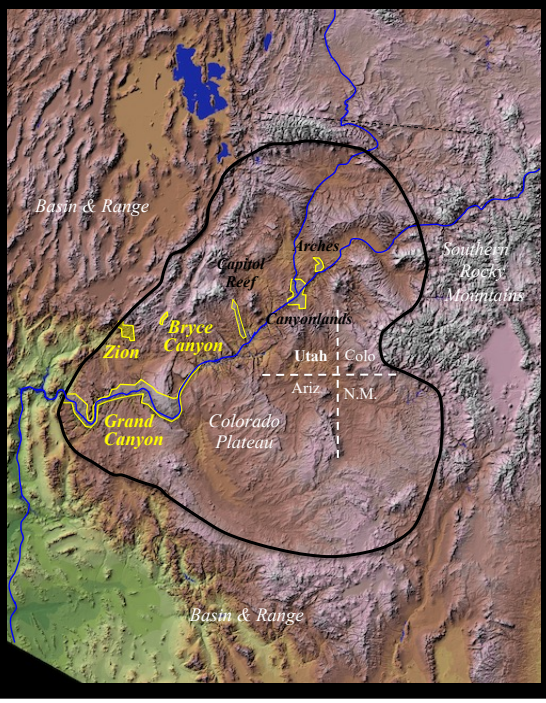
National Parks of the Colorado Plateau

Zion & Bryce Canyon NPs (southern Utah)



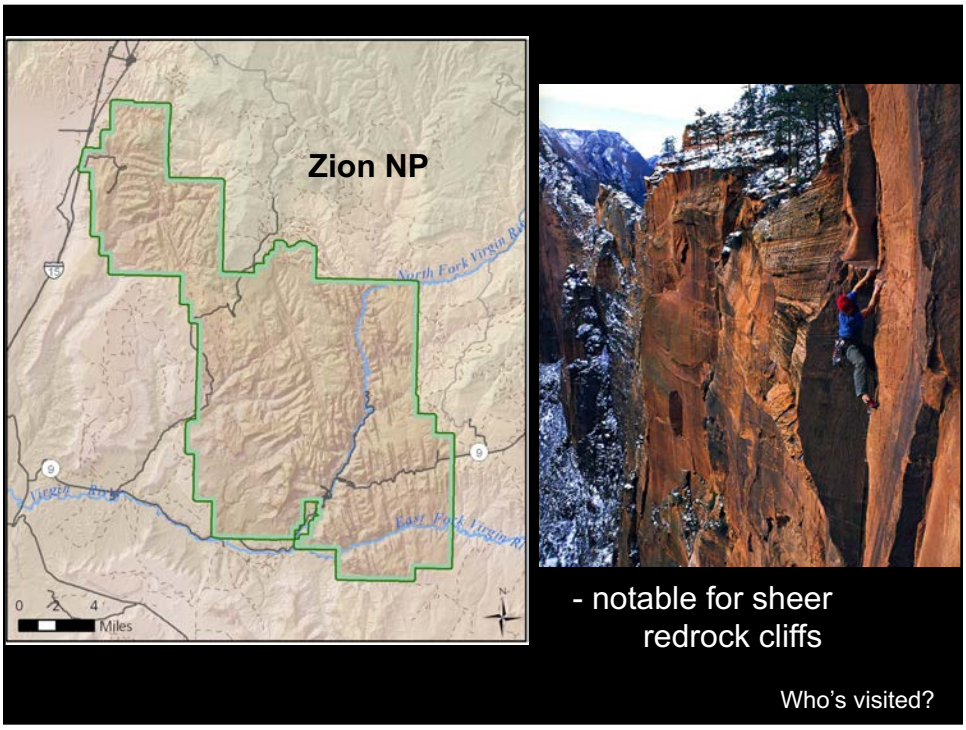
Zion notes/images in Files
Textbook: Ch 4, p.52-60

