EARTHQUAKE

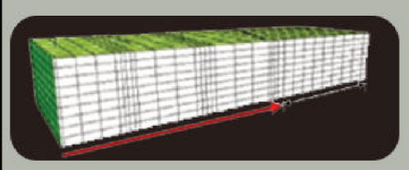
Sudden endogenic force that is caused by release of accumulated energy in deformed rocks.

FOCUS → Precise plutonic spot where rock begins to rupture/shift is called focus

EPICENTRE → Point on earth's surface directly above focus

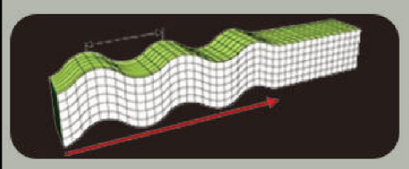
SEISMIC WAVES
- BODY WAVES
  - PRIMARY WAVES
  - SECONDARY WAVES
- SURFACE WAVES
  - RAYLEIGH WAVES
  - LOVE WAVES

BODY WAVES



PRIMARY WAVES

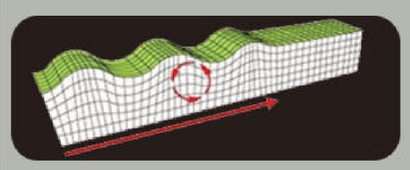
Fastest moving seismic waves (6-7 k.m.); first recorded seismic wave; waves initiated from focus; rocks near focus expand; other rocks get compressed beyond volume; rocks experience alternate sequence of compression and expansion in same direction as wave propagation.



SECONDARY WAVES

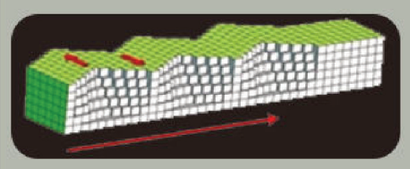
Passes through earth's interior at 3.5 km/s; secondary wave is perpendicular to direction of wave propagation; creates drag effect on neighbouring rock; induces shearing stress; changes shape not volume.

SURFACE WAVES



RAYLEIGH WAVES

Represents sea swell motion, generating vertical ground shift.



LOVE WAVES

Represents whipping motion, generating horizontal ground shift.

OFFICERS IAS ACADEMY™
IAS ACADEMY BY IAS OFFICERS

EARTHQUAKE 2

GEOMORPHIC EFFECT OF EARTHQUAKE

GROUND SHIFT | LIQUEFACTION | TSUNAMI | SEICHES

GROUND SHIFT

RAYLEIGH WAVE

Seismic waves that transmit via the crustal rocks inducing the effectivity are largely applied as ground shift.

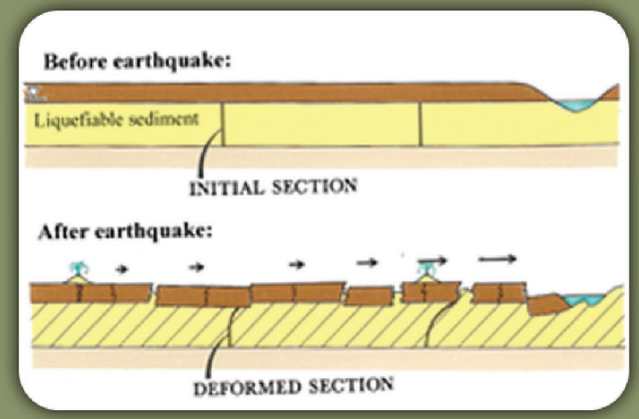
Ground shift example of earthquake induced modification on the existing topographical features

Love Wave aids development of horizontal ground shift. Best example: San Andreas fault.

Rayleigh wave denotes possibility of vertical ground shift depending on its intensity

SAN ANDREAS FAULT

LIQUEFACTION



Liquefaction Effect includes a wide spectrum of influences on the existing topography.

Earthquakes accelerate wasting of weathered material.

