Grand Canyon National Park

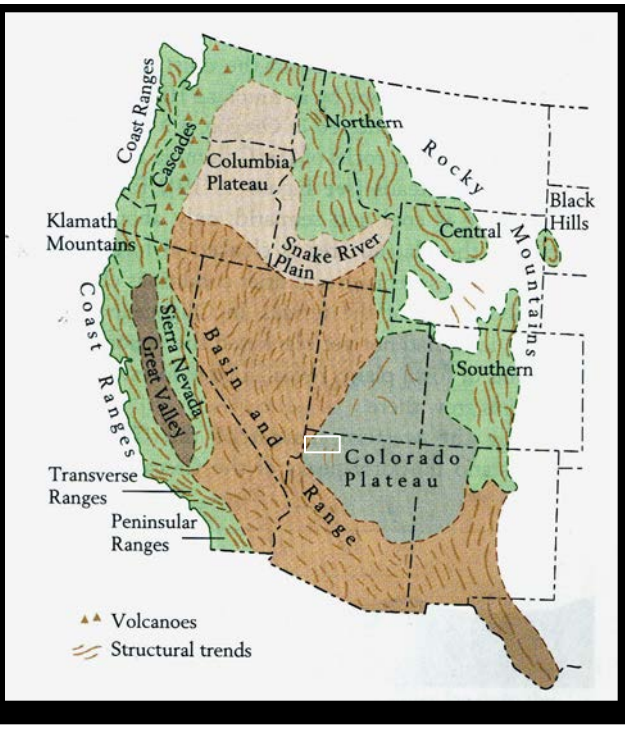
Notes and images for this topic in Files
Textbook: Chapter 2 (p. 32-35), Chapter 3 (p. 36-40), Chapter 1 (p. 18-20)

1

geologic provinces of the western U.S.

- provinces are defined by similarities in the geology and physical landscapes of a region

- geology vs geography



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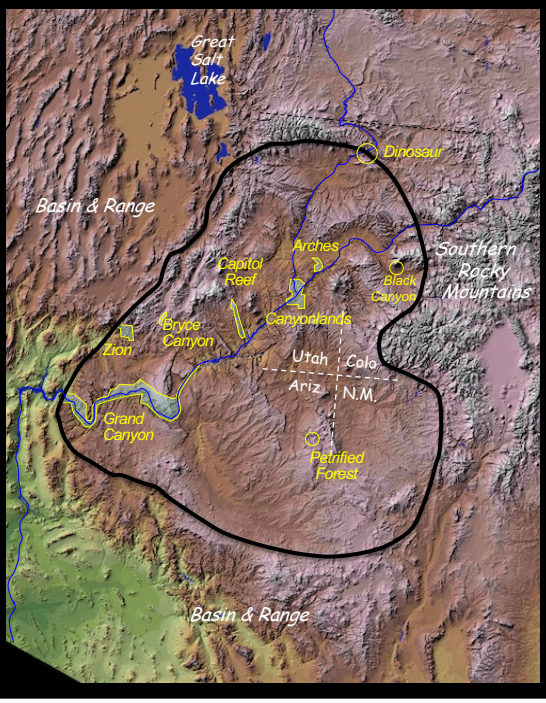
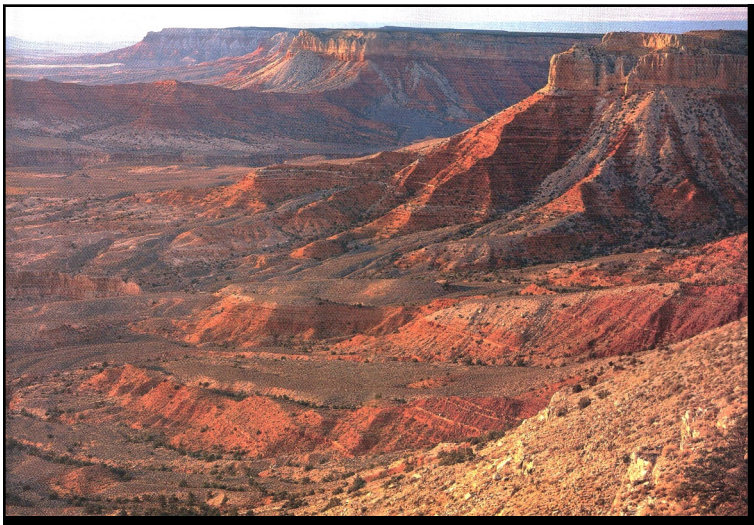


