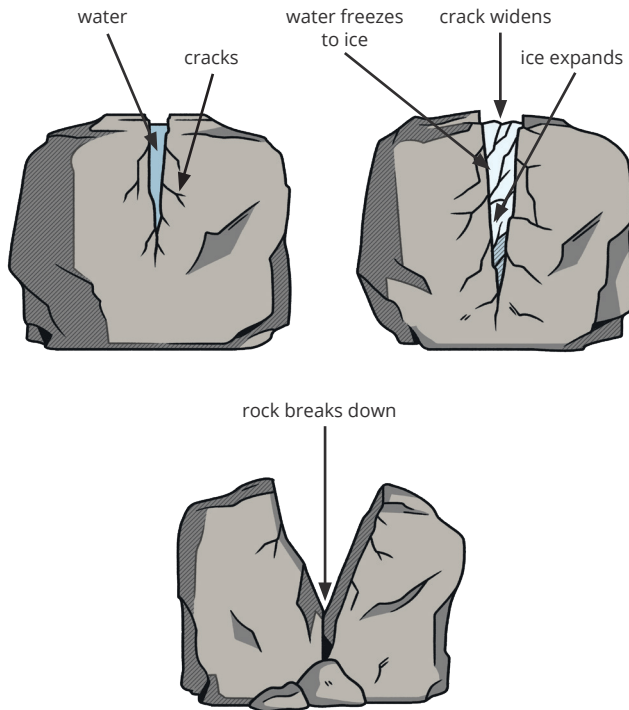


Coastal Landscapes in the UK Knowledge Organiser

Coastal Processes

Weathering Processes

**Freeze-Thaw Weathering** - A type of erosion that occurs when water continually seeps into cracks, freezes and expands, eventually widening the cracks and breaking the rock apart.



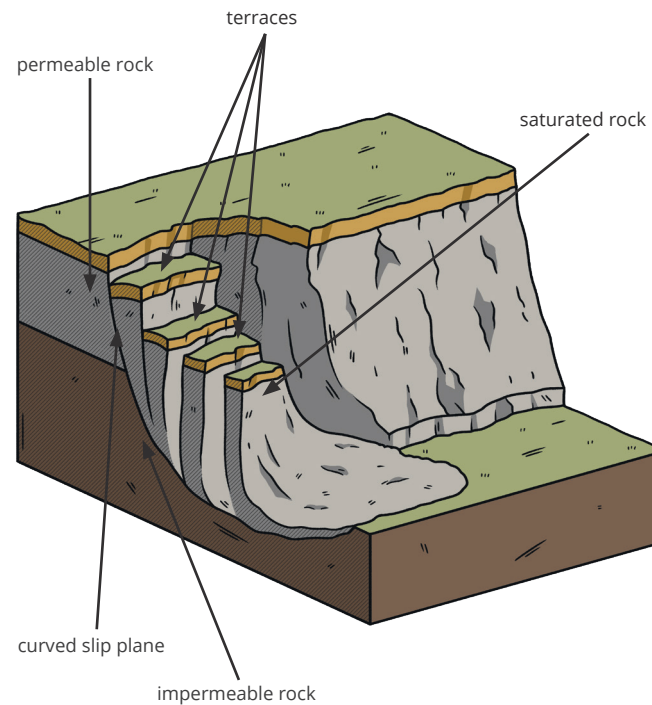
**Chemical Weathering** - The break-down of rocks caused by a chemical change within the rock. At the coast, this type of weathering is often the result of the seawater containing certain minerals that react with, change and dissolve the minerals in the rocks.

