

Explain, with reference to examples that you have studied, how the theory of plate tectonics helps to explain the distribution of earthquakes around the world

(30 marks)

Vine and Matthews established a global map positioning the major plate boundaries in the 1960's. This evidence supported the fact that plate tectonics stated that the earth's crust is broken up into 14 – 21 sections called plates and these plates float on the semi-molten asthenosphere. Almost all earthquakes could therefore be mapped at the margins of the earth's tectonic plates. About 80% of earthquakes occur around the Pacific Ocean for example. The most destructive earthquakes occur at destructive and transverse (also known as passive or transverse) plate margins, while shallow weak earthquakes also occur at the third plate boundary, which is constructive.

At constructive plate boundaries, oceanic plates may separate, driven by convection currents from the earth's mantle bringing magma to below the crust. At the surface lava pours out and fills the empty space on the sea bed, therefore creating new sea floor made of basalt e.g. at the Mid-Ocean Ridge between the North American and Eurasian plates. When this new basalt rock splits, weak shallow earthquakes occur. The earthquakes' focus is at a depth of between 0 – 70 km under the seabed, and generally to the lower end the richter scale measurements.

Earthquakes also occur at destructive plate boundaries along subduction zones. Where two plates collide there is generally a lot more stress and energy involved. An example of a destructive plate boundary is where an oceanic plate collides and subducts under a continental plate. The descending plate moves in sudden surges which triggers powerful earthquakes, e.g. the Asian tsunami in 2004. All the earthquakes occur along the line of the sinking plate. This line is called the Wadatti-Benioff zone. The subduction zone off the coast of Japan is the most earthquake prone area in the world. The Mariana trench can also be found in this region. Where two continental plates collide, and fold mountains are formed, powerful shallow or intermediate earthquakes (70-300km depth) can occur e.g. the Himalayas. These mountains were formed where the Indian plate and the Eurasian plate collided 65 million years ago. As the plates collide land is buckled upwards and shallow earthquakes occur causing huge damage, e.g. Sichuan earthquake in China in 2008. As the convection currents are in constant motion in the asthenosphere, and no subduction is taking place here, pressure is released and felt at the epicenter (surface) causing huge damage.

Finally earthquakes also occur at passive plate boundaries, where two plates slide past each other. Shallow earthquakes occur at this type of boundary e.g. The San Andreas fault - Pacific plate and the North American plate. As these plates lock pressure may build up over time and then suddenly release. When the rocks in the crust can no longer withstand the pressure, earthquakes are felt as the tremors radiate out from the epicenter. There is no subduction here.