

Direct Sources

1. The most easily available solid earth material is surface rock or the rocks we get from mining areas. These rocks provide a large volume of information.
2. Volcanic eruption forms another source of obtaining information.

Indirect Sources

1. Analysis of properties of matter indirectly provides information about the interior.
2. Meteors
3. Gravitation
4. Magnetic field
5. Seismic activity

Earthquake

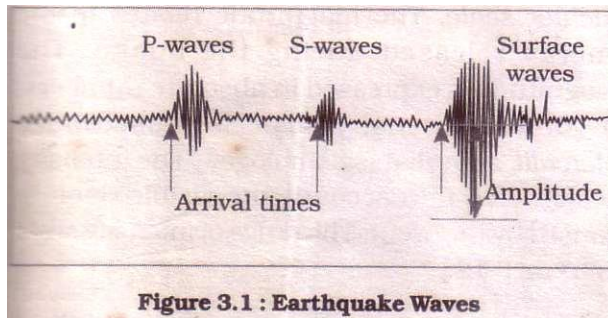
It is the shaking of the earth. It is caused due to release of energy which generates waves that travel to all directions.

Why does earth shake?

The release of energy occurs along the fault line. Rocks along the fault tend to move in opposite directions. As the overlying strata press them, the friction locks them together. However, their tendency of movement overcomes the friction. As a result, the blocks get deformed. They slide past one another. This causes release of energy. Energy waves travel in all directions. Seismology is the science which studies various aspects of seismic waves generated during the occurrence of earthquakes. Seismic waves are recorded with the help of an instrument known as seismograph. The place of the occurrence of an earthquake is called '**focus**' and the place which experiences the seismic event first is called '**epicentre**', which is located on the earth's surface and is always perpendicular to the 'focus'. The different types of tremors and waves generated during the occurrence of an

earthquake are called 'seismic waves' which are generally divided in 3 broad categories e.g. primary waves, secondary waves and surface waves.

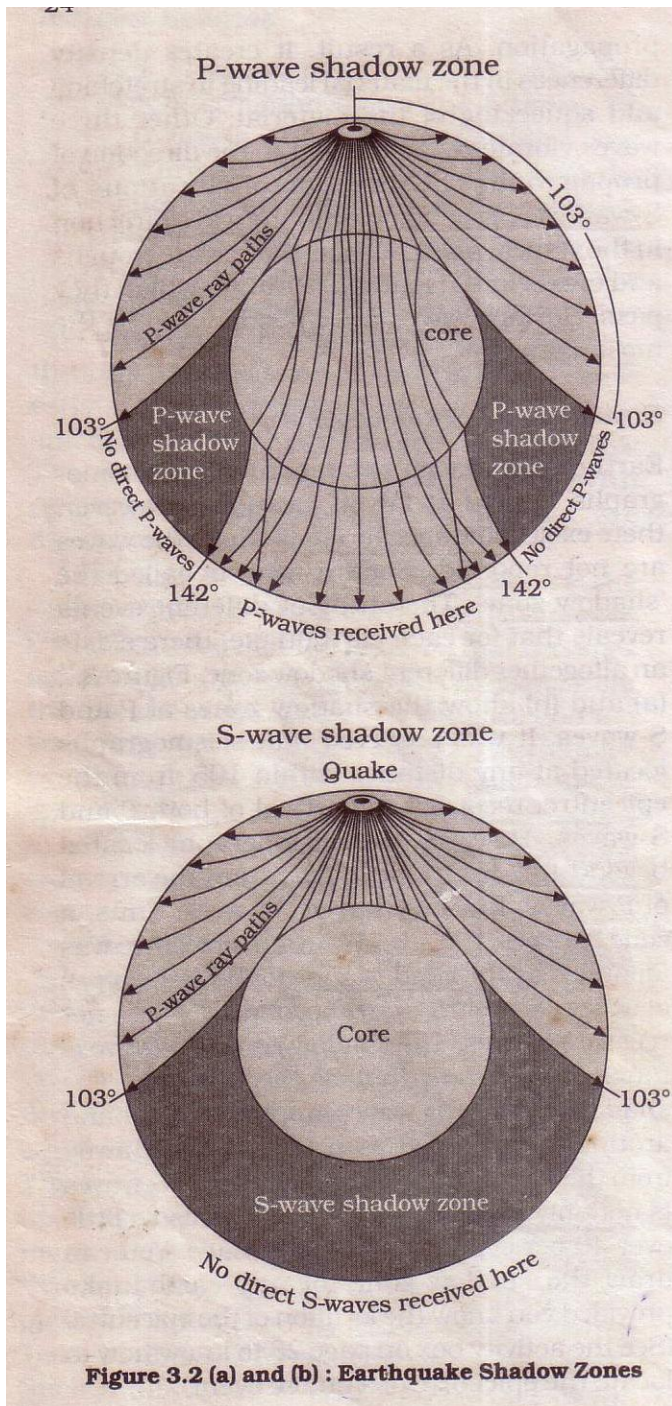
- (i) **Primary Waves** also called as longitudinal or compressional waves or simply 'P' wave's wherein particles move both to and fro in the line of the propagation of the ray. P waves travel with fastest speed through solid materials. Though these also pass through liquid materials but their speed is slowed down.



