

One of the main fundamentals of earthquakes is the movement of **tectonic plates**. The movement of the plates are the building blocks of how earthquakes occur. Each year **tectonic plates** move approximately 2-5 centimetres and they move slowly over the globe. Due to the slow movement of **tectonic plates**, earthquakes can't occur all that often. **Tectonic plates** move because the **radioactivity**/heat from the earth's core pushes against the **tectonic plates** causing it to move, and as the gas cools down it moves back down into the earth's core (**Convection**). This is an incredibly slow process and can take years to make a major earthquake occur. The way that the **tectonic plates** move is determined on which way the gas rubs against the **tectonic plates**, this is also why some plates move towards each other and some plates move away from each other. When they move into each other this is called the subduction zone and this is where the **tectonic plates** collide. When they move apart this is called divergent plate boundaries.

When the crust goes under and over each other at the subduction zones (sometimes these collide causing an earthquake), the crust goes down into the mantle later melting into magma/lava becoming part of the mantle. Some of it goes into the magma chamber of a volcano, and as the pressure slowly builds up a volcanic eruption occurs. This can be seen looking at a map of volcanoes and **tectonic plates**, on the boundaries of the **tectonic plates** there are multiple volcanoes, this is also why the ring of fire exists. On a subduction zone this is where the plates go under and over each other, and where the rocks may be on a fault. It is also where the plates occasionally collide causing an earthquake, and is where most earthquakes occur. At subduction zones an oceanic plate slides under a continental plate or under another oceanic plate, (this is because oceanic plates are denser therefore floating lower on the mantle while the continental plates are less dense and they float higher on top of the mantle). This is where geo hazards (earthquakes & volcanoes) occur. The actual earthquakes are caused when rock that is underground breaks along a fault, and then the seismic energy and seismic waves make the ground shake. However, how this energy is released is when the 2 rocks and/or plates are rubbing against each other, the place that the rocks broke is rigid, so they won't slide smoothly against each other. So the rocks on either side will catch on to each other, but the rocks are still pushing against each other but the rocks are stopping the motion. So soon there will be too much pressure built up and the rocks will break, releasing seismic waves, causing an earthquake. The severity of an earthquake is caused by how much pressure is built up when the rocks stopped the plates rubbing against each other.

The positioning of the plates change a lot of things as well, because as stated earlier, where the tectonic plate boundaries are is basically prone to earthquakes and/or volcanoes. Volcanoes are just the crust that had melted after it had gone into the mantle when the **tectonic plates** were moving under and over each other and the crust had to go somewhere. At because at the divergent plate boundaries the gap spreads, which would leave a giant gap, well, the magma from the mantle rises up, because there is not enough room when the crust melted at the subduction zones. So in reality the earth is just recycling rock that was melted into the mantle, over and over again. On **tectonic plates** there are also things called collisional boundaries, this is where 2 plates of the continental lithosphere collide. As they collide the rock is pushed upwards therefore creating mountains, this is apparently how the Himalayas and the Alps were formed. This would also create devastating earthquakes.

Pangea what a phenomenon that occurred 300 million years ago when all the land masses we know as countries and continents all were formed together. Until 175 million years ago the **tectonic plates** began to move, therefore moving the continents/continental plates away from each other, hence the name, Continental drift. Because of the ways **tectonic plates** work, NASA estimates that in 250 million years from now, Pangea will form again and what they call Pangea Ultima. This would probably cause devastating earthquakes that would be unimaginable. Although our countries won't go underneath each other and engulf each other, because only oceanic crust goes under continental crust, continental crust doesn't go under continental crust. Instead the continent will clash, causing earthquakes; these would be collisional boundaries and will cause a lot of mountains to form.

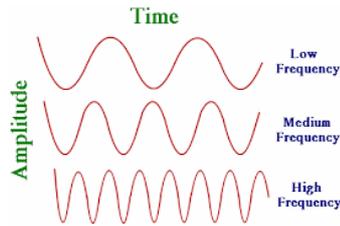
Things to work on:

Introduction and conclusion?

Change from personal to impersonal voice

Possibly breaking up some sentences and paragraphs

Earlier I said something about seismic waves. When an earthquake occurs there are 2 types of seismic waves, surface waves and body waves, Body waves are seismic waves that travel through solids & liquids, so they travel through the earth, the rock and the mantle.