Exposes new slope, more weathering to follow

Mass wasted material deposited at piedmont

Creates lakes of differing size, flooding probability increases

Liquefaction also applies to accelerated wasting of water saturated material (mud slides, solifluction etc)

TSUNAMI

Tsunamis occur when the epicentre is below an ocean and the earthquake has sufficient magnitude (>5 on Richter scale)

Tsunamis are waves generated by sudden vertical movement of the sea floor during submarine quakes.

Submarine landslides/vertical shift causes uplift of seafloor and subsequent pileup of water

When water returns to original levels, it spreads rapidly at 700-800 km/h

Seismic sea waves can incorporate wave lengths of upto 160 km, wave heights from upto 6m

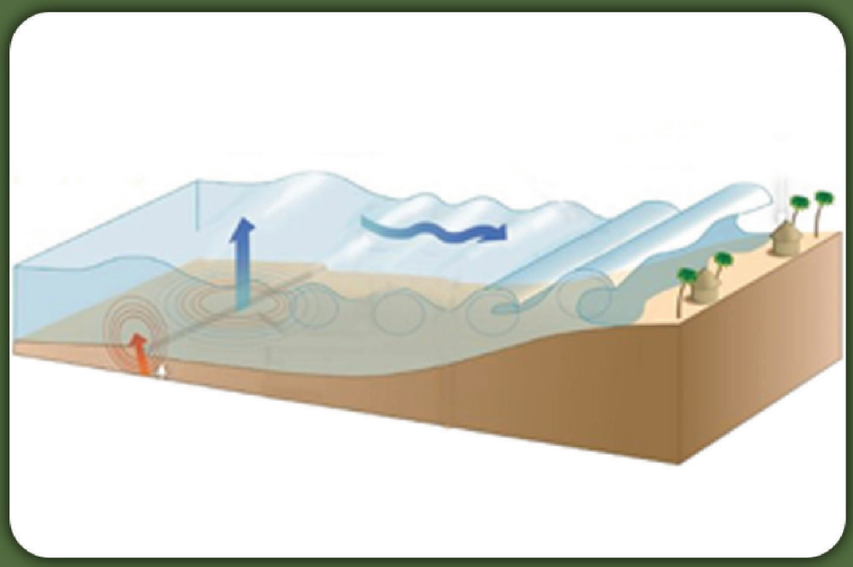
Near shore line, waves lose velocity and gain height of 15-30m

Change attributed to shallowness of water near shore

Can affect not just coastal areas but also interior locations

Water movement maintains long wavelength in the open horizon and so backwash is delayed.

Delay makes Tsunamis devastating as water levels continuously rises up on land line



OFFICERS IAS ACADEMY™
IAS ACADEMY RUN BY FORMER CIVIL SERVANTS

SEICHES

Tsunamis of marginal water bodies More frequent on land due to proximity to shore line

OFFICERS IAS ACADEMY™
IAS ACADEMY RUN BY FORMER CIVIL SERVANTS

EARTHQUAKE 3

EARTHQUAKE & PLATE TECTONICS

SHALLOW

Focus between 20-30 km, caused due to ocean divergence.

DEEP

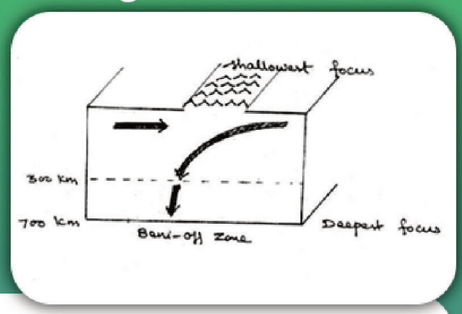
Focus between 50-80 km, caused due to continent divergence

