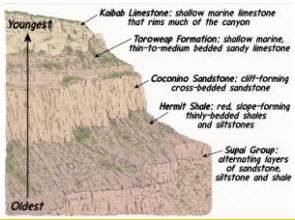
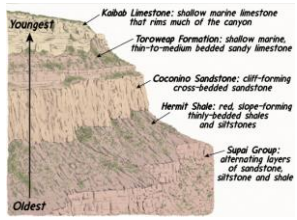
## Stratigraphy




- Stratigraphy is a sub-science of geology that attempts to organize the rock record into some manageable classification scheme:
  - Lithostratigraphy deals with the arrangement and succession of strata (rock layers) based on observable rock properites
  - Biostratigraphy uses fossils to establish relative ages of rocks and correlate successions of sedimentary rocks within and between depositional basins
  - Chronostratigraphy studies the age of rock strata in relation to time

1

## Formations



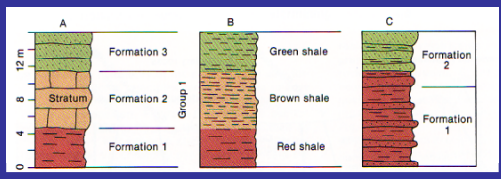

- The basic local unit of stratigraphy is the formation
- A particular rock unit is grouped into a formation based on a distinctive appearance and/or other characteristics:
  - Lithology (rock type)
  - Color
  - Sedimentary structures
  - Certain depositional patterns

2

## Lithostratigraphy (Formations)

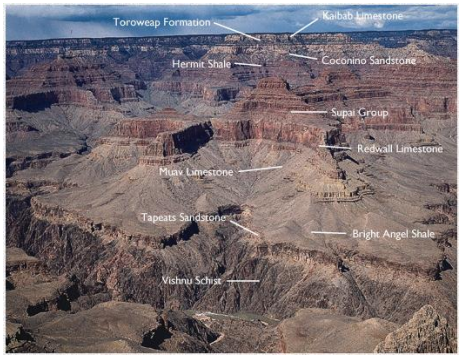
**Distinguished by:**

**mineral composition**
**textural properties**
**organic remains**
**color**
**thickness**
**outcrop character**



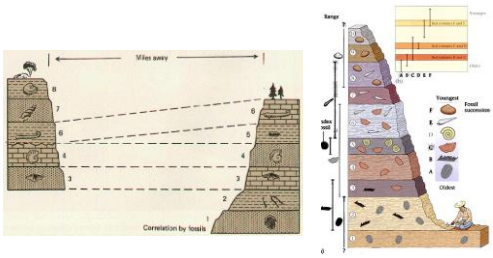

3

## Formations of the Grand Canyon, Arizona




4

## Biostratigraphy Uses Fossils To Establish The Relative Ages Of Rock And Correlate Successions Of Sedimentary Rocks

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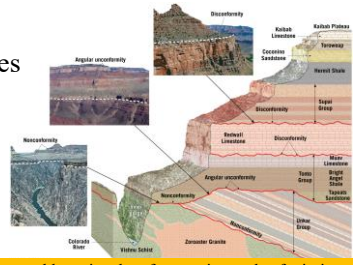
## Unconformities




- Unconformities represent old erosional surfaces or intervals of missing strata within a rock sequence
- Three types of unconformities:
  - Angular unconformity
  - Nonconformity
  - Disconformity

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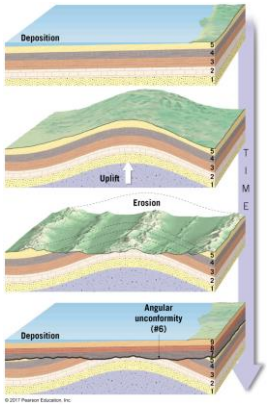
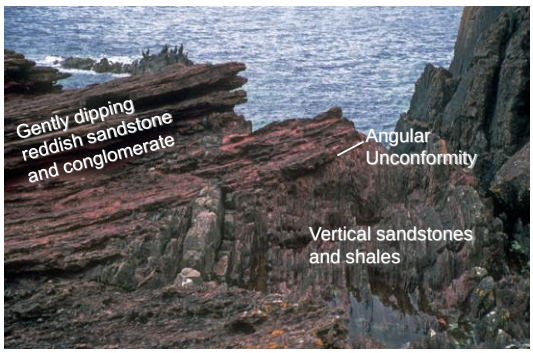
## Angular Unconformity

