Year 9 Revision Booklet.

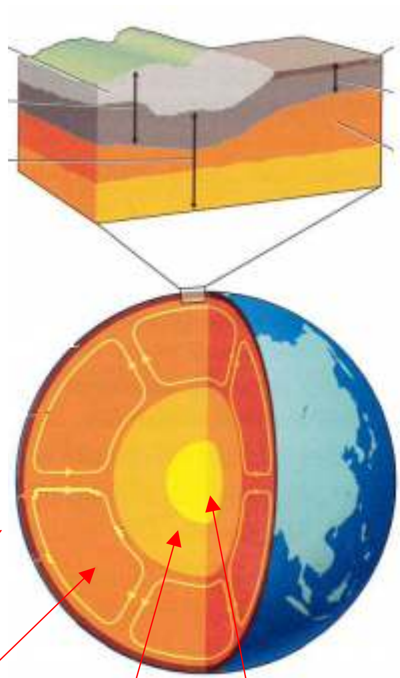
Plymstock School
SPECIALIST SPORTS COLLEGE

Inside the earth

The Earth is made up of several layers – the inner and outer core, the mantle, and the crust. They each have different compositions and unique physical properties.

The Lithosphere and Asthenosphere:
These two parts make up the upper mantle and are involved in tectonic activity.

1. **Lithosphere:**
This includes the crust and the top layer of the mantle, it is about 80-100km thick (thinner under the oceans). This part is broken up into tectonic plates which float on the asthenosphere below
2. **Asthenosphere:**
This is a denser, more mobile layer in the upper part of the mantle (100-300km deep). The temperature is much higher here so the rock is partially melted allowing plate movement



The Crust:

- Thinnest layer
- Two types of crust:
  - **Oceanic** (ocean) – thin 5-8km and is denser (heavier) and made of basaltic rock
  - **Continental** (land) – 30 – 40km, however thickness varies, lighter as it's made of granite rock

The Mantle:

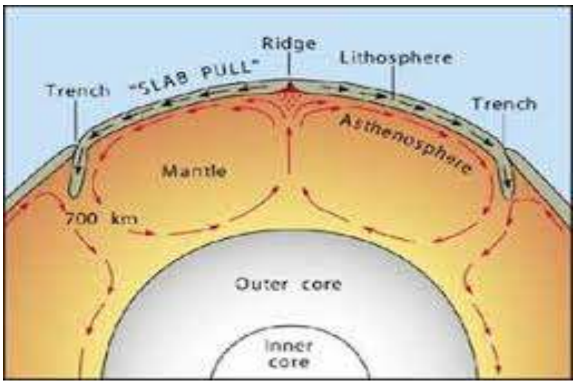
- Thickest layer – nearly 2,900km
- Temperature ranges from 1000°C (near the crust) to 3,700°C (near the core)
- It can be divided into two layers:
  - Upper mantle is mostly solid. It is slow moving
  - Lower mantle – solid, it gets hotter and denser with depth.

The Core:

- Centre of the Earth
- Very hot and dense
- Two types:
  - Outer Core: Hot (4,500-5,000°C), made of iron and nickel
  - Inner core: Hot (6000°C), solid ball of iron and nickel

What drives movement in the Mantle?

Convection currents are the driving force behind tectonic plate movement. These currents move in a circular motion.
Rock is heated in the lower mantle and rises
When it reaches the asthenosphere it cools and is forced sideways by the lithosphere above
It continues to cool and sinks back towards the core
This process continues as it's reheated by the core.



Tectonic Plates

Tectonic plates are large areas of rock that make up the Earth's crust.
They are sometimes called 'lithospheric plates). These are important because they float on the asthenosphere in the mantle below and are moved by the convection currents acting in the mantle.
The way these plates move are driven by the convection currents. This is turn gives us different types of plate boundaries which can lead to earthquakes, volcanoes etc.