1

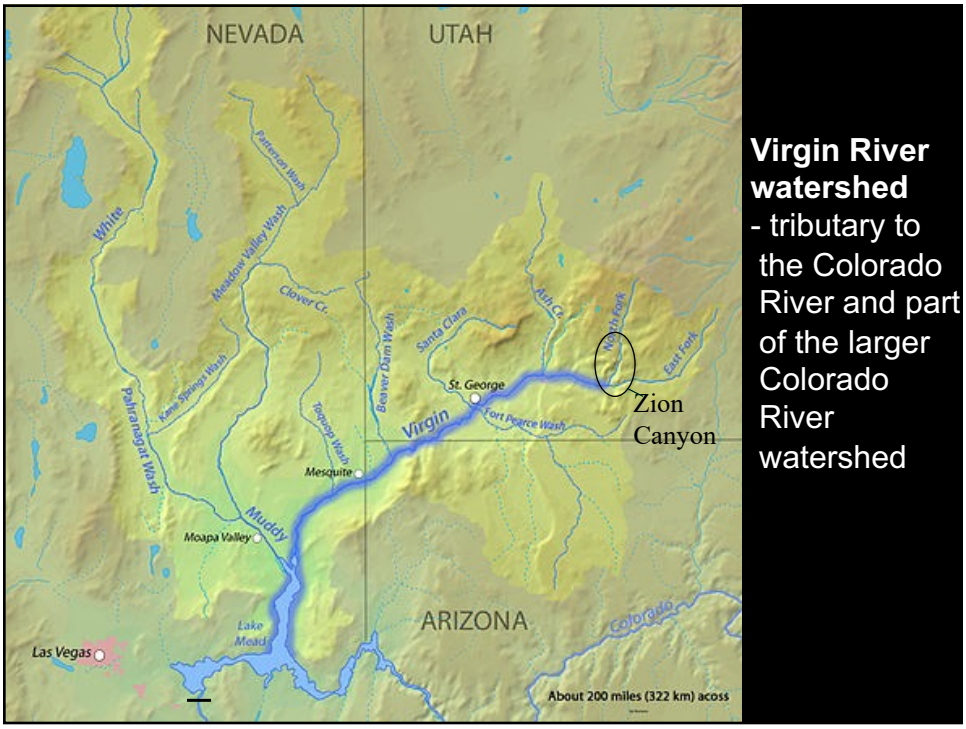
Zion NP

- 2500 ' deep main canyon cut by Virgin River

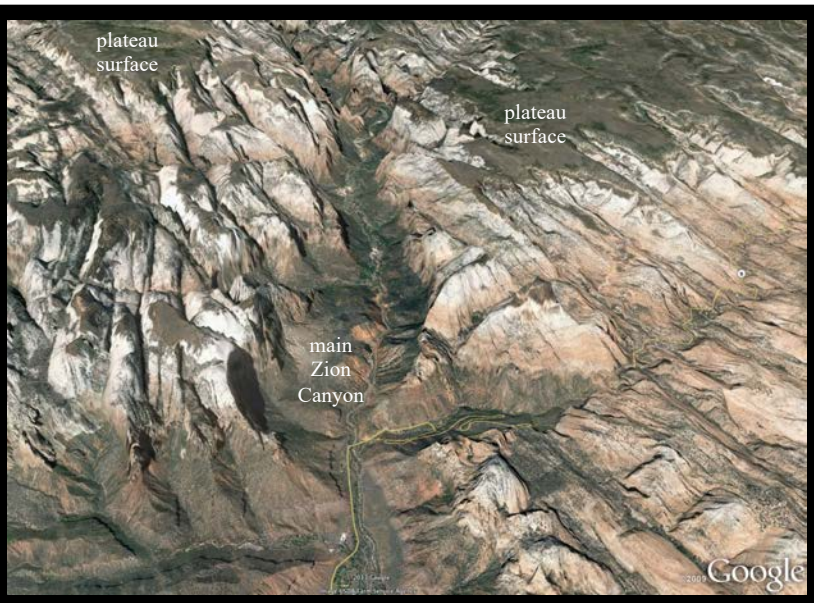
2


Zion NP
North Fork Virgin R
East Fork Virgin R
0 2 4
Miles
- notable for sheer redrock cliffs
Who's visited?

