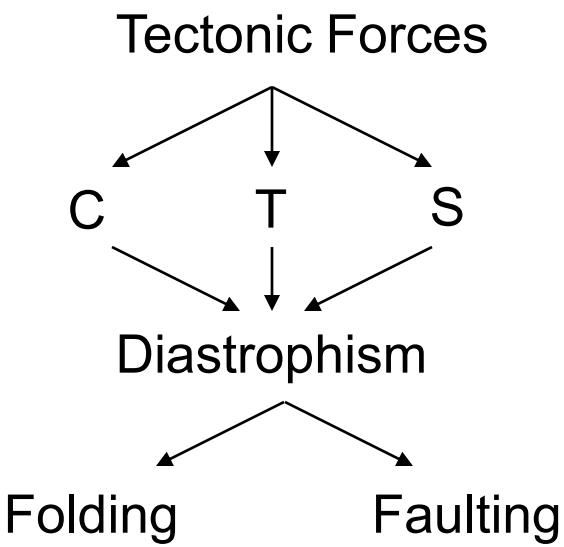
Internal Processes

Part III

"Zeal is a volcano, on the peak of which the grass of indecisiveness does not grow."
—**Kahlil Gibran**

❖ Diastrophism

- Deformation of Earth's Crust
- Involves Earth Movements
  - Tectonic Forces
    - Compression - C
    - Tension - T
    - Shear - S
  - Diastrophism (earth movements)



❖ Folding

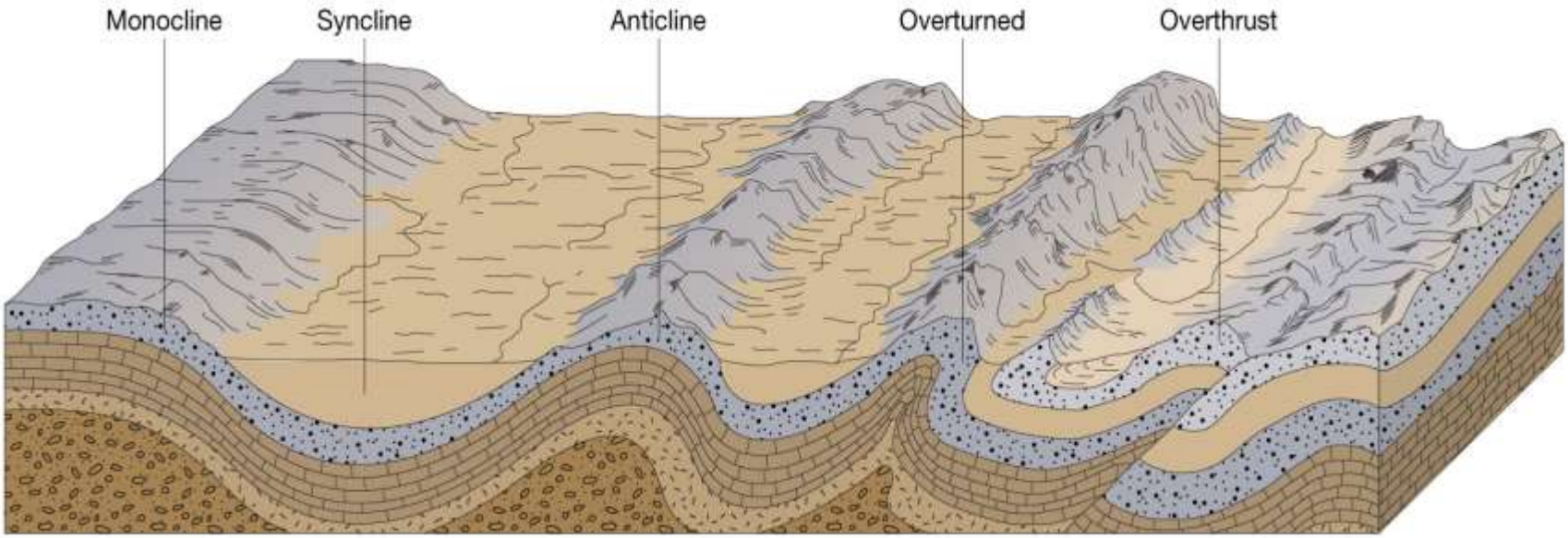
Animation (Folding)

- Lateral compression

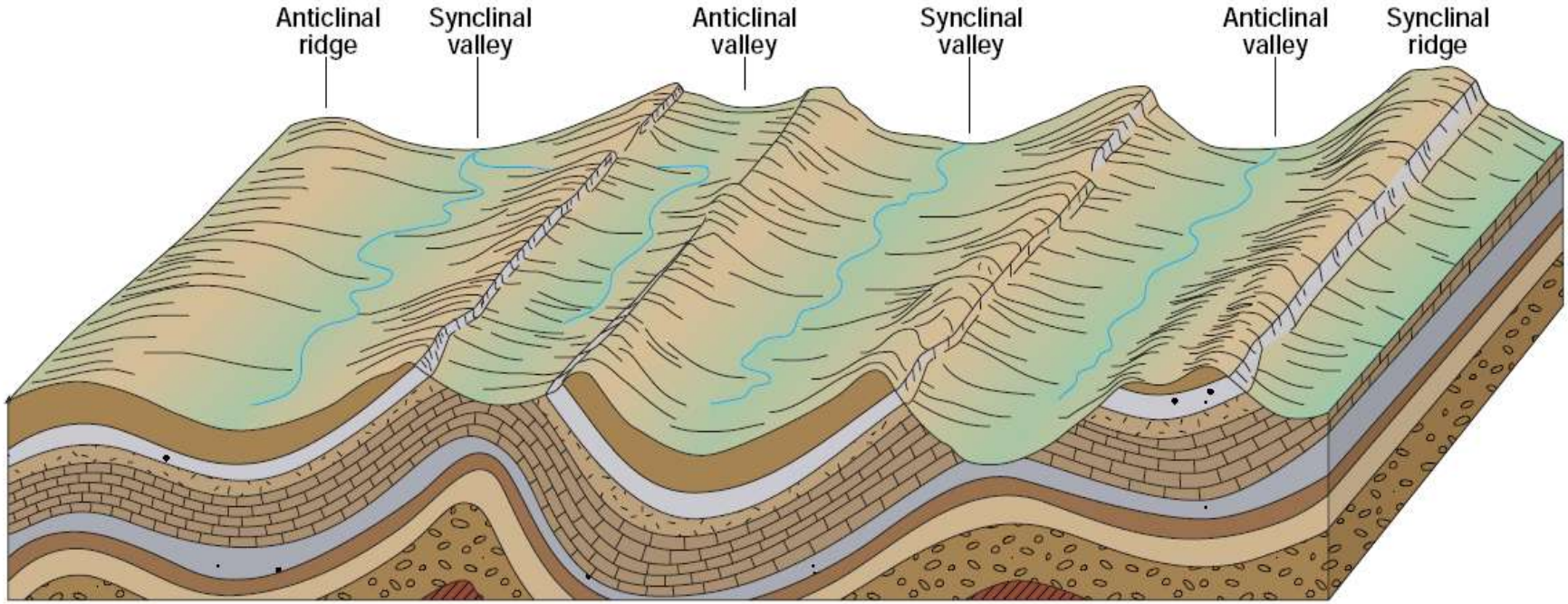
(b)

