PLATE TECTONICS

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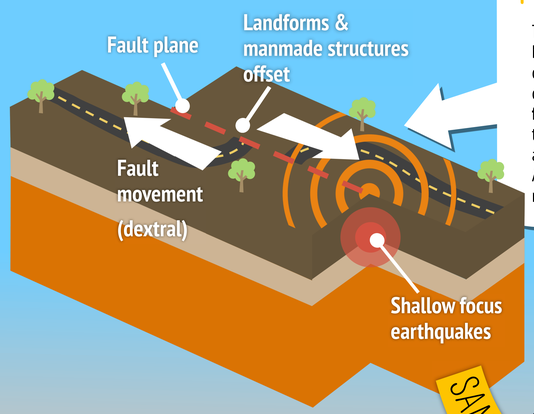
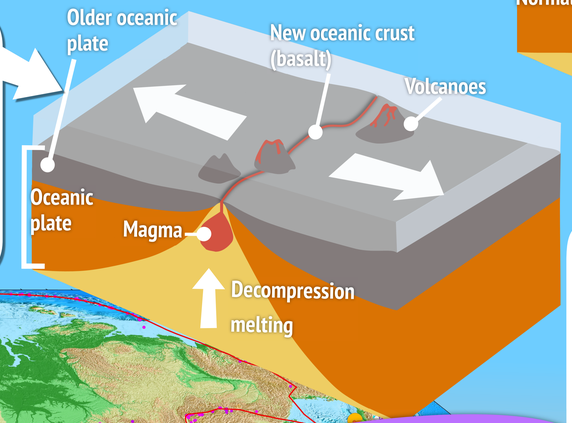
TRANSFORM BOUNDARY

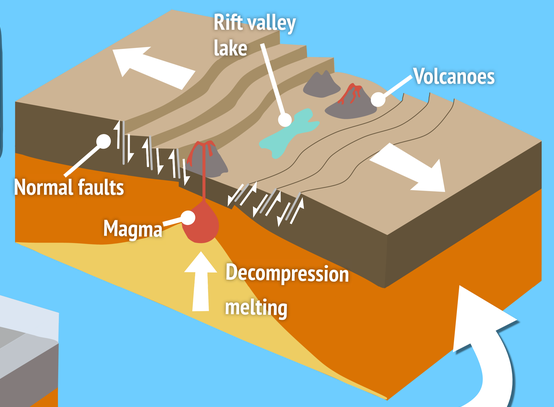
Transform plate boundaries, also known as conservative plate boundaries, occur at the edges of plates that are sliding past each other, either in opposite directions or in the same direction but at different speeds. As the plates grind past each other **frictional forces** lock blocks of rock together and **pressure** builds up. When the blocks eventually slip past each other this pressure is released as **seismic energy,** causing **shallow focus earthquakes**. The San Andreas Fault is an example of a conservative plate boundary and runs along the boundary of the Pacific and North American plates.



DIVERGENT BOUNDARY (MID OCEAN RIDGE)