National Parks of the Colorado Plateau

- **named for the Colorado River**

- 8 national parks

3



Colorado Plateau

'redrock country'

- high elevation plateaus (5000-10,000')
- deeply incised canyons
- reddish, horizontally layered rocks
- elongate escarpments
- semi-arid climate

4

Colorado River
drainage basin
(aka 'watershed')

the Colorado River and its tributaries are the main agents of erosion by flowing water that create the landscapes of the Colorado Plateau

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Grand Canyon NP, northern Arizona

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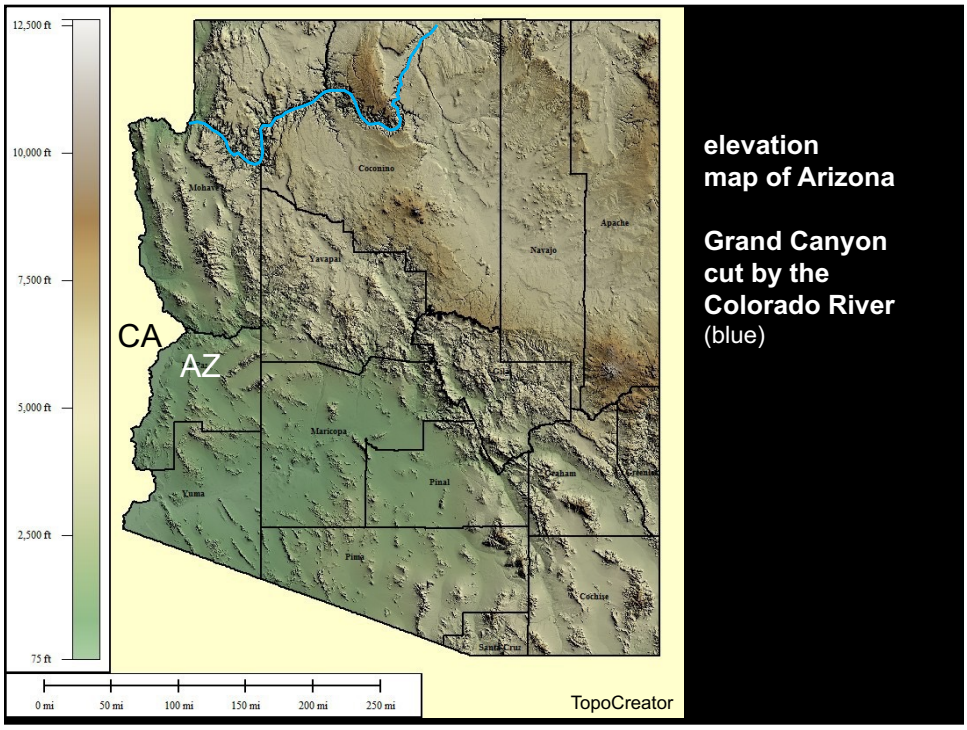

elevation map of Arizona

Grand Canyon cut by the Colorado River (blue)

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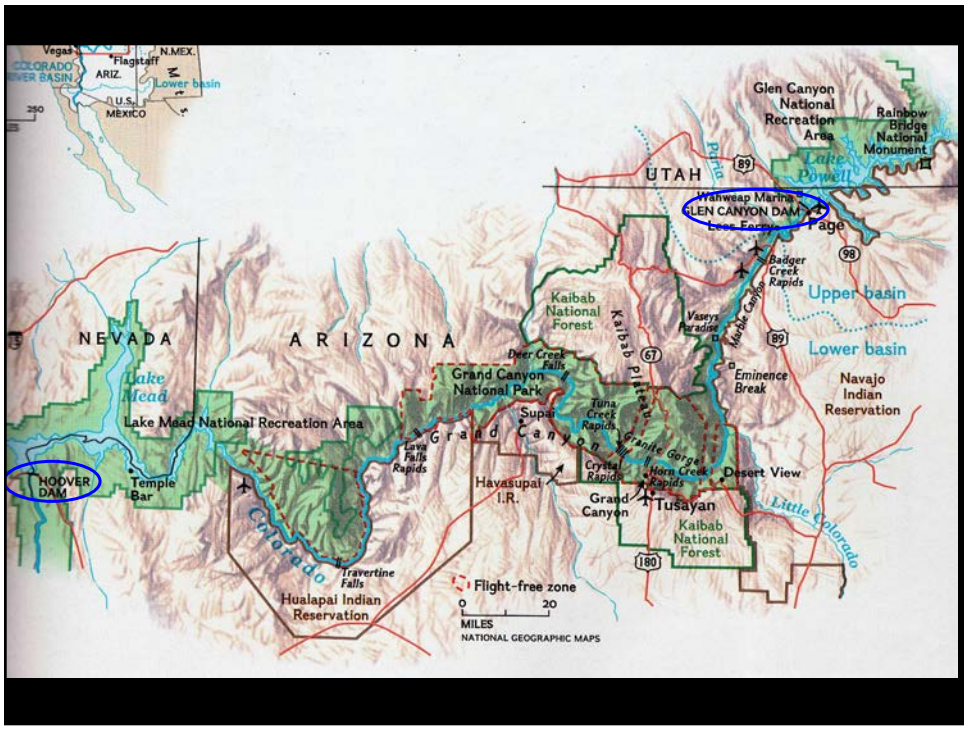

