



26 July 2019

## EARTHQUAKE

Earthquake refers to tremors or oscillation in the crustal rocks caused by flow of earth's internal energy in wave motion.

Earthquakes are caused by catastrophic / shock waves release of potential energy of the rocks into kinetic energy as the faulting / rifting & pulverisation of rocks continuous with the Hypogene forces. (Internal forces).

SEISMIC WAVES.

Focus & Epicentre

Earthquake shadow zone.

### MEASUREMENT OF EARTHQUAKE

Richter Scale - It is no upper limit generally measure 1-10 but the highest mag<sup>n</sup> of earthquake recorded 9.8 in Chile. It is logarithmic scale and mag<sup>n</sup> of the earthquake rise by 10 times on each scale. It measure the mag<sup>n</sup> of earthquake which means quantum of energy released in kilojoule.

Mercally Scale - Upper limit 1-12 It measures the intensity of earthquake which means degree of devastations.

MM Scale - Momentum Magnitude Scale It measures the Specially / areal extent of the earthquake on the basis of Quantum of energy released. It is also called modified Mercally Scale.

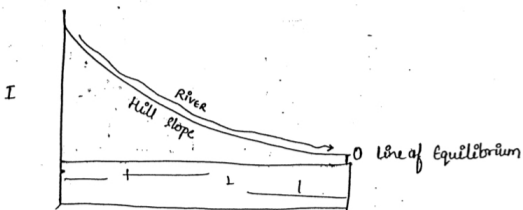


## CAUSES OF EARTHQUAKE

1. Radioactivism - max<sup>m</sup> b/w 35-75 km specially below the mountain roots.
2. Thermal Convent & faulting - The intrusives magma provides heat to the upper crustal rocks which expand & break down this energy is released causing the earthquake.
3. Elastic Rebound theory: By Professor Reid.

His studies were based on the Californian earthquakes along San Andreas fault line all represent transform boundary where 2 plates are sliding past each other.

In the process the rocks are stretched beyond their elastic limits these rocks are shattered or they break down which release the potential energy into kinematic motion. Such EQ's are frequent, intense, high mag<sup>s</sup> and devastated b/c after the breaking down of the rocks they readjust to the new situation and in the process they cause upheavals. Responsible for the EQ.



2

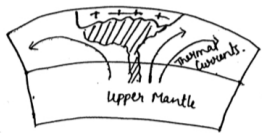
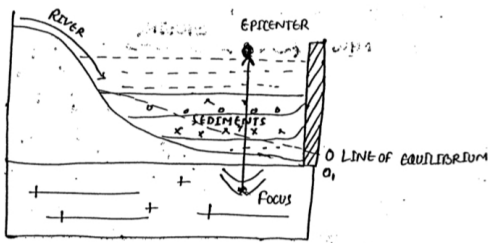
Radioactivity is most in siliceous matter.

Intraplate Volcanos

Based on Elastic rebound Reservoir Induced seismicity can be explained. Once Reservoirs and dams are constructed they disturb the Mechanical equilibrium of the hill slopes with the running water.

The Reservoir accumulates huge amount of sediments and stores water which by the superimposed weight over the underlying rocks these rocks once they reach their elastic limits are shattered and thus energy is suddenly released these shattered rocks readjust and reorganize which generate shock waves which is called RIS Reservoir Induced seismicity. In the close reservoir suddenly standing waves are produced known as Stelches also known as Mini Tsunami which may cause flooding and even breaking down of dams.  
eg: Kohina Earthquake, Mangla dam etc.

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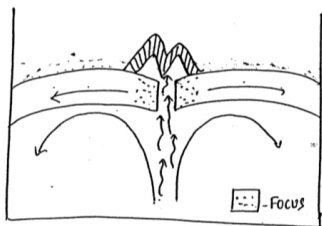


3

## PLATE TECTONICS AND EARTHQUAKE.

1. Divergent boundary and Earthquake - AIC to PIT, EQ's can be classified as-
- (a) Shallow Focus EQ : 0-35 km (Crust) Crustal EQ.
  - (b) Medium Focus EQ : 35-75/100 km found in lithosphere or plates
  - (c) Deep focus EQ : 100-400 km. Asthenospheric EQ's.
  - (d) Plutonic EQ : 400-700 km Mantle EQ / Upper Mantle. It generally occurs around 670 km.

Along the divergent boundary, shallow to medium focus EQ's are found b/c of the thrust of the magma below the mid-oceanic ridges. Esp. the CRV (Central Rift Valley's) receives regular thrust of intrusive magma. These EQ's are frequency but with low intensity and non-catastrophic the highest possibility on Richter scale (Richter) is 4.5.



2. Convergent boundary & Earthquakes : Convergent boundaries are zone of subduction of the Oceanic Margins which is also called Benioff zone. or the Benioff Badoff Zone.