Mass Movement (Sub-Aerial Processes)

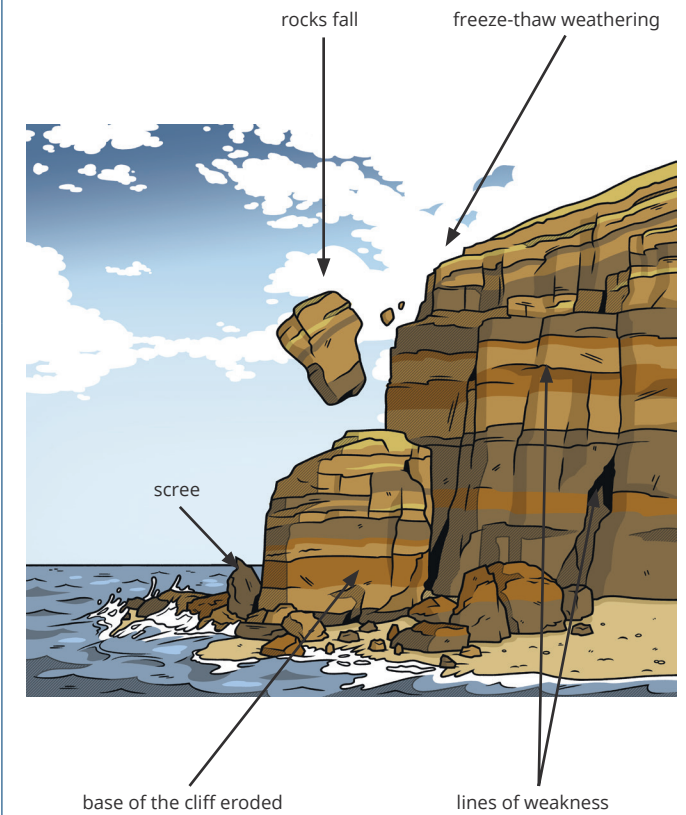
The downhill movement of sediment due to gravity. For example, rock falls, slumping, mudflows or landslides.

**Sliding** - When loose surface material becomes so saturated after a period of heavy rain that the extra weight causes the material to become unstable and move rapidly downhill.

**Slumping** - A rapid mass movement of rocks and debris down-slope.



**Rock Falls** - A type of mass movement where fragments of rock fall from the cliff face, often due to processes such as freeze-thaw weathering. The unsupported rock falls due to gravity and breaks down into smaller pieces.



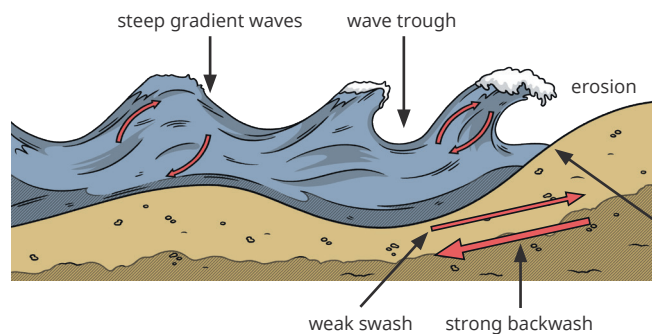
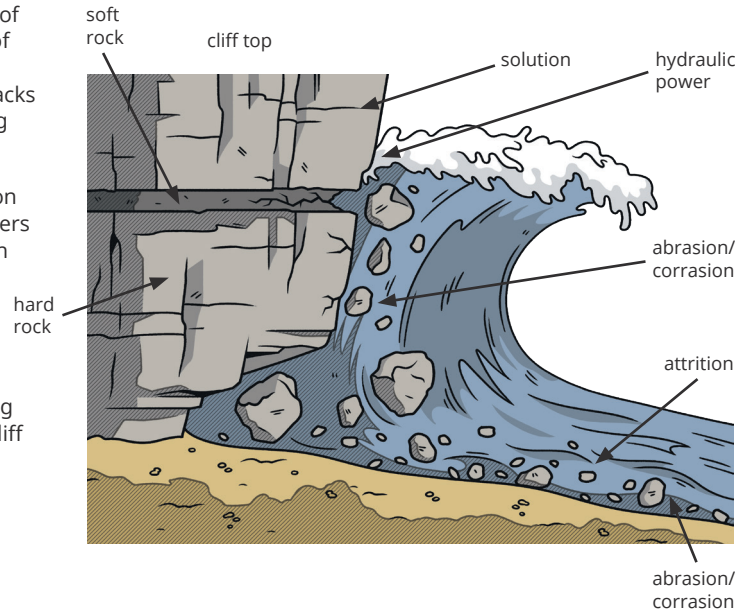
Coastal Processes

Erosion

**Hydraulic Power** – A type of erosion where the power of seawater crashing against rocks forces air into the cracks in the rocks or land causing them to break apart.