An angular unconformity is an old erosional surface separating tilted or folded sedimentary rocks below from flat-lying sedimentary rocks above




7

*Observe the orientation of rocks at Siccar Point, Scotland*

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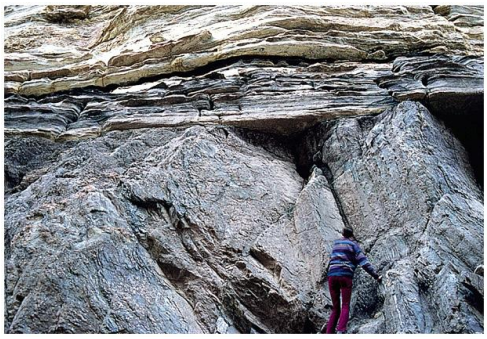
## Angular Unconformity



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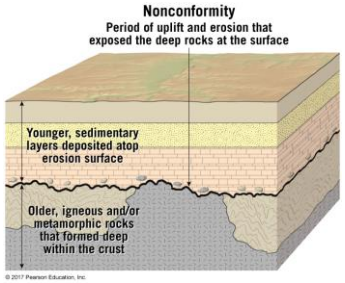
## Nonconformity

A nonconformity is an old erosional surface separating younger sedimentary rocks above from older igneous or metamorphic rocks below

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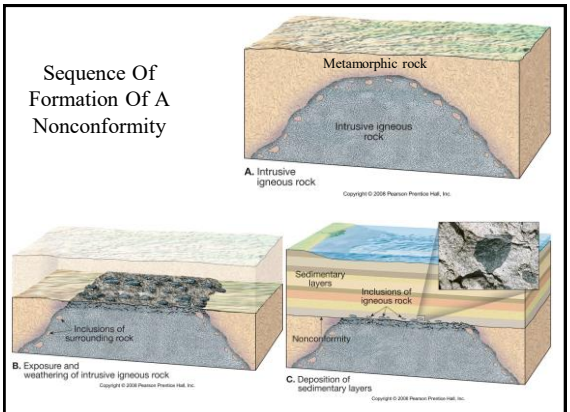
## Sequence Of Formation Of A Nonconformity

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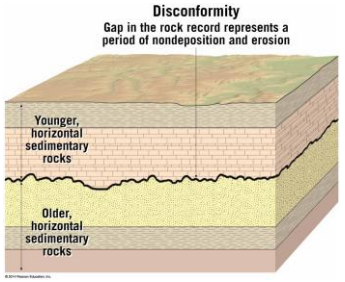
## Disconformity

A disconformity is an old erosional surface where layered sedimentary rocks occurring above and below the unconformity are parallel

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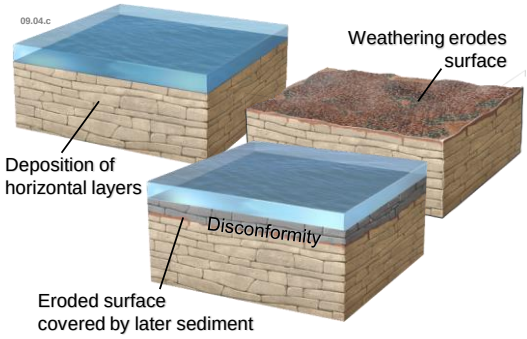
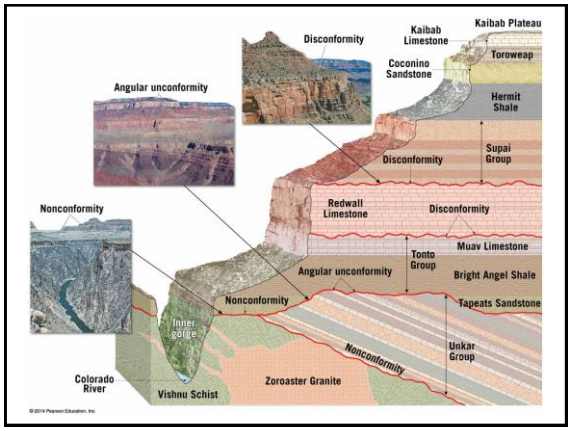
## How Do Disconformities Form?




