles N of Canyonlands

B. Mesa Verde – SW Colorado

~180 mi E of Bryce

II. Stratigraphy & Geologic History fit with Bryce-Zion-Grand Canyon

A. Setting

1. Recall: GC-Zion stratigraphy/geologic history records transgressions and regressions as Seas flood and recede from the continent.
2. Canyonlands, & Arches record the same events. Rocks are different because these areas are further east (further inland).
3. Mesa Verde continues sediment record from Bryce (upper Cretaceous)

B. New Rocks/History

1. Paradox Formation - Pennsylvanian
  - a. These are evaporites interbedded with clastic sediments
  - b. Evaporites = rocks made of salt precipitated during evaporation of lagoons in arid environment
2. Paradox Basin
  - a. Formed during Uncompahgre uplift
    - i. Formed Uncompahgre mountains in SW Colorado
    - ii. Left low-lying basins
  - b. Seawater from regressing Penn. Ocean (remember the Supai Group, Hermit Shale and Coconino SS of Grand Canyon?) is trapped in these basins
    - Evaporation forms thick (up to 5000 feet) evaporite deposits.
3. Remaining rocks exposed in Canyonlands and Arches are equivalent to rocks exposed in Zion and Bryce

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- Extending up to Dakota SS and Mancos Shale (these form the base of stratigraphy exposed in Bryce).

4. Mesa Verde Stratigraphy/Geologic History – Cretaceous

- a. Dakota SS is at the base – These rocks deposited on beaches of transgressing Cretaceous seaway
- b. Mancos Shale (similar to Tropic Shale of Bryce Canyon) = deeper water deposits transgressive over the Dakota (flooding of the continent).
- c. Mesaverde Group = Sands, silts and coals
  - i. Deposits from shifting shorelines of the Cretaceous seaway
  - ii. Sands (dominate the group) = beaches and dunes
  - iii. Coals (minor) indicate swampland

III. Canyonlands – Paradox salt and formation of canyons; and stream rejuvenation

A. Salt Domes of Paradox Formation

1. Salts become buoyant at depth
  - a. Salts are low density and are plastic at moderate T and P
  - b. So, they rise as ‘plumes’, forcing the overlying strata to dome-up
2. The domes extend (brittle),
  - a. Forming joint sets along which weathering is focused
  - b. The center of the domes are weathered away – producing the bull’s eye pattern
  - c. This is how Upheaval Canyon formed

B. Stream rejuvenation

1. Rivers down-cut to base level (level of lake or sea they feed)
  - a. As a river reaches base level it begins to meander
  - b. e.g. Mississippi River
2. Drop base level (either by uplifting land or lowering sea level)
  - a. Meandering stream begins to down-cut
  - b. Incised Meanders develop – this is beautifully displayed in Canyonlands

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IV. Mesa Verde – Cuesta, groundwater

A. Mesa Verde

1. The mesa is a Cuesta – Large ridge of tilted strata
2. Mesa Verde group (sands) form the cliffs at the top
3. Mancos Shale forms the slopes at the base.

B. Why Anasazi settled here (1150-750 AD) – Continuous water supply

1. Snow melt & rain seeps into Mesa Verde sandstones
  - a. Permeable sands – connected pores, able to transmit water by gravity flow
  - b. Aquifer: Permeable geologic unit (e.g. Mesa Verde group)
2. Mancos shale is impermeable
  - a. Cannot transmit water
  - b. Flow from above ponds on the Mancos and flows laterally where it discharges as springs in the canyons of Mesa Verde