



## **Chapter Eighteen: Earth's History and Rocks**

- **18.1 Geologic Time**
- **18.2 Relative Dating**
- **18.3 The Rock Cycle**



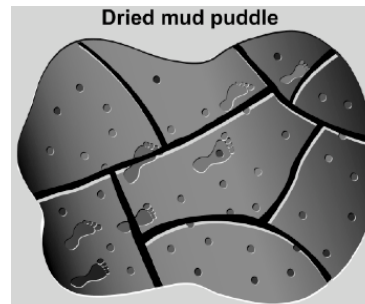
## 18.2 Learning Goals

- Compare and contrast methods of relative dating.
- Discover the contributions of scientists whose theories help to develop modern geology.
- Explain the importance of fossils.

## Investigation 18B

### Relative Dating

- **Key Question:**  
How does relative dating tell a story?



## 18.2 The beginnings of geology

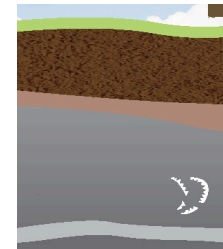
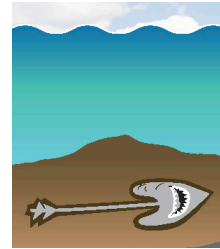
- In 1666, Nicholas Steno, a Danish anatomist, studied a shark's head and noticed that the shark's teeth resembled mysterious stones called "tonguestones".





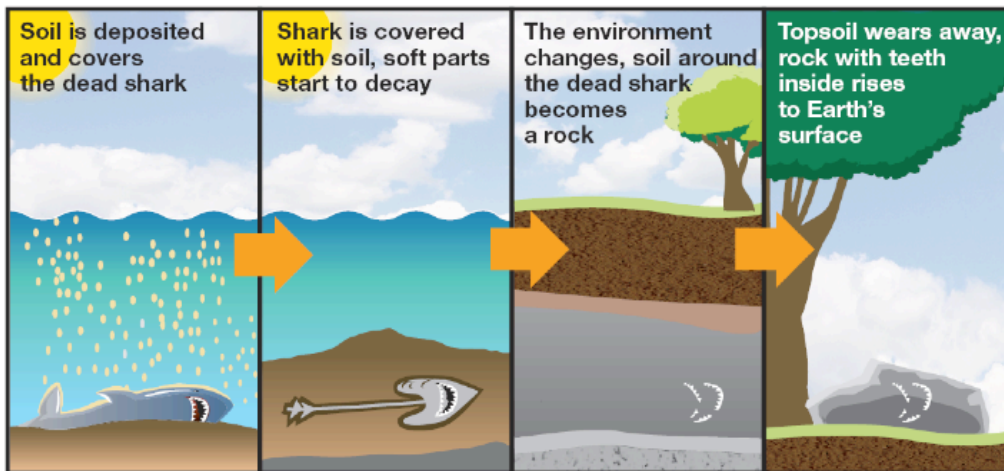
## 18.2 The beginnings of geology

- Steno theorized that tonguestones looked like shark's teeth because they actually were shark's teeth that had been buried and became fossils.



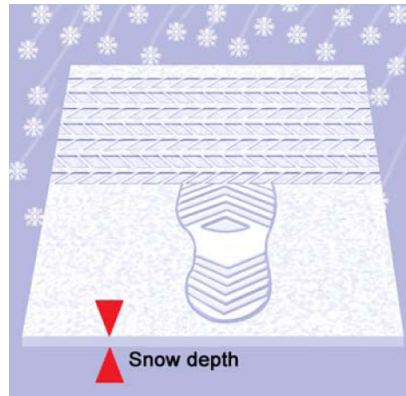


## Fossil Formation





## 18.2 Relative dating



**Which event happened first?**

- Steno's principles are used by geologists to determine the age of fossils and rocks in a process called relative dating.
- Relative dating is a method of sequencing events in the order they happened.



## 18.2 Relative dating



- James Hutton (1726–1797) showed how processes today might explain what happened a long time ago.
- For example, grooves left behind by flowing rainwater helped explain the formation of the Grand Canyon from the Colorado River.



