

THE GLOBAL EARTHQUAKE THREAT

By

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Recent earthquakes, e.g. in Kobe, Japan, on January 17, 1995, captured media headlines and evoked great sympathy worldwide for the victims and for the surviving members of their families. The Kobe earthquake killed over 6,000 people and caused damage estimated at between 10 and 20 trillion Yen. Horrific earthquakes may become increasingly more common in the future because of the locations of many of the world's large and fastest growing cities.

The Russian earthquakes in the late 1980s were major disasters. The Armenian earthquake which occurred on December 7, 1988, had particularly horrendous consequences, killing 30,000 people, injuring as many more and destroying vast amounts of property. The Tadzhikistan earthquake on January 23rd 1989 killed 1,000 people.

The Armenian earthquake measured 9.6 on the Richter scale. An earthquake of this dimension occurs somewhere in the world about once every month. Normally such earthquakes are of little consequence because they occur in very sparsely populated regions. The Russian earthquakes in the late 1980s were devastating, not because the tremors were unusually severe, but because they occurred in areas of high population. Unfortunately over one third of the world's largest cities are located in areas that are susceptible to earthquakes.

The science of Geology has discovered that the spherical Earth is made up of numerous layers, somewhat like an onion. The layers differ from each other in composition, density and physical consistency. We live on the crust of the Earth which is the surface of the outer solid layer (the Lithosphere) of our globe. The Lithosphere is only 70 km deep and the crust itself represents only about one per cent of the Earth's volume. Beneath the solid Lithosphere is a layer called the Asthenosphere which is about 200 km deep. The rocks of the Earth contain naturally occurring radioactive elements that are continually disintegrating. Heat is released during the radioactive disintegration. This heat cannot be easily dissipated under the high pressure conditions that exist within the Earth. The temperature is high in the Asthenosphere, largely because of this radioactive decay. The heat tends to melt the rocks and they may even flow.

The Lithosphere of the Earth is therefore sitting on a partially molten underlayer. The Lithosphere has a number of faults or cracks running through it and those faults divide it into several great segments called plates. These great plates, bearing the continents and oceans of the world, move slowly relative to each other on the underlying pliable Asthenosphere. In some places neighbouring plates bump into each other, in other places they slide past each other and in other places one plate dips beneath the neighbouring plate edge. The movements of the Earth's great plates explain many geological phenomena, including earthquakes and volcanoes. The general theory of plate movement and associated phenomena is known as 'plate tectonics'.

Probably the best known tectonic fault is called the San Andreas Fault that runs along the western edge of California, dividing the American plate from the Pacific plate. The American and Pacific plates slide laterally relative to each other and areas lying along and near the fault are consequently at risk from earthquakes. Famous earthquakes that have occurred in the past associated with this fault and its southern extension are the San Francisco earthquake of 1906 which killed 500 people and the earthquake that devastated Mexico City in 1985 killing 100,000 people.

A recent survey shows that approximately 40 per cent of the world's largest cities are situated either close to a tectonic plate boundary or near where an earthquake has occurred in the past. Each of these cities will have over 2 million inhabitants by the year 2000. In total, over 600 million people will live in these cities by the year 2035. Since these cities are situated in areas of higher seismic risk, the stage may be set for unprecedented major disasters. The figure shows the world's plate boundaries in relation to the major cities.

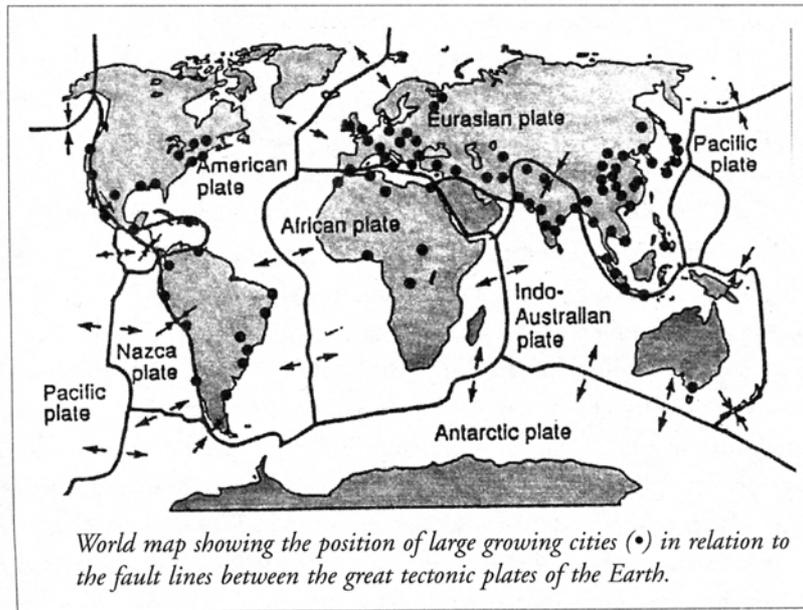
Most of the deaths that occur in an earthquake are caused by falling buildings. It follows therefore that the construction of buildings that are resistant to earthquakes should lessen the loss of life. It is widely acknowledged that much of the damage in the recent Armenian earthquake resulted from the collapse of poorly constructed buildings. In recent years many new multi-storey apartment blocks were built in the region to cope with the growing population. These were often built with low quality concrete, badly designed joists and lacking steel reinforcements. Similarly, many of the new fast growing cities in the world, situated in regions of high seismic risk, contain only basic shelter for people and not earthquake-resistant buildings.

While much of the damage from future earthquakes will probably occur in the Third World, cities in the developed world are certainly not earthquake-proof. Tokyo is probably the most earthquake conscious city in the world. It was destroyed by an earthquake in 1923, which killed more than 100,000 people. Elaborate precautions have been incorporated into the present city in order to limit the damage that a future earthquake might cause. In spite of this a recent study estimates that an earthquake measuring 9.5 on the Richter scale occurring just east of Japan (similar to the 1923 earthquake) would destroy about 2.5 million buildings, cause about 150,000 deaths and 200,000 injuries.

What is the risk that Ireland would ever suffer a significant earthquake? Ireland is a very stable land with little risk of a major earthquake. The early annals record earthquakes felt in Ireland, but most did little or no damage. An exception occurred in Co. Sligo in 1490 when it is recorded that 100 people were killed along with many horses and cows, and a lake opened up.

Most earthquakes felt in Ireland are minor and many of them originate in Britain or in the Irish Sea. There is a zone along the Irish coast from Cork to Dublin that is active and produces small earthquakes from time to time. The most active area is near Enniscorthy in Co. Wexford. In 1985 this centre produced an earthquake of magnitude 2 on the Richter scale. Activity was also reported in September 1988.

Irish earthquakes are minor events caused by the relaxation of stressed rocks. They are not connected with plate movement. The nearest plate boundary to Ireland is the Mid-Atlantic Ridge which is about 2,500 kms to the west. This is an active area and it is not impossible, although highly unlikely, that a major earthquake on the ridge could cause damage in Ireland. In 1755 such an earthquake destroyed Lisbon, killing 60,000 people. The damage was completed by a tidal wave. These waves are produced at the sea bottom by the earthquake shock. They have great energy and wreak havoc when they reach land. Perhaps ancient tales of huge unexpected waves hitting the Irish coast record tidal waves produced by earthquakes in the Mid-Atlantic.



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