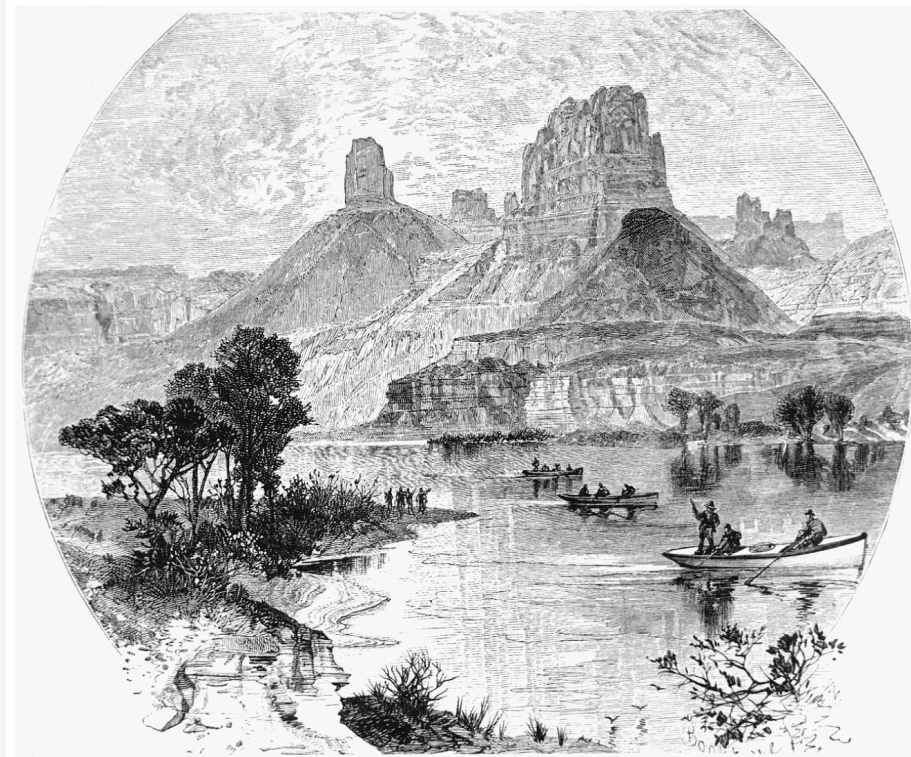


Chapter 9

Geologic Time



A.

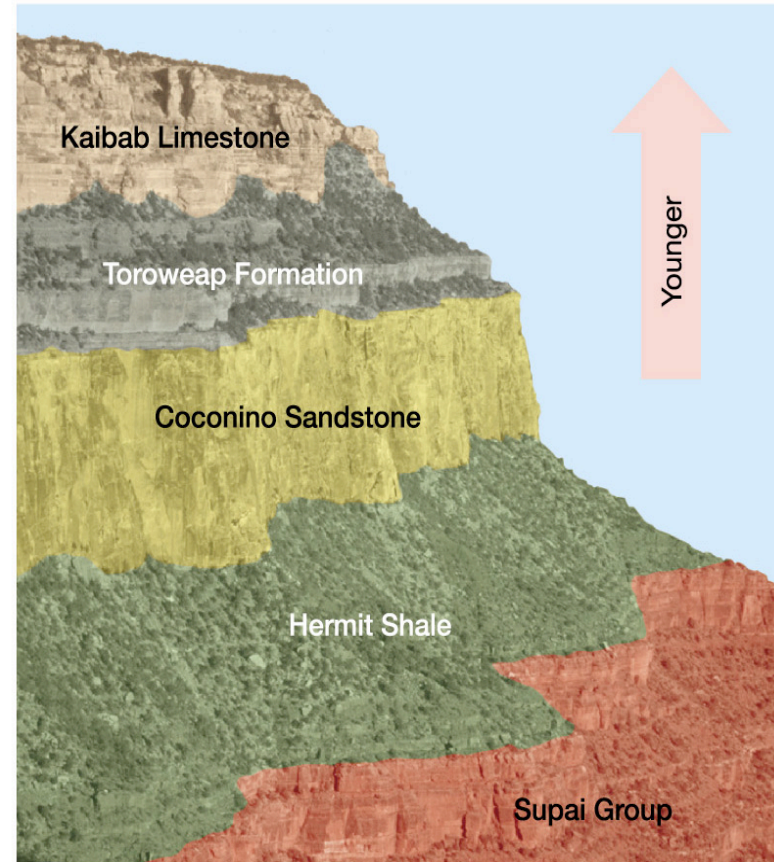
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Relative dating-Principles

■ Law of superposition- Steno in 1669



A.



