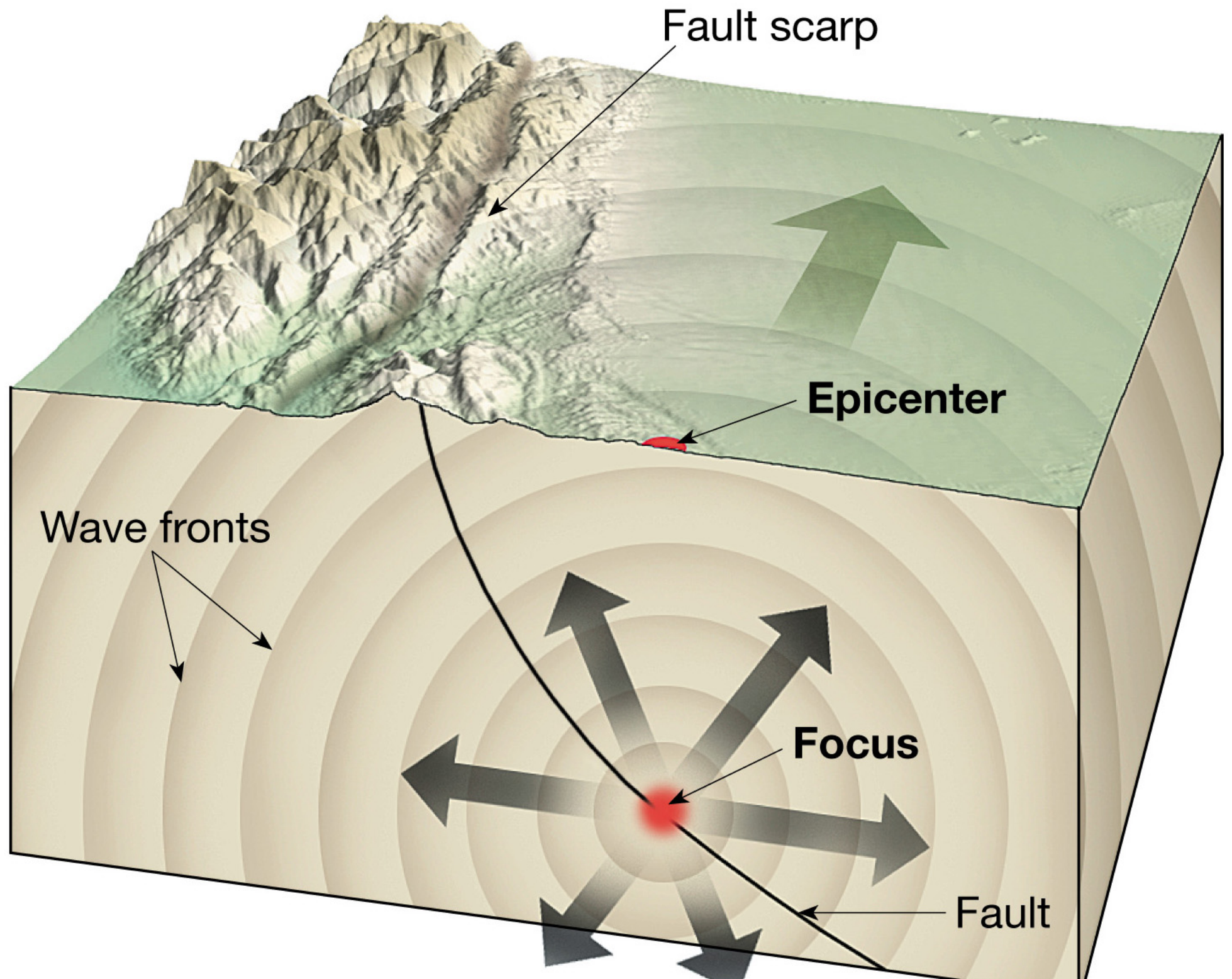


# Evidence of Plate Tectonics

## Earthquakes



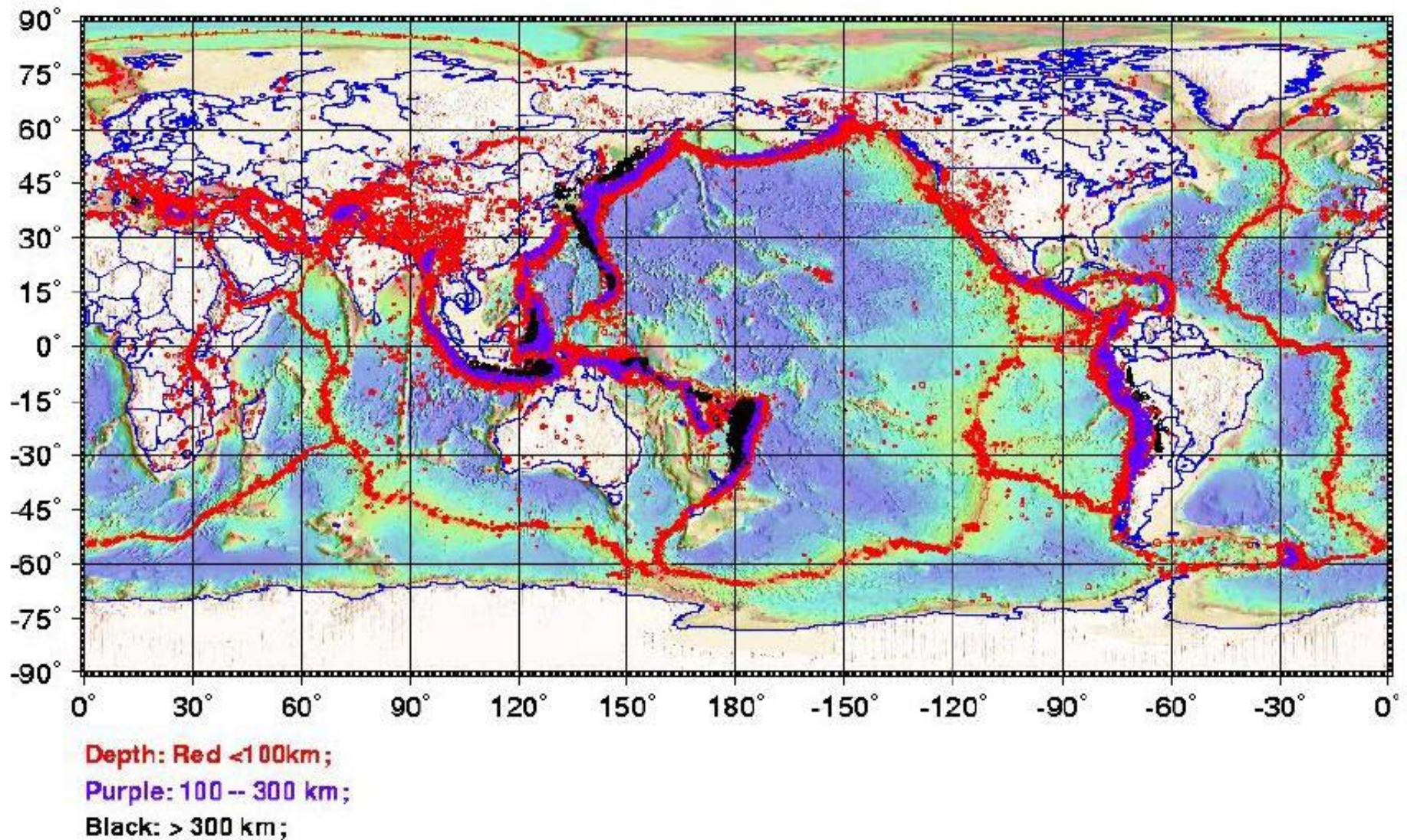






# Earthquake Locations

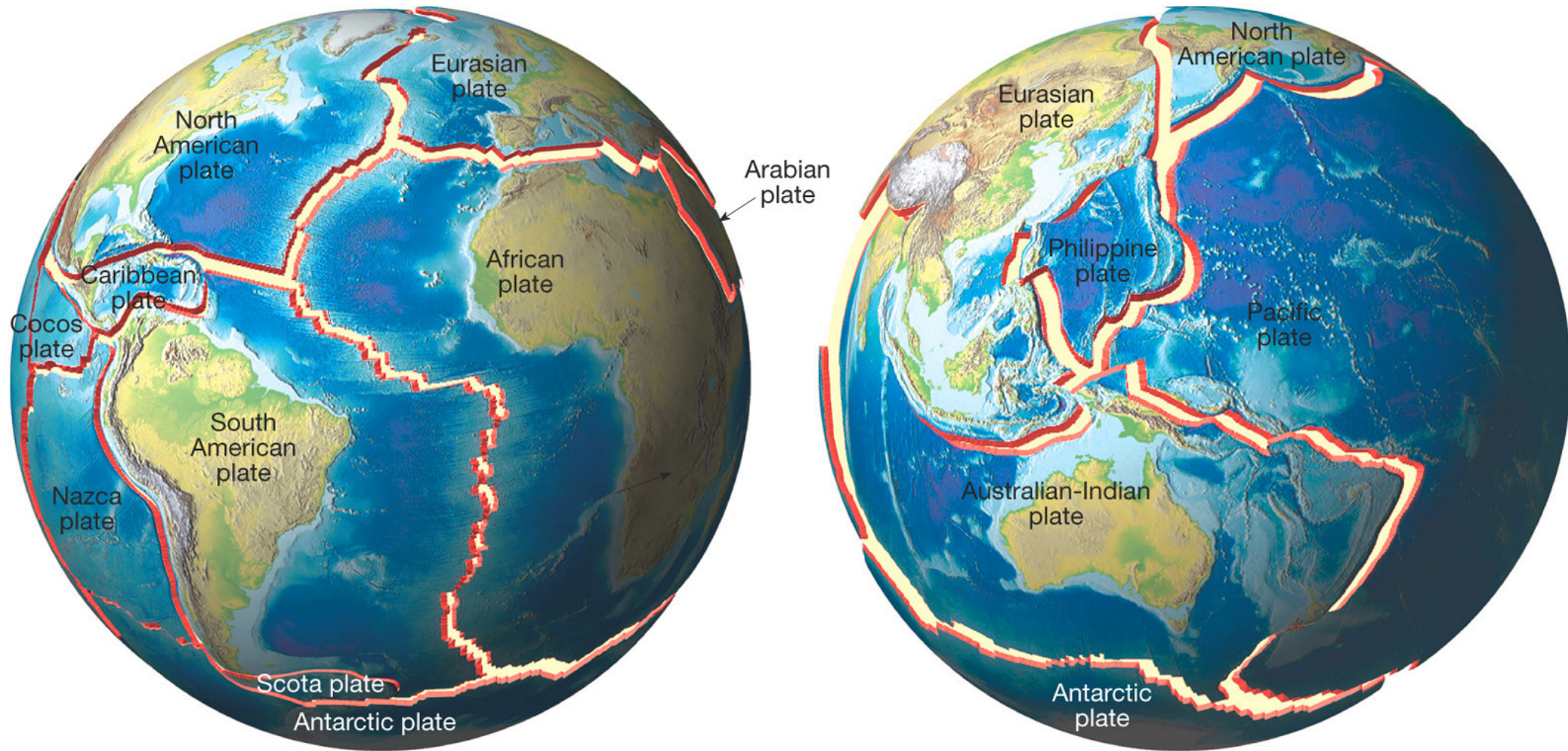
Global Seismicity (1910 - 99, magnitudes  $\geq 4.5$ )