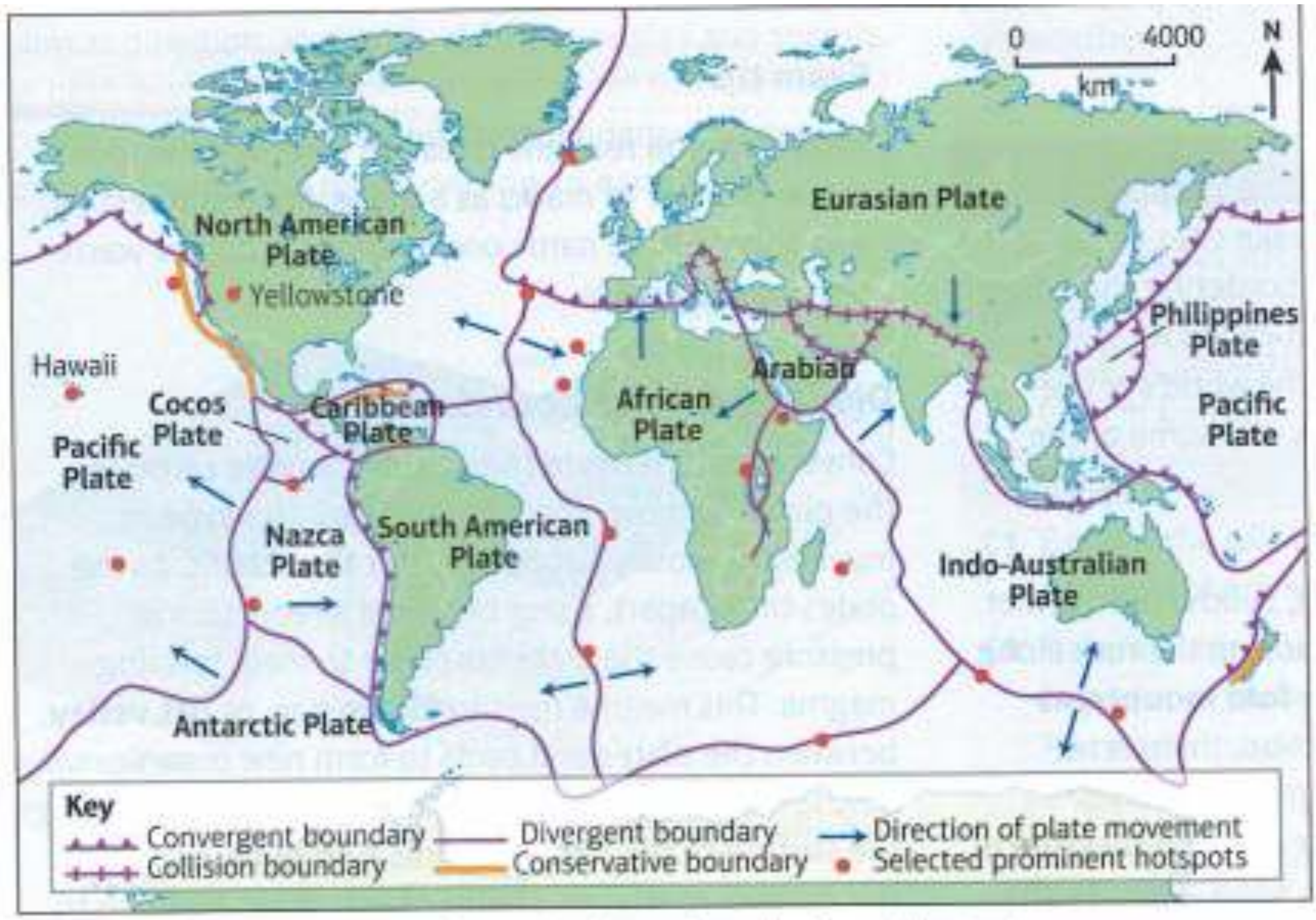


Figure 2 Global distribution of tectonic plates, boundaries and hotspots

Types of Plate Boundaries

The different types of plate boundaries are all controlled by the convection currents in the mantle. Different boundaries give different features. Volcanoes and earthquakes tend to be found along plate boundaries.
Below are the 4 different types of plate boundaries.

Boundary	**Description**	**Features**	**Examples**
Convergent (Oceanic and continental crust)	Convection currents in the mantle cause the plates to move **towards** each other. The ocean plate **subducts** beneath the continental plate as it is denser into the asthenosphere. As it subducts the increase in temperature due to friction and pressure force the curst to melt. This creates magma which can lead to a volcanic eruptions	Ocean trench Trench Composite volcano	Peru and Chile Trench Andes Mountains
Convergent (Continental and continental crust)	Convection currents in the mantle move the plates **towards** each other. As the plates are the same density there is **no** subduction, the collision causes the boundaries to crumble forming **fold mountains**. As there is no subduction there is no volcanic activity here. However, major **earthquakes** do occur due to the pressure of the colliding plates which causes rocks to fault	Fold mountains	Himalayas, Tibetan Plateau
Divergent	Convection currents cause the plates to move **away** from each other. This mainly occurs under the oceans. As the plates break apart the rising heat and reduction in pressure cause the asthenosphere to melt forming magma. The magma rises to fill the rift between the two plates creating **new** crust. Where the magma breaks through a **shield volcano** is formed. **Earthquakes** are also found here	Shield volcano Rift valley	Iceland-Eurasion plate Mid-Atlantic ridge
Conservative	Convection currents cause these plates to **slide** past each other. The plates can move in opposite directions or in the same direction but at different speeds. In both examples, the plates tend to get stuck, increasing the tension and pressure. The pressure builds until one plate jerks and causes an **earthquake**.	Fault lines	San-Andreas fault (USA)

Earthquakes

Earthquakes are intense vibrations within the Earth's crust that make the ground shake. They are sudden events.