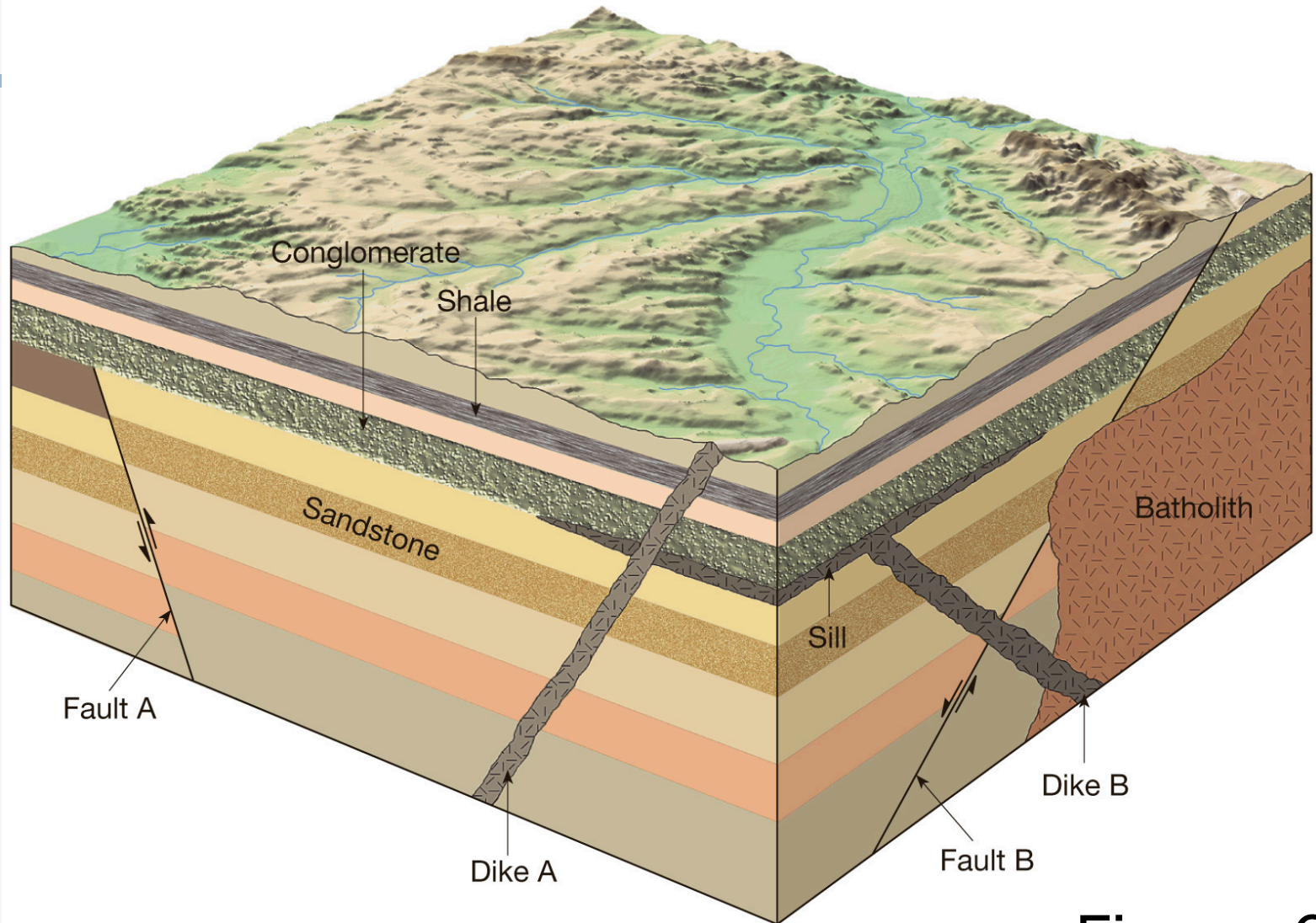
B.