(a)

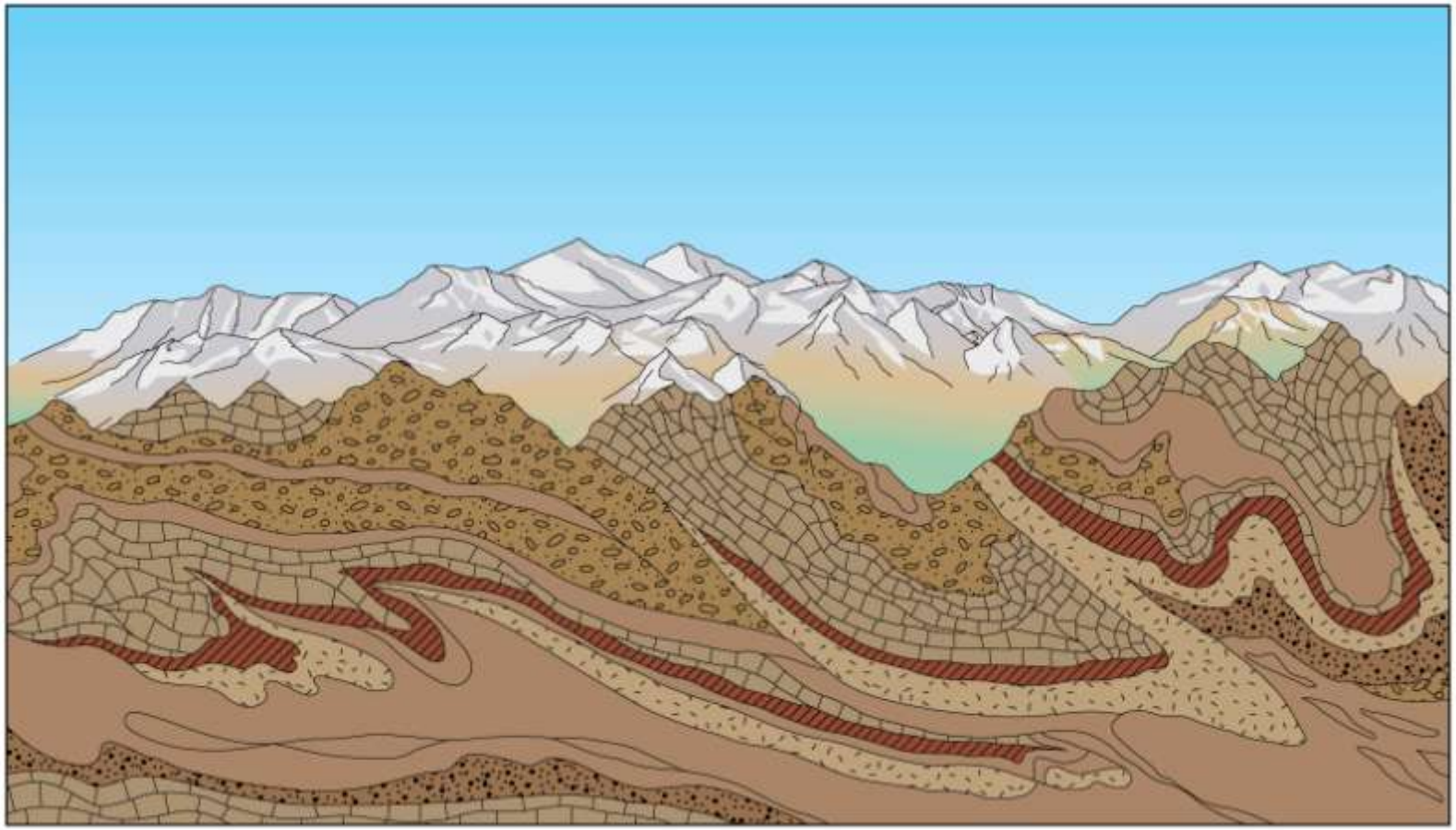
- Basic Types of Folds



- Formation of Anticlinal Valleys and Synclinal Ridges



Intensely folded Appalachian topography in the eastern United States.