Body waves are faster than surface waves and are of higher frequency, there is a chart of frequency shown above. But there are specific types of body waves; there are P waves and S waves. P waves, also known as the primary wave, these are the fastest type of seismic wave, and they are the first to arrive at the `seismic station`. P waves push and pull rock, although these are not that deadly because people normally only felt the rattle of the wave. P waves are also called compressional waves because of the way that they act, the particles move in the same direction that the wave moves, or the same direction the energy is moving, this is called the `direction of propagation`, here is a link to show a better understanding;

http://www.geo.mtu.edu/UPSeis/images/P-wave_animation.gif

But P waves are not the only type of body wave; there are also S waves, also known as; Secondary Waves. S waves are the second waves you would feel in an earthquake, therefore making it slower than the P wave and faster than both surface waves. But what makes it special is that the S wave cannot move through liquid, it can only move through a solid, S waves move the rock particles up and down and side to side, perpendicular to the direction the wave is travelling in, (The direction of wave propagation), here is yet another link to explain how S waves work;

http://www.geo.mtu.edu/UPSeis/images/S-wave_animation.gif

During my description of S waves I said that S waves can only go through solids and not liquids, so this is what led seismologists to believe that the earth's outer core is actually a liquid.

But there are also things called surface Waves, these waves don't go through the inner layers of the earth, instead they travel along the surface of the earth. Unlike Body waves, surface waves only travel through the crust and have a lower frequency than body waves. These arrive after the body waves, and are mainly responsible for the destruction caused by an earthquake. The first type of surface wave is the Love wave, this is the fastest type of surface wave and moves the particles entirely from side to side, and this wave was named after A.E.H Love who found the mathematical model for this wave in 1911. This is how the love wave works;

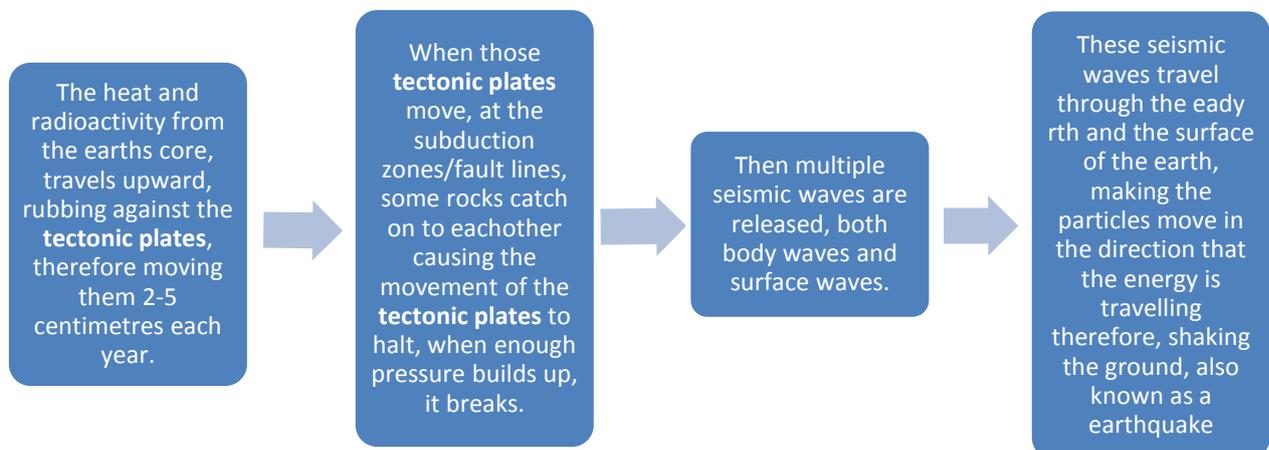
http://www.geo.mtu.edu/UPSeis/images/Love_animation.gif

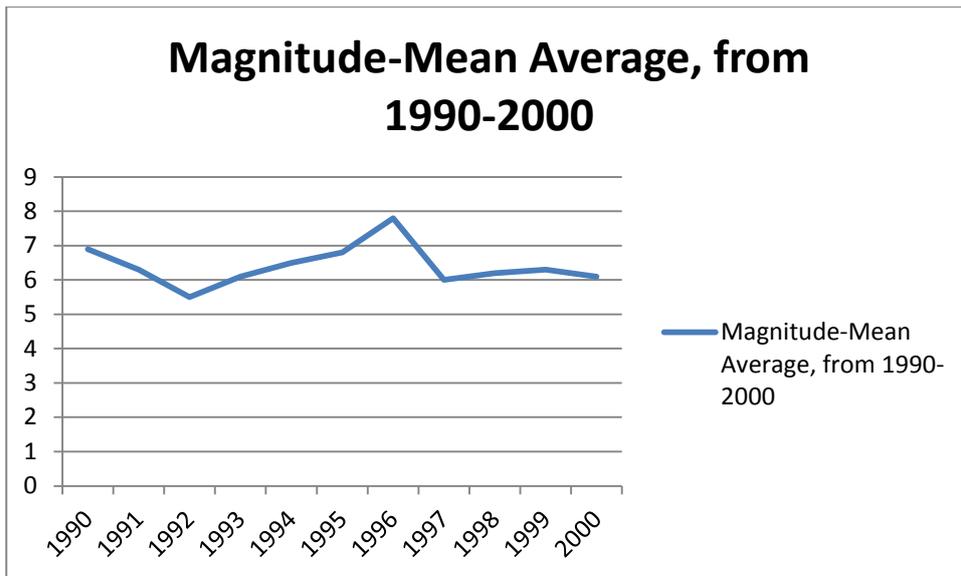
then there is the Rayleigh wave. A Rayleigh wave rolls along the ground like a wave rolls along the ocean, this moves up and down, side to side in the direction that it is moving, Rayleigh waves are one of the biggest waves, and causes most of the shaking, here is a diagram to show how it works;

http://www.geo.mtu.edu/UPSeis/images/Rayleigh_animation.gif

System Analysis:

If there actually wasn't any radiation coming from the earth's core, therefore, the **tectonic plates** don't move so at the subduction zones nothing will happen so no seismic waves will be released so there will be no such thing as an earthquake. Now if you change that there is no such thing as subduction zones/fault lines, so that would probably mean that the continents will just move in a circle around the sphere that is earth, endlessly, which wouldn't change that much, and there will also be no such thing as earthquakes. But if no rocks got stuck on each other, firstly the earth will have to be completely spherical and there would be no mountains, the earth will have to be COMPLETELY spherical so the rocks couldn't catch onto each other and would just run smoothly into the mantle, and once again there would be no such thing as earthquakes. BUT what if the rocks that caught onto each other didn't break, like an immovable object?, Well I would guess that the whole entire movement of **tectonic plates** will halt, and the earth's continents wouldn't move, therefore leading to no earthquakes, but what if the movement of **tectonic plates** was an unstoppable force?, because you would think the earth and **tectonic plates** would be able to break it, right? If there were no seismic waves?, Well quite simply if no seismic waves were released the earth wouldn't shake, so there would be no earthquakes, BUT what if there was no such thing as body waves. Well as stated before body waves only cause minor damage and surface waves cause the most damage so most of the damage will still happen, but if there was no such thing as surface waves most of the damage will still happen, and finally if the seismic waves didn't move any particles at all, there would be no such thing as earthquakes, and seismic waves probably wouldn't be noticeable and we would never know of their existence.





Here is a graph of the mean average of the magnitudes of DEADLY earthquakes from 1990-2000, the question posing was; have the magnitude of earthquakes gone higher over the years? The graph looks like it's in a completely random order, because it is. It is up to chance if the magnitude of earthquakes will be increasingly higher or lower each year, and it will always be that way. Because the **tectonic plates** always move about the same each year, and earthquakes have developed a system that will most probably never stop, so the magnitudes of earthquakes is just chance. Most likely earthquakes will just have random magnitudes.

Bibliography Source #

Source 1

<http://www.bucknell.edu/>

Source 2

<http://www.sanandreasfault.org/>

Source 3

<http://www.geo.mtu.edu/>

Source 4

www.reference.com

Source 5

https://en.wikipedia.org/wiki/Main_Page

Source 6

<http://science.nasa.gov/>

Source 7

<http://www.sms-tsunami-warning.com/>

Source 8

<http://www.geo.mtu.edu/UPSeis/waves.html>

Source 9

<http://hyperphysics.phy-astr.gsu.edu/>

Source 10

www.sciencedaily.com

This diagram shows the layers of the earth and many other minor details regarding the topic that this information text is about. First of all there is the inner core, iron and a few other elements. Which this ranges from 5000-7000 degrees Celsius, (the iron has not melted due to the sheer pressure of the weight on it). Then there is the outer core, this is a liquid layer of the earth's core. And the heat is ranging from 4000-5000 degrees Celsius. While the mantle is made up of magma (semi-molten rock) and its heat is from 500-900 degrees Celsius. Finally there is the crust, this is where the tectonic plates lie and where all the magic, that is earthquakes happen. There is a dark grey line that is the lithosphere; the lithosphere is the uppermost part of the mantle and all of the crust. And the lithosphere is made up of tectonic plates, so the lithosphere IS the tectonic plates except it represents the tectonic plates as a whole. There are also those arrows, these are called `Convection currents`. Convection is how heat is transferred by mass motion of air and water (fluids) when a heated fluid is forced to move away from the source of heat carrying energy (the heat) with it. Convection above a hot surface occurs because when the air is heated it expands and becomes less dense, therefore it rises, and a convection current is simply when a current in a fluid that is caused by convection, much like how a current in water works. So convection currents come from the earth's core, because of the heat making the fluid less dense, causing it to rise with the energy (heat) then when it reaches the mid-ocean ridges/tectonic plates the energy (heat) is lost. Causing the fluid to cool down, which makes the fluid denser therefore making it float back to the earth's core. There are also mid-ocean ridges; this is where an underwater mountain range is created by tectonic plates. This is caused when the convection currents rise under the oceanic crust, and that created magma where 2 tectonic plates meet at a divergent plate boundary.

EARTH'S LAYERS