Relative dating-More Principles

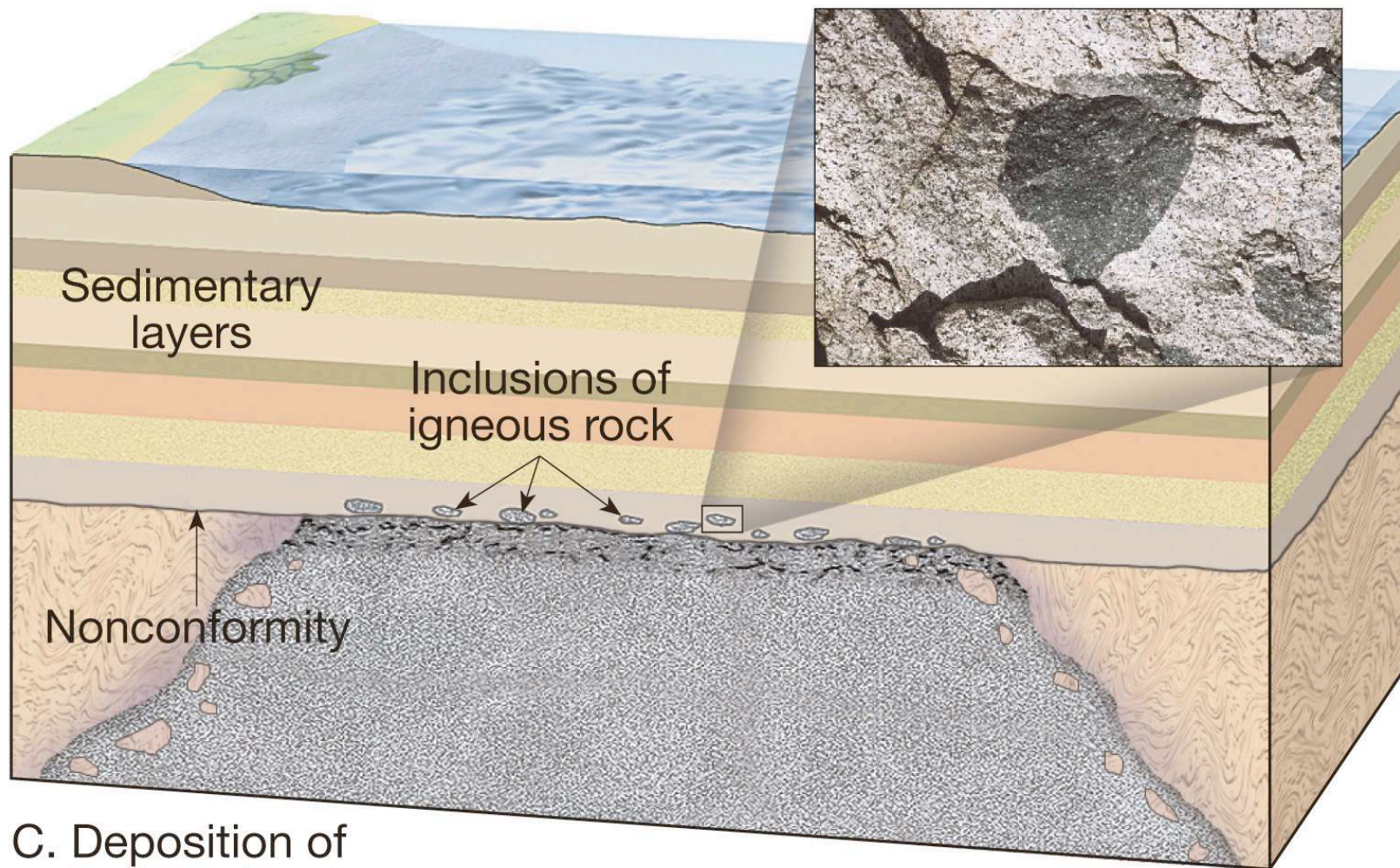
- **Principle of original horizontality**
 - **Layers of sediment are generally deposited in a horizontal position**