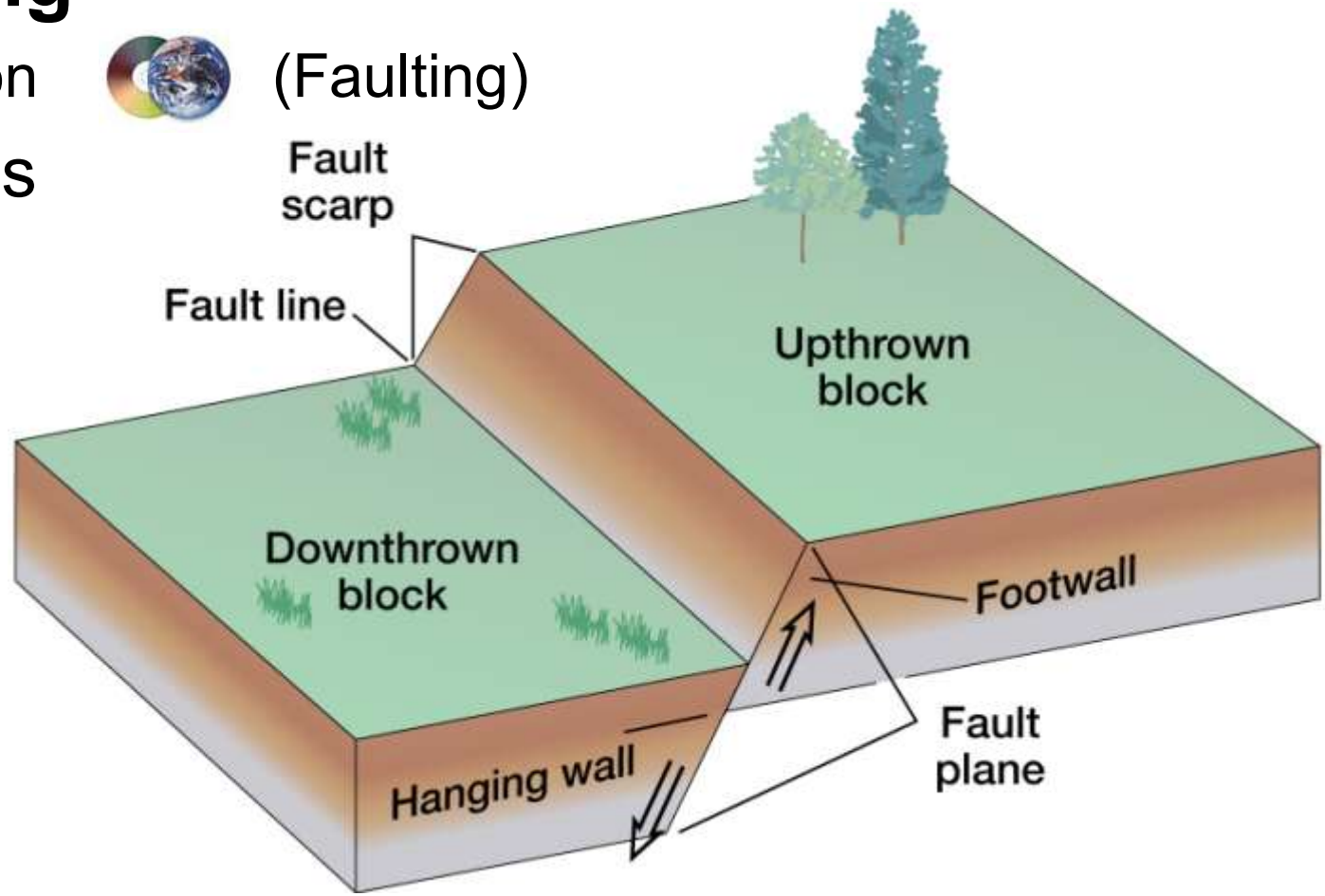


Cross section through the Swiss Alps, showing the enormous complexity of fold structures.

❖ Faulting

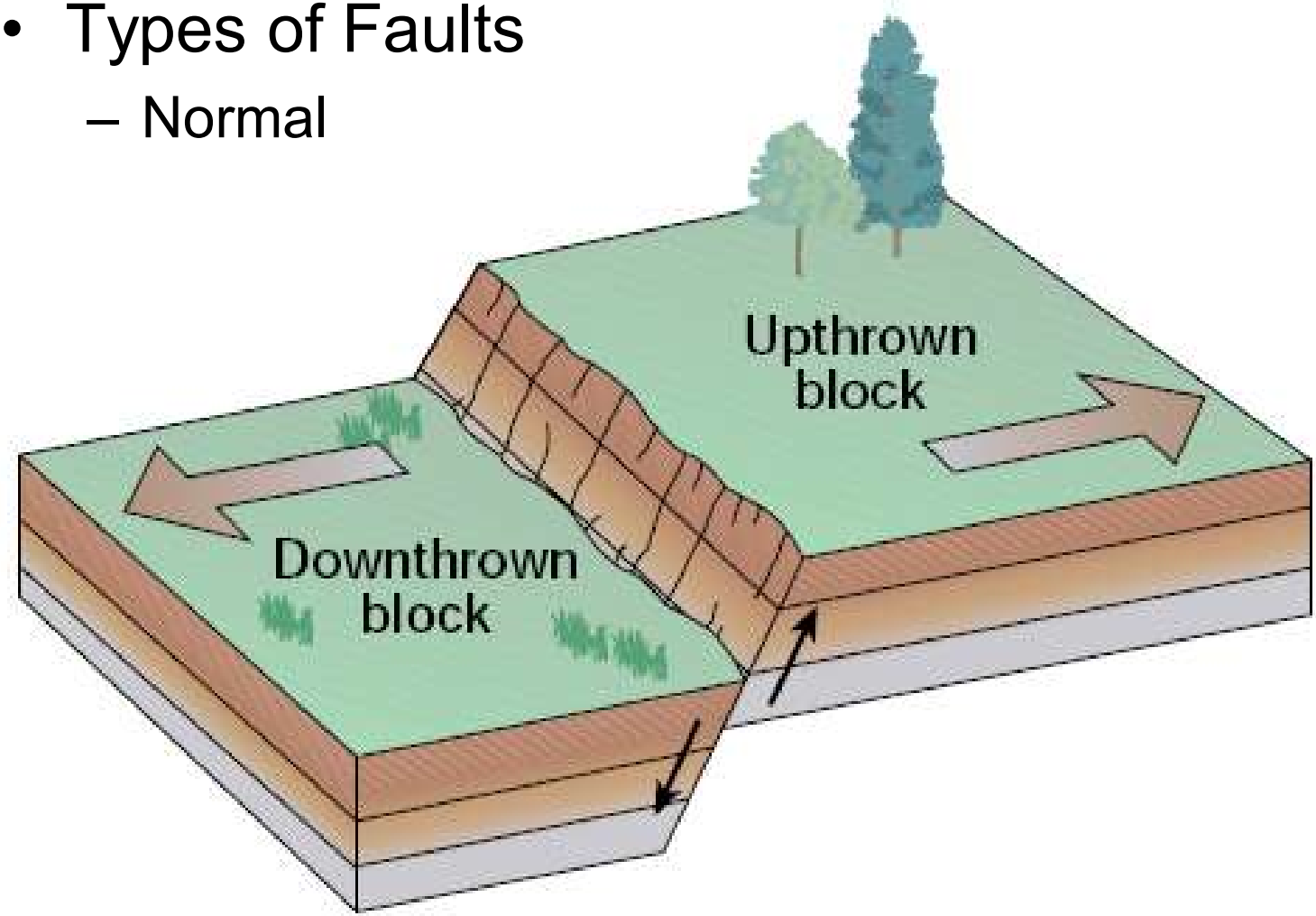
Animation (Faulting)