3


NEVADA
UTAH
ARIZONA
White
Meadow Valley Wash
Clover Cr.
Santa Clara
Beaver Dam Wash
Kane Springs Wash
Pahranagat Wash
Toquop Wash
Virgin
St. George
Fort Pearce Wash
North Fork
East Fork
Zion Canyon
Mesquite
Muddy
Moapa Valley
Lake Mead
Las Vegas
Colorado
About 200 miles (322 km) across
Virgin River watershed
- tributary to the Colorado River and part of the larger Colorado River watershed

4



Oblique view northward into Zion Canyon (~1 km wide)
– note near-parallel fractures (called **joints**) cutting the rock
- high plateau cut by fractures & incised by Virgin River

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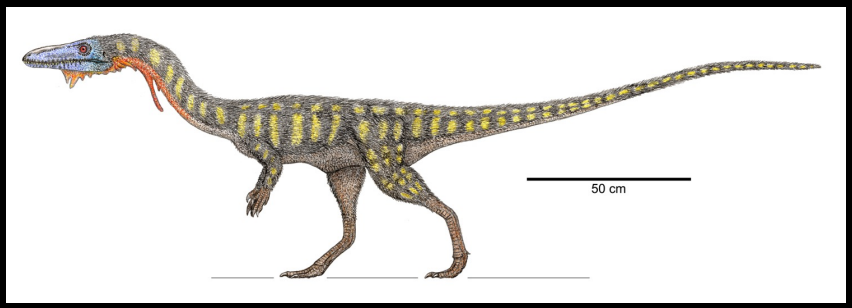
Zion NP dominated by Mesozoic sedimentary rock
- environments represented include shallow seas, coastal plain rivers, tropical swamps, and vast coastal deserts
- now uplifted and eroded as part of the larger Colorado Plateau

6

Zion NP dominated by resistant cliffs of Navajo Sandstone overlying slopes of less-resistant Kayenta Formation.

7

Three-toed trackways of a dinosaurian, likely *Megapnosaurus*, found in floodplain deposits of the Kayenta Formation.



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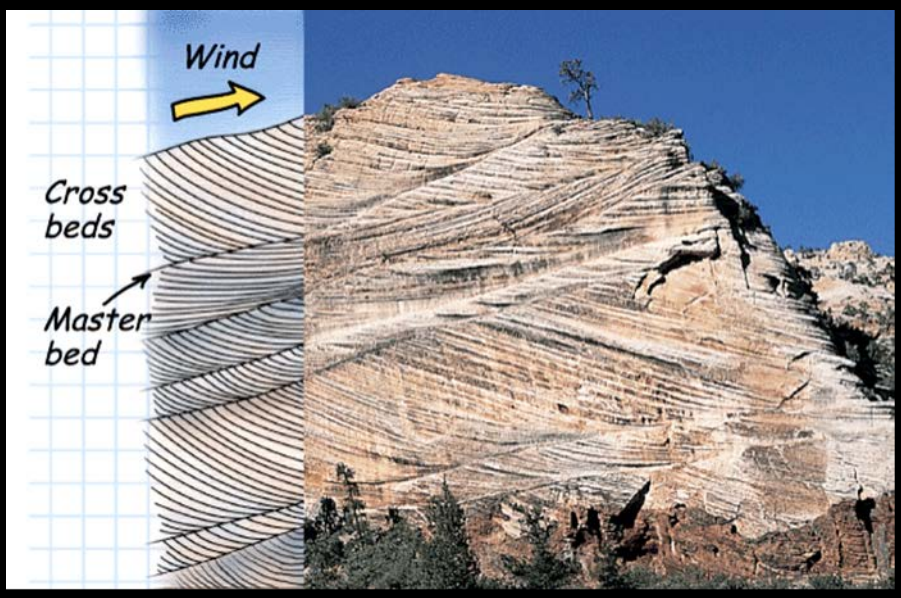
Navajo Sandstone ***Court of the Patriarchs***

~200 m.y. old - Mesozoic

9

Cross-bedding in Navajo - vast coastal desert system

10



Cross-bedding in Navajo - Zion NP

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Sand grains will self-organize into dunes under the influence of strong prevailing winds

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The orientation of the dunes reveals the direction of prevailing winds. Dunes are steeper on their downwind side and gentler on their upwind side.