Cross-cutting relationships



Principle: Rock Inclusions



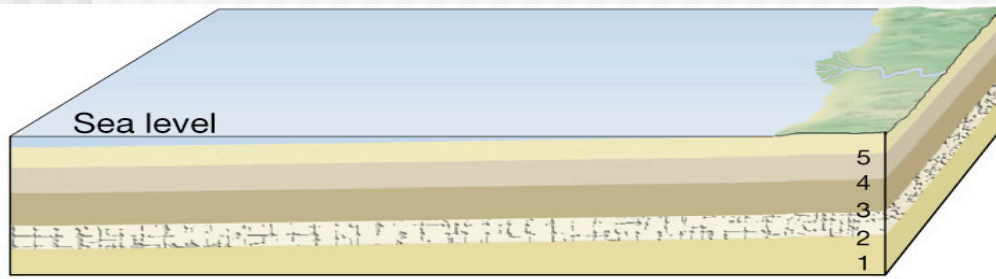
C. Deposition of
sedimentary layers

Relative dating

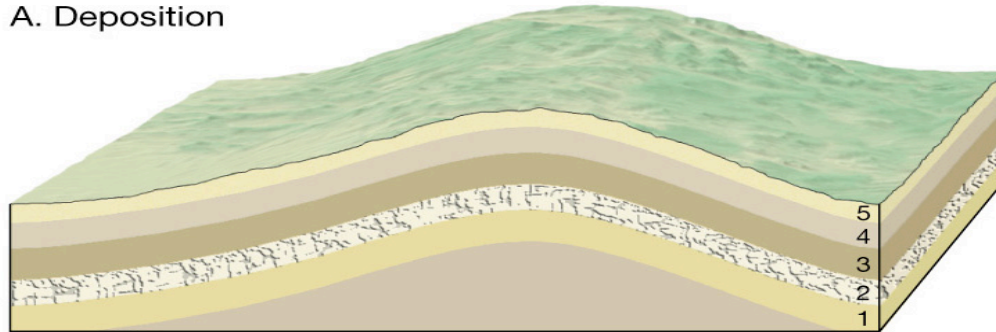
- **Unconformity-break in rock record**



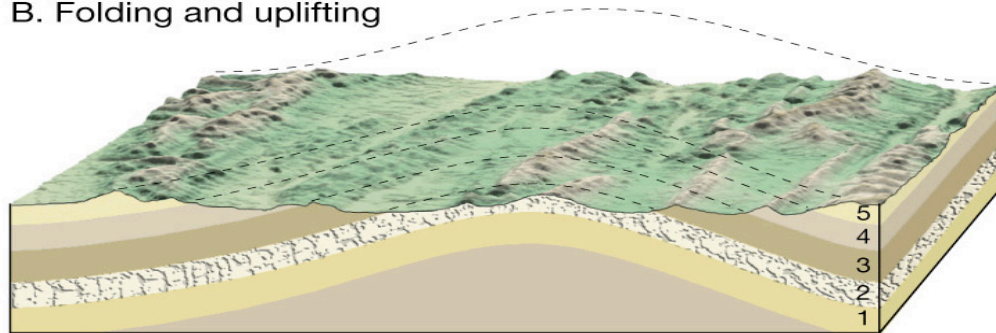
E.