- Terms

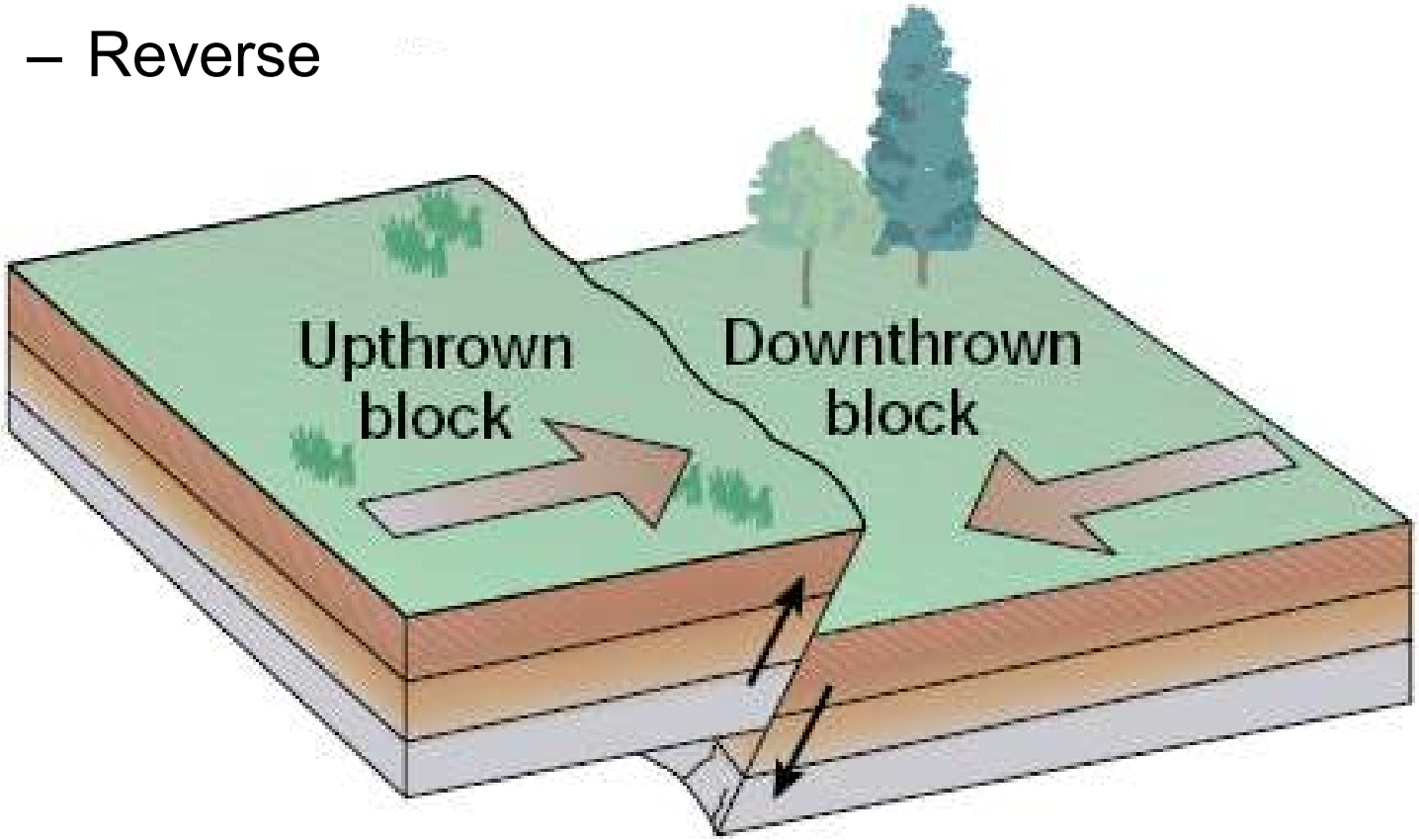


A simple fault structure.