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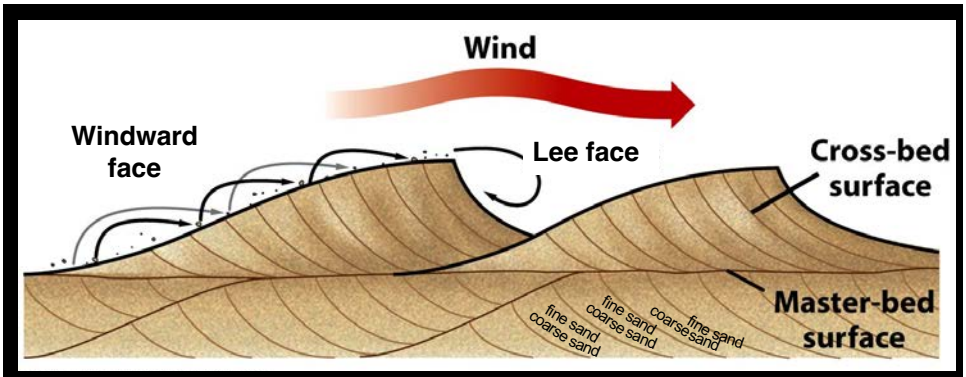

Formation of cross-bedding by winds

- most sand dunes are asymmetric
- sand grains bounce up the gentle windward side of the dune, then avalanche down the steep leeward side
- as grains avalanche downward, they separate according to small differences in size or density, forming a discrete cross-bed
- the “master-bed” surface commonly represents erosion of the top of a dune by wind, which transports that sand elsewhere

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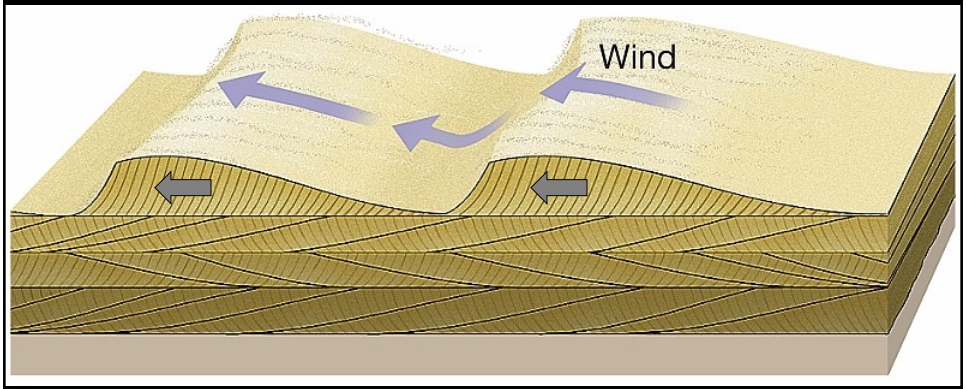

The sand composing dunes is always being moved around by the wind, transferred from the broad upwind side to the steep downwind side. The dune is constantly moving forward, as long as the winds continue to blow.

Horizontal bodies of cross-beds were stabilized by groundwater beneath the upper part of the dune.

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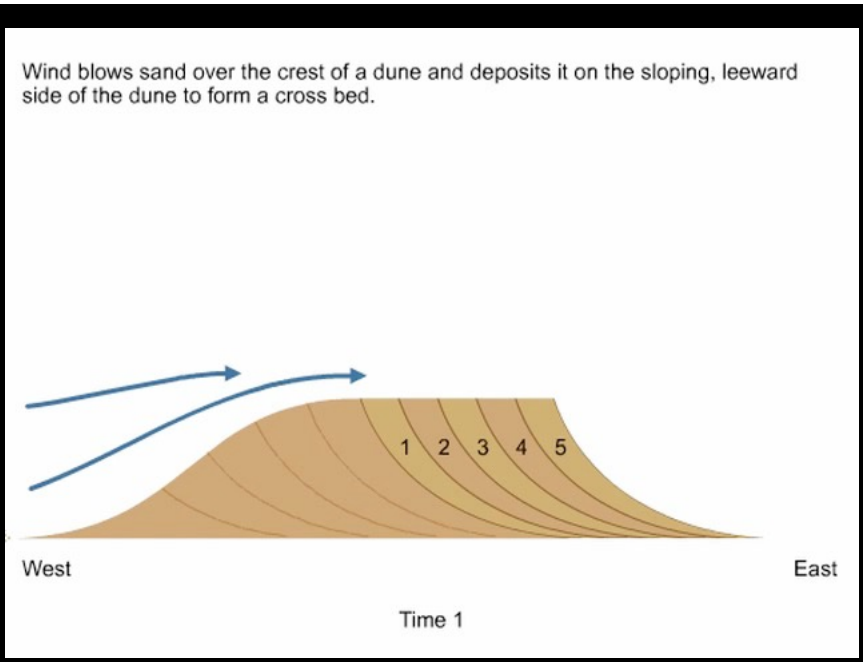

