Chapter

1 Introduction

1.1 Some Basics

While there are a few earthquakes that are due to volcanic activity, collapse of underground caves, or mining activities, most earthquakes are of tectonic origin and take place at or near to the edges of the world's tectonic plates. The vast majority of these tectonic earthquakes are caused by a sudden slippage along a fault, which releases energy and causes seismic waves that make the ground shake. *Figures 1.1* and *1.2* present the maps of the world's major tectonic plates and the world's recorded earthquakes, respectively.[1] The coincidence of plate boundaries and earthquake locations can be clearly seen by comparing these two figures. In fact, recording the location of earthquakes over time has led to defining the current boundaries between the world's tectonic plates. Plate boundaries represent transform, divergent, convergent or zones. That is, they either grind past each other, slide apart from each other, collide (with one disappearing beneath the other), or form regions, where the boundaries and interactions between plates are not clear.[2] These interactions cause earthquakes. The following are some examples of movements at the plate boundaries: transform motion of the San Andreas Fault Zone (≈5 cm/year),[2] divergence of the Mid-Atlantic Ridge (≈2.5 cm/year),[2] divergence of the East Pacific Rise (≈15 cm/year),[2] and India converging on the Himalayas (≈5 cm/year).[3]

In line with other past and contemporary visionaries, Alfred Wegener in 1912 proposed the concept of continental drift,[4] which provoked disagreement, debate, and finally proof. This resulted in the development of the scientific theory of plate tectonics in the second half of the twentieth century.[5] Plate tectonic theory states that the rigid crust of the earth (the lithosphere) is broken up into "plates" moving on a low-viscous layer (the asthenosphere) with a fluid mechanics behaviour. The very cause of earthquakes is, thus, the movement of such large plates that compose the outer shell of the earth's crust. Heat from the layers below the lithosphere and the difference between the light density of the lithosphere and the heavy density of the underlying asthenosphere explain such movements and are viewed as the most important source of energy that drives plate tectonics. The difference in density also allows the asthenosphere to sink into the deep mantle at subduction zones (where plates converge). Tectonic plates include continental crust, oceanic crust, or both.

An earthquake is a sudden, transient, and sometimes extremely violent movement of the earth's surface. In order for an earthquake to occur, a mechanism is needed to supply the energy and stress

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