PLATE TECTONICS

Transform plate boundaries, also known as conservative plate boundaries, occur at the edges of plates that are sliding past each other 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. This magma then up-wells and erupts on the surface creating new oceanic crust.

Convergent boundaries are sites where new oceanic crust is created by sea-floor spreading. In oceans, convergent 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 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.

Convergent boundaries are sites where new oceanic crust is created by sea-floor spreading. In oceans, convergent 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.

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 hotspots 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 surface as a volcanic seamount. As the plate gradually moves like a conveyor belt over the stationary mantle hot spot, a chain of hotspots is formed recording the past movements of the plate.

CONVERGENT BOUNDARY (OCÉANIC-CONTINENTAL)

When an oceanic plate is moving towards a continental plate, at a convergent, or destructive, boundary the denser oceanic plate (2.9 g/cm³) will sink beneath the more buoyant continental plate (~2.7 g/cm³) in a process known as subduction. During subduction the descending oceanic plate slides 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 subducted rock called the Benioff zone which can extend to more than 600 km in depth. During subduction, hydrous minerals (minerals containing water in their structure) 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 mafic magma. The hot magma (up to 1500°C) is more buoyant than the surrounding sediments so it rises and erupts 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 converge, the older, colder 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 permits partial melting to form magma. The hot, buoyant magma rises and erupts on the surface producing an arc of volcanoes typically made from andesite. Volcanic arcs such as the Philippines, the Caribbean Islands and the Aleutian Islands have all been formed from oceanic-continental convergent boundaries.

CONVERGENT BOUNDARY (OCÉANIC-OCÉANIC)

When two oceanic plates converge, the older, colder 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 permits partial melting to form magma. The hot, buoyant magma rises and erupts on the surface producing an arc of volcanoes typically made from andesite. Volcanic arcs such as the Philippines, the Caribbean Islands and the Aleutian Islands have all been formed from oceanic-continental convergent boundaries.

DIVERGENT BOUNDARY (MID-OCEAN RIDGE)

The Mid Atlantic Ridge is an example of a constructive plate boundary on Earth, it is actually a huge chain of underwater volcanoes. When these plates pull apart hot magma rises up to fill in the gap and new crust is created between the two plates.

DIVERGENT BOUNDARY (CONTINENTAL RIFT VALLEY)

Within continents, divergent margins produce rift valleys, a series of elongate lowland valleys bounded 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.

DIVERGENT BOUNDARY (OCÉANIC-OCÉANIC)

When two oceanic plates converge, the older, colder 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 permits partial melting to form magma. The hot, buoyant magma rises and erupts on the surface producing an arc of volcanoes typically made from andesite. Volcanic arcs such as the Philippines, the Caribbean Islands and the Aleutian Islands have all been formed from oceanic-continental convergent boundaries.

DIVERGENT BOUNDARY (CONTINENTAL-CONTINENTAL)

When two continental plates converge, the older, colder 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 permits partial melting to form magma. The hot, buoyant magma rises and erupts on the surface producing an arc of volcanoes typically made from andesite. Volcanic arcs such as the Philippines, the Caribbean Islands and the Aleutian Islands have all been formed from oceanic-continental convergent boundaries.