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Lake Powell impounded behind Glen Canyon Dam
- hydroelectricity, flood control, recreation
- restricts flow of sediment

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Lake Powell – dammed Colorado River

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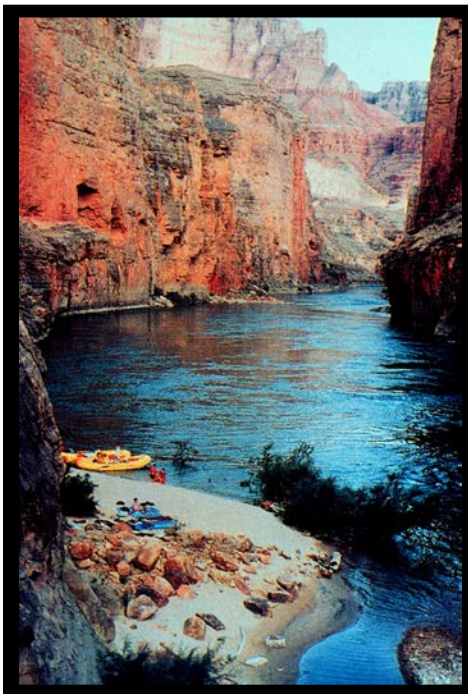

Colorado River in Grand Canyon before the dam

Colorado River in Grand Canyon after the dam

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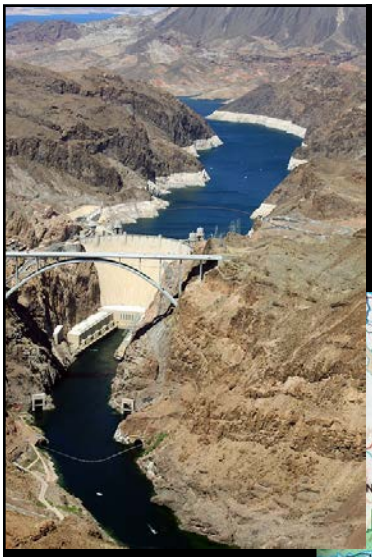

Hoover Dam – creates Lake Mead at the downstream (western) end of the Colorado River near Grand Canyon

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River incision of the Grand Canyon

Before the dams, the Colorado River and its tributary streams cut down (process called incision) into the rocks of the plateau, exposing them to view.

- river incision during countless turbulent floods over millions of years

*By reason, the rocks had to have been there **before** the river cut into them*

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The layers of the cake (layers of rock) had to have been formed before the knife (the river) could incise downward into the layers. The slice removed is analogous to the canyon left behind after rock was eroded away by river incision.

The bottom layers must be older than overlying layers. (The platter is the oldest of all)