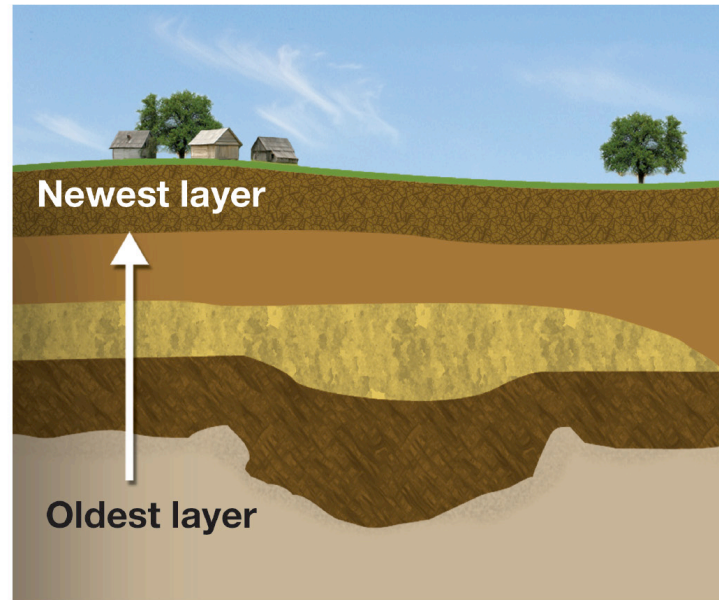


## 18.2 Law of superposition

- Steno's ideas for relative dating include superposition, original horizontality, and lateral continuity.
- Steno identified the law of superposition, which states that the bottom layer of a rock formation is older than the layer on top.



## Rock Layering



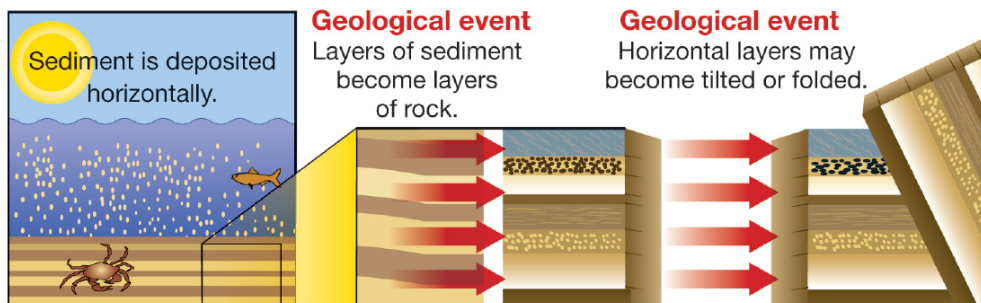


## 18.2 Law of horizontality

- **Steno also identified the law of original horizontality which refers to how sediment particles settle to the bottom of a body of water in response to gravity.**
- **Horizontal layers of rock might become tilted or folded by a geological event.**



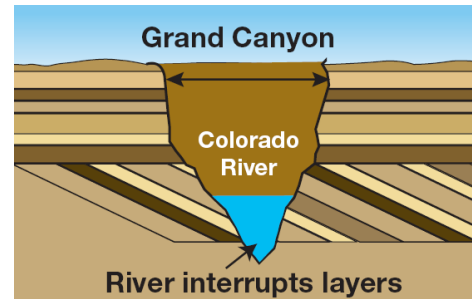
## 18.2 Original horizontality



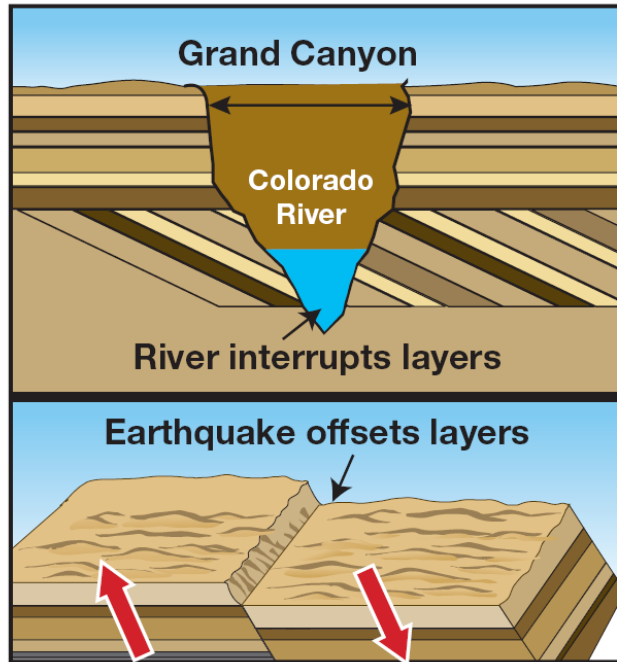
**Layers might be tilted at any angle and can even be upside down.**

## 18.2 Law of lateral continuity

- **The law of lateral continuity refers to how layers of sediment extend in all directions horizontally unless a river erodes them or an earthquake moves them.**



