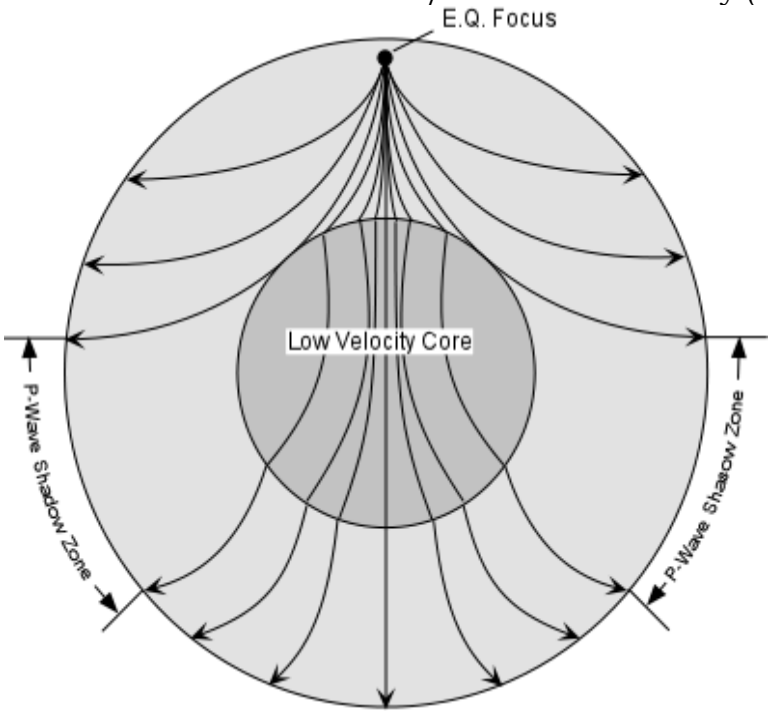
Geomorphology

Earth's Interior – Earthquake Waves – Shadow Zone

Most of the knowledge we have about Earth's deep interior comes from the fact that seismic waves penetrate the Earth and are recorded on the other side. Earthquake ray paths and arrival times are more complex than illustrated in the animations, because velocity in the Earth does not simply increase with depth. Velocities generally increase downward, according to Snell's Law, bending rays away from the vertical between layers on their downward journey; velocity generally decreases upward in layers, so that rays bend toward the vertical as they travel out of the Earth . Snell's Law also dictates that rays bend abruptly inward at the mantle/outercore boundary (sharp velocity decrease in the liquid) and outward at the outer core/inner core boundary (sharp velocity increase).



Major Points to remember about P S and Love waves

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- **P wave** or **primary wave**. This is the fastest kind of seismic wave, and, consequently, the first to 'arrive' at a seismic station.
- The P wave can move through solid rock and fluids, like water or the liquid layers of the earth.
- P waves are also known as **compressional waves.**
- **S wave** or **secondary wave**, which is the second wave you feel in an earthquake. An S wave is slower than a P wave and can only move through solid rock, not through any liquid medium.
- Travelling only through the crust, **surface waves** are of a lower frequency than body waves, and are easily distinguished on a seismogram as a result.

Earth's Layers – Earth's Composition

The Crust of Earth

It is the outermost and the thinnest layer of the earth's surface, about 8 to 40 km thick. The crust varies greatly in thickness and composition – as small as 5 km thick in some places beneath the oceans, while under some mountain ranges it extends up to 70 km in depth.

The crust is made up of two layers- an upper lighter layer called the Sial (Silicate + Aluminium) and a lower density layer called Sima (Silicate + Magnesium).The average density of this layer is 3 gm/cc.

The Mantle of Earth

This layer extends up to a depth of 2900 km.

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Mantle is made up of 2 parts: Upper Mantle or Asthenosphere (up to about 500 km) and Lower Mantle. Asthenosphere is in a semi-molten plastic state, and it is thought that this enables the lithosphere to move about it. Within the asthenosphere, the velocity of seismic waves is considerably reduced (Called 'Low Velocity

The line of separation between the mantle and the crust is known as Mohoviricic Discontinuity.

The Core of Earth

Beyond a depth of 2900 km lies the core of the earth.The outer core is 2100 km thick and is in molten form due to excessive heat out there. Inner core is 1370 km thick and is in plasticform due to the combined factors of excessive heat and pressure. It is made up of iron and nickel (Nife) and is responsible for earth's magnetism. This layer has the maximum specific gravity.The temperatures in the earth's core lie between 2200°c and 2750°c. The line of separation between the mantle and the core is called Gutenberg-Wiechert Discontinuity.

Earth Movements – Endogenetic Movements

The interaction of matter and temperature generates these forces or movements inside the earth's crust. The earth movements are mainly of two types: diastrophism and the sudden movements.

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The energy emanating from within the earth is the main force behind endogenic geomorphic processes.

This energy is mostly generated by radioactivity, rotational and tidal friction and primordial heat from the origin of the earth. This energy due to geothermal gradients and heat flow from within induces diastrophism and volcanism in the lithosphere.

Diastrophism

Diastrophism is the general term applied to slow bending, folding, warping and fracturing.

Wrap == make or become bent or twisted out of shape, typically from the action of heat or damp; make abnormal; distort.

All processes that move, elevate or build up portions of the earth's crust come under diastrophism. They include:

orogenic processes involving mountain building through severe folding and affecting long and narrow belts of the earth's crust;

epeirogenic processes involving uplift or warping of large parts of the earth's crust;

earthquakes involving local relatively minor movements;

plate tectonics involving horizontal movements of crustal plates.

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In the process of orogeny, the crust is severely deformed into folds. Due to epeirogeny, there may be simple deformation. Orogeny is a mountain building process whereas epeirogeny is continental building process.

Through the processes of orogeny, epeirogeny, earthquakes and plate tectonics, there can be faulting and fracturing of the crust. All these processes cause pressure, volume and temperature (PVT) changes which in turn induce metamorphism of rocks.

Epeirogenic or continent forming movements

In geology, Epeirogenic movement refers to upheavals or depressions of land exhibiting long wavelengths [undulations] and little folding.

The broad central parts of continents are called cratons, and are subject to epeirogeny.

The movement is caused by a set of forces acting along an Earth radius, such as those contributing to Isostacy and Faulting in the lithosphere

Epeirogenic or continent forming movements act along the radius of the earth; therefore, they are also called radial movements. Their direction may be towards (subsidence) or away (uplift) from the center. The results of such movements may be clearly defined in the relief.

Uplift

Raised beaches, elevated wave-cut terraces, sea caves and fossiliferous beds above sea level are evidences of uplift.

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