**Attrition** – A type of erosion caused by rocks and boulders colliding and breaking each other apart into smaller pieces.

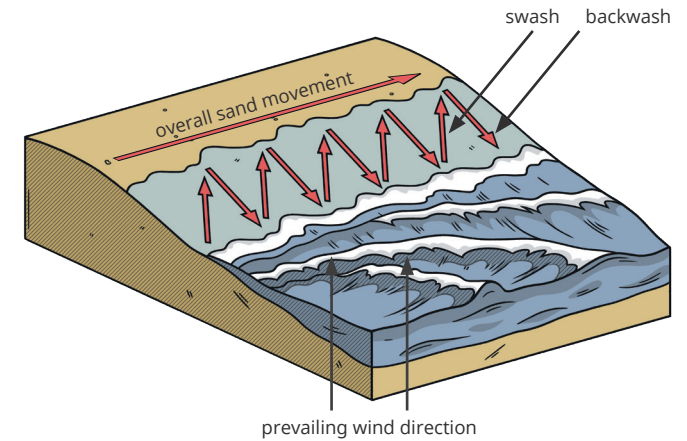
**Abrasion/Corrasion** – A type of erosion caused by sediment, flung by breaking waves, wearing away the cliff face.



**Destructive Waves** – High-energy waves which remove material from beaches by dragging it into the sea. The backwash is stronger than the swash.

Transportation

**Longshore Drift** – The process by which material is transported along a beach through a combination of swash and backwash.

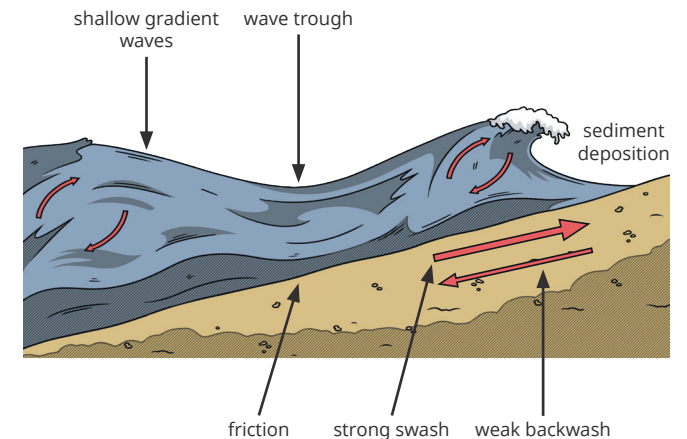


Deposition

**Constructive Waves** – Waves which add material to beaches by carrying sediment onto the beach when the swash is stronger than backwash.

Key characteristics:

- low and long waves;
- low frequency waves (6-8 waves a minute);
- the wash is more powerful than the backwash, depositing material on the coast.