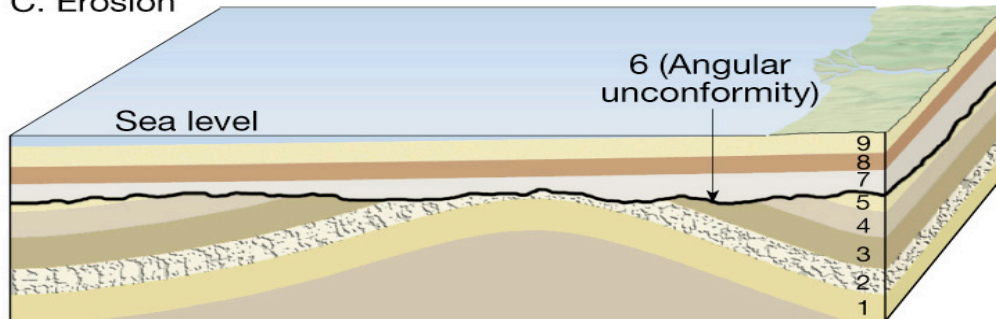
A. Deposition



B. Folding and uplifting



C. Erosion



D. Subsidence and renewed deposition

Formation of an angular unconformity

Figure 9.7

Unconformities in the Grand Canyon

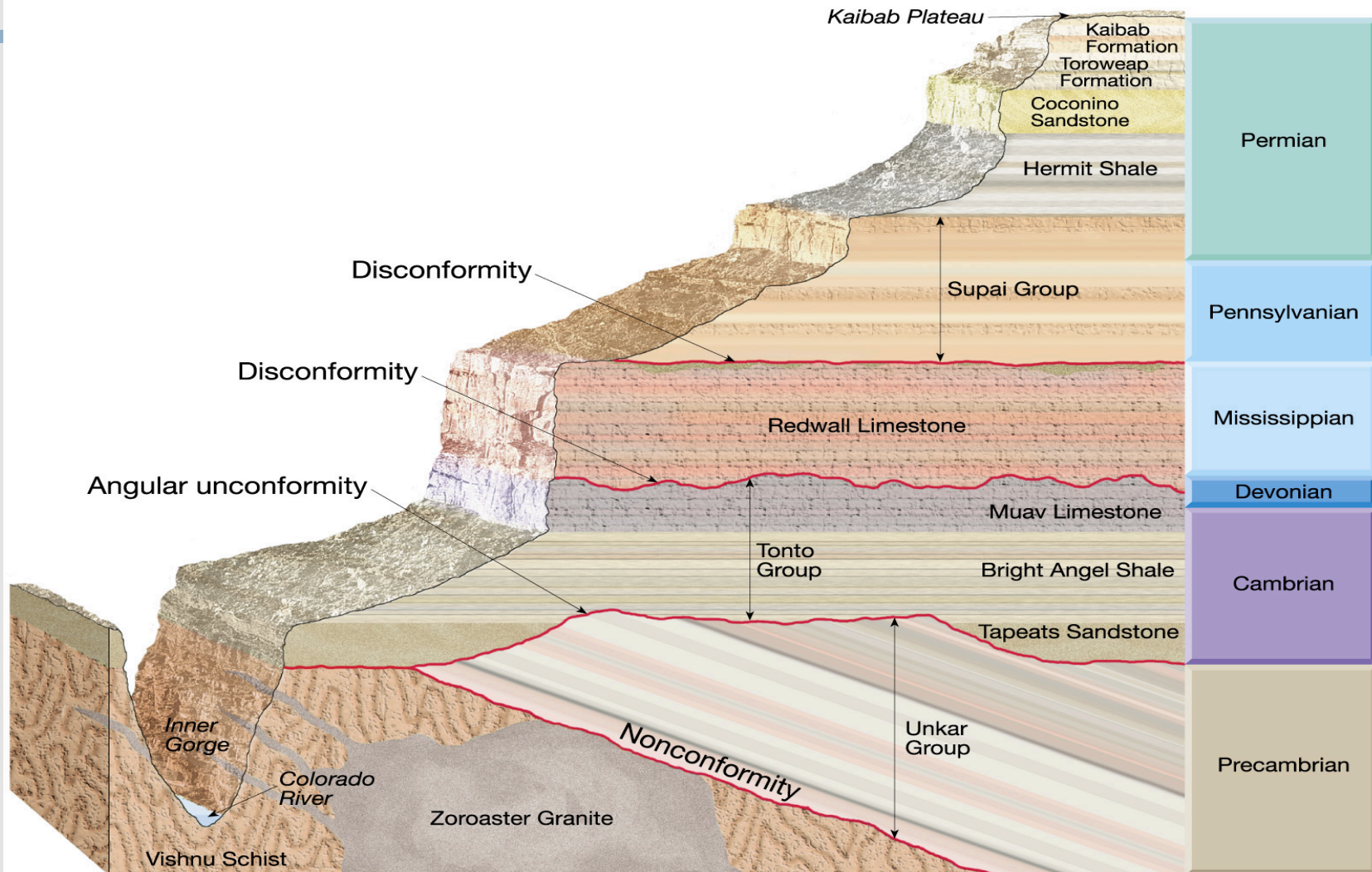


Figure 9.6

Principle: Fossils and correlation

- **Matching of rocks of similar ages in different regions is known as **correlation****



Fossils and correlation

Index fossil – geographically widespread fossil that is limited to a short span of geologic time



E

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Dating rocks using overlapping fossil ranges

