

EARTHQUAKES

Over the last 4,000 years, it has been estimated that more than 13 million people have died in earthquakes. In Japan alone, 225 destructive earthquakes have occurred in the past 1,500 years (Ramsey, Burckley.1965.). Earthquakes are vibrations of the Earth's crust (lithosphere), caused by the accumulation of elastic strain in rocks, suddenly rupturing and fracturing, when the stress exceeds the strength of the rock. The severity of the earthquake depends on how much deformation has taken place, the type of rock and the way in which the rock moved. The vibrations can be hardly noticeable or cause catastrophic destruction (Encarta.1996.)

The elastic rebound theory of earthquakes, is the theory that pressure exerted on two adjacent rock areas from opposing directions, over long periods, causes the rocks to bend slowly and eventually split, when the strain is too much (Ramsey.Burckley.1965). The initial strain is elastic, but then permanent deformation causes cracks to develop, which fill with water and increase the volume of the rock, weakening it further. This is known as dilatation (Park.1983).

Six different kinds of shock-wave are produced by an earthquake. Two travel through the Earth, whilst the other four travel across the Earth's surface. The way they travel determines the type of wave. Primary (P) or compressional waves are longitudinal, push-pull waves, that send particles back and forth in the same direction that they are travelling. Secondary (S) or transverse shear waves, are side to side or up and down waves, vibrating perpendicular to the direction they are travelling (Encarta.1996.).

The P waves travel at greater speeds than the S waves and so are the first to be recorded at geophysical research stations. Both S and P waves are reflected and refracted, or bent, as the density of the rock they travel through changes. S waves can not pass through liquid, but P waves can. P waves cause back and forth shaking of surface formations and S waves, shake up and down (Encarta. 1996.).

The site of the earthquake on the surface of the Earth is called the epicentre, although it is more of a line, than a point. The site of the actual rock movement underground is known as the focus. Most earthquake foci are 5 to 15 miles below the surface. However, they can be as deep as 420 miles down (Ramsey.Burckley.1965.). The depth of foci increase bit by bit from the outer edge of island arcs, towards the continent that they are close to, this is called the Benioff zone (Billings.1972).

The greatest cause of earthquakes, is activity along the edges of tectonic plates. As the plates collide against each other in various ways, faulting occurs and causes earthquakes. It is convection currents in the asthenosphere, that cause the tectonic plate movements. Where a continental and oceanic plate collide, the oceanic plate is subducted and this is called a destructive margin. Friction in the subduction zone movements of destructive margins cause nearly 50% of the worlds destructive earthquakes (Encarta. 1996.). The existence of the Benioff zone is evidence that subduction takes place, as the foci become deeper, as the oceanic plate subducts under the continental plate. When plates slide past each other, which is known as a conservative margin, transform faults are formed, which can be the sites of very destructive earthquakes. The San Andreas fault in California is a prime example. It is nearly 900 km long (Bradshaw, Abbott, Gelsthorpe.1981.). Also, when the plates move apart, at a constructive margin, small earthquakes occur at fairly shallow depths.

The areas where earthquakes occur and the areas of volcanism often coincide. This is in most part due to the activity along the plate margins. Over 90% of earthquakes occur in the Pacific belt (Ramsey , Burckley.1965). This is where the Pacific plate, meets the American plate, along the coasts of North and South America and on the other side of the Pacific, the Eurasian plate, where the destructive margin is along the coasts of China, the Philippines, Japan , Indonesia , and New Zealand. The Eurasian plate also meets the Indian and African plates, along the Mediterranean region and Himalayas. Margins that collide where there are continents, produce young fold mountains and earthquake activity is very strong. The destructive earthquakes that have occurred in Peru, Central America and Alaska are proof of this.

There are two scales of measurement to describe the severity of earthquakes. The Mercalli scale and the Richter scale. The Richter scale is more universally used, and is a logarithmic scale, that runs from

1 to 9. A quake with a scale of 7, is ten times more powerful than one with a scale of 6, hundred times more powerful than one of 5 and so on (Encarta.1996). The Richter scale is in theory open-ended. The highest recorded earthquake so far, was in Alaska in 1964, which was measured at 9.2 on the Richter scale (Encarta .1996).

Under sea earthquakes cause Tsunami, which , like the one at Lisbon, Portugal in 1755, which killed 60,000 people, can cause great destruction and loss of life (Ramsey , Burckley.1965).

Seismologists use seismic instruments to record the shock waves, by detecting the earth's movements, using optical or electromagnetic methods (Encarta.1996). Seismographs show the waves as a series of peaks. The World Wide Standard Seismograph network, has 125 stations around the world (Encarta.1996). The countries that are most affected by earthquakes are researching into them, these include, China, Japan, Russia and the U.S.A.. In Montana, in 1965, L.A.S.A. was built , the 'Large Aperture Seismic Array' . There are 525 seismometers, buried 200 feet below ground, over an area as large as Wales. Waves take 10 seconds to cross the array. L.A.S.A. , like a telescope can detect waves from any direction inside the Earth. Tremors can be detected that move the ground by as little as 1 millionth of an inch. The information is then transmitted by computer to other laboratories in the United States (Calder1972)

The Earthquake Research Institute of Tokyo university, issued warnings before a series of earthquakes at Matsushiro in 1965-67. Tilting of the ground was seen at Nigata , before a major quake struck there in 1964, but earthquakes are notoriously hard to predict (Calder 1972.). Evidence shows that the full moon, high tides, heavy rainfall and changes in barometric pressure are connected with the start of earthquakes (Ramsey, Burckley.1965). In 1975 at Haicheng, the Chinese evacuated 90,000 people, two days before a highly destructive 7.3 earthquake. Scientists, look for a string of low-magnitude tremors, or fore-shocks, as was the case at Haicheng. Other clues may be bulging of the ground or changes in the magnetic field, water levels in wells alter and animals may behave strangely. However, even taking all this into account it is still very difficult to predict earthquakes (Encarta 1996).

Earthquakes can be very destructive forces, taking lives and making countless homeless. They are natural disasters, that are difficult to predict , despite mans advanced technology. They have been shaping the Earth for millions of years and will probably continue to do so for millions more.

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References:-

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