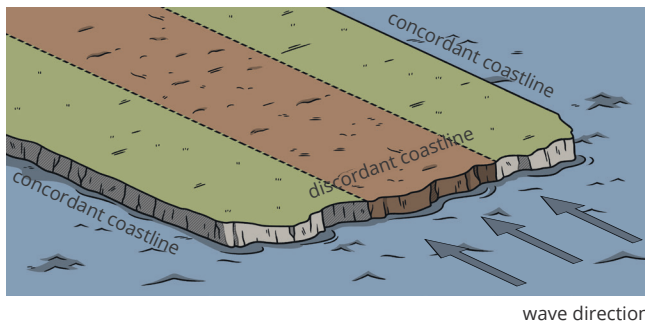


Coastal Landforms

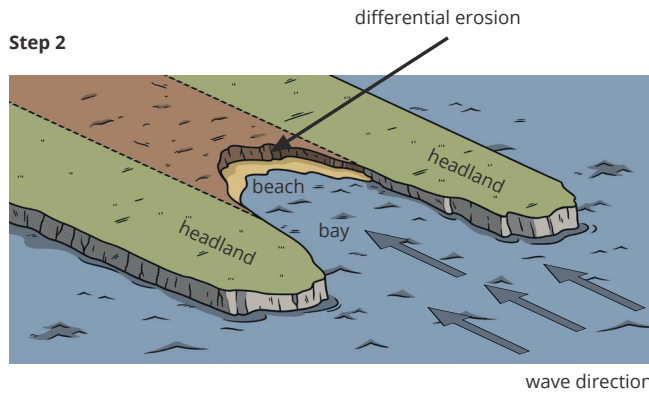
Erosional Landforms

**Headlands and Bays** – Discordant coastlines formed of different types of rock, erode at different speeds. The least resistant rock is eroded fastest, forming a bay. The more resistant rock is eroded slowly, forming headlands on either side of the bay.

Step 1



Step 2

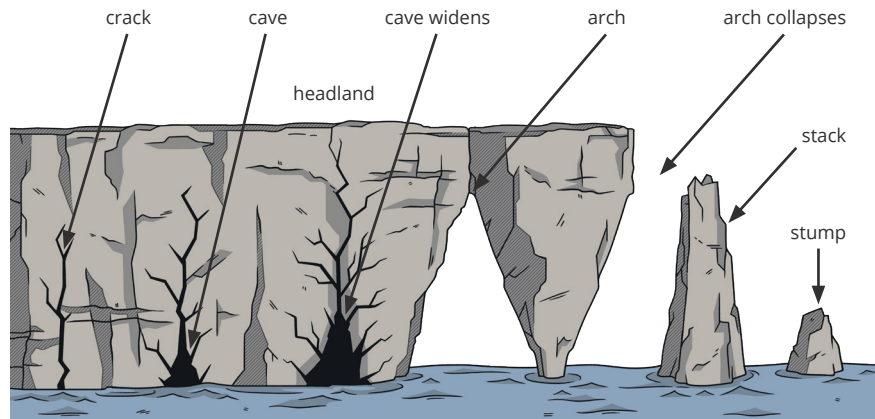


**Caves** – A hollow in a cliff-face, open on one side with solid rock on the other three sides created by waves forcing their way into cracks in the cliff-face.

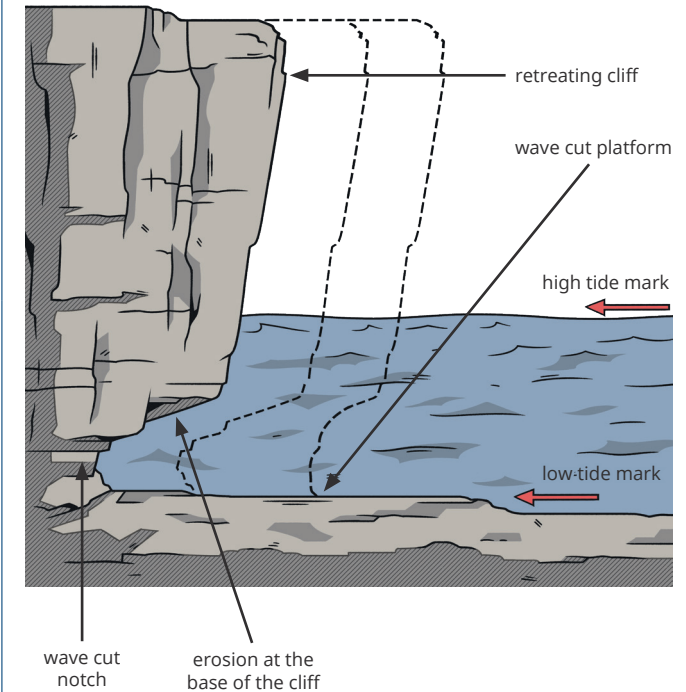
**Arches** – A large wave-eroded hollow passage through a headland formed when the backwall of a cave in the headland is completely eroded and cuts through to the other side of the rock.

**Stacks** – A steep, vertical column of rock in the sea near the coastline, formed when a previous arch collapses.

**Stump** – A short vertical column of rock in the sea near the coastline, usually an eroded stack.



**Wave-Cut Platforms** – Waves erode the base of cliffs creating a wave-cut notch. The rock above will eventually collapse and the cliff will retreat, leaving a large, flat horizontal platform rock in front of the cliff.