90% of earthquakes occur where plates are colliding at convergent plate boundaries. Energy builds up until the rock fractures along a fault, and the energy is released in an earthquake. The point of rupture is called the focus. Shockwaves or seismic waves radiate out from this point on the ground surface (epicentre). These make the ground shake. Earthquakes can also occur along conservative and divergent plate boundaries. They are caused as the plate moves and gets stuck.

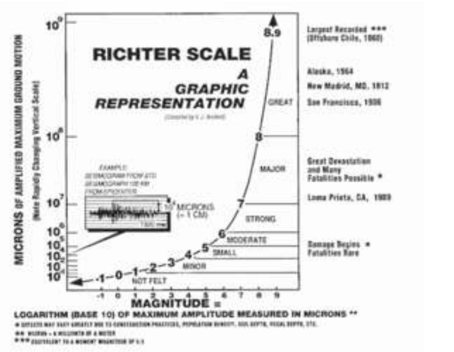
The amount of damage caused by earthquakes

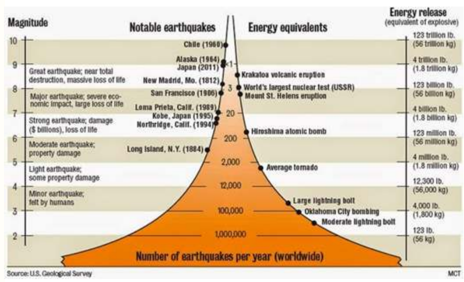
- The scale of the event in terms of energy, the area affected and how long it lasts
- The density of human settlements in an area
- The time of day/week – there are more casualties if people are inside buildings
- The level of development
- The degree to which the country and people are prepared
- The depth of the focus – shallow earthquakes can be more deadly than deep ones

How are earthquakes measured?

The size of an earthquake is recorded using a seismometer. The magnitude (size) is given according to the Richter scale which gives a value between 1 – 10.

- The scale is logarithmic – meaning an earthquake measured at a 7 is 10x more powerful than an earthquake measured at 6 and 100x more powerful than 5.





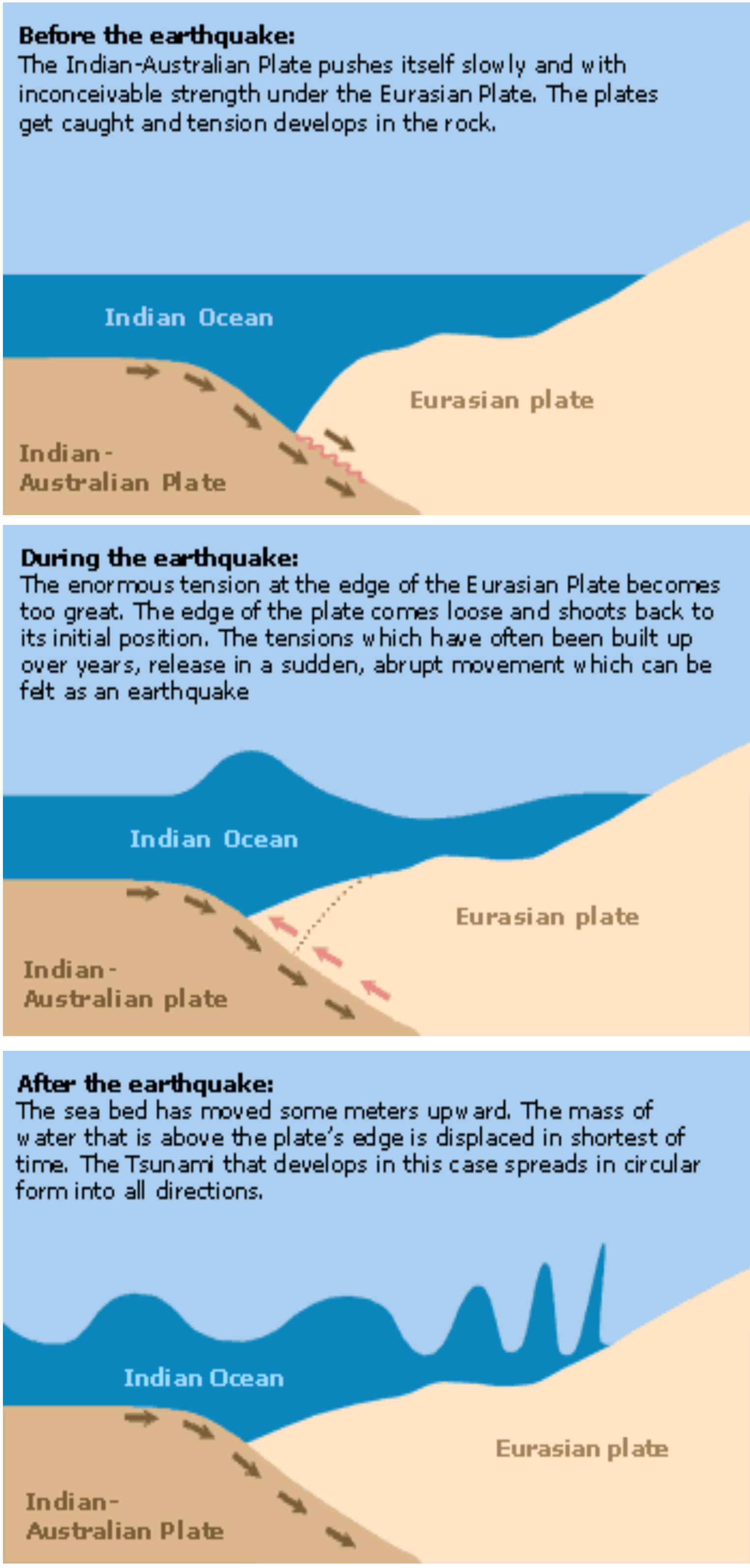
Another scale is the Moment Magnitude Scale (Mw) is frequently used.