The layered rocks are older than the river and the canyon

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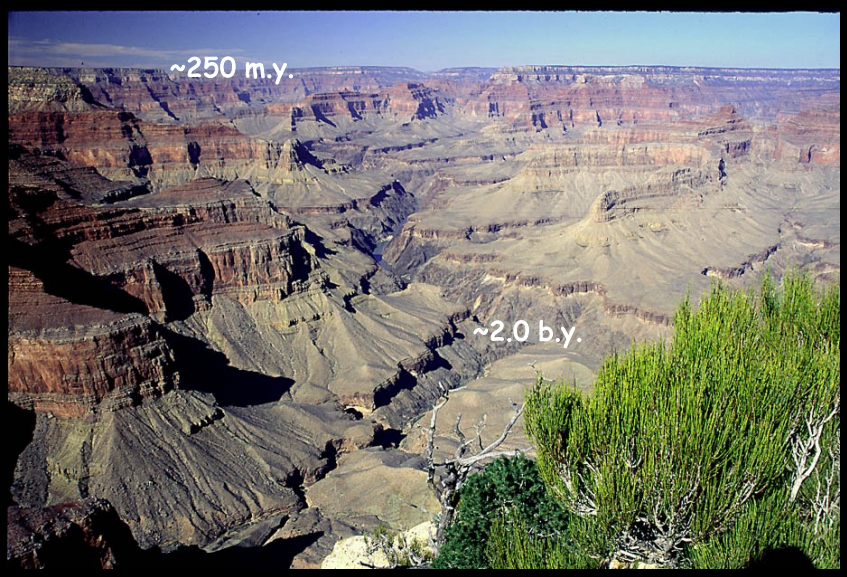

Rocks forming the Grand Canyon span ~2 billion years.
The canyon itself is "only" about 5 to 6 million years old.

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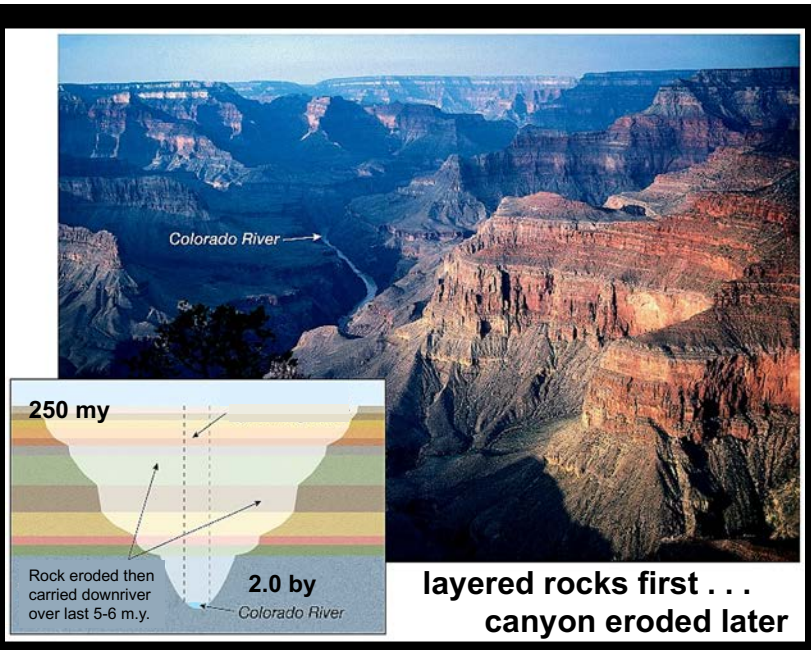

layered rocks first . . .
canyon eroded later

The modern landscape is always younger than the rocks beneath.

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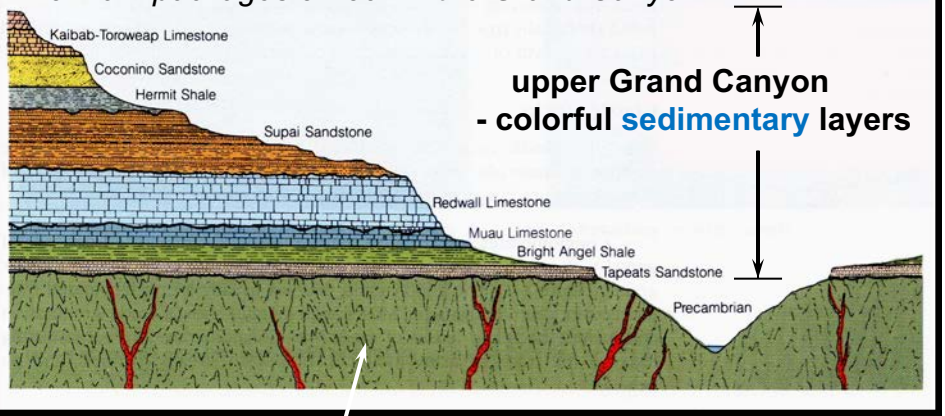
How did the rocks of the upper GC form?
Sedimentation & Sedimentary Rocks