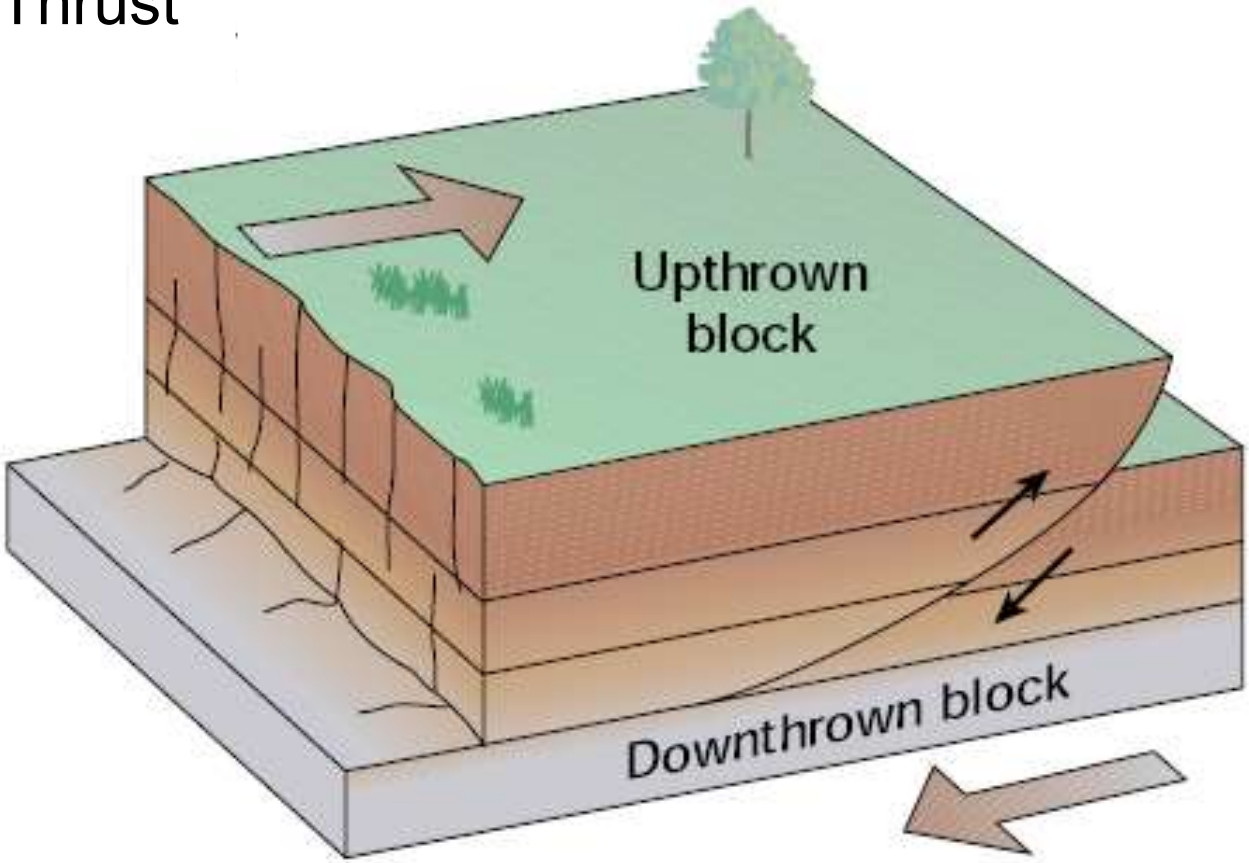
- Types of Faults
  - Normal



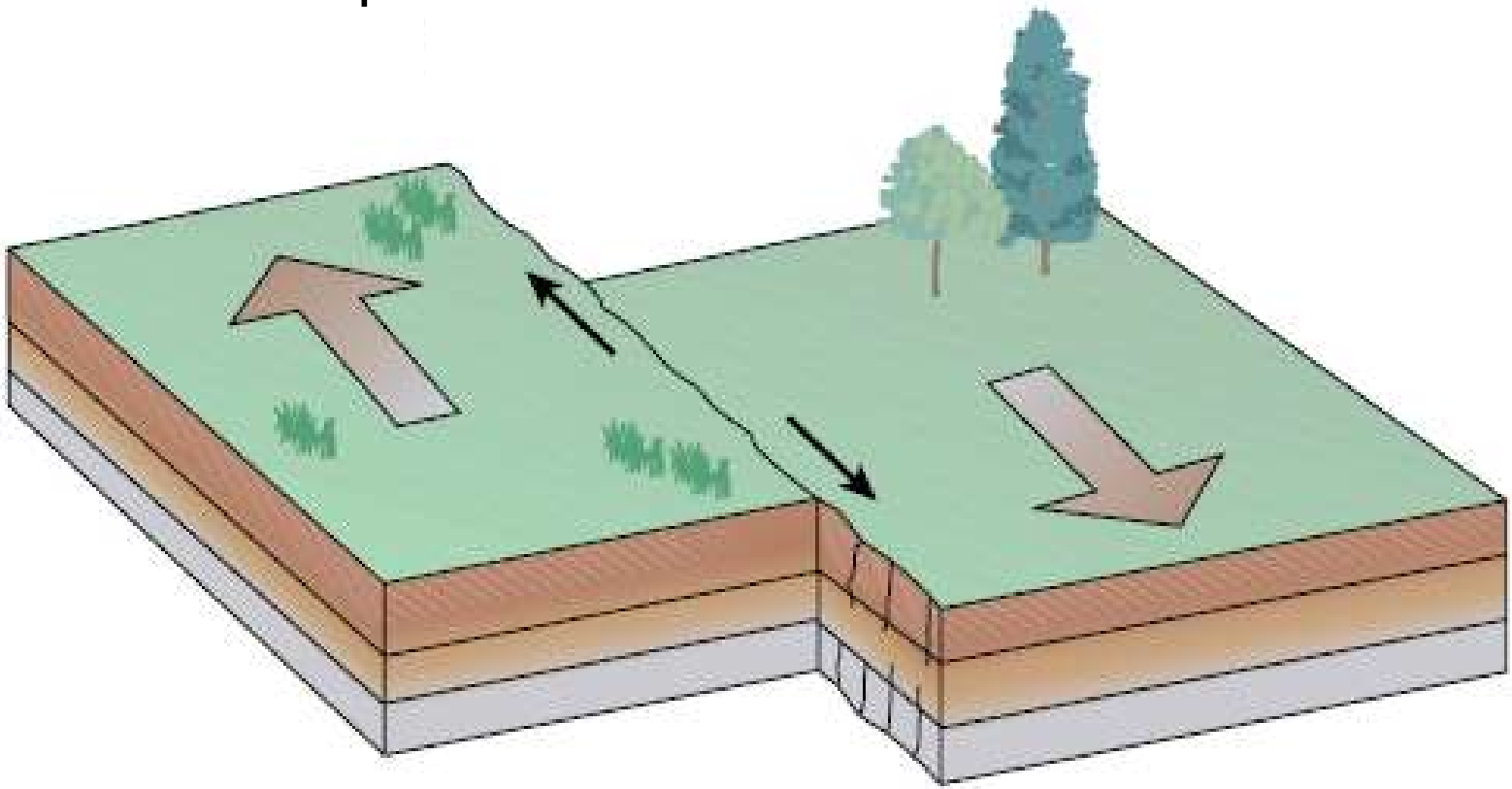
– Reverse



– Thrust



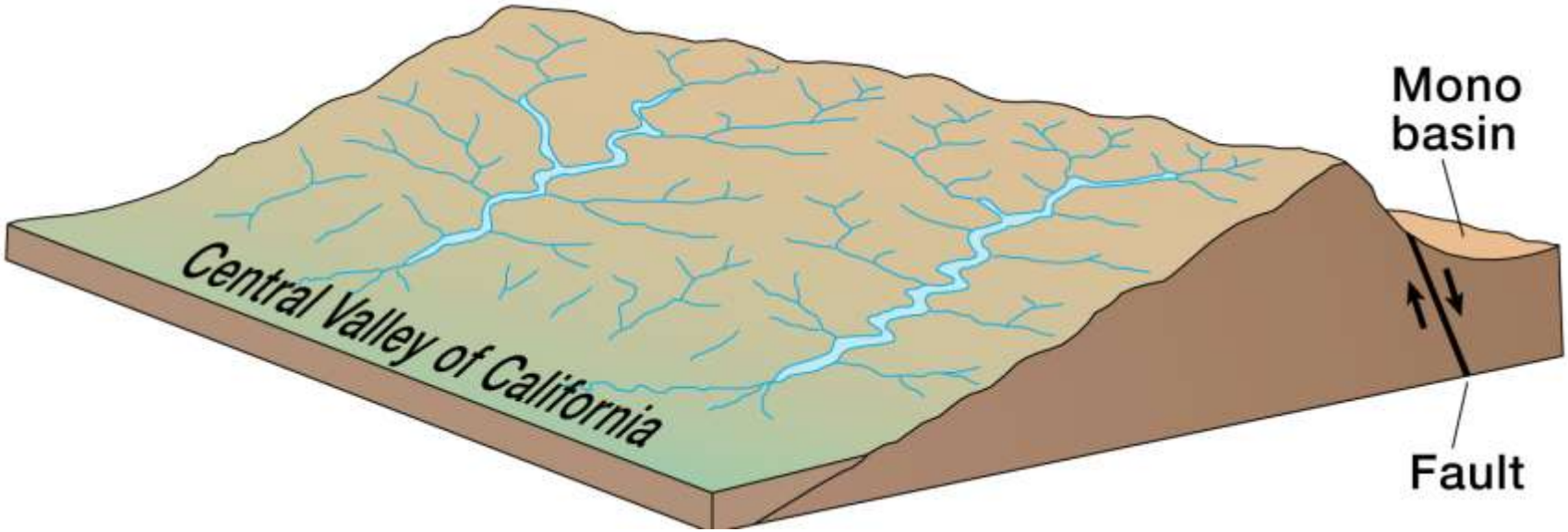