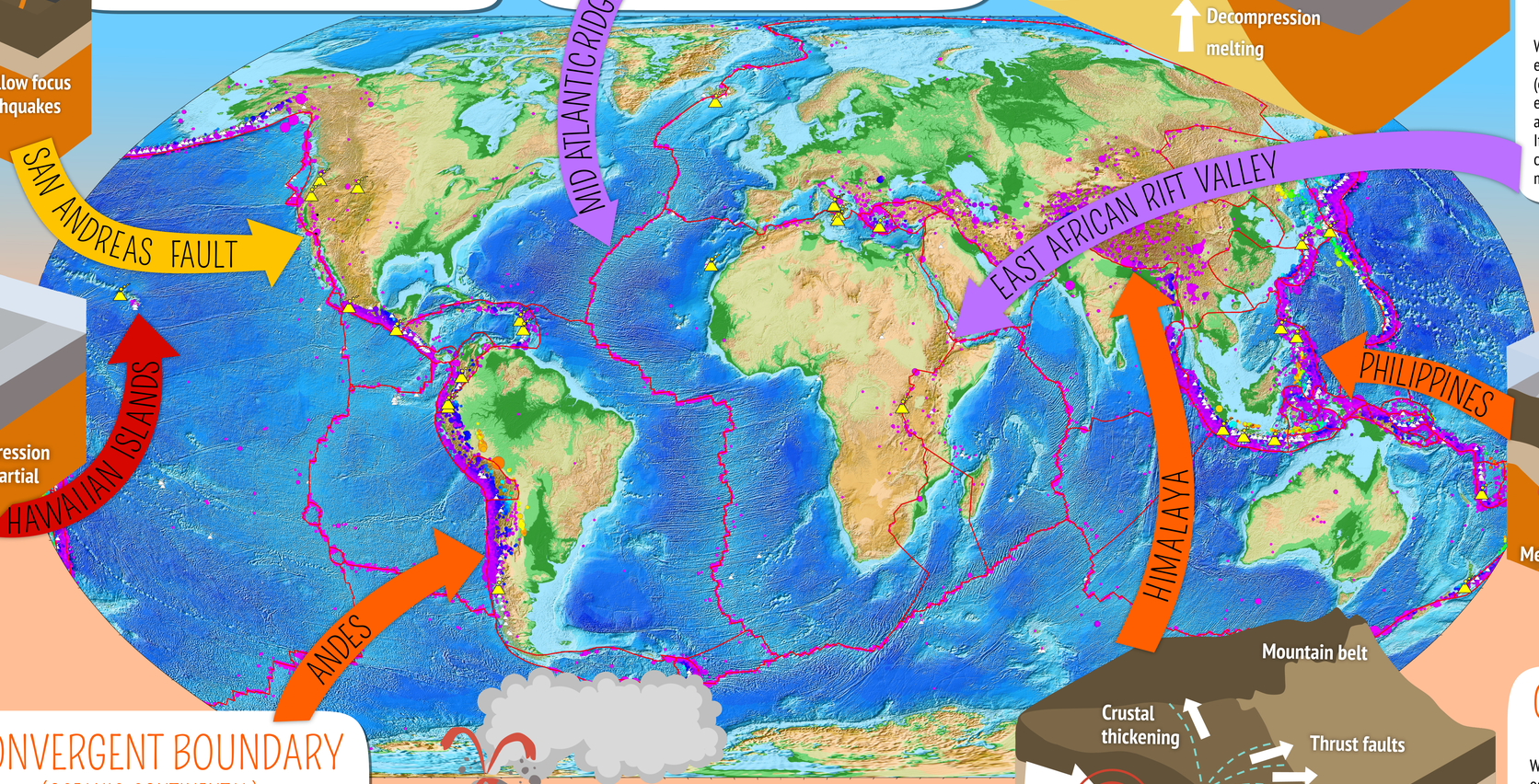
Divergent plate boundaries are sites where new **oceanic crust** is created by **sea floor spreading**. In oceans, divergent boundaries generate **mid ocean ridge** systems like the Mid Atlantic Ridge (slow spreading ridge) and the East Pacific Rise (fast spreading ridge). As the plates pull apart the underlying hot mantle up-wells to the surface. As it rises, the pressure acting upon the mantle rocks reduces and they start to **partially melt** in a process known as **decompression melting**. This produces pockets of **basaltic magma** which then erupts on the surface creating new oceanic crust.

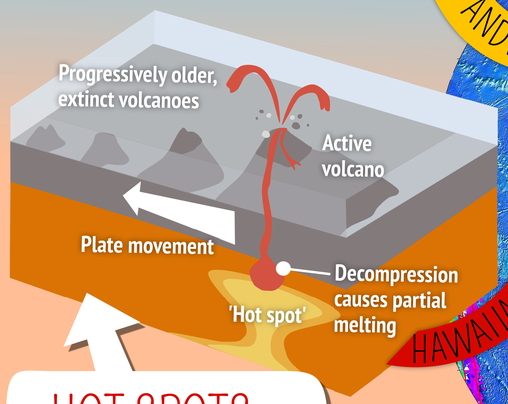




DIVERGENT BOUNDARY (CONTINENTAL RIFT VALLEY)

Within continents, divergent margins produce **rift valleys,** a series of elongate lowland valleys bound by steeply dipping **normal** (extensional) **faults**, for example the East African Rift Valley. As extension continues along continental rift valleys, they sink lower and lower eventually allowing ocean waters to flood into the basin. If rifting continues, new **basaltic oceanic crust** may form along the centre of the rift producing a new narrow ocean basin with its own mid ocean ridge.