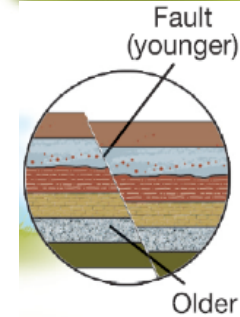
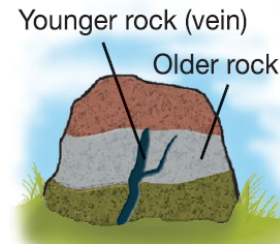
# Lateral Continuity





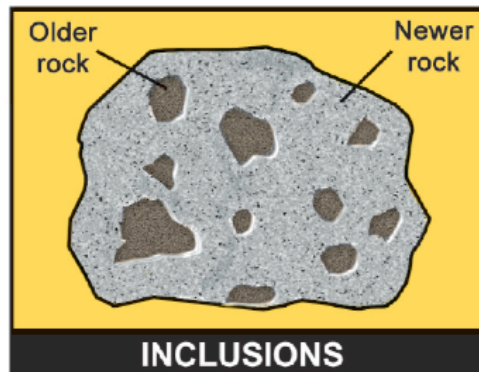
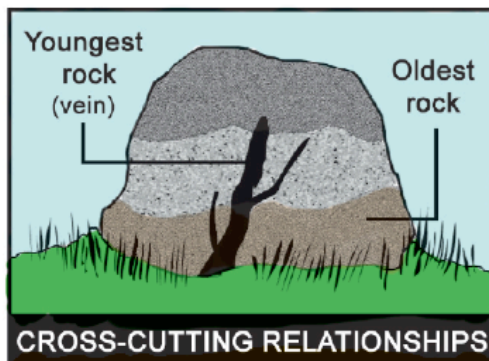
## 18.2 The relative age of a rock

- **The principle of cross-cutting relationships states that a vein of rock or a fault that cuts across a rock's layers is younger (more recent) than the layers.**
- **The middle and top layers formed after the bottom layer but before the vein.**





## Cross-Cutting Relations and Inclusions

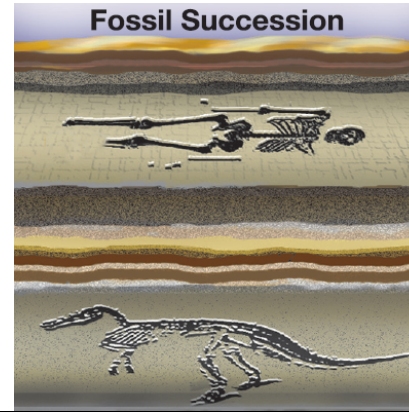






## 18.2 Fossil succession

- The principle of fossil succession means that fossils can be used to identify the relative age of the layers of a rock formation.
- The organisms found in the top layers appeared after the organisms found in the layers below them.





## 18.2 Fossils and Earth's changing surface

- Most of the land on Earth was part of a large landmass called Pangaea about 250 millions of years ago.

Where organisms lived on Pangaea



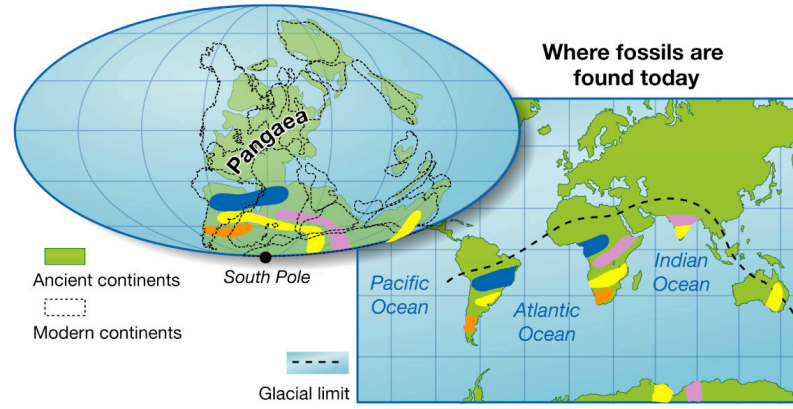
## 18.2 Fossils and Earth's changing surface

- Fossils provide evidence for how Earth's surface has changed over time.
- Scientists map fossil locations.
- Understanding Earth's past helps explain how similar plants and animals ended up in different locations.



# Fossil Locations

Where organisms lived on Pangaea



Where fossils are found today

Ancient continents  
Modern continents

South Pole

Glacial limit

Range of organisms



*Cynognathus*



*Glossopteris*



*Lystrosaurus*



*Mesosaurus*