13

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## Principles of Relative Dating

- **Law of superposition**
- **Principle of original horizontality**
- **Principle of lateral continuity**
- **Principle of cross-cutting relationships**
- **Inclusions**
- **Unconformities**

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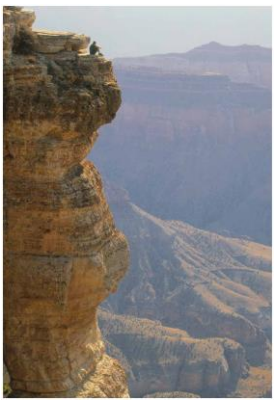
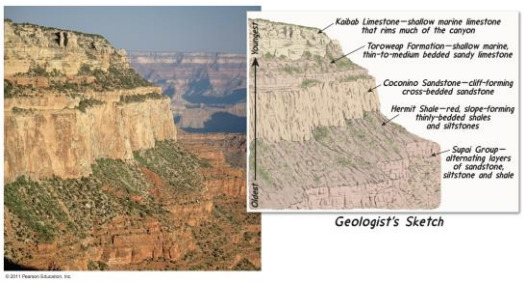
## Law of Superposition

In an undeformed sequence of sedimentary rocks, each rock layer is older than the one above and younger than the one below



16




Applying the law of superposition, the Supai Group is oldest and Kaibab Limestone is youngest

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## Principle of Original Horizontality

- Sediments are initially deposited as horizontal layers
- Resulting sedimentary rocks should also be horizontally layered
- If sedimentary rocks are folded or faulted, then the deformation occurred after formation

18

*Observe the layers in these two photographs, which show the same sequence of rocks. What is different and what do you think happened?*

09.01.a

Most sediment is deposited in horizontal layers

If layers are not horizontal, something has happened (deformation)

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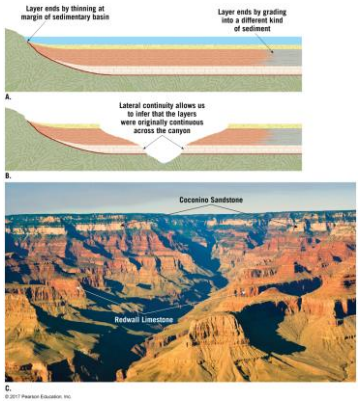
## Principle of Lateral Continuity

Sedimentary rocks originally form as continuous layers that extend in all directions until eventually thinning out at the edge of the basin

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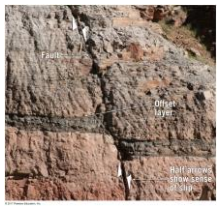
## Principle of Cross-cutting Relationships

If a fault cuts rocks or a magma intrudes rocks…

- The fault/magma are younger than the rocks they cut
- Faulting and intrusion occurred after the original rocks formed



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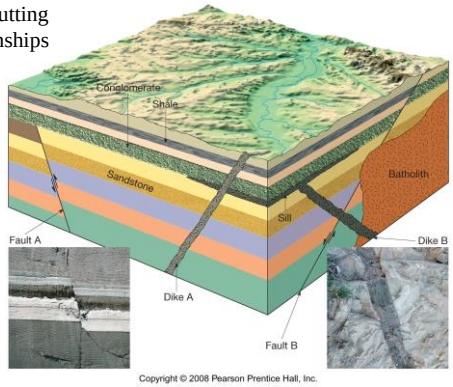
## Cross-cutting Relationships

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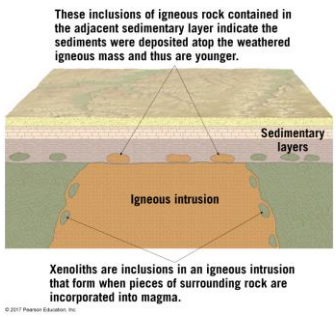
## Inclusions

- Inclusions are fragments of a rock unit enclosed in another rock unit
- The rock unit that supplied the inclusions must be older than the rock containing the inclusions

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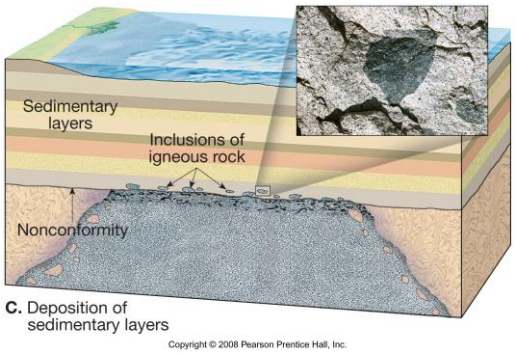


