

## Earth Movements

The earthquakes in India are due to the drifting to the so-called Indian Plate. Scientists divide the globe into a number of major tectonic plates that drift very slowly. As these plates slide against each other a tremendous amount of energy is released causing heavy destruction.

### Earthquake

There was a time – some 225 million years ago-when the continents were not separated by oceans. The earth's surface knew only one massive continent, called Panagea. The some 200 million years ago, Panagea split into two major continents, one of them Gondwana-land (which contains Africa, South America, India and Australia). Gondwanaland continued to split into smaller land masses, one of them is the Indian Plate. It drifted at a speed of 9 meters per century towards the Eurasian plate. Where these giant plates met under enormous pressure, the Himalayans were formed.

Types: Natural Earthquakes caused by endogenic forces. (i) Volcanic -caused due to volcanic eruptions, e.g., Mt Etna. (ii) Tectonic-caused due to stress and strain along Earth's plates or dislodging of rocks during faulting. (iii) Isostatic -caused by isostatic imbalance due to sudden geological activity at a regional scale. (iv) Plutonic -earthquakes originating deep inside the earth between 250 to 650 km deep.

How Earthquakes Occur? There are many fault-lines in the Earth's crust. A fault is where blocks of crust on either side are moving relative to one another. The typical average rate is around a millimeter per year. If this movement happened gradually it would pose few problems for people living near by. Unfortunately rocks do not behave that way. Strain builds up for decades or centuries until it reaches a critical level, and then everything gives in at once. Once a fault has given way at one point, slip movement may occur along its whole length, which may be hundreds or thousands of kilometers, though movement is usually restricted to a much shorter portion of the whole fault. The strongest seismic waves are generated at the initial break-point. The closer to the break-point, the greater the energy and the greater the potential for destruction, especially if the break-point is called the earthquake focus, and the point on the surface directly above it is referred to as the epicenter. Slip further along the fault and readjustments close to the focus usually cause a series of smaller aftershocks, which continue for days (even years in extreme cases) after the initial earthquake. Such kinds of energy release are called waves because of the way they move. Most of the damage caused by an earthquake is not done by the P-waves and S-waves.

These waves travel through the body of the Earth, and their energy is spread over a rapidly increasing volume as they propagate. It is other waves of the sort that travel along the surface of the ground that do most of the harm. These include up-and-down waves (like waves on the ocean) and strong side-to-side shaking waves. The P-and S-body waves travel faster than the surface waves, and, if felt, can give a few seconds (minute, if further away) warning of the arrival of the more damaging surface waves.

When next? Scientists can't predict earthquakes but they know in which regions earthquakes are most likely to occur. Taking into account the speed and direction of the

drift of the plates, the structure of the land masses and in particular the measurements of the tensions between different areas almost accurate probabilities can be calculated. Based on tension measurements and past movements of the Indian plate scientists know that a very major earthquake is going to hit the Shillong plateau in the north-eastern part of the country before 2010.

## **Seismic Scale**

The Richter scale is a logarithmic scale, devised in 1935 by geophysicist Charles Richter, for representing the energy released by earthquakes. More relevant as a measure of earthquake strength is the intensity, for which the modified Mercalli scale is used.

## **Volcanoes**

A volcano is a mountain or hill with an opening on top known as a crater. Hot melted rock (magma), gases, ash, and other material from inside the Earth mix together a few kilometers underground, rising up through cracks and weak spots in the mountain. Every once in a while, the mixture may blast out, or erupt, through the crater. The magma is called lava when it reaches the air. Lava may be as hot as 1000 degree Centigrade. Gradually the lava cools and solidifies on the earth surface making new landforms. In some eruptions, huge fiery clouds rise over the mountain, and glowing rivers of lava flow down its sides. In other eruptions, red-hot ash and cinders shoot out from the mountain top, and large chunks of hot rock are blasted high into the air. A few eruptions are so violent eruptions occur on volcanic islands. Such islands are the tops of volcanic mountains that have been built up from the ocean floor by repeated eruptions. Other eruptions occur along narrow cracks in the ocean floor. In such eruptions, lava flows away from the cracks, building up the sea bottom.

## **Types of Volcanoes**

### **Periodicity**

- (i) Active-that which is alive now. e.g. Etna, Stromboli, Pinatubo, etc.
- (ii) Dormant that which has not erupted for quite some time now. e.g. Vesuvius, Barren Islands.
- (iii) Extinct- which has not erupted for several centuries/millennia or may not occur in near future too.

### **MODE of ERUPTION**

- (i) Central/Explosive-e.g. Hawaiian type, Vesuvius type, Pelean type, etc.
- (ii) Fissure/Quite eruption: in which lava flow or flood, mud flow and fumaroles.

## **Plate tectonics**

Plate Tectonics tells us that it is not only the continents that are in motion, but the oceans as well. This is so, because the top crust of the Earth is not a complete single shell of granite and basalt, but a mosaic of several rigid segments, called plates. The theory of plate tectonics explains how the Earth's crust is moving in vast, rigid sections (plates) and is a modern revolution in our understanding of the planet. These plates include not only the Earth's solid upper crust, but also parts of the denser mantle below called Asthenosphere, and carry the continents and oceans on their backs like mammoth rafts. The plates with an average thickness of 100 km float on the Asthenosphere and move continuously against one another at a rate of up to 20 cm a year. Continents form only a part of the plates, the surrounding oceans form the rest of the plates. It is the plates containing both continents and oceans that move. The relation of inter-plate movement is defined by the type of plate margin: Constructive, Destructive or Conservative.

Constructive Plate movement is obvious in the Atlantic Ocean. At the mid-ocean ridge, new ocean floor is continuously being produced as the Americas move further apart from Europe and Africa.

Destructive Plate is found on all sides of Pacific Ocean, as the various plates slide down beneath the surrounding lithosphere.

Conservative Plate movement can cause the most destructive earthquakes. It arises where adjacent plates slide past one another along transform faults, such as the San Andreas fault.