- Similar to the Richter scale
- But works over a wider range of earthquakes and is more accurate

Earthquakes and Tsunamis

Tsunamis are usually triggered by earthquakes and can therefore be defined as a secondary hazard.

Tsunamis are a series of giant ocean waves that can be up to 30m in height



Formation of Tsunamis

Tsunamis are caused by earthquakes at sea.

A Tsunami forms when energy from an earthquake vertically jolts the seabed by several meters, displacing the ocean above.

Large waves begin moving through the ocean, away from the earthquakes epicentre.

In deep water, the tsunami moves at great speeds. When it reaches shallow water near coastal areas the tsunami slows but increases in height.

Before a tsunami hits land, the sea looks like it is retreating exposing hundreds of metres of beach and seabed.

Tsunami waves hit shorelines in intervals causing widespread destructions.

Case study: Haiti

At 4.53pm on 12th January 2010 an earthquake (magnitude of 7) stuck Haiti. It occurred along a conservative plate boundary.

Impacts

- Looting and crime increased as the government and police collapsed
- Estimated at 316,000 deaths and 300,000 injured
- Airport control tower collapsed so no flights could go
- 3 million were impacted by the earthquake, 1.5m were made homeless
- Electric, water, sanitation and communications were badly disrupted or destroyed
- 8 hospitals collapsed or were damaged
- One prison collapsed, 4,000 inmates escaped
- Factories closed and no tourists economic losses increased
- Cholera spread through the camps
- 8 hospitals collapses or were damaged
- 5,000 schools were damaged or destroyed including 3 universities collapsed
- 19 million m^3 of rubble and debris were created

Short-term Relief	Long-term Relief
• Many countries sent search and rescue teams to help search for survivors • Food, water, medical supplies were sent from the US and Dominican Republic • US engineers and divers cleared the port so aid could be unloaded • UN and US troops provided security when distributing the aid • The UK raised £100 million, this provided emergency shelters, medication, bottled water and purification tablets and sanitation	• The Government moved 235,000 people from Port-au-prince to less damaged cities • Three quarters of the damaged buildings were inspected and repaired • 200,000 people were paid or received food for public work such as clearing away the rubble • Money was given by individuals and governments around the world (included €300 million Euros from the EU, $100 million from the USA, £20 million from the UK: The World Bank also cancelled Haiti's debt repayments for 5 years

Reducing the impacts

On rebuilding Haiti, the government want to rebuild buildings with more technical designs to withstand future earthquakes.
A new building code will be priority as well as getting people out of high density slum housing into more stable housing off hillsides.