- (ii) **Secondary Waves** are also called as transverse or distortional or simply S waves. Here the particles move at right angles to the rays. S waves cannot pass through liquid materials.
- (iii) **Surface Waves** are also called as Long Period waves or simply L waves. These waves generally affect only the surface of the earth and die at smaller depth.

What is **Shadow Zone**?

There are some specific areas where the waves are not reported. Such a zone is called the 'shadow zone'. Seismographs located at any distance within 105° from the epicenter, recorded the arrival of both P and S –waves. The seismographs located beyond 145° from the epicenter, record the arrival of P – waves, but not S-waves. A zone between 105° and 145° from the epicenter was identified as shadow zone for both the types of waves. The entire zone beyond 105° does not receive S-waves. The shadow zone of P-waves appears as a band around the earth between 105° and 145° away from the epicenter.



Types of Earthquakes

- (i) **Tectonic earthquake** – These are generated due to sliding of rocks along a fault plane. When the large, thin plates of the Earth's crust and upper mantle become stuck as they move past one another. They lock

- together, and pressure builds up. When they finally release, earthquake occur.
- (ii) **Volcanic earthquake** – It is type of earthquake caused by the movement of magma beneath the surface of the Earth. The movement results in pressure changes where the rock around the magma has experienced stress. At some point, this stress can cause the rock to break or move. These are confined to areas of active volcanoes.
 - (iii) **Collapse earthquake** – These are small earthquakes in underground caverns and mines that are caused by seismic waves produced from the explosion of rock on the surface. In the areas of intense mining activity, sometimes the roofs of underground mines collapse causing minor tremors. These are called collapse earthquakes.
 - (iv) **Explosion earthquake** -Explosion earthquakes are produced by the detonation of chemicals or nuclear devices. When a nuclear device is detonated in a borehole underground, enormous nuclear energy is released.
 - (v) **Reservoir induced earthquake** -The phenomenon of **dam-triggered earthquakes** is known as **reservoir-induced seismicity**. When a **dam** is built and the **reservoir** filled with water, the amount of pressure exerted on the earth in that area changes dramatically.

Measuring earthquakes

The magnitude of earthquake is measured by **Richter scale**. The magnitude is expressed in absolute numbers, 0-10.

Effects of Earthquake

- (i) Ground shaking
- (ii) Differential ground settlement
- (iii) Land and mud slides
- (iv) Soil liquefaction
- (v) Ground lurching
- (vi) Avalanches
- (vii) Ground displacement

- (viii) Floods from dam and levee failures
- (ix) Fires
- (x) Structural collapse
- (xi) Falling objects
- (xii) Tsunami