Two main packages of rock in the Grand Canyon



upper Grand Canyon
- colorful sedimentary layers

dark 'basement' of the "lower" Grand Canyon
(igneous & metamorphic rocks)

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Sedimentation & Sedimentary Rocks

Layering (or bedding) – most distinguishing characteristic of sedimentary rock

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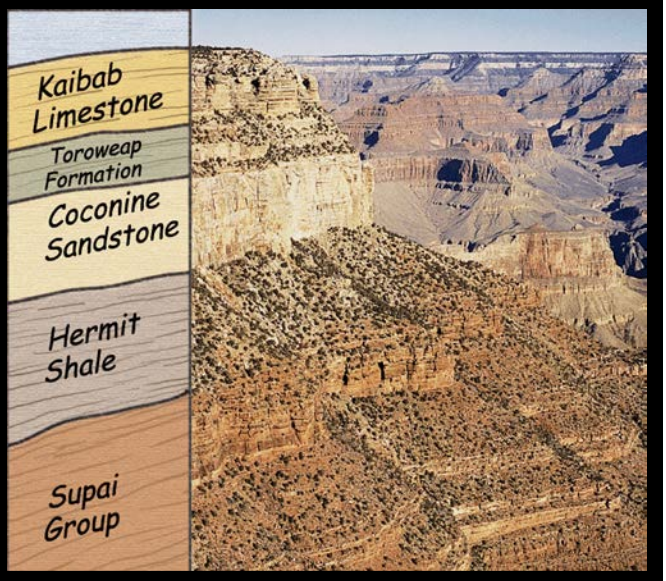
Individual layers of sedimentary rock, tens to hundreds of feet thick, exhibit distinct characteristics and are labeled with formal names called formations or groups.

Formations composed of individual beds of rock (aka 'strata')



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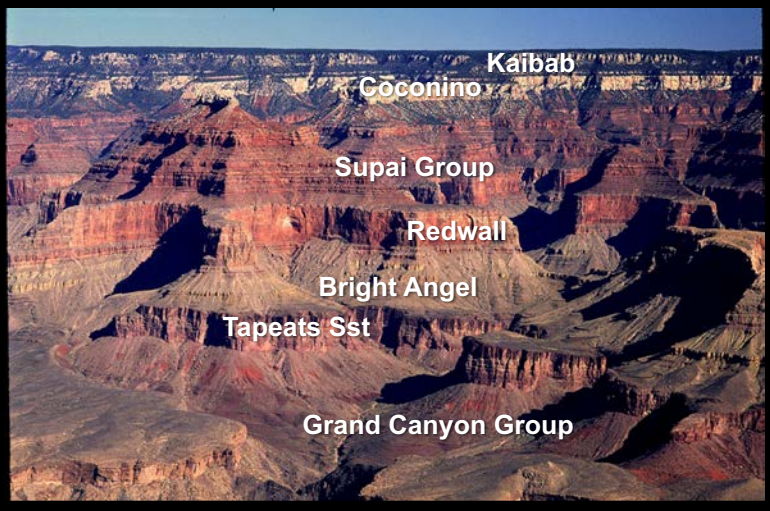
Major formations / groups of the Grand Canyon



Superposition - layers of rock on the bottom are the oldest, with progressively younger rocks layered above.

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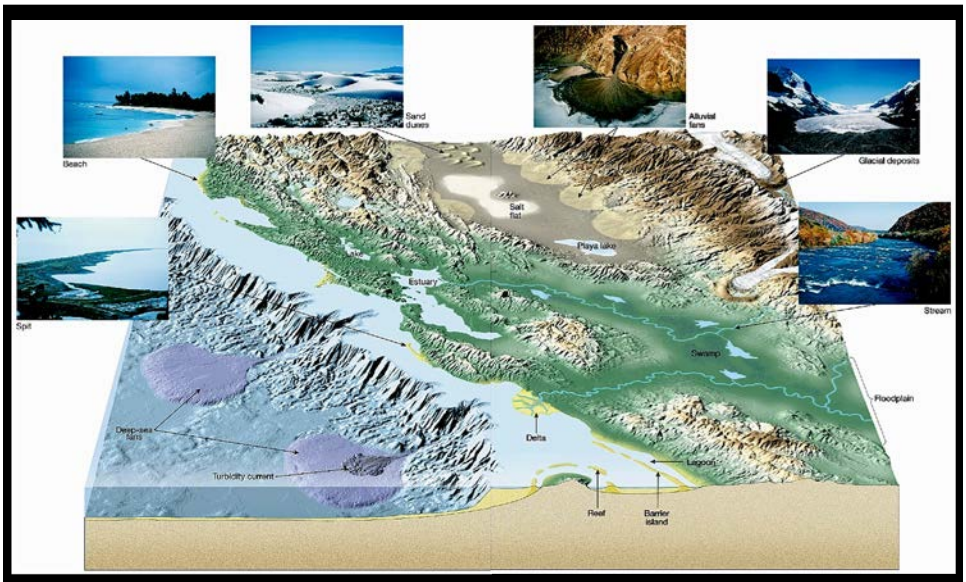