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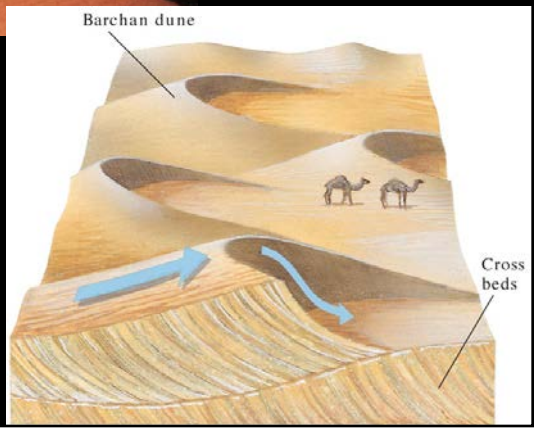
Avalanching of sand grains down the steep face of an advancing dune (using actualism to understand ancient wind-blown sandstones)

17

Actualism used to interpret ancient sand dunes

Dunes of Navajo Desert may have been 100's of feet high



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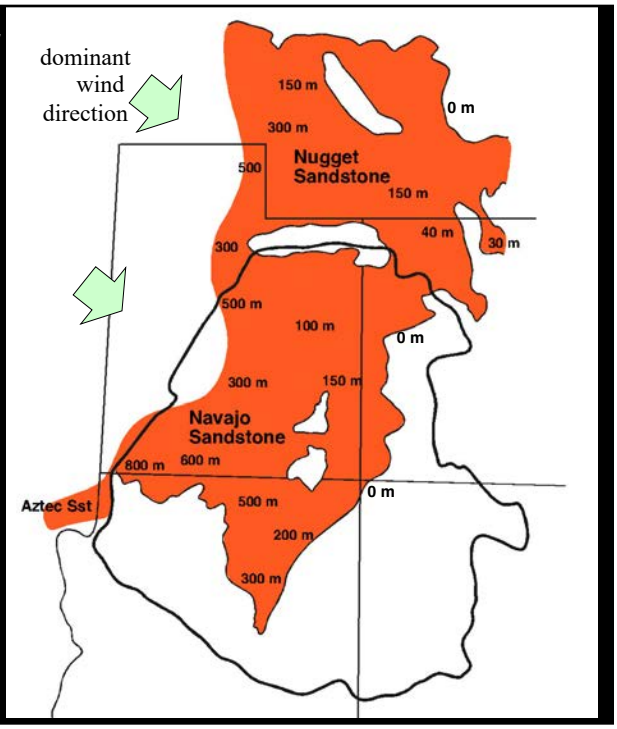
What is the shape of the Navajo Sst layer?

Areal distribution and thickness of the Navajo Sandstone (and its equivalents) - wedge, not sheet

Map created using several exposures and the principle of lateral continuity.

Navajo exposed along Lake Powell, Capitol Reef NP, Canyonlands NP, Arches NP



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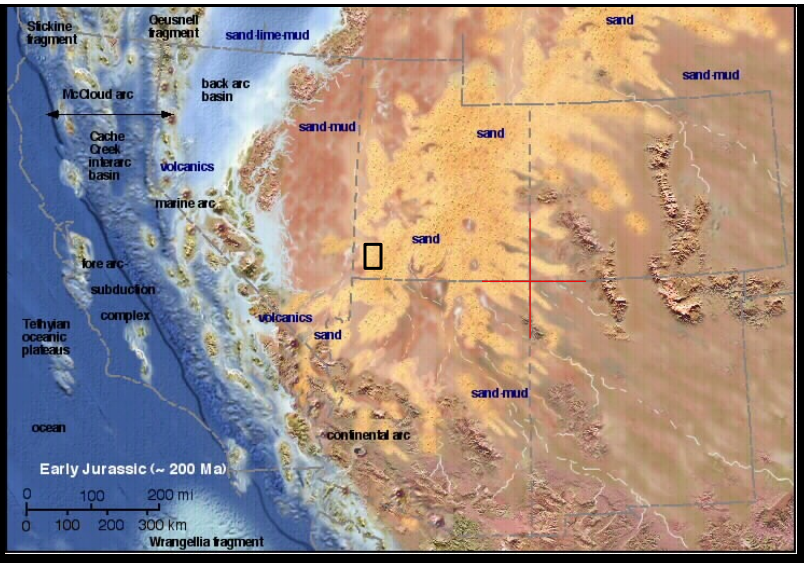

Paleogeography during Navajo time (~200 m.y.a.)