**Coastal Landforms**

**Depositional Landforms**

**Beaches** – The zone of deposited material that extends from the low water line to the limit of storm waves. The beach can be divided into the foreshore and the backshore.

- In sheltered bays, sediment deposition often leads to the formation of sandy beaches with a gentle slope.
- If cliffs are eroded and there are high-energy waves, this could lead to the formation of a pebble beach with a steep gradient.
- At the top end of the beach is found a storm beach where the strongest waves have deposited boulders and shingle in a storm.
- There may also be a line of shingle and sand below this called a berm – this marks the normal high tide.

**Sand Dunes** – Coastal ridges of sand located above the high tide mark. They are formed and shaped by the wind.

**Incipient Dune** – Covered with grass and often changes shape due to weather conditions.

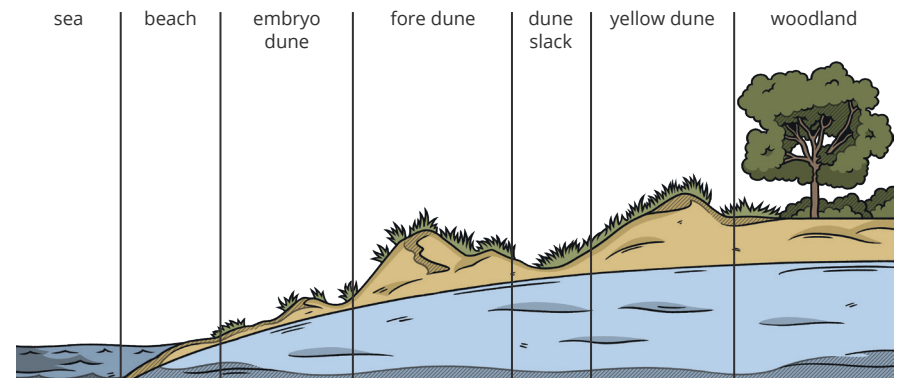
**Foredune** – Covered with established soils, large amounts of vegetation and are not affected by ocean spray or wind.

**Hind Dunes** - established soils, large vegetation, little affect from ocean spray/winds

**Spits** – A narrow stretch of sand deposited by the sea, joined to the land at one end, usually forming where the coastline abruptly changes direction.

**Bars** – A strip of deposited material parallel to the coast. Formed when a spit grows across a bay, eventually enclosing the bay to create a lagoon. Offshore bars can develop as a result of breaking waves.

**Sand Dune Succession/Development**



**Examples of UK Coastlines**

The Dorset coast has many features of coastal erosion.

**Chesil Beach**

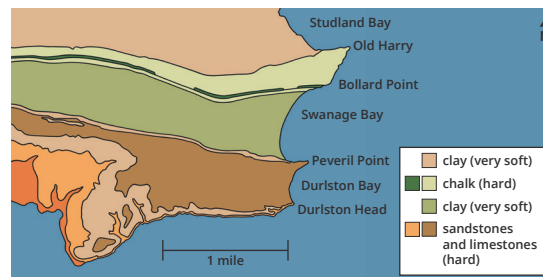
A 30km tombolo (a type of bar which connects an island to the mainland) which encloses Fleet Lagoon.



**Headlands and Bays**

Formed along a discordant coastline, where resistant rock forms headlands (Ballard Point and Durlston Head) and softer rock erodes to form bays (Studland Bay and Swanage Bay).

**Swanage Bay Geological Map**



**Old Harry Rocks**

A cave and a stack (Old Harry Rock) has been eroded from the chalk headland.



Coastal Management Strategies

The Costs and Benefits of Management Strategies

Hard Engineering

- 1. Sea Walls** – A wall-like structure built at the edge of the land along the coastline to protect the land from the erosive force of the sea.
  - Pros:** Coastal erosion and flooding is prevented.
  - Cons:** They are expensive to build and maintain. Can cause greater erosion downdrift due to waves reflecting off seawall.
- 2. Rock Armour** – Huge boulders of resistant