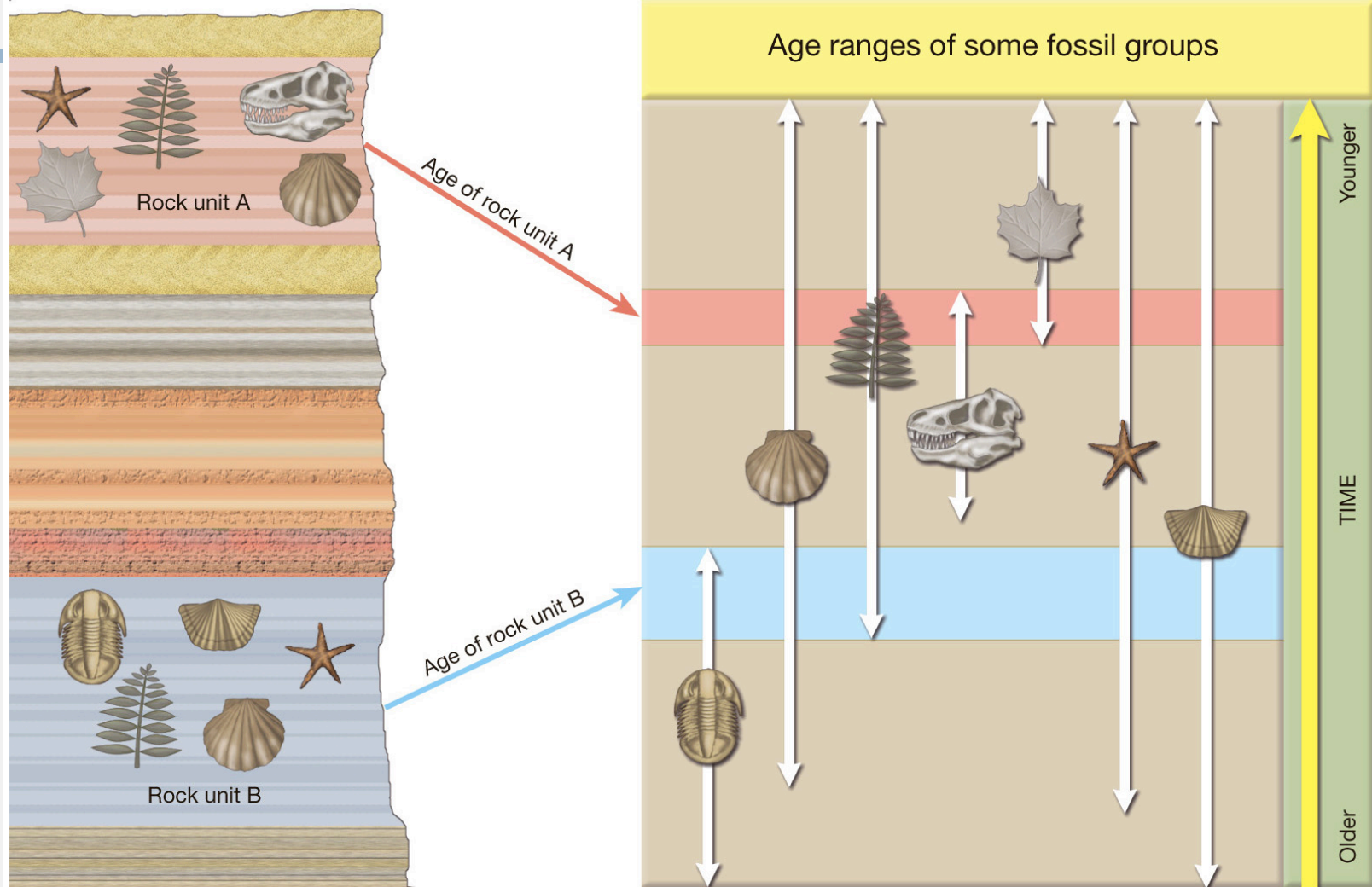


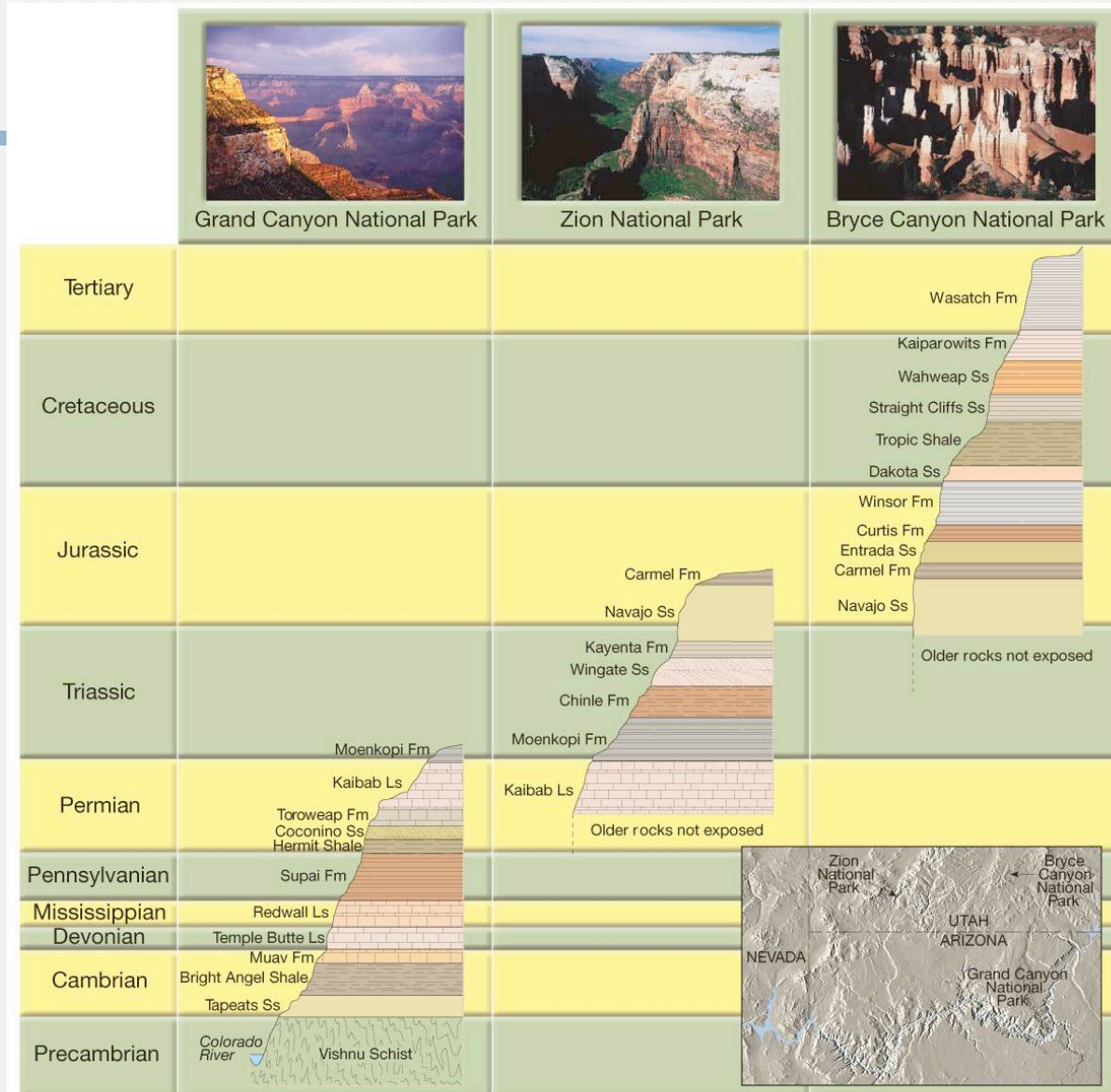
TABLE 9.2 Major Divisions of Geologic Time

Cenozoic Era (Age of Recent Life)	Quarternary period	The several geologic eras were originally named Primary, Secondary, Tertiary, and Quaternary. The first two names are no longer used; Tertiary and Quaternary have been retained but used as period designations.
	Tertiary period	
Mesozoic Era (Age of Middle Life)	Cretaceous period	Derived from Latin word for chalk (creta) and first applied to extensive deposits that form white cliffs along the English Channel (see Figure 7.11).
	Jurassic period	Named for the Jura Mountains, located between France and Switzerland, where rocks of this age were first studied.
	Triassic period	Taken from word "trias" in recognition of the threefold character of these rocks in Europe.
Paleozoic Era (Age of Ancient Life)	Permian period	Named after the province of Perm, Russia, where these rocks were first studied.
	Pennsylvanian period*	Named for the state of Pennsylvania where these rocks have produced much coal.
	Mississippian period*	Named for the Mississippi River Valley where these rocks are well exposed.
	Devonian period	Named after Devonshire County, England, where these rocks were first studied.
	Silurian period	Named after Celtic tribes, the Silures and the Ordovices, that lived in Wales during the Roman Conquest.
	Ordovician period	
	Cambrian period	Taken from Roman name for Wales (Cambria), where rocks containing the earliest evidence of complex forms of life were first studied.
Precambrian		The time between the birth of the planet and the appearance of complex forms of life. About 88 percent of Earth's estimated 4.5 billion years fall into this span.