– Strike-slip



- Example of a strike-slip fault.

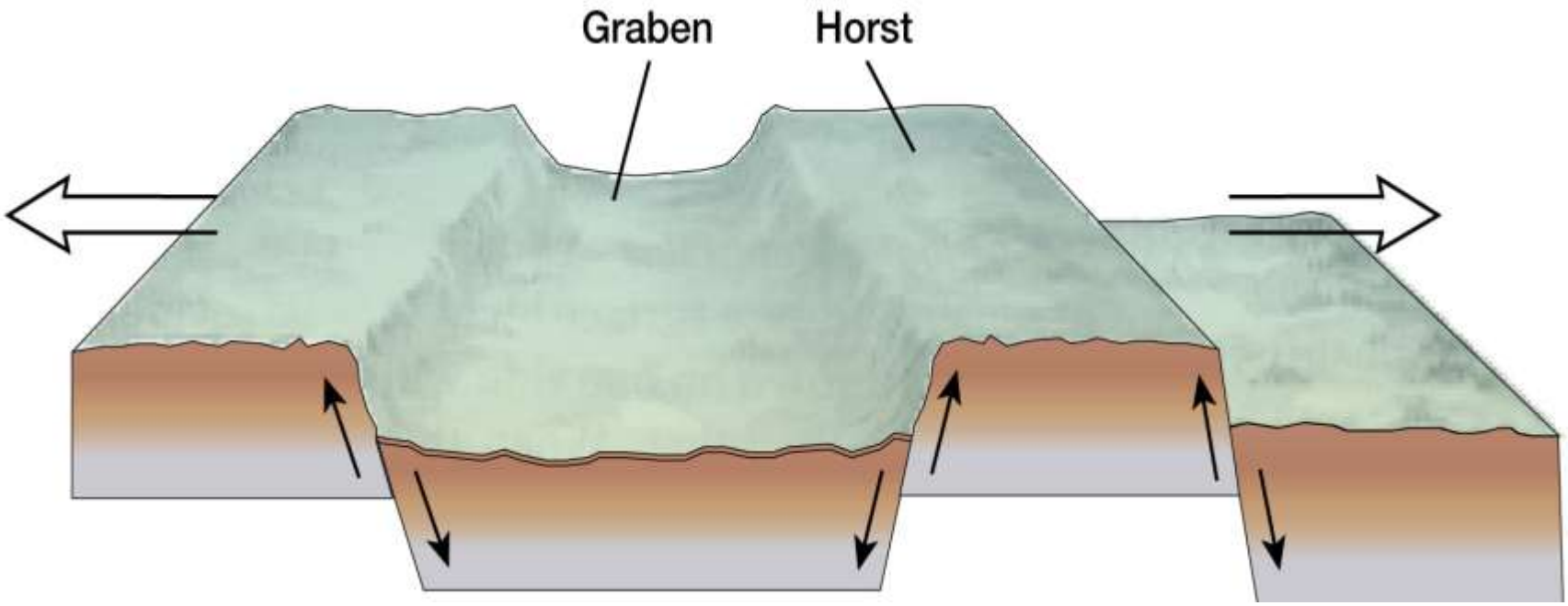
Calaveras fault, Hollister, CA. Offset wall and sidewalk.