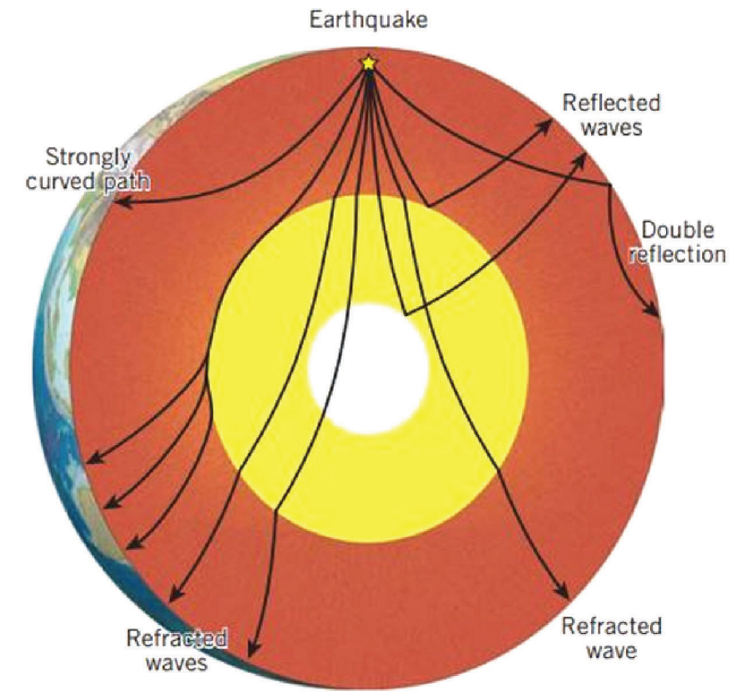
SHALLOWEST

Focus typical for continent-continent convergence, due to slide of a crustal slab over the other crustal slab

DEEPEST

Focus typical for destructive boundary, along Benioff Zone





BEHAVIOURS OF SEISMIC WAVES AND THE EARTH'S INTERIOR:

P-waves compress materials through which they pass, influencing volume of rock/material
Post-compression rock returns to original volume easily, accelerating P wave velocity
Inelasticity of liquid medium reduces P wave velocity, explains disappearance of S waves
As S waves moves by inducing shearing stress, only solid medium can facilitate propagation

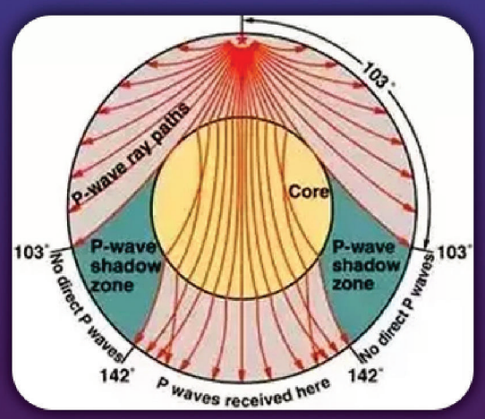
In light of these properties, scholars made the following observations:

If the interior structure of the earth was homogeneously solid, P waves and S waves would have travelled at constant speed and been recorded in the seismographs opposite focus
The subversion of this, is what led to the shadow zone hypothesis.

SHADOW ZONE

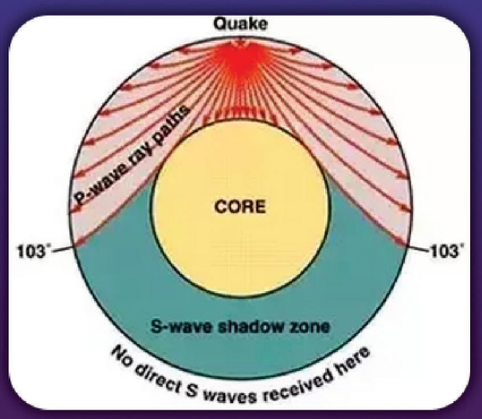
When earthquake occurs, a large area opposite focus does not detect seismic waves

P WAVE



The P wave shadow zone extends to a quarter of the circumference of the earth, opposite to focus but between 105° to 145°

S WAVE



The S wave shadow zone extends to half the circumference of the earth, opposite to focus and between 105° to 105°