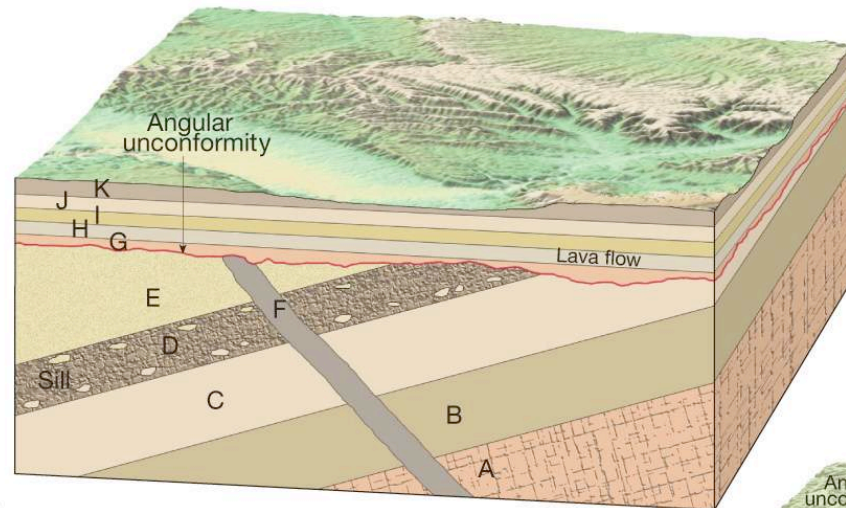
SOURCE: U.S. Geological Survey.

*Outside of North America, the Mississippian and Pennsylvanian periods are combined into the Carboniferous period.

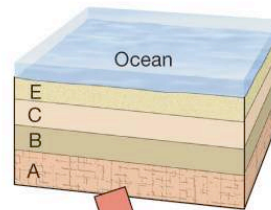
National Parks and Time



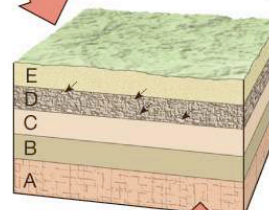
Sequence Geology



Interpretation:

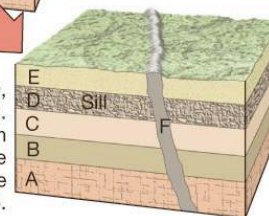


1. Applying the law of superposition, beds A, B, C, and E were deposited in that order.



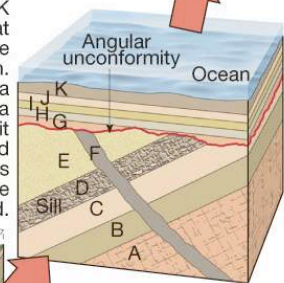
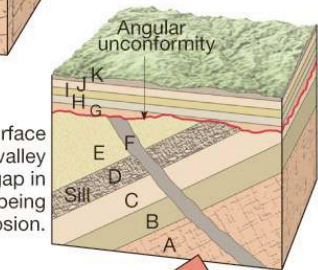
2. Bed D is a sill (a concordant igneous intrusion). Evidence that sill D is younger than beds C and E are the inclusions in the sill of fragments from these beds. If this igneous mass contains pieces of adjacent strata, then the adjacent strata must have been there first.

3. Following the intrusion of sill D, the intrusion of dike F occurred. Because the dike cuts through beds A through E, it must be younger than all of them (principle of cross-cutting relationships).



6. Finally, the irregular surface and the stream valley indicate that another gap in the rock record is being produced by erosion.

5. Beds G, H, I, J, and K were deposited in that order, again using the law of superposition. Although the lava flow (bed H) is not a sedimentary rock layer, it is a surface deposited layer, and thus superposition may be applied.



4. Next, the rocks were tilted and eroded. The tilting happened first because the upturned ends of the strata have been eroded. The tilting and erosion, followed by further deposition, produced an angular unconformity.

End of Chapter 9