Coastal Landscapes

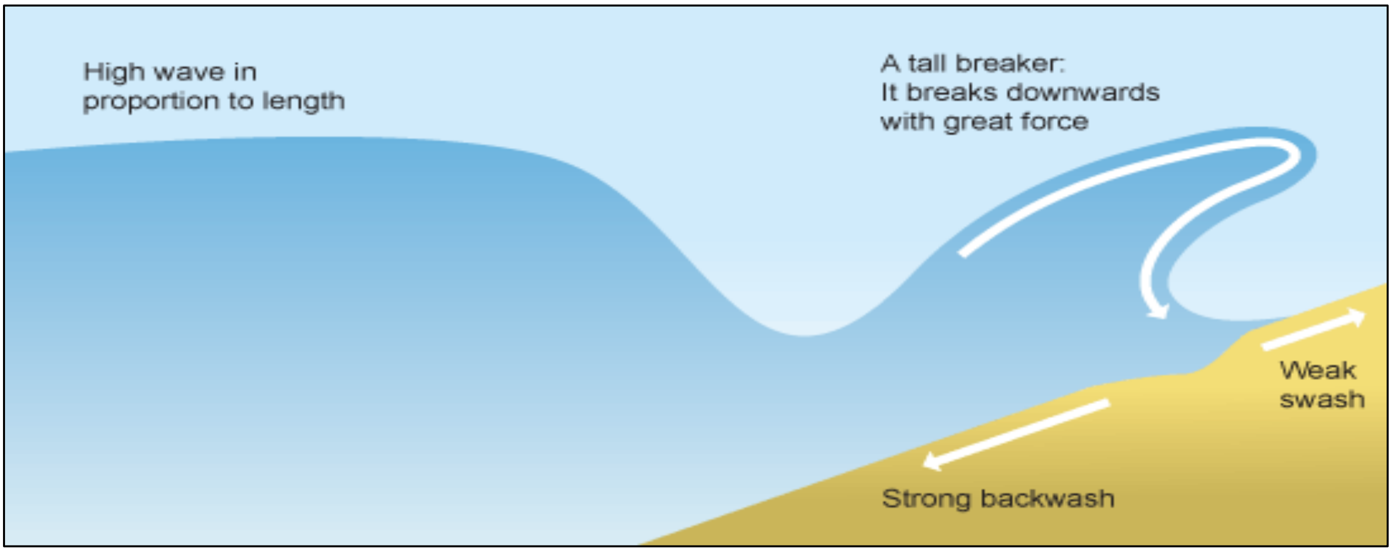
What are the different types of wave?

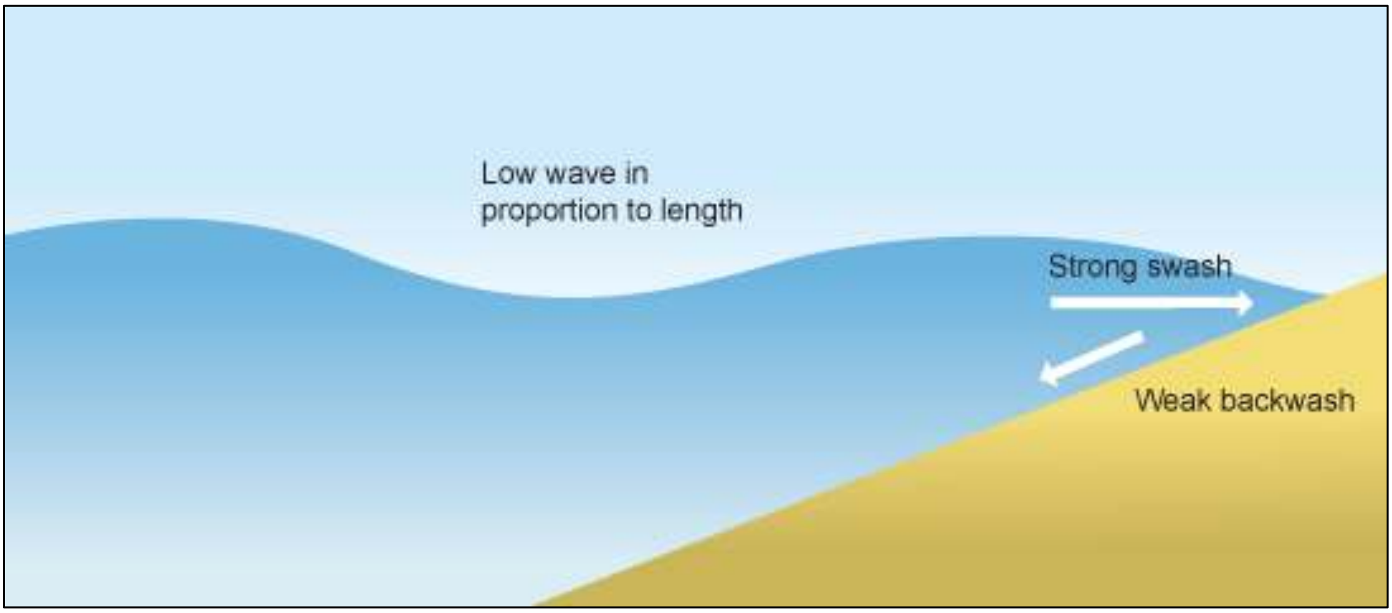
Coasts are shaped by the sea and the action of waves. The processes that take place are erosion, transportation and deposition.
The action of waves
The power of waves is one of the most significant forces of coastal change. Waves are created by wind blowing over the surface of the sea. As the wind blows over the sea, friction is created - producing a swell in the water. The energy of the wind causes water particles to rotate inside the swell and this moves the wave forward.
The size and energy of a wave is influenced by:

- how long the wind has been blowing
- the strength of the wind
- how far the wave has travelled (the fetch)

Waves can be destructive or constructive.