- Landforms Associated with Normal Faulting
  - Tilted Fault-Block Mountains

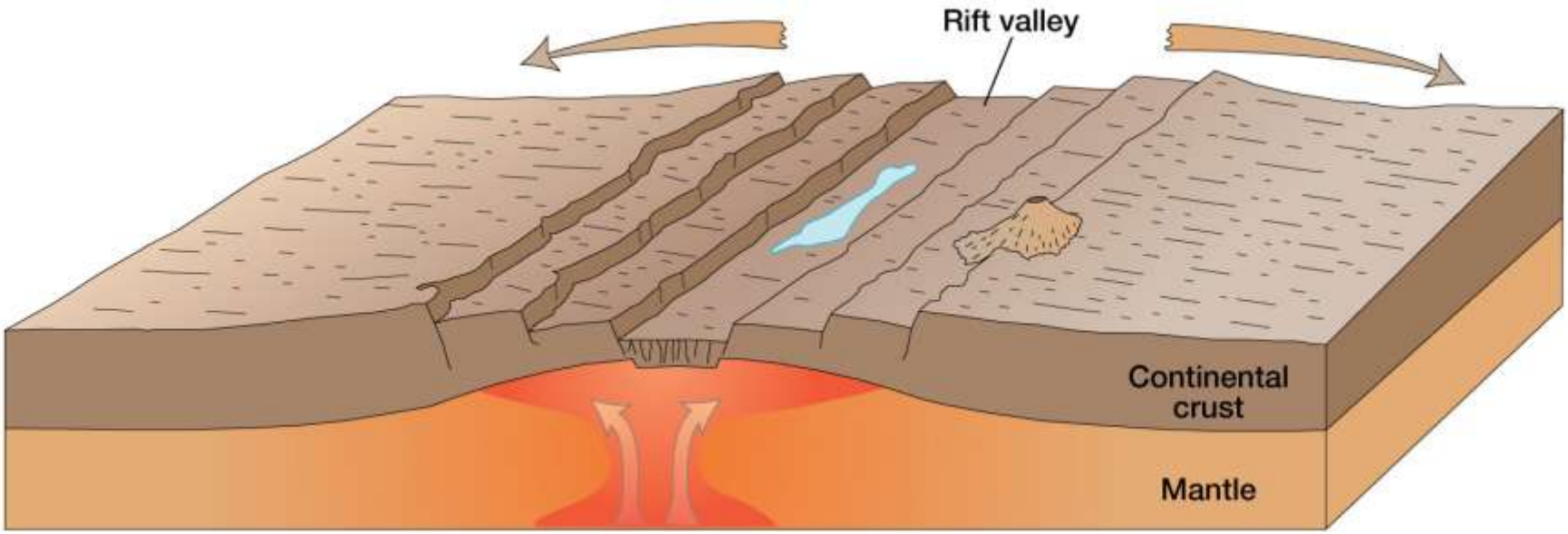


Sierra Nevada, CA. Gentle western slope and short, steep eastern slope (fault scarp).

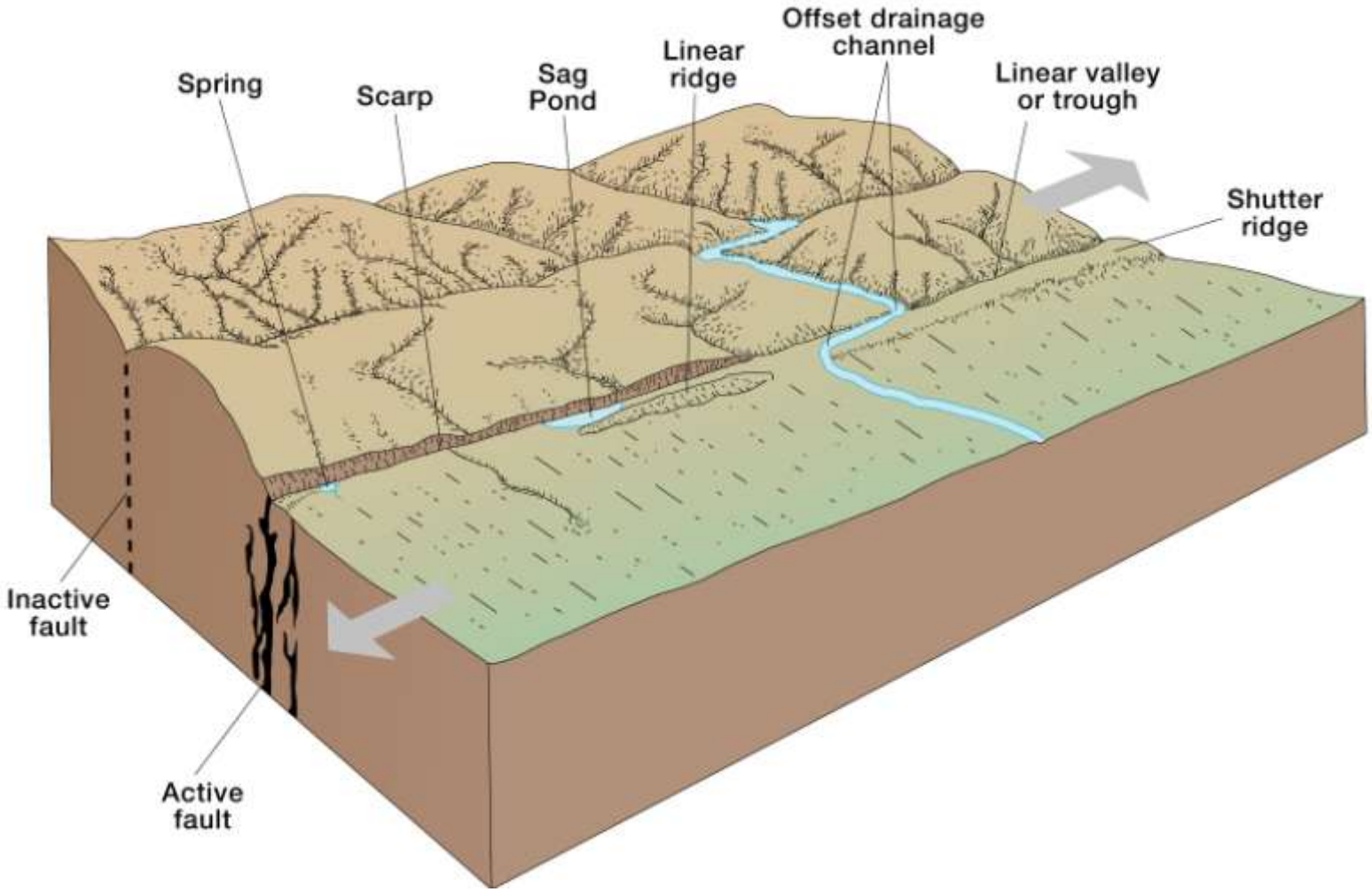
– Horst and Graben
  - Extensional faulting