Many sedimentary rocks are formed from clay, silt, sand and other loose sediment that is deposited as horizontal layers in various depositional environments.

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river pouring sediment-laden water through a delta into open water

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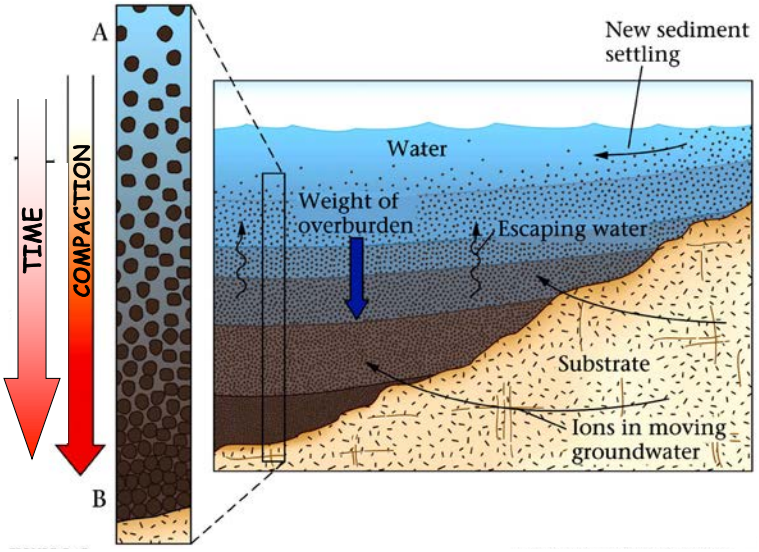

4 - Burial, compaction and cementation of loose sediment into hard sedimentary rock

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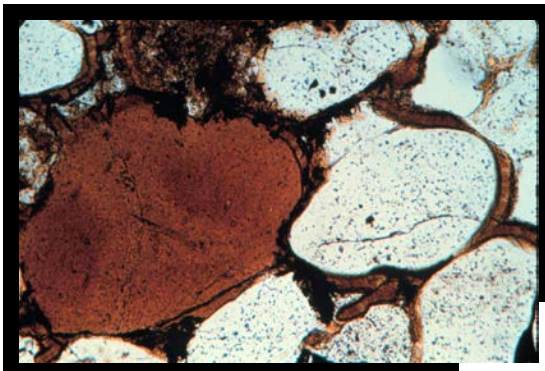
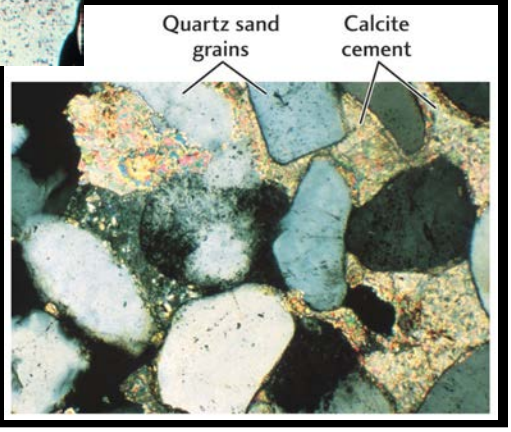


iron oxide cement binding quartz grains



Ions (Ca, Si, Fe) transported in solution by groundwater. When the solution becomes concentrated enough in pores between grains, Fe oxide, calcite, or silica may precipitate as a cement.

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Sandstone: grains of sand

Shale: fine clay particles

Siltstone: silt particles

Conglomerate: cobbles, pebbles, sand, silt

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Stacks of layered sedimentary rocks like those of the Grand Canyon represent changing depositional environments, sea level & climate through time

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Interpretations of depositional environments are based on the principle of actualism
- what we can actually see occurring in today's world is likely to have occurred in the past

'The present is the key to the past.'

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