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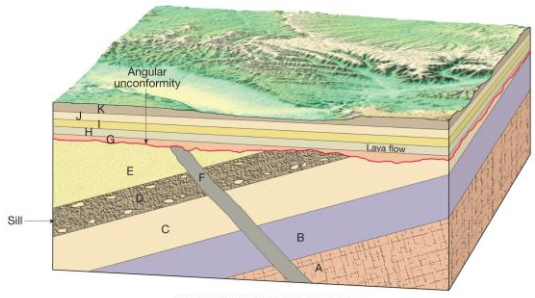
What is the Relative Sequence of Events?






25

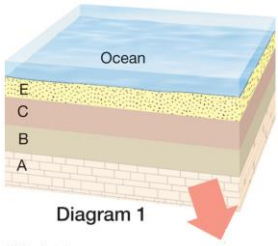



Diagram 1

**1.** Beneath the ocean, beds A, B, C, and E were deposited in that order (law of superposition).



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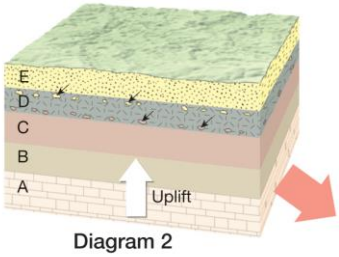


Diagram 2

**2.** Uplift and intrusion of a sill (layer D). We know that sill D is younger than beds C and E because of the inclusions in the sill of fragments from beds C and E.



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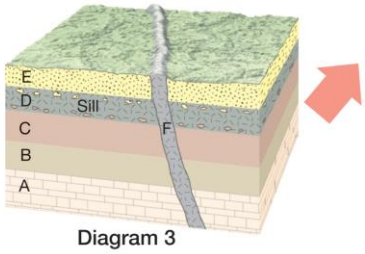


Diagram 3

**3.** Next is the intrusion of dike F. Because the dike cuts through layers A through E, it must be younger (principle of cross-cutting relationships).



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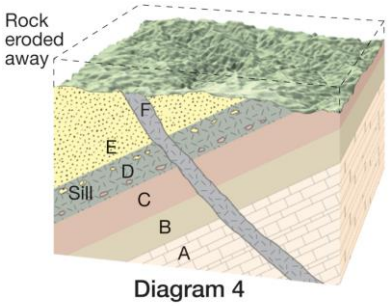


Diagram 4

**4.** Layers A through F were tilted and exposed layers were eroded.



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**5.** Next, beds, G, H, I, J, and K were deposited in that order atop the erosion surface to produce an angular unconformity. Because layer H is a lava flow, superposition applies to it as well as the surrounding sedimentary beds.

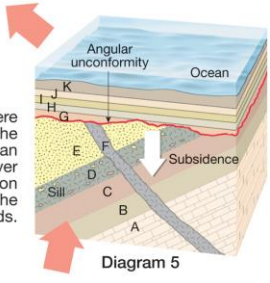


Diagram 5



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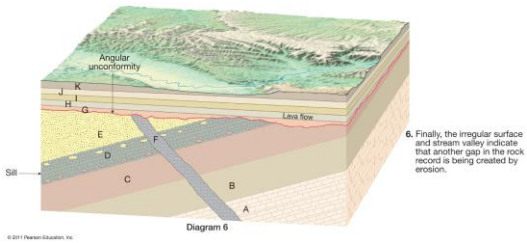


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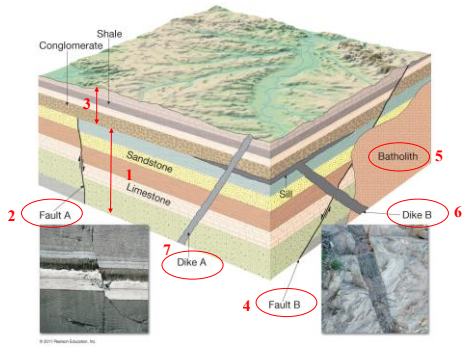
What is the Relative Sequence of Events?

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