– Rift Valley
  - Extensional faulting



- Landforms Associated with Strike-Slip Faulting

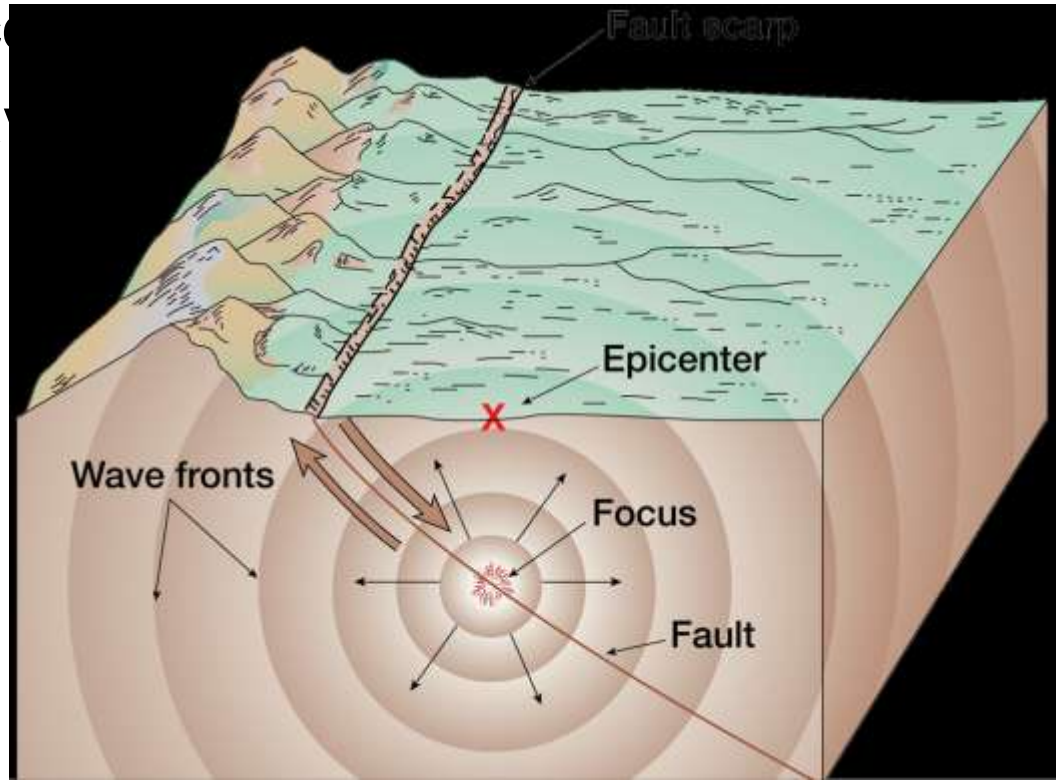


- Earthquakes

  Animations

  1. Earthquake Waves
  2. Seismographs

  - Focus and Epic
  - Earthquake Wa
    - P waves
    - S waves



Relationship among focus, epicenter, and seismic waves of an earthquake.

- Earthquake Magnitude
  - Amount of energy release
  - Richter Scale (logarithmic)
    - M3 or less (small)
    - M7 or greater (enormous)
  - Famous earthquakes and their magnitudes
    - Chile (1964), 9.5
    - Alaska (1964), 9.2
    - Sumatra (2004), 9.0
    - San Francisco, CA (1906), 7.7
    - Loma Prieta, CA (1989), 7.0
    - Northridge, CA (1972), 6.8

Magnitude	Number per Year
<3.4	800,000
3.5–4.2	30,000
4.3–4.8	4800
4.9–5.4	1400
5.5–6.1	500
6.2–6.9	100
7.0–7.3	15
7.4–7.9	4
>8.0	1 every 5–10 years

Vast majority of annual earthquakes are not felt. Sixty or seventy earthquakes cause damage or loss of life.

– Earthquake Intensity

- Mercalli scale – intensity of local shaking

I. Not felt except by very few people under especially favorable circumstances

II. Felt only by a few persons at rest, especially on upper floors of buildings

III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake

IV. During the day felt indoors by many, outdoors by few; sensation like heavy truck striking building

V. Felt by nearly everyone, many awakened; disturbances of trees, poles, and other tall objects sometimes noticed

VI. Felt by all; many frightened and run outdoors; some heavy furniture moved; few instances of fallen plaster or damaged chimneys; damage slight

VII. Everybody runs outdoors; damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures

VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures; fall of chimneys, factory stacks, columns, monuments, and other vertical features

IX. Damage considerable in specially designed structures; buildings shifted off foundations; ground cracked conspicuously

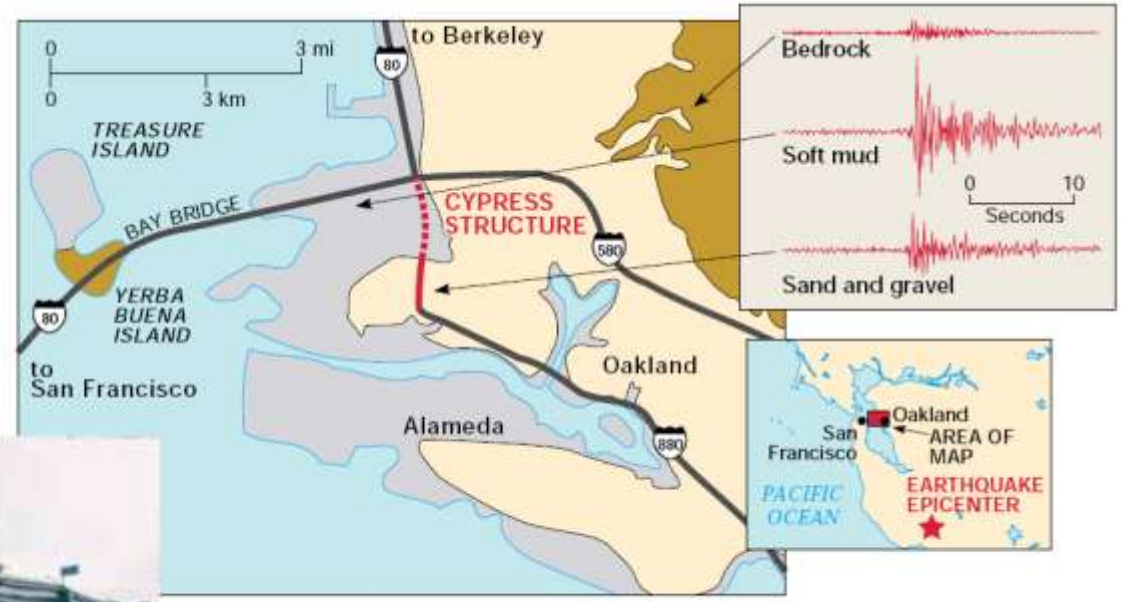
X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked

XI. Few, if any, masonry structures remain standing; bridges destroyed; broad fissures in ground

XII. Damage total; waves seen on ground surfaces; objects thrown upward into the air

– Earthquake Hazards

- Building damage due to shaking
- Liquefaction
- Landslides
- *Seiches*
- *Tsunami*



Loma Prieta earthquake and liquefaction of soft muds.

❖ Summary

- The theory of plate tectonics provides a big picture of how Earth's internal forces cause crustal dynamics.
- Alfred Wegener is credited as the founder of the theory.
- The theory explains how tectonic plates (large moving sections of the lithosphere) move and interact to create vast mountain systems and expansive plateaus and plains areas.

- The theory also explains the nature and geographical distribution of earthquakes and volcanic activity along plate boundaries.
- There is also abundant evidence that ties plate movements to hot spots, island chains, and subduction trenches.
- Volcanic hazards and earthquakes pose their greatest threats along the boundaries of moving tectonic plates.