- coastline ran through central Nevada into Idaho
- Navajo Sandstone was a coastal desert near sea level
- uplift of Colorado Plateau happened much later

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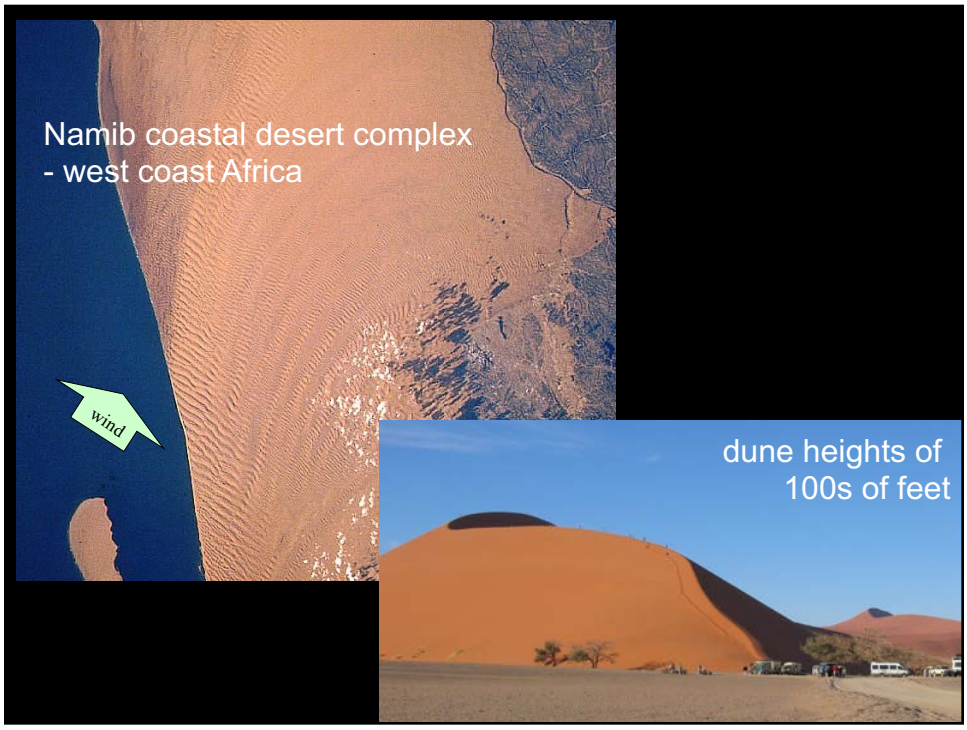

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How does Zion Canyon deepen & widen?

Erosion of Kayenta by the Virgin River during floods

Rockfall on Towers of the Virgin 12/30/10

22

Canyon widening via rockfalls

- infiltration of water through the Navajo sandstone along vertical fractures (joints) dissolves natural cement holding sand grains together, weakening the rock

rockfall at Zion

23

Rock-climbers ascend "Space Shot" along joints (Zion NP)

Note the angular scars of old rockfalls

Landscapes of national parks of the Colorado Plateau are **erosional** in origin – deep canyons, steep vertical cliffs, broad escarpments

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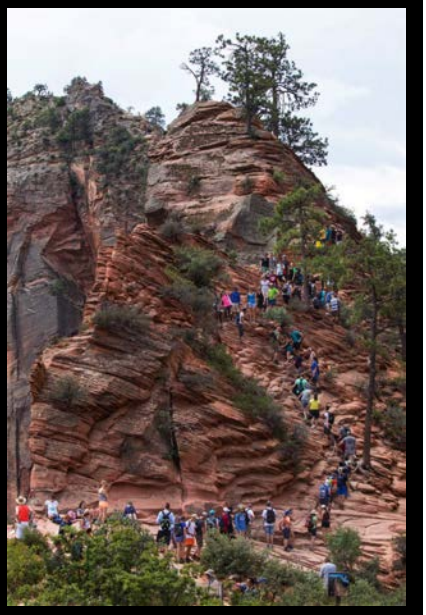

Angel's Landing trail
Zion NP

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canyoneering in the Narrows, Zion NP

26

Overcrowding in the Narrows, Zion NP

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