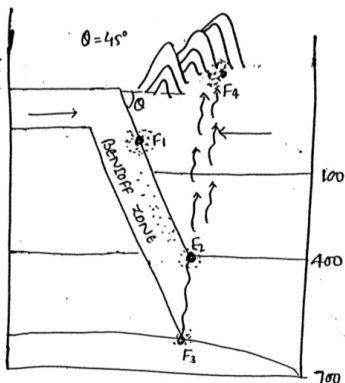
Benioff zone refers to the subduction zone where the focus of the EQ's are distributed. The Plate Subduct roughly at  $45^\circ$  angle and there are 3 main areas of the origin of the Earthquakes.

F<sub>1</sub>: Found below the trench it has medium EQ's produced by Plate Collision & breaking down of rocks due to enormous friction. These EQ's are devastating, sudden and has low frequency but high intensity and magnitude.

F<sub>2</sub>: Deep Earthquakes due to melting of the plates & the upward thrust of the magma.

F<sub>3</sub>: The remaining part of the Plate enters the mantle and crashes over the solid lower mantle. Such EQ's are Plutonic less frequent & non-devastating.

F<sub>4</sub>: Shallow focus EQ's: EQ's are produced by thrust of the magma below the volcanic arc and sometimes arise due to volcanic eruptions.



F<sub>4</sub> = not a part of Benioff zone

(15)

### 3. Conservative Boundary - Elastic Rebound [Californian EQ's]

Such

4. Hotspot Earthquakes - They are mild Intraplate Volcanos with Mantle plumes creating major thrust.

## DISTRIBUTION OF EQ'S

### 1. Pacific Ring of Fire / Circum Pacific Belt

It includes Aleutian Is. to Alaska running to Andes and Rockies to Erabus on Antarctica and New Zealand to New Guinea, Philippines, Indonesia to Japanese Islands and Kiribati. This zone has 2/3rd of the seismic volcanic events. It is subduction zones or the Benioff zone where the convergent plate boundary is located.

### 2. Mid Continental Belt

1/4th of the earthquakes and volcanic activities in subduction zone, convergent boundary thus EQ's are catastrophic, mid Cr-tal Belt. It starts from -

Zura Mt. to Alps, Himalayas & the Andaman's.

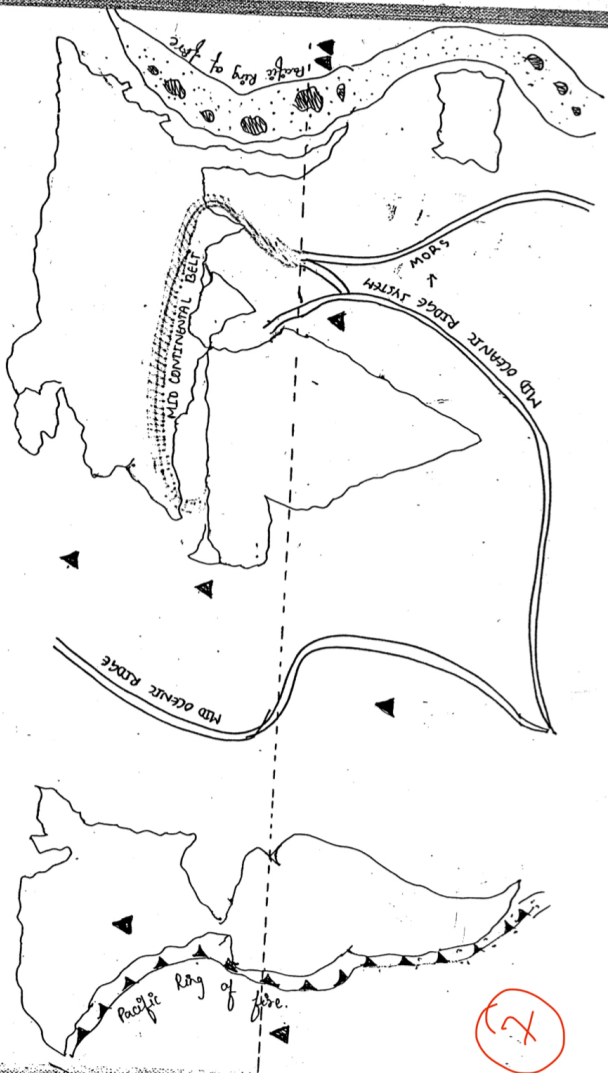
### 3. Mid Oceanic Ridges / Divergent boundary.

mild EQ, It accounts 9% of seismic volcanic events. High Frequency, low Intensity

### 4. Hotspot areas

It accounts only 1% eg:- Hawaiian, St. Helena, Galapagos, Iceland, Reunion, Yellowstone N.P.





27