- [http://earth.geol.ksu.edu/sgao/g100/plots/0916\\_global\\_seismicity.jpg](http://earth.geol.ksu.edu/sgao/g100/plots/0916_global_seismicity.jpg)



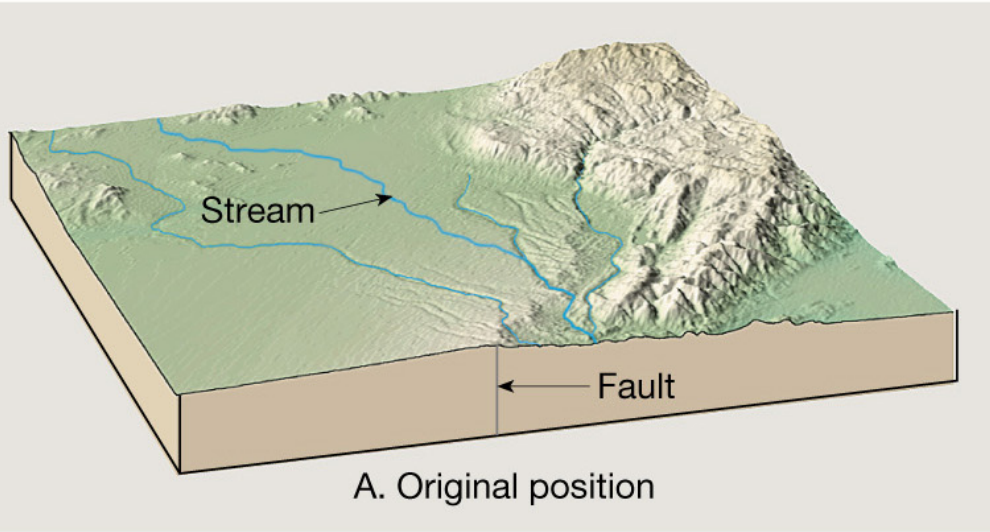
# Lithospheric Plates



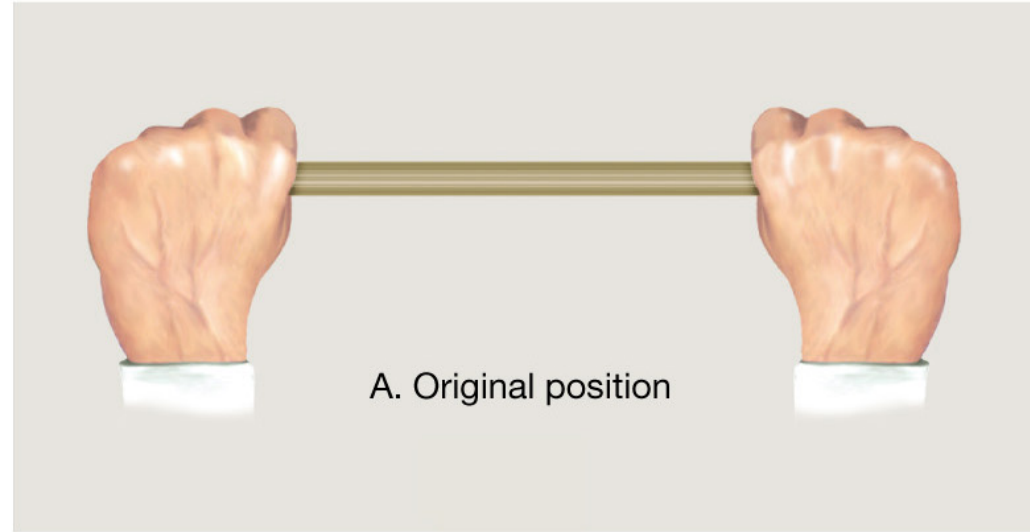
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# Before deformation

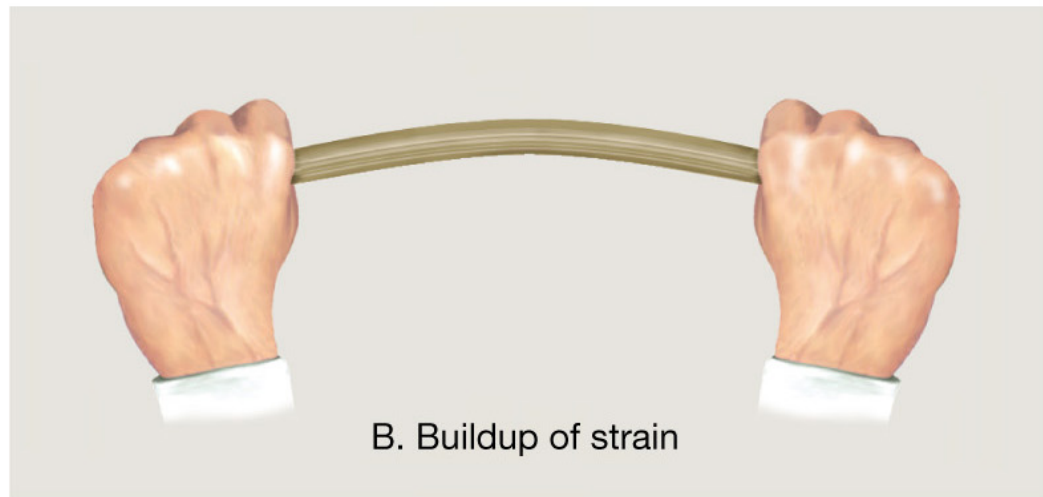
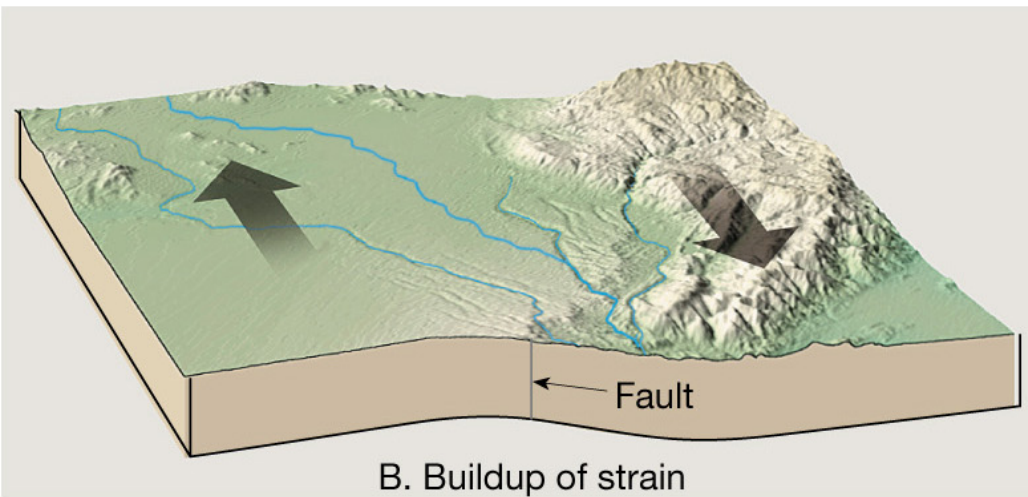
Deformation of rocks



Deformation of a limber stick

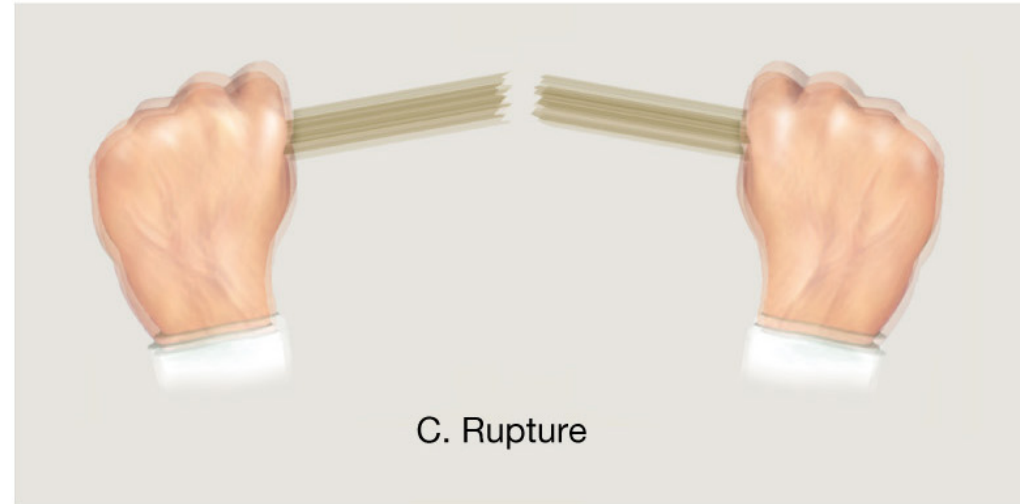
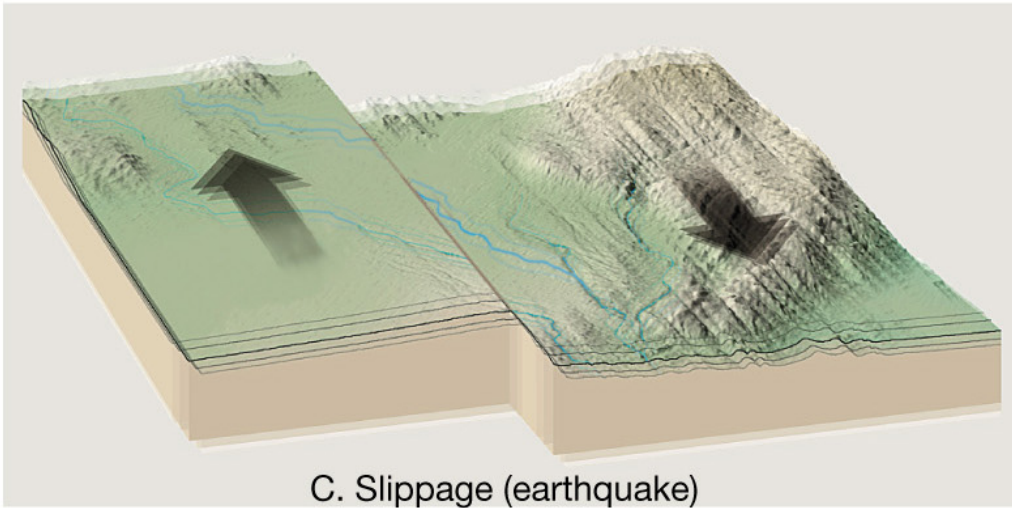


# Strain



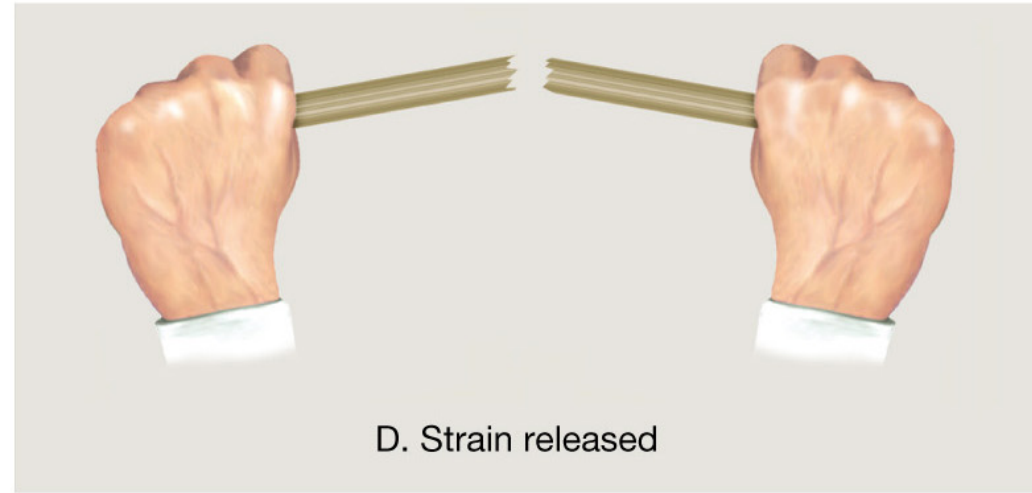
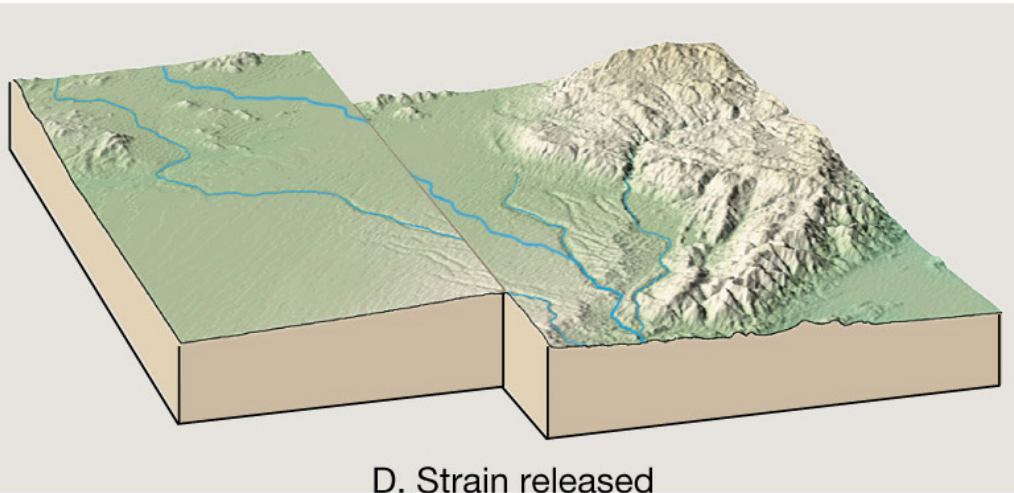


# Release of strain

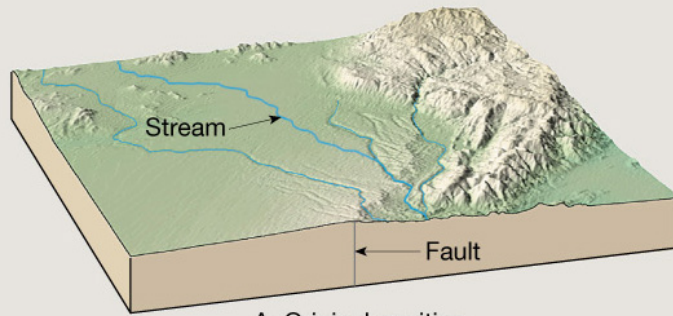




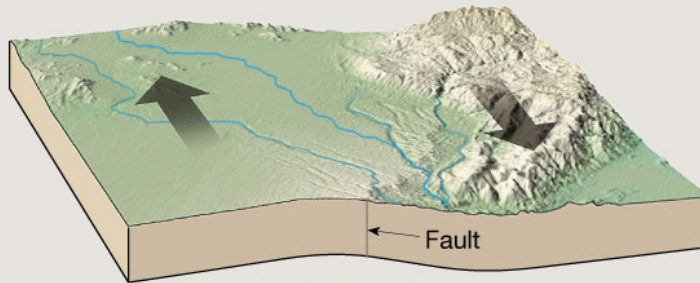
# After strain released



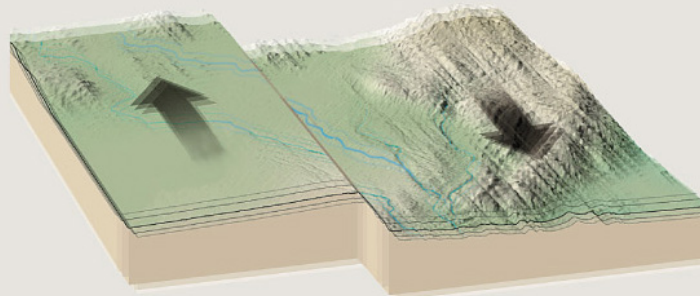
### Deformation of rocks



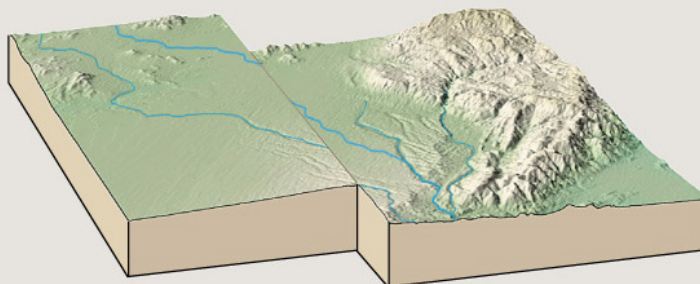
A. Original position



B. Buildup of strain



C. Slippage (earthquake)

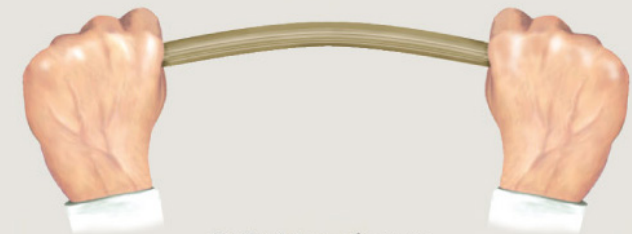


D. Strain released

### Deformation of a limber stick



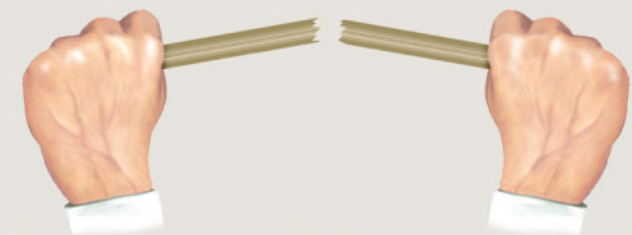
A. Original position



B. Buildup of strain



C. Rupture



D. Strain released



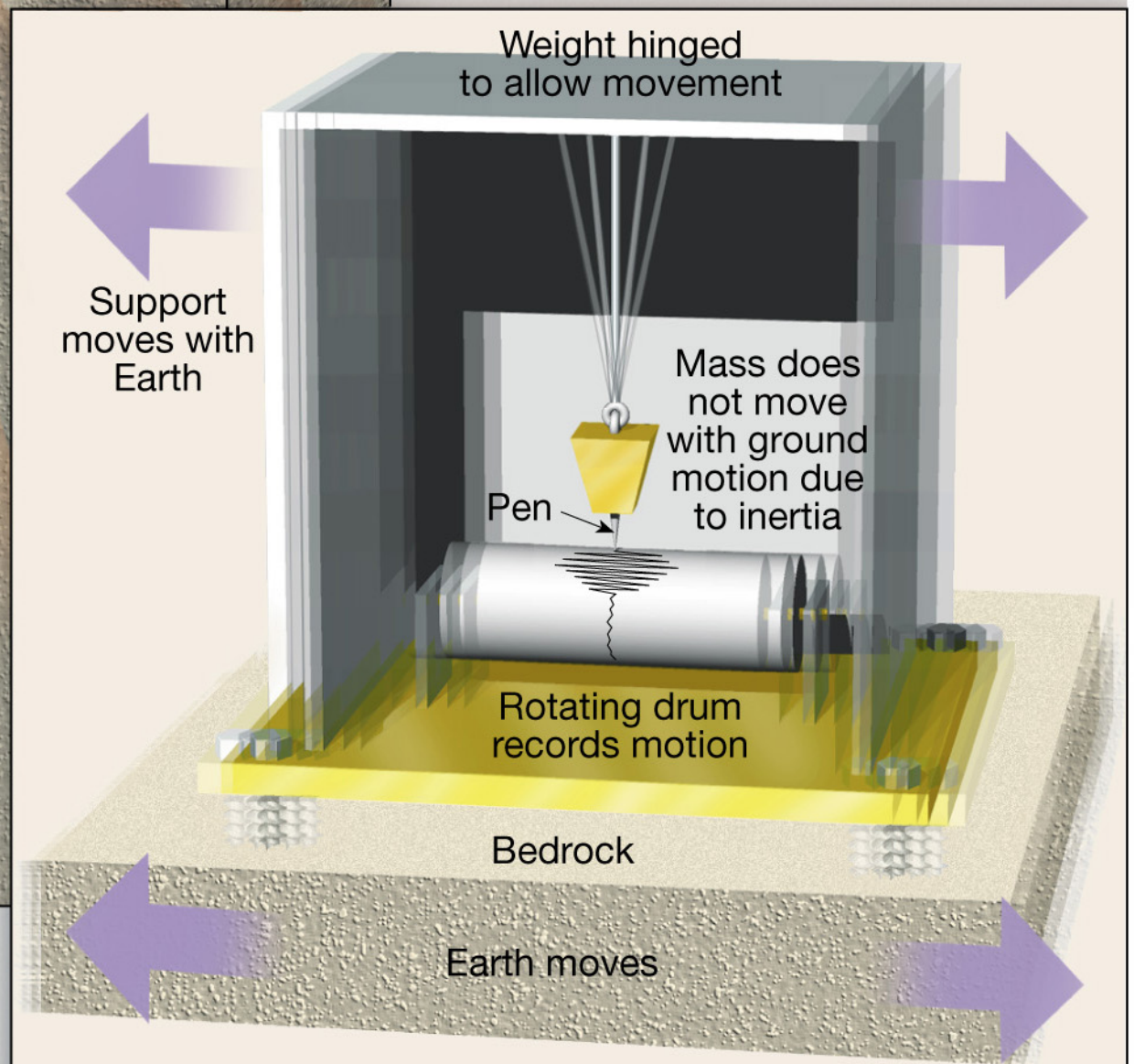
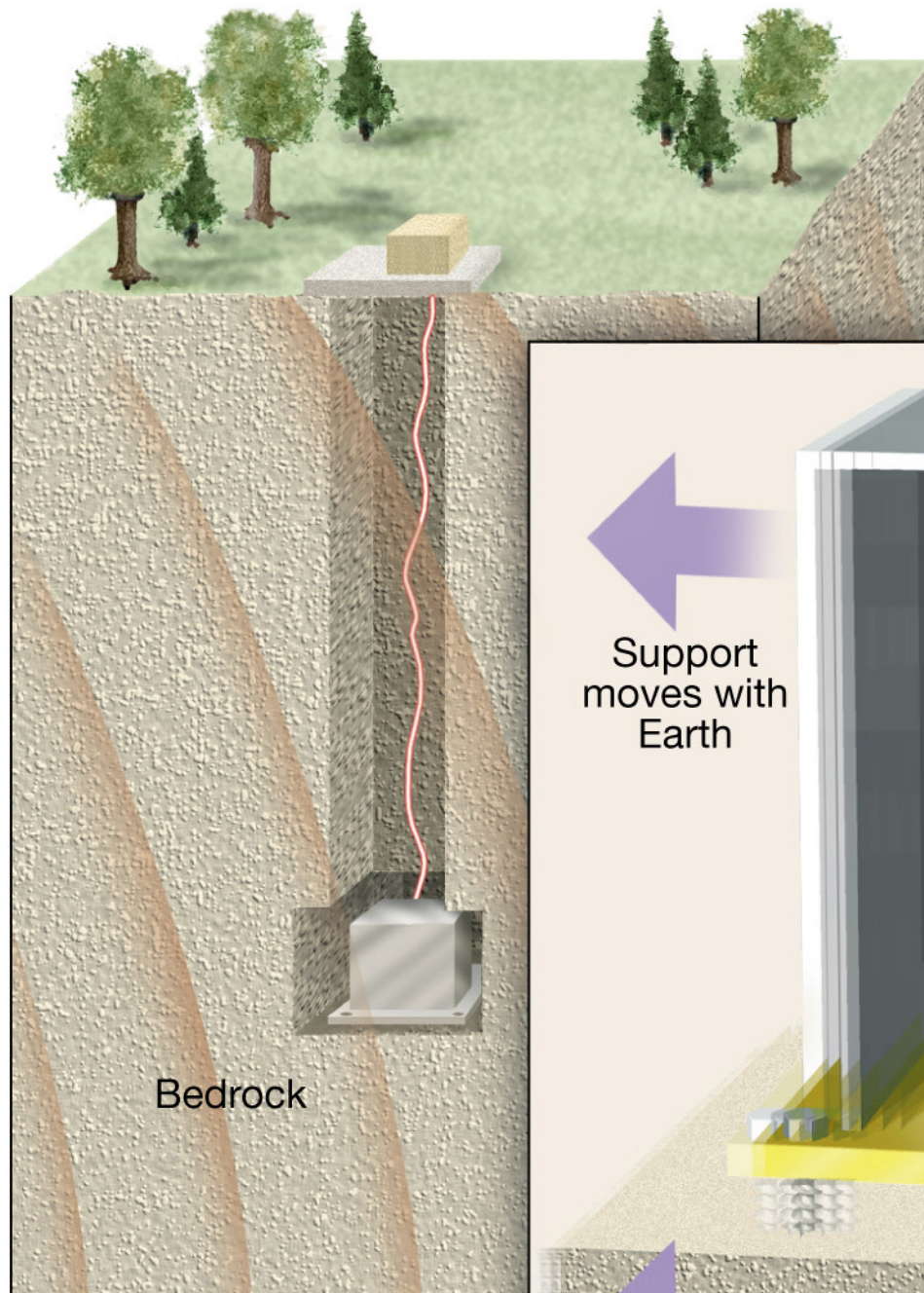
# San Andreas Fault in Southern California











# Primary Wave

Source moves  
left and right

Coils move  
left and right



Energy Transport



# Pressure Wave

- Push-pull motion
- Parallel to direction of wave energy movement (propagation)
- Go through all types of materials
  - Sound waves are pressure waves
  - Primary seismic waves are pressure waves

# Secondary Wave

Source moves  
up and down

Coils move  
up and down



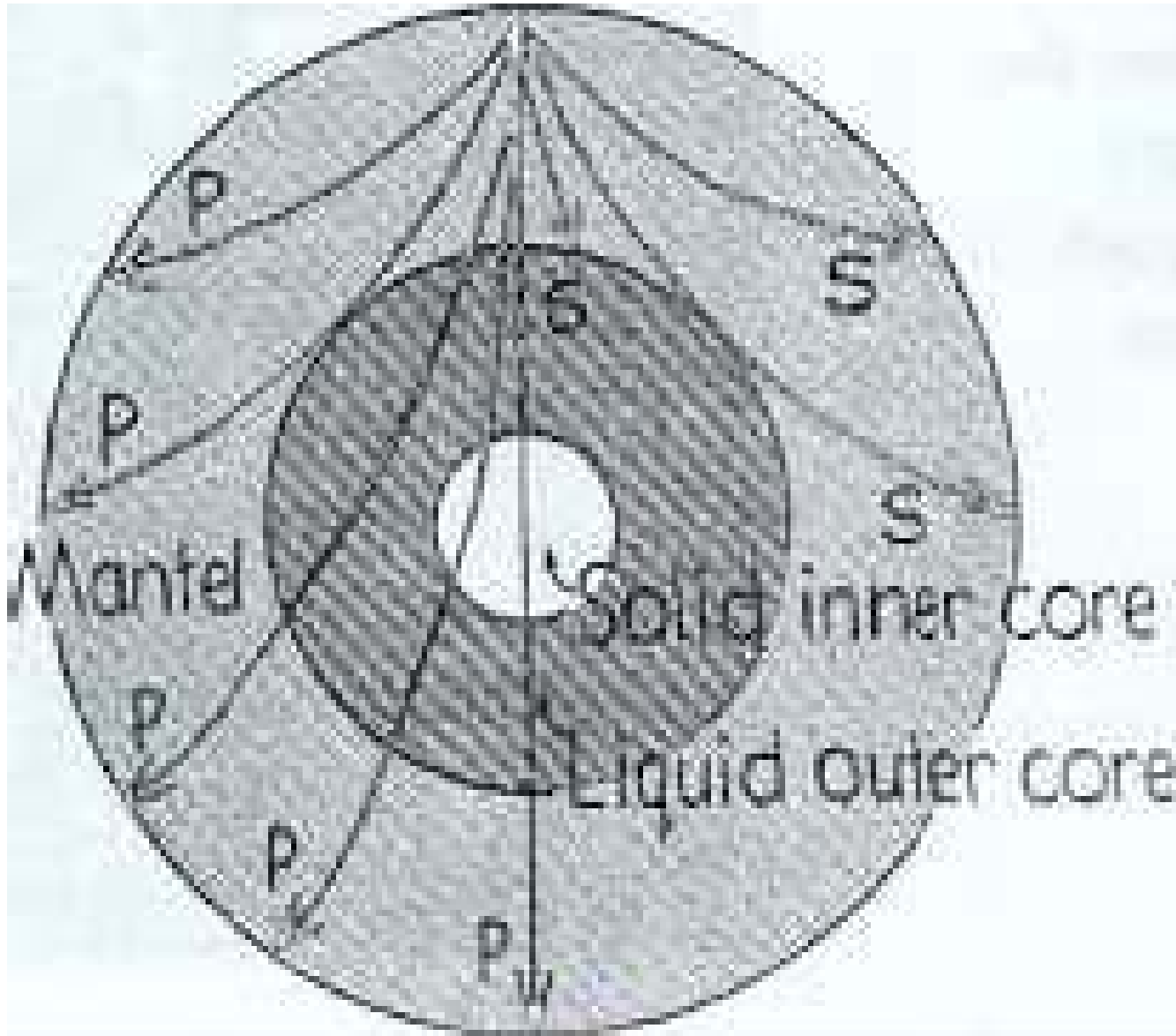


# Shear Wave

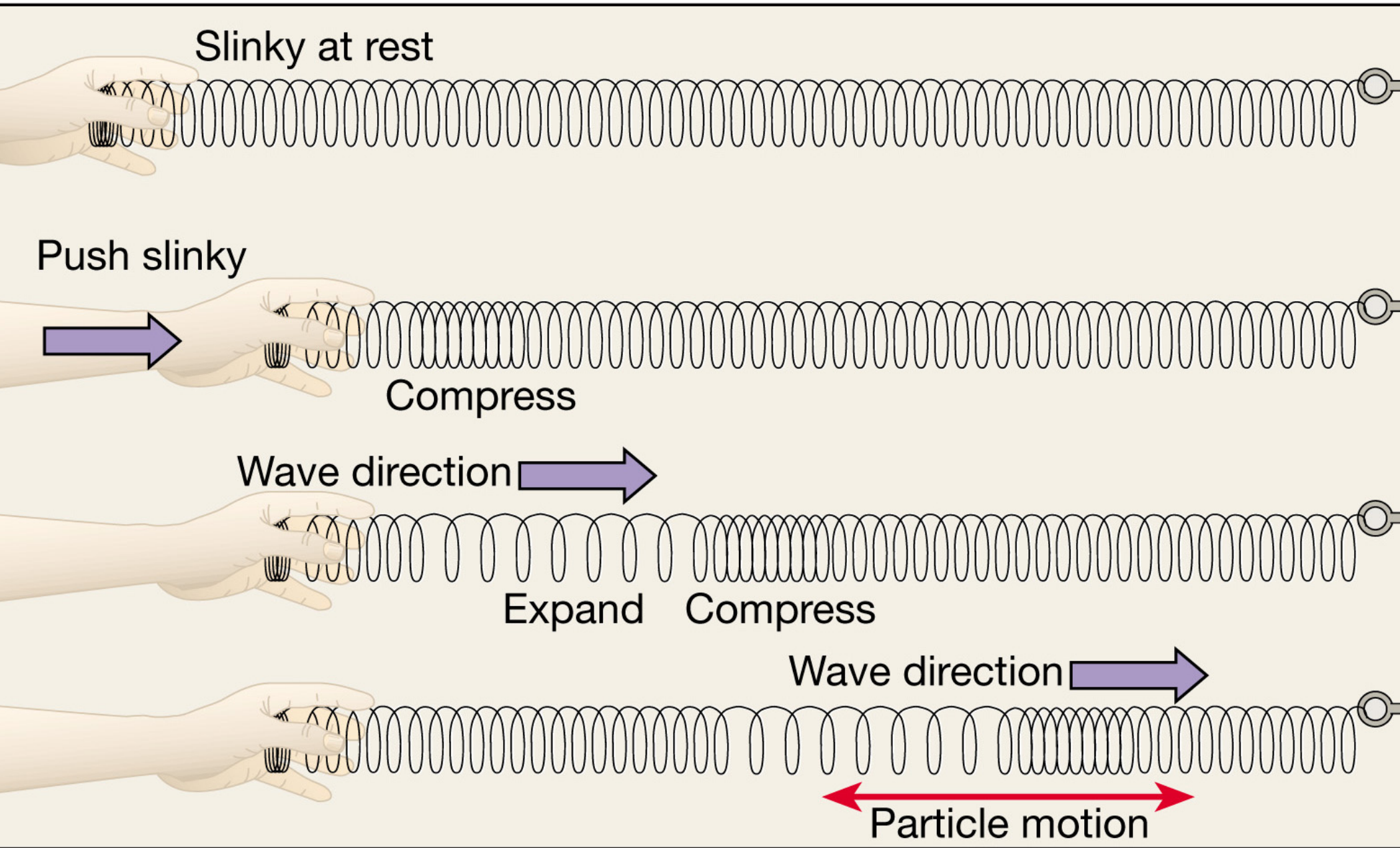


- Transverse--Side to side motion
- Can only go through solid materials
- Secondary seismic waves
- Slower than primary waves

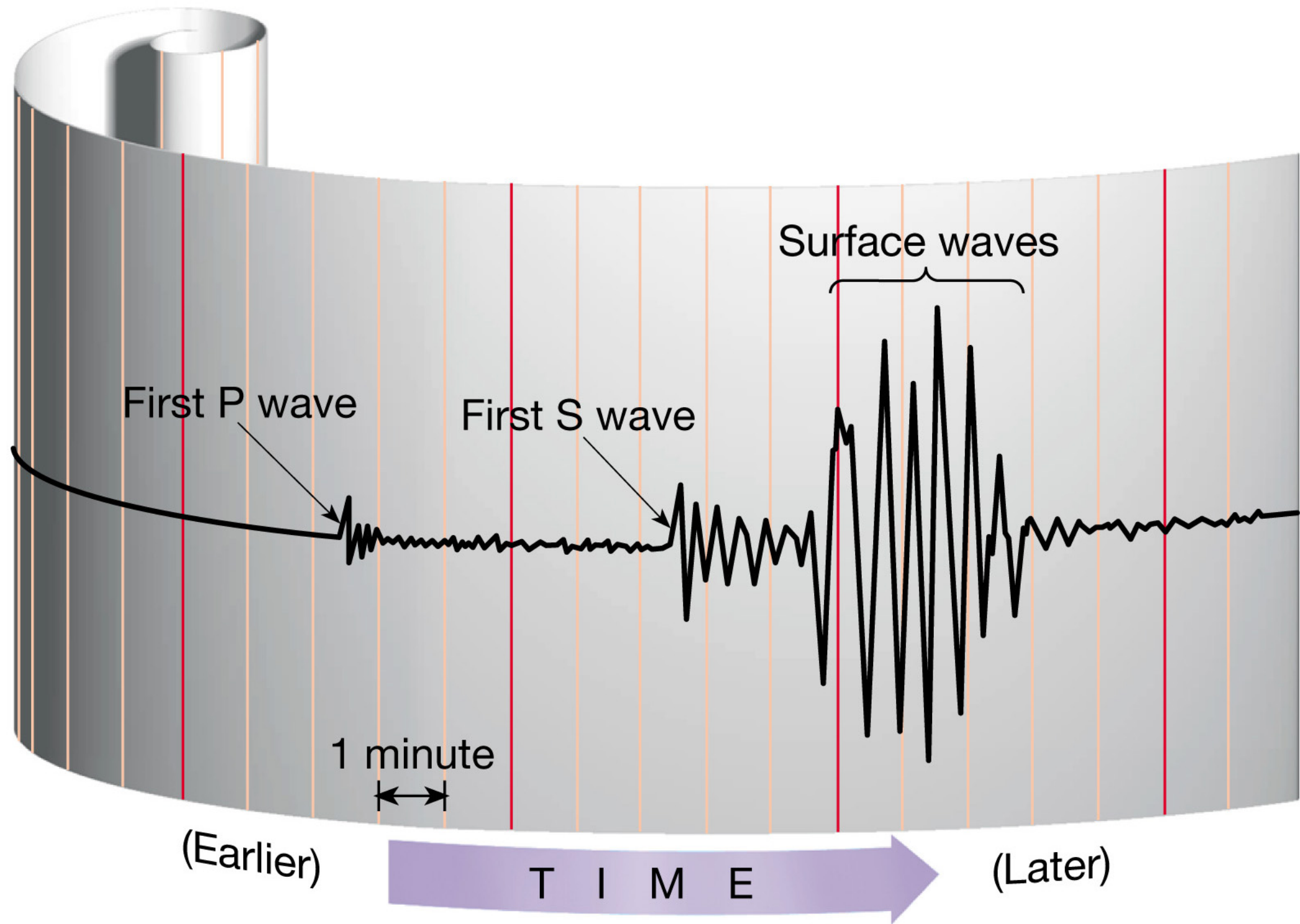
# Earthquake: seismic waves



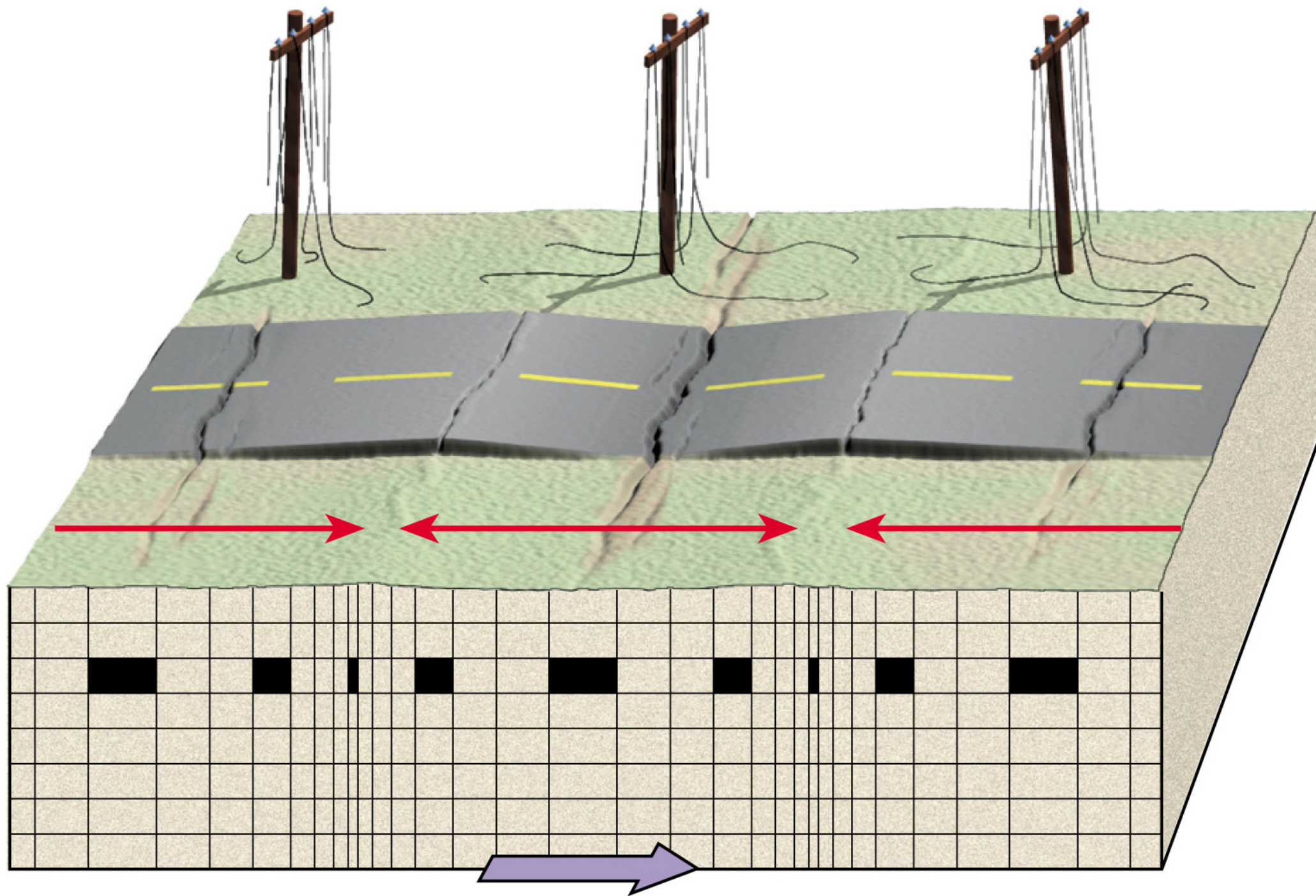




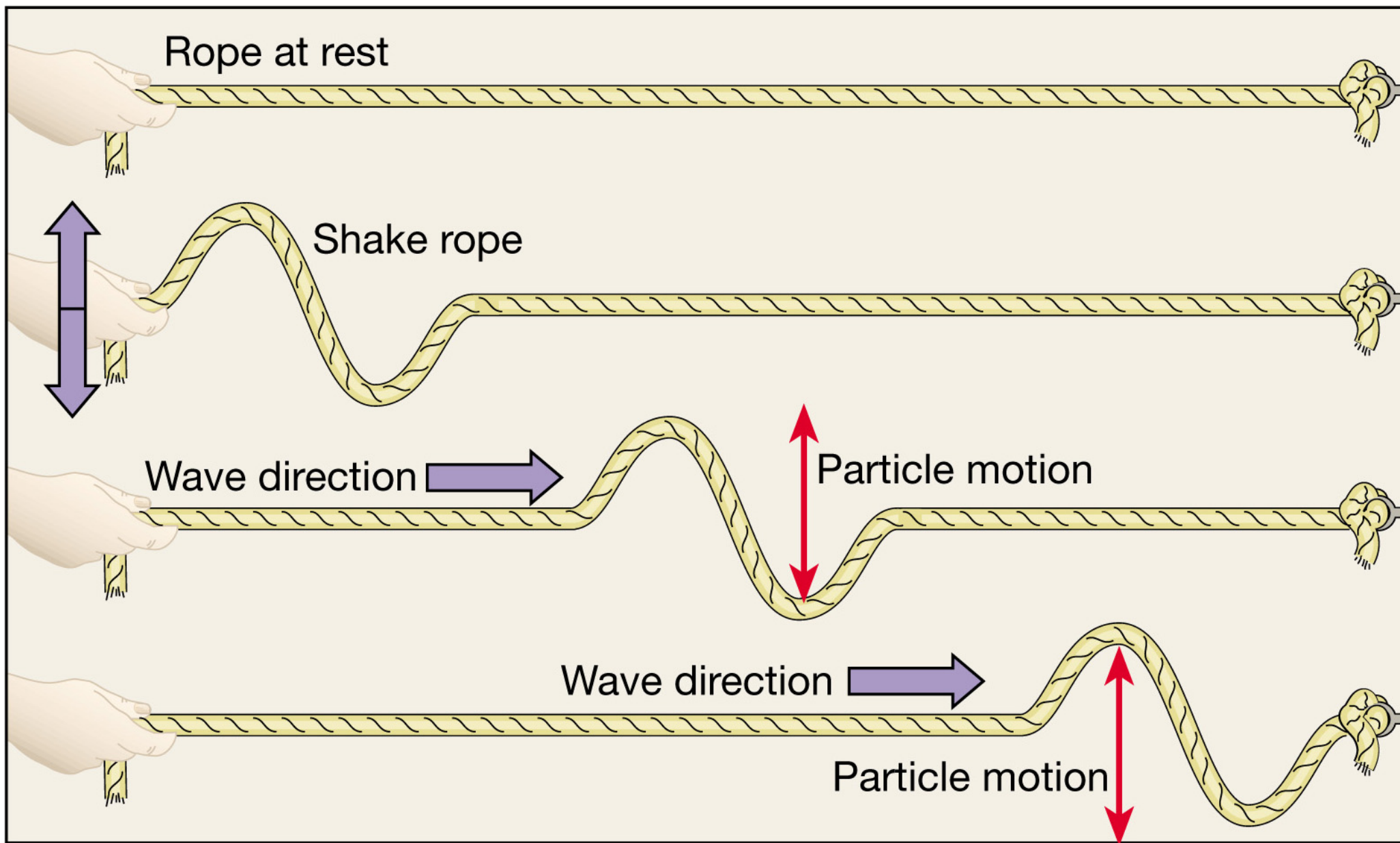
A. P waves generated using a slinky





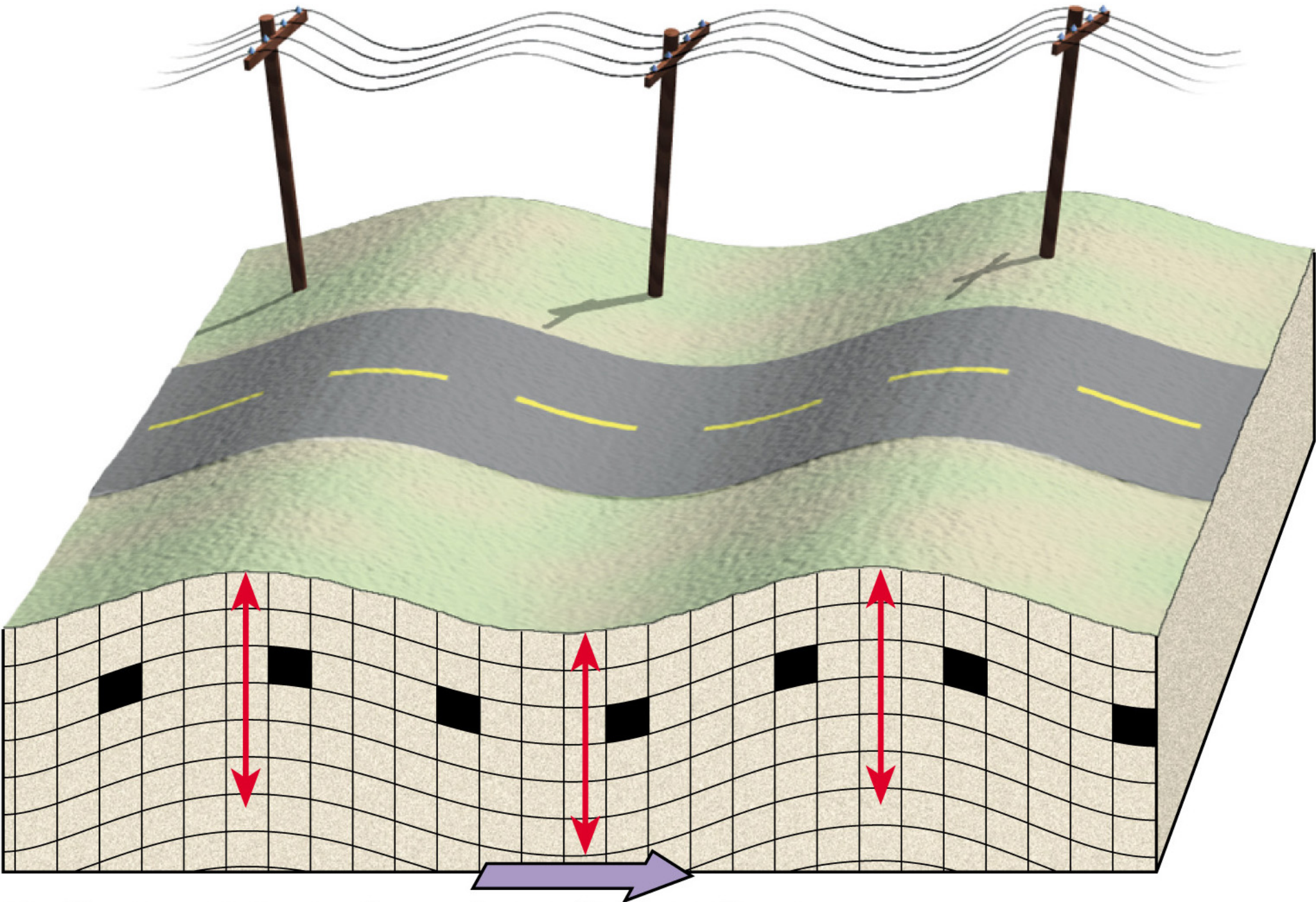


B. P waves traveling along the surface



C. S waves generated using a rope

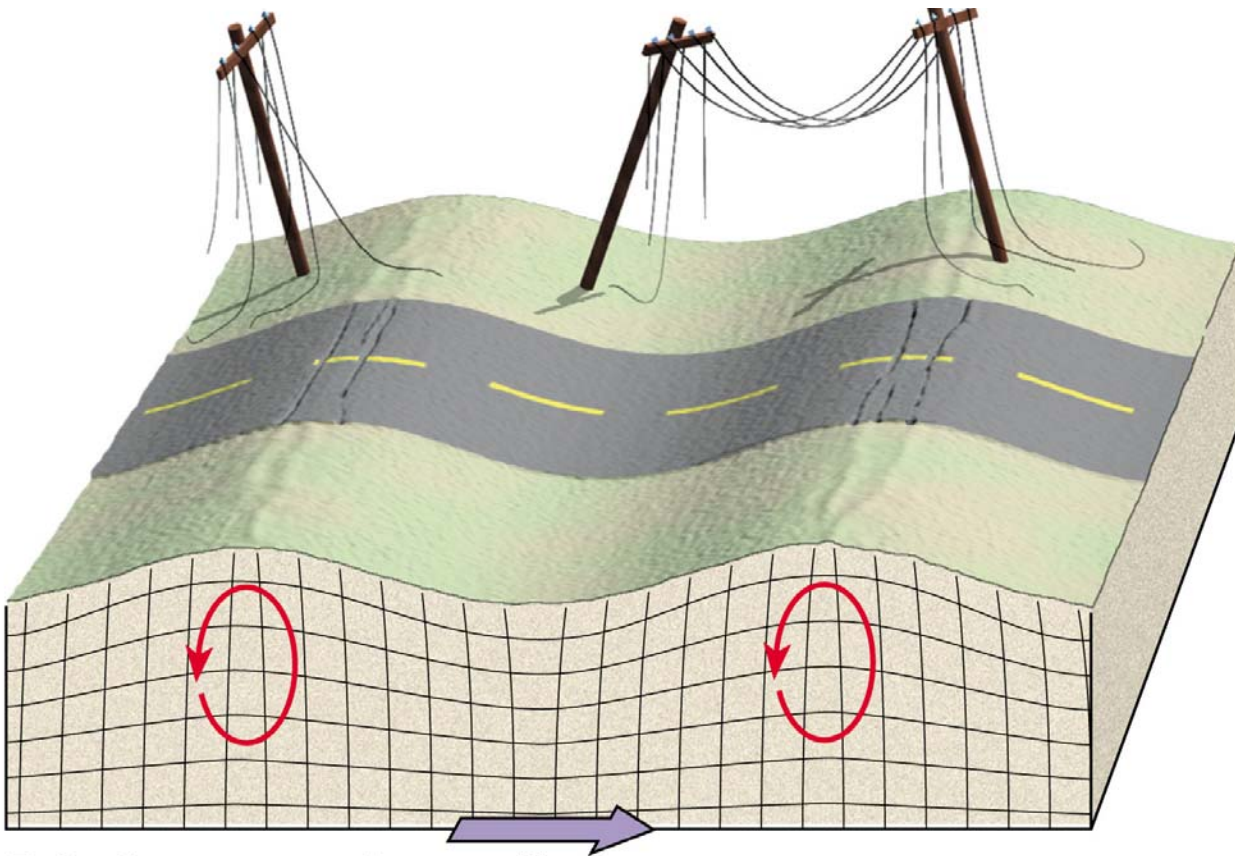




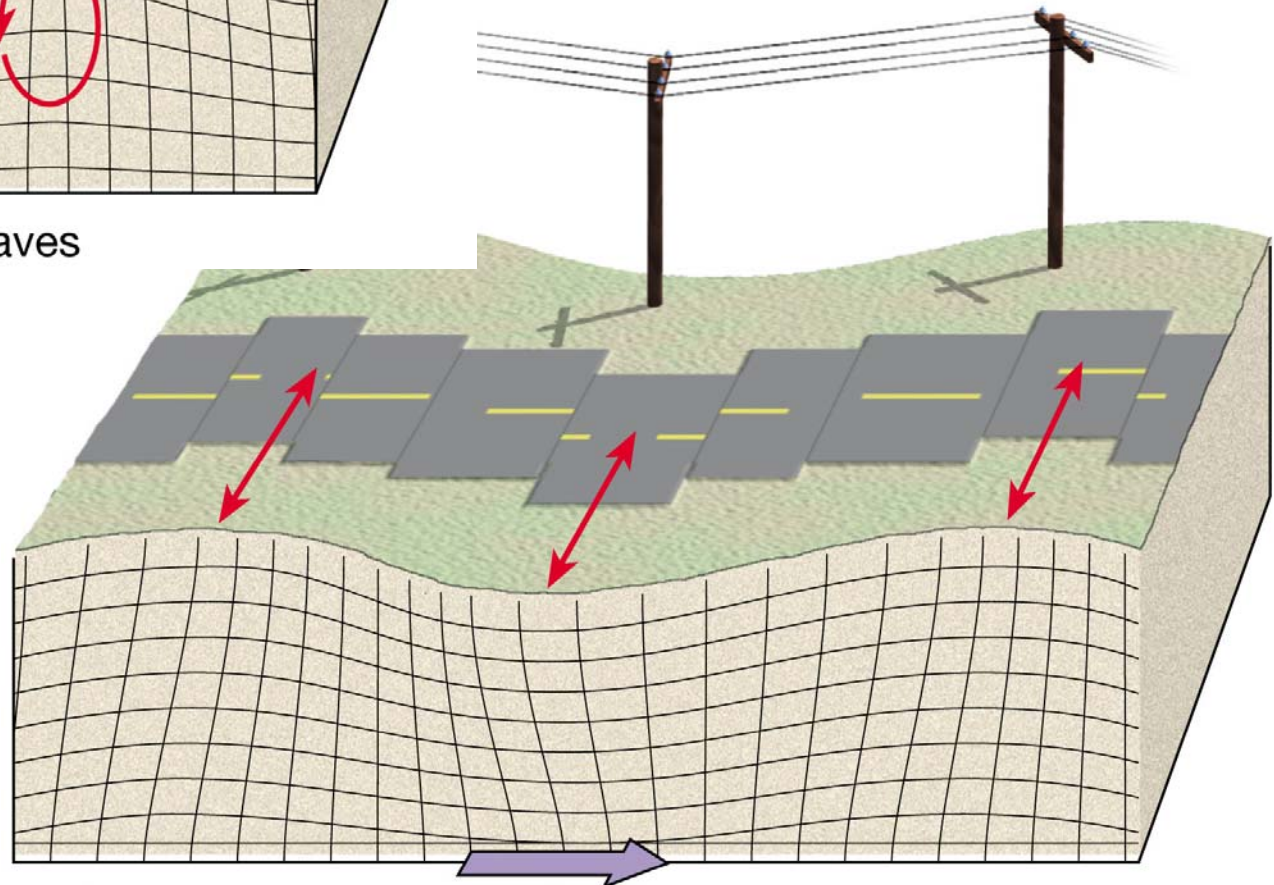
D. S waves traveling along the surface



# Surface waves

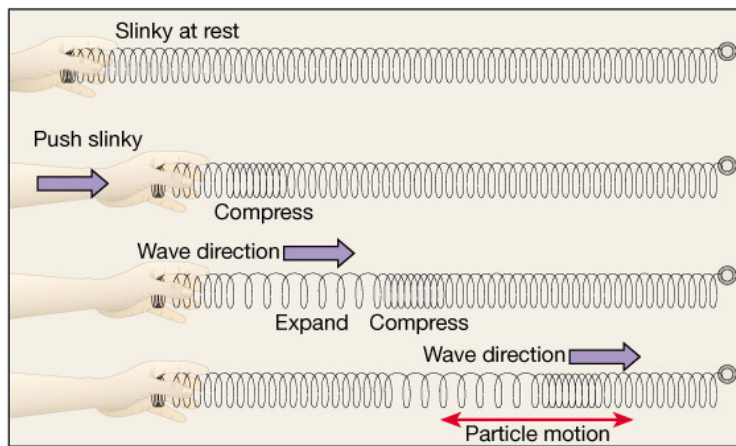


F. Surface waves that are like ocean waves

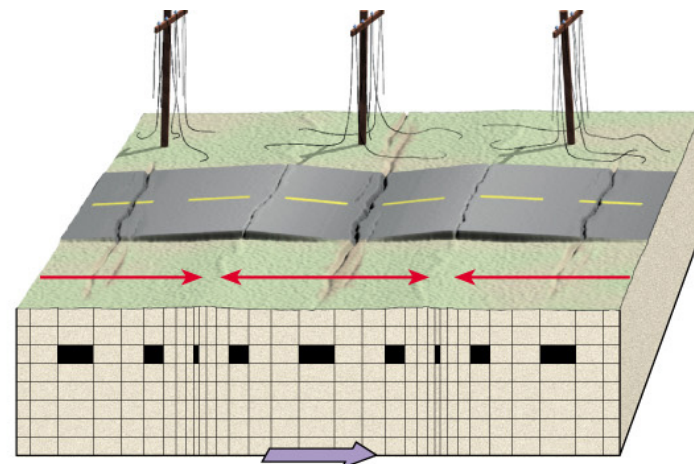


E. Surface waves that are like S waves

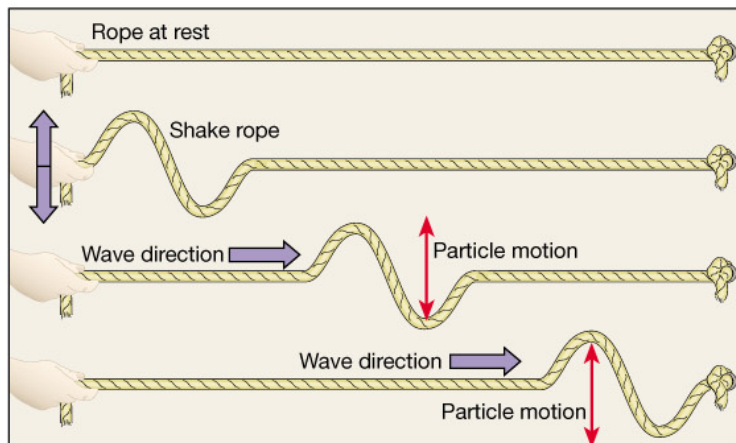




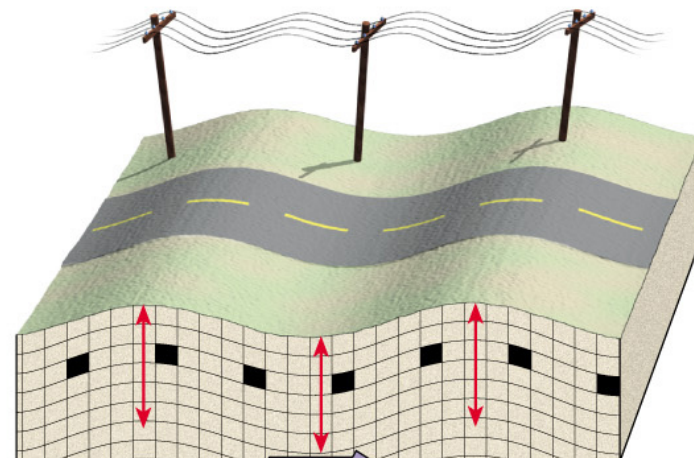
A. P waves generated using a slinky



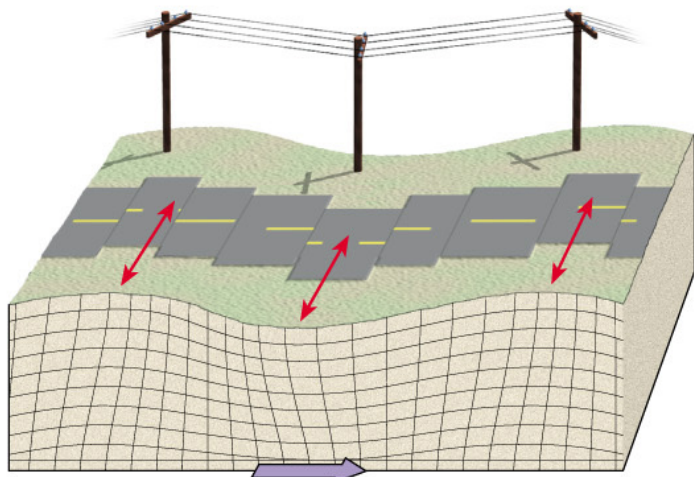
B. P waves traveling along the surface



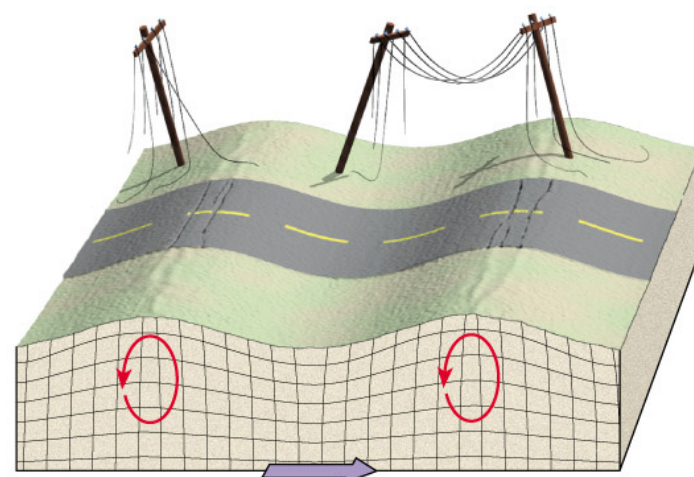
C. S waves generated using a rope



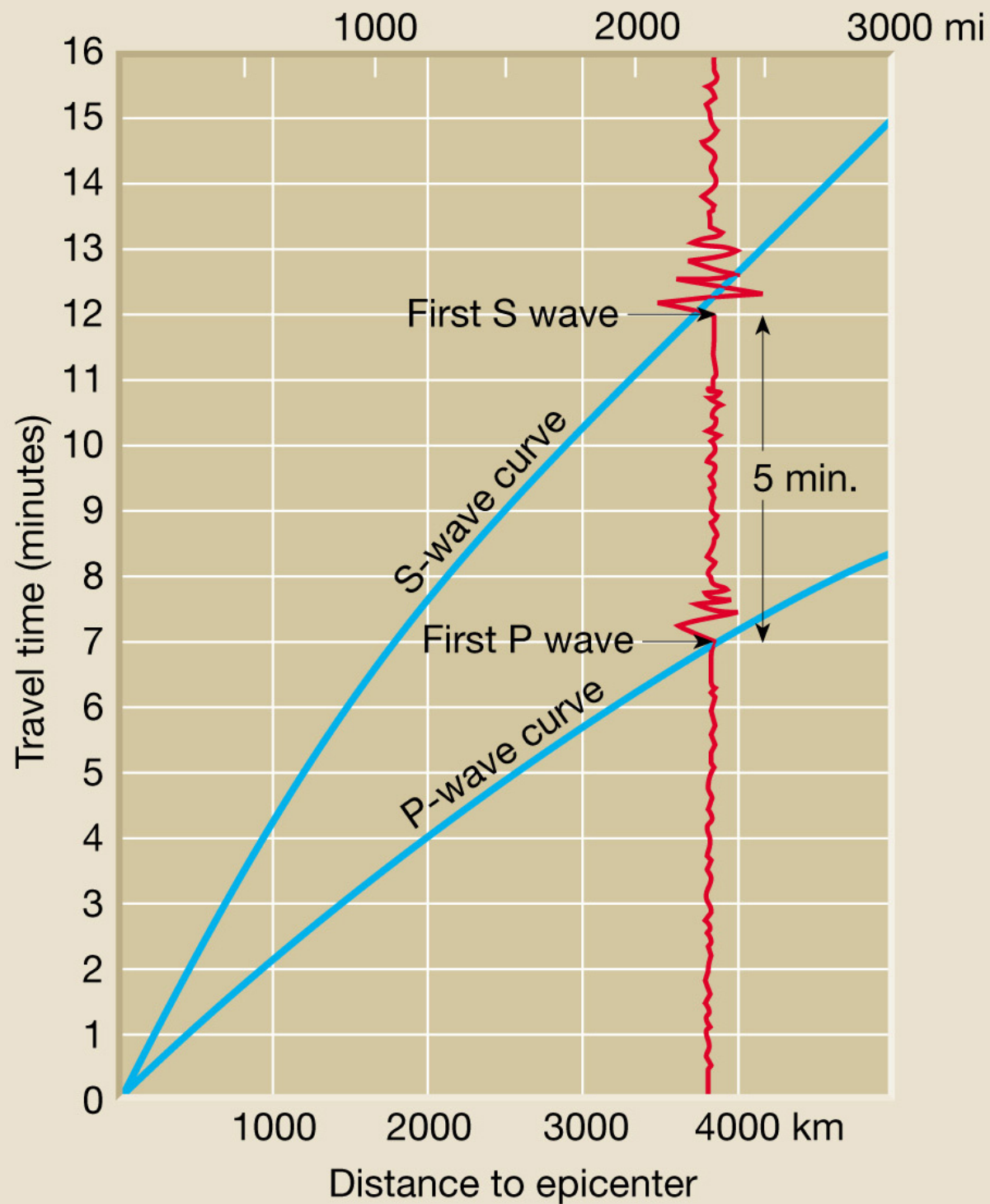
D. S waves traveling along the surface



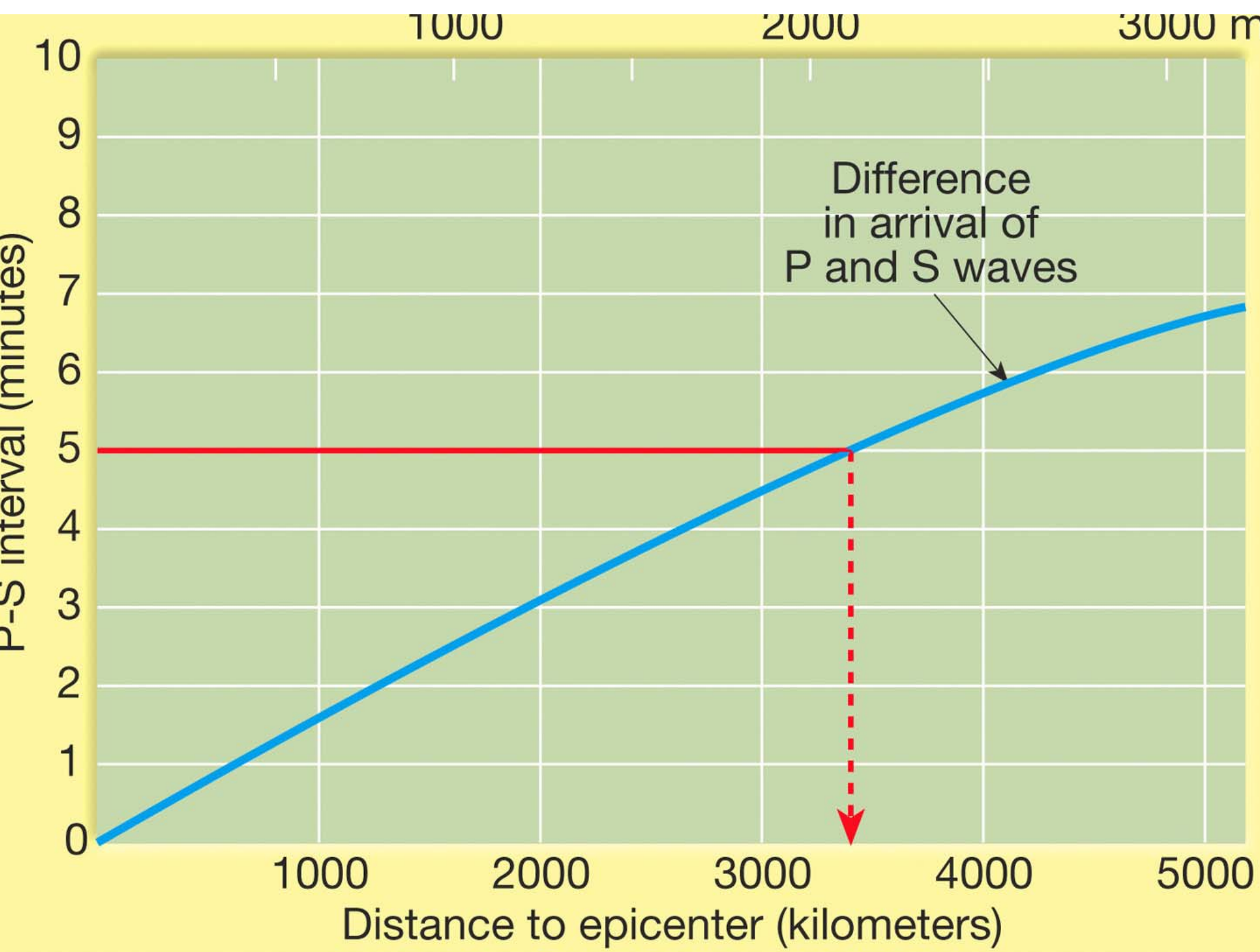
E. Surface waves that are like S waves



F. Surface waves that are like ocean waves

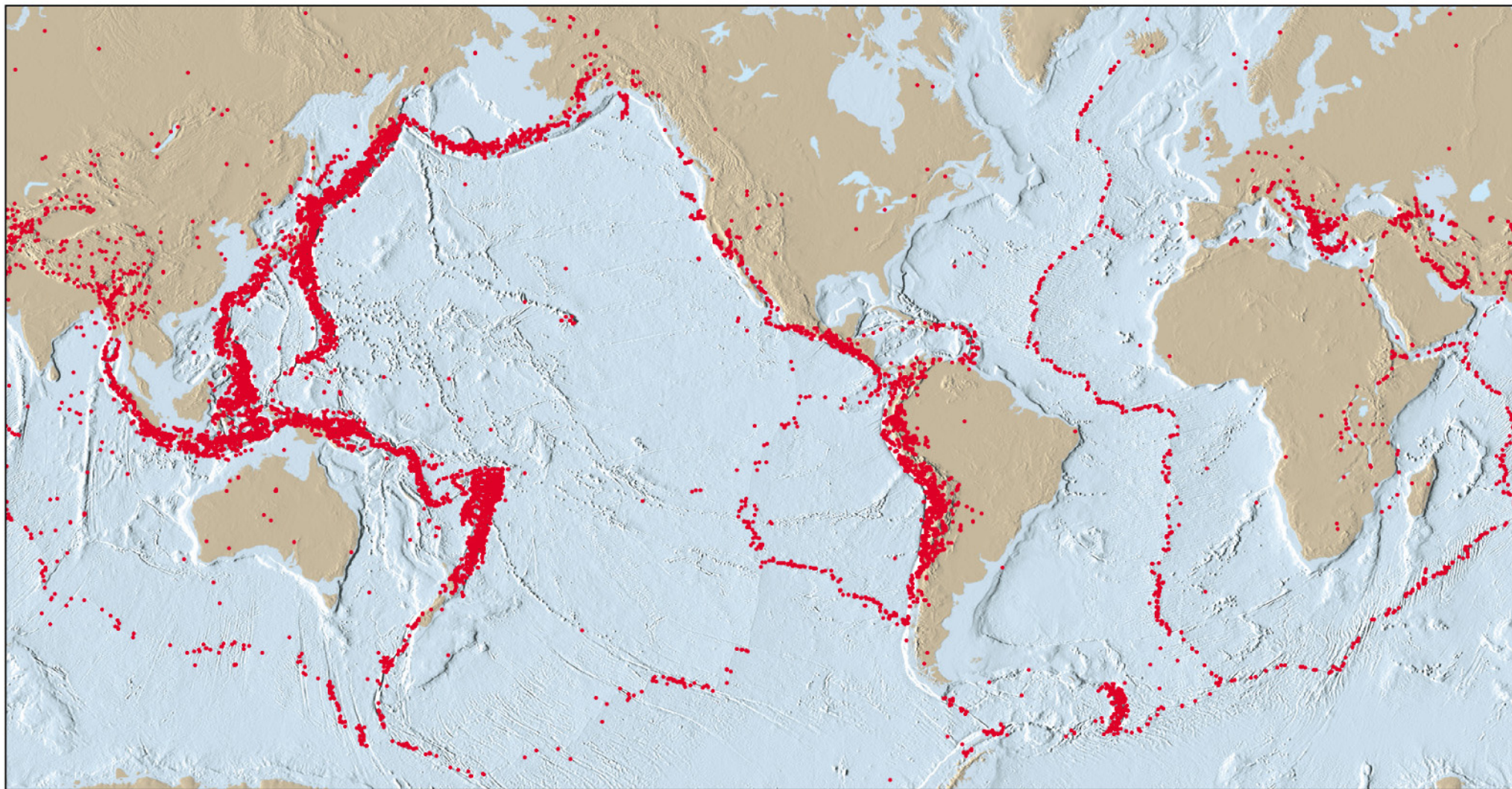














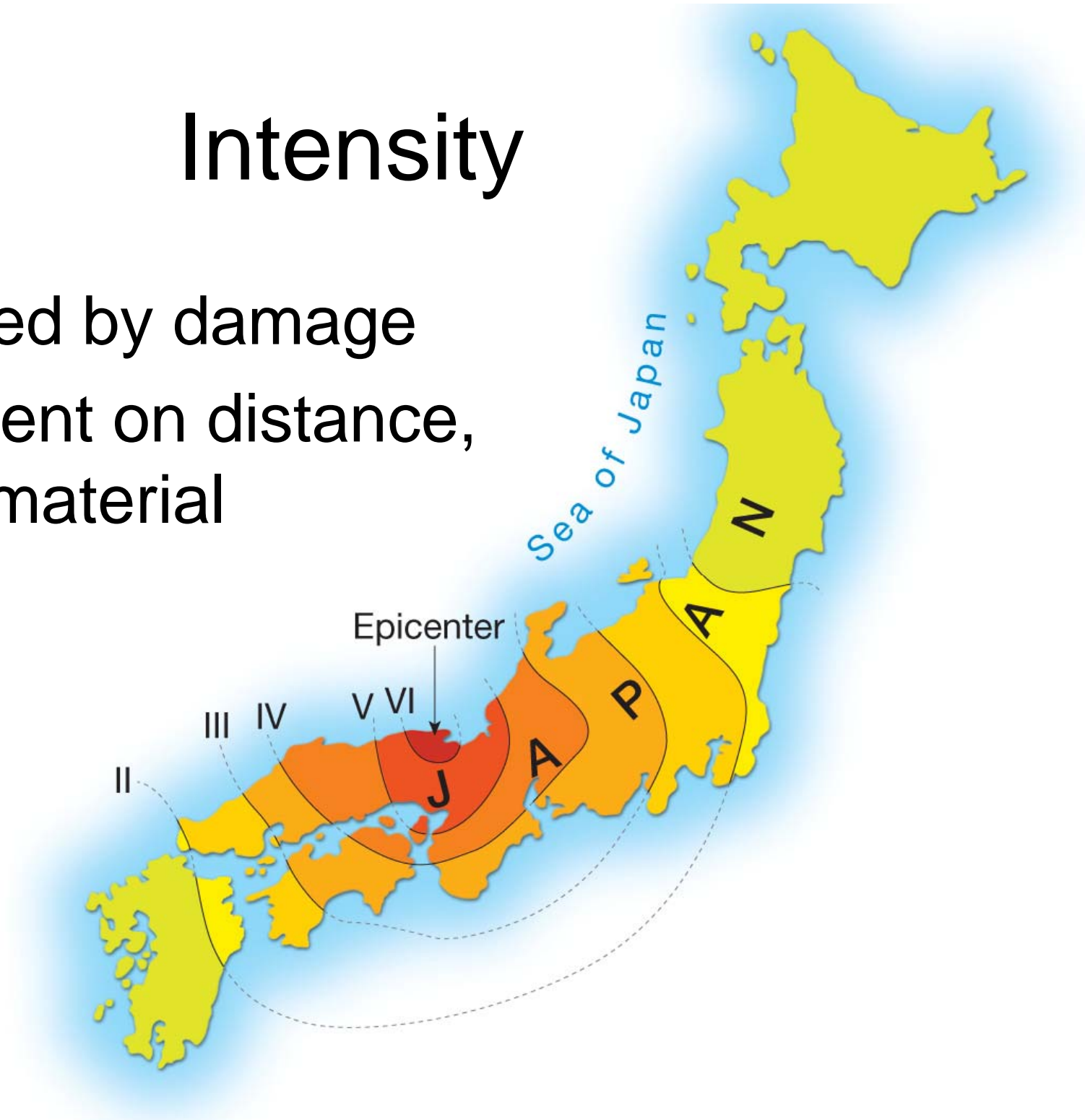
**TABLE 7.1** Modified Mercalli Intensity Scale.

- I** Not felt except by a very few 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 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, walls.)
- 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. 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 air.



# Intensity

- Measured by damage
- Dependent on distance, type of material





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# Seattle, WA

- Feb 28, 2001, Nisqually quake rocked the Central Puget Sound region
- 6.2 Richter Magnitude
- 6.8 Moment magnitude
- Centered 57.5 km south-southwest of Seattle and 52.4 km deep

<http://www.scec.org/earthquakes/>

<http://128.205.131.100:591/archives/Seattle.html>





**TABLE 7.2** Earthquake Magnitudes and Expected World Incidence.

Richter Magnitudes	Effects Near Epicenter	Estimated Number
<2.0	Generally not felt, but recorded.	600,000
2.0–2.9	Potentially perceptible.	300,000
3.0–3.9	Felt by some.	49,000
4.0–4.9	Felt by most.	6200
5.0–5.9	Damaging shocks.	800
6.0–6.9	Destructive in populous regions.	266
7.0–7.9	Major earthquakes. Inflict serious damage.	18
8.0 and above	Great earthquakes. Destroy communities near epicenter.	1.4

Source: *Earthquake Information Bulletin* and others.

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