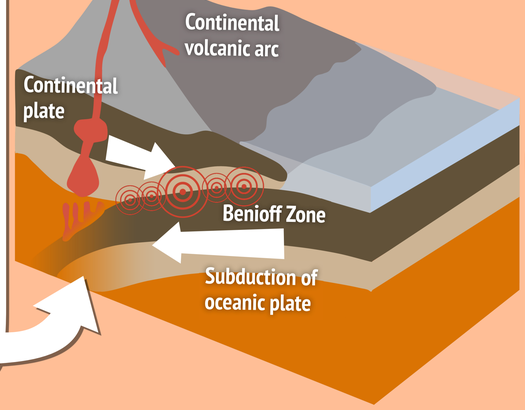
HOT SPOTS

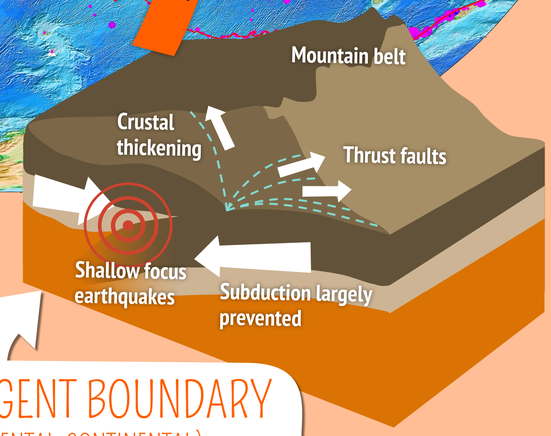
Whilst most volcanic activity occurs at plate boundaries, volcanoes can erupt in the middle of plates, for example the Hawaiian Islands. These volcanoes are known as **intraplate volcanoes** and are thought to lie above '**hot spots**', regions of super-heated material in the mantle. As these hot rocks rise, they partially melt (**decompression melting**) to form pockets of **basaltic magma**. This magma then up-wells and erupts on the sea floor as a volcanic **seamount.** As the plate gradually moves like a conveyor belt over the stationary mantle hot spot, a chain of volcanoes is formed recording the past movements of the plate.

CONVERGENT BOUNDARY (OCEANIC-CONTINENTAL)

When an oceanic plate is moving towards a continental plate, at a convergent, or destructive, boundary, the denser oceanic plate (~2.9 g/cm^3), will sink beneath the more buoyant continental plate (~2.7 g/cm^3) in a process known as **subduction**. During subduction the descending oceanic plate drags against the overlying plate, causing both to fracture and deform. This results in frequent earthquakes that get deeper as the ocean plate descends further. This defines an inclined narrow zone of **earthquake foci** known as the **Benioff zone** which can extend to more than 600km in depth.

During subduction **hydrous minerals** (minerals containing water in their structures) in the oceanic plate are heated and release water into the mantle. This lowers the melting point of the mantle causing it to **partially melt** and generate pockets of molten magma. The hot magma (up to 1000°C) is more buoyant than the surrounding rocks so rises and erupts on land typically as **andesitic lava,** creating a **continental volcanic arc** above the subduction zone, for example the Andes in South America.





CONVERGENT BOUNDARY (CONTINENTAL-CONTINENTAL)

When two continental plates collide at a convergent boundary they will ultimately form a wide **mountain belt** like the Himalaya. Because continental plates are thicker and more buoyant than oceanic plates, subduction is largely prevented during continental collision. As the plates converge, fragments of crust and sediments on the continental margin can become caught in the **collision zone** between the continents, forming a highly deformed zone of rock. **Compressional stresses** also cause extensive **folding** and **faulting** of rocks within the two colliding plates. This deformation causes the crust to **thicken** and can extend hundreds of miles into the plate interior, causing a broad zone of **shallow earthquakes.**

CONVERGENT BOUNDARY (OCEANIC-OCEANIC)

When two oceanic plates converge, the older, cooler and denser oceanic plate is **subducted** beneath the younger, more buoyant plate forming a **subduction zone**. As at oceanic-continental convergent boundaries, the descending oceanic plate is heated and **minerals** in the crust **dehydrate** to release water into the mantle. This lowers the melting point of the mantle which **partially melts** to form magma. The hot, buoyant magma rises and erupts on the sea-floor producing an arc of volcanic islands typically made from **andesite**. Volcanic arcs such as the Philippines, the Caribbean islands and the Aleutian Islands have all been formed from oceanic-oceanic convergent boundaries.

Plate Tectonic Stories

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