

11. Earthquakes and Seismic Waves

- A. Earthquake: The shaking that results from the movement of rock beneath Earth's surface.
1. Most earthquakes are too small to notice but some can be large enough to produce dramatic changes & cause great damage.
 2. The forces of plate movement create stress on Earth's crust by forming faults.
 3. Stress increases along a fault until the rock breaks and an earthquake is produced.
 4. Most earthquakes begin in the lithosphere, within about 100 km of Earth's surface.
 - a. focus: The point beneath Earth's surface where rock breaks under stress & causes an E.Q.
 - b. epicenter: The point on Earth's surface directly above an earthquake's focus.

B. Types of Seismic Waves

1. An earthquake produces seismic waves: Vibrations that travel through Earth carrying the energy released during an earthquake.
2. There are three main types of seismic waves:
 - a. P waves: compress & expand the ground; told the ground like an acceleration; can travel through land & water.
 - b. S waves: move the ground up & down or side to side shaking structures violently; cannot travel through water.
 - c. Surface waves: form when P waves & S waves reach Earth's surface; move more slowly but still cause severe damage; can make the ground roll like a wave or shake from side to side.

C. Measuring Earthquakes

1. There are over 20 different measures for rating earthquakes. Each one has different advantages and disadvantages.
- a. The three most commonly used methods:
- 1) The Mercalli Scale: uses a 12-step scale to rate E.Q. according to their intensity & how much damage they cause.
 - 2) The Richter Scale: rates an E.Q.'s magnitude based on the size of its seismic waves; accurate for smaller or nearby E.Q.s but not larger ones or further away.
 - a) magnitude: The measurement of an E.Q.'s strength based on seismic waves and movement along faults.
 - b) seismograph: A device that records ground movement caused by seismic waves as they move through Earth.
 - 3) The Moment Magnitude Scale: rates E.Q.s by estimating the total energy released; good for E.Q.s of all sizes and distances.
- b. Comparing Magnitudes
- 1) Magnitude of 1-2: barely noticeable.
 - 2) Magnitude of 3-4: small; cause little damage.
 - 3) Magnitude of 5-6: can cause moderate damage.
 - 4) Magnitude of 7: can cause great damage.
 - 5) Magnitude of 8 or above: most powerful; create the most damage; rare.

D. Locating the Epicenter: Geologists use seismic waves to locate an earthquake earthquake's epicenter.

1. P waves arrive first, with S waves following close behind.
2. To tell how far the epicenter is from the seismograph, scientists measure the distance between the arrival of P Waves and S waves.
3. The farther away an earthquake is, the greater the time between the arrival of the P waves and S waves.
4. Geologists then draw 3 circles using data from 3 different Seismographs all over the world.
5. The center of each circle is a seismograph's location.
6. The point where 3 circles intersect is the location of the epicenter