When a wave breaks, water is washed up the beach - this is called the swash. Then the water runs back down the beach - this is called the backwash. With a constructive wave, the swash is stronger than the backwash. With a destructive wave, the backwash is stronger than the swash.





Coastal erosion

The sea shapes the coastal landscape. Coastal erosion is the wearing away and breaking up of rock along the coast.

Destructive waves erode the coastline in a number of ways:

- **Hydraulic action**. Air may become trapped in joints and cracks on a cliff face. When a wave breaks, the trapped air is compressed which weakens the cliff and causes erosion.
- **Abrasion**. Bits of rock and sand in waves grind down cliff surfaces like sandpaper.
- **Attrition**. Waves smash rocks and pebbles on the shore into each other, and they break and become smoother.
- **Solution**. Acids contained in sea water will dissolve some types of rock such as chalk or limestone.

Transportation

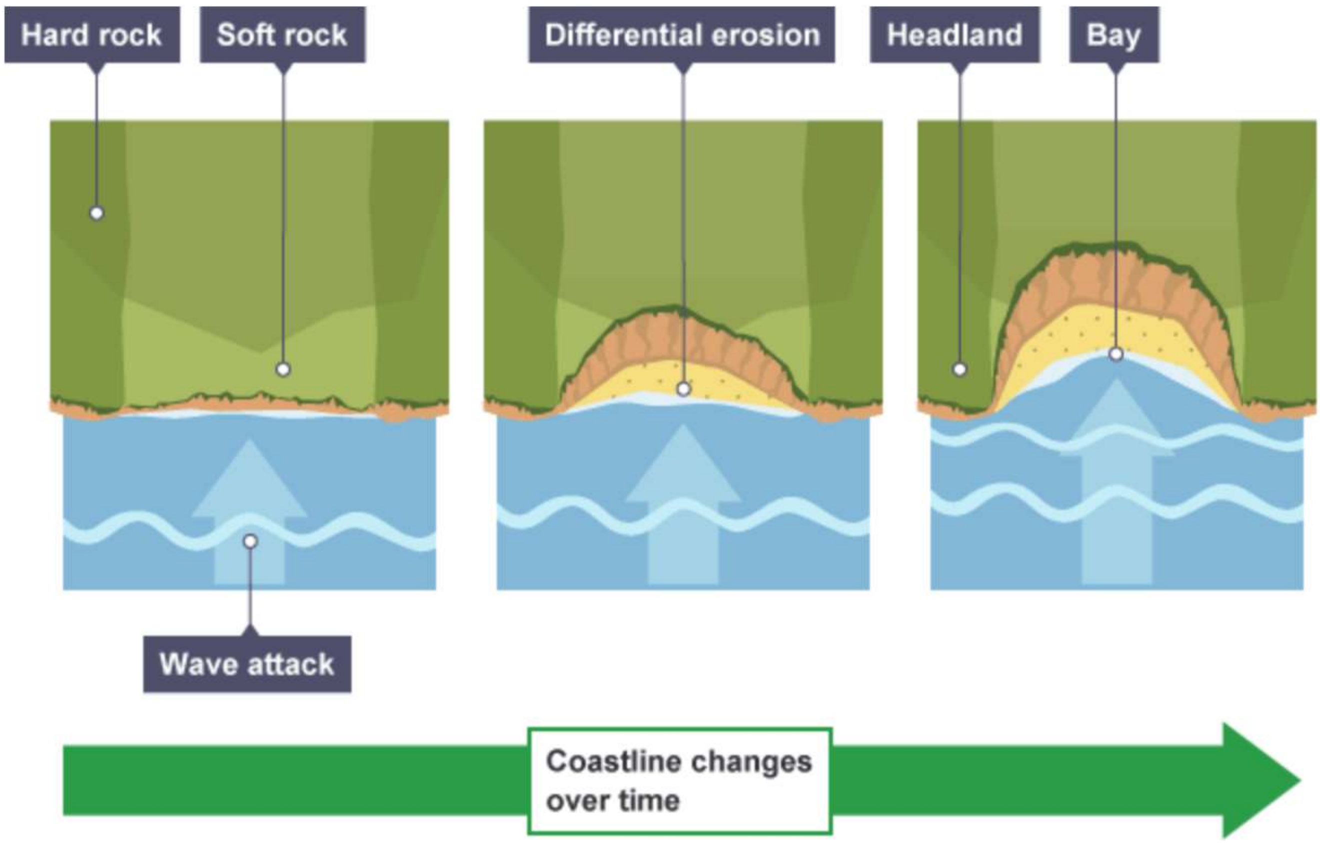
There are various sources of the **material** in the sea. The material has been:

- eroded from cliffs
- transported by longshore drift along the coastline
- brought inland from offshore by constructive waves
- carried to the coastline by rivers

Waves can approach the coast at an **angle** because of the direction of the prevailing wind. The swash of the waves carries material up the beach at an angle. The backwash then flows back to the sea in a straight line at 90°. This movement of material is called **transportation**.

Continual swash and backwash transports material sideways along the coast. This movement of material is called **longshore drift** and occurs in a zigzag.

Headlands and Bays



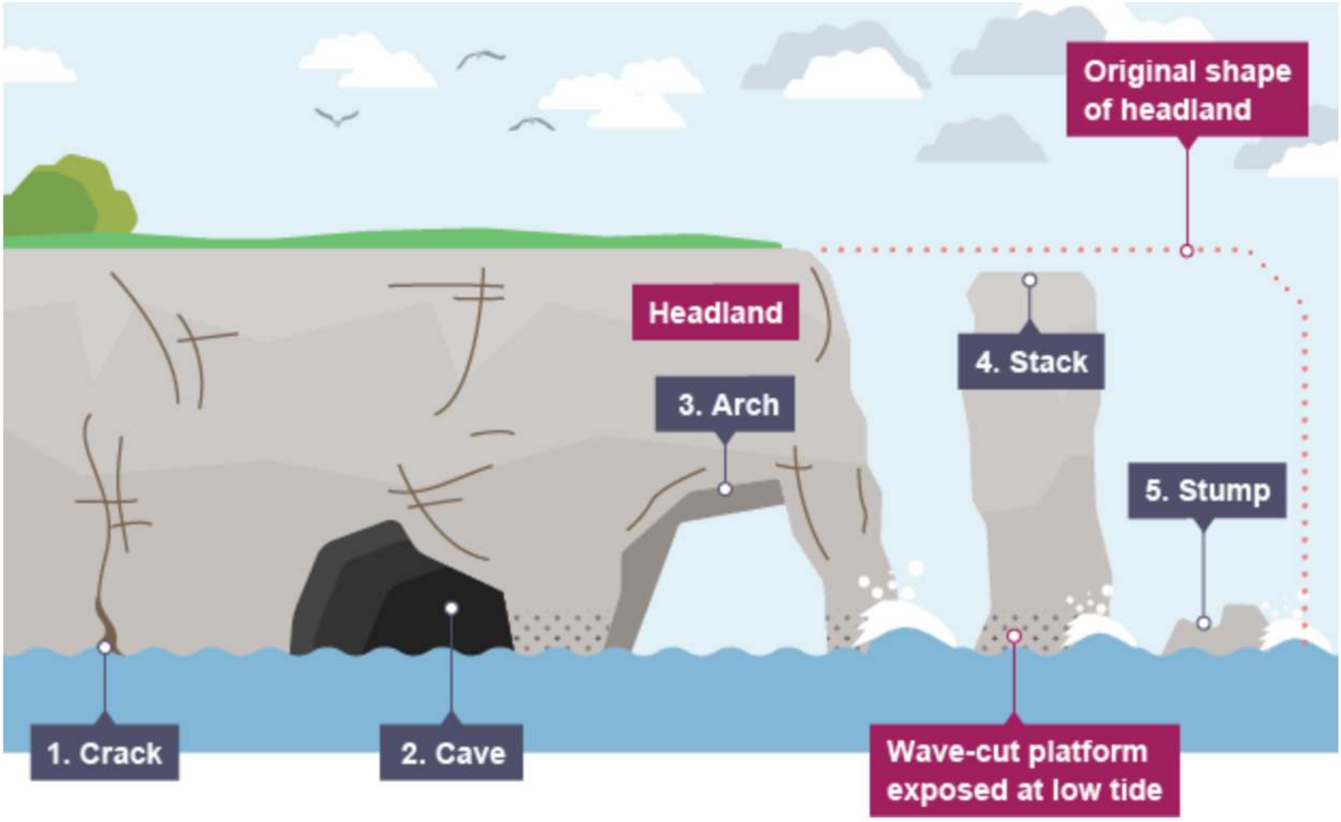
Headlands and bays form where erosion resistance is different Some types of rock are more resistant to erosion than others.

Headlands and bays form where there are alternating bands of resistant and less resistant rock along a coast.

The less resistant rock (e.g. clay) is eroded quickly and this forms a bay – bays have a gentle slope.

The resistant rock (e.g. chalk) is eroded more slowly and it's left jutting out, forming a headland – headlands have steep sides.

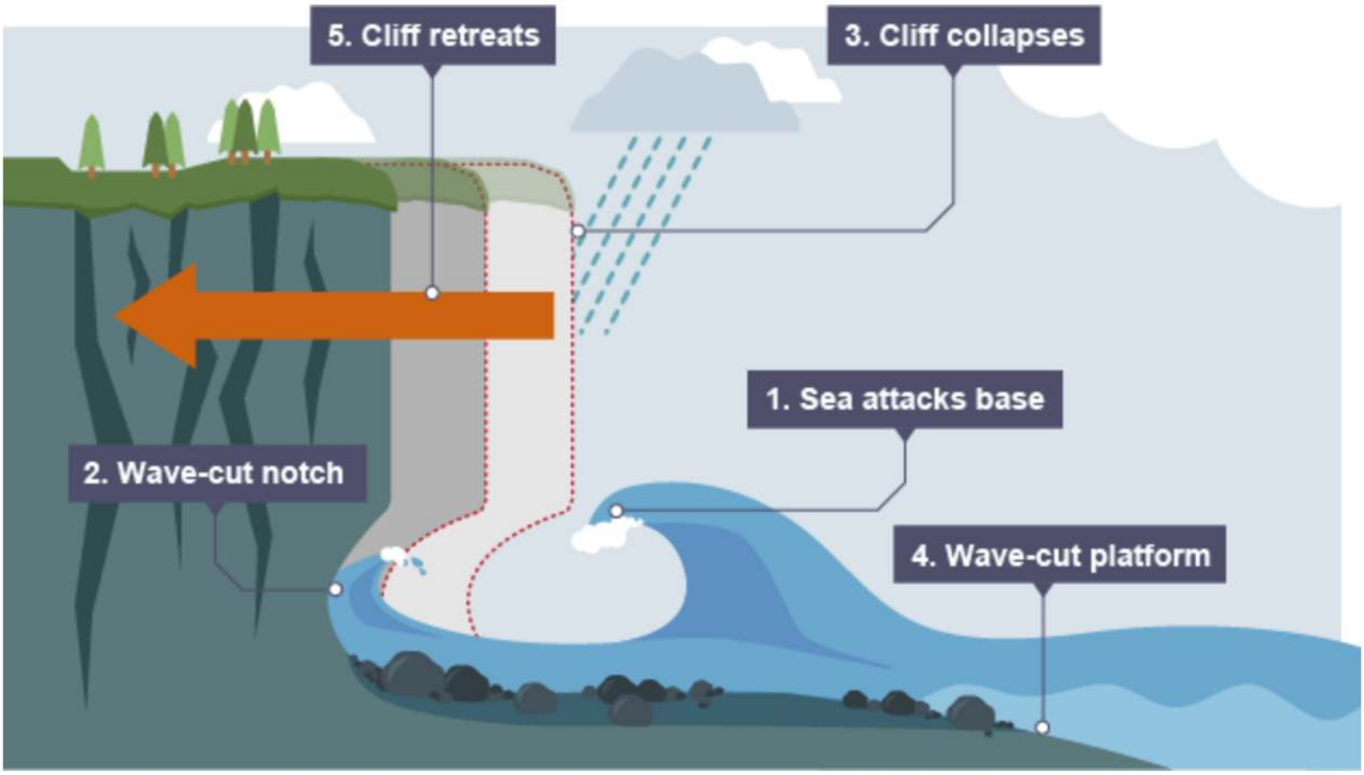
Caves, arches, stacks and stumps



1. Headlands are eroded to form caves, arches, stacks .and stumps
2. Headlands are usually made of resistant rocks that have weaknesses like cracks.
3. Waves crash into the headlands and enlarge the cracks – mainly by hydraulic power and abrasion.
4. Repeated erosion and enlargement of the cracks causes a cave to form.
5. Continued erosion deepens the cave until it breaks through the headland – forming an arch (e.g. Durdle Door in Dorset).
6. Erosion continues to wear away the rock supporting the arch, until it eventually collapses.
7. This forms a stack – an isolated rock that's separate from the headland, e.g. Old Harry in Dorset.

Wave Cut Platforms

Cliffs are shaped through **erosion** and weathering. Soft rock erodes quickly and forms gentle sloping cliffs, whereas hard rock is more resistant and forms steep cliffs. A wave-cut platform is a wide gently-sloping surface found at the foot of a cliff.



A wave-cut platform is formed when the following occurs:

1. The sea attacks the base of the cliff between the high and low water mark.
2. A wave-cut notch is formed by erosional processes such as abrasion and hydraulic action - this is a dent in the cliff usually at the level of high tide.
3. As the notch increases in size, the cliff becomes unstable and collapses, leading to the retreat of the cliff face.
4. The backwash carries away the eroded material, leaving a wave-cut platform.
5. The process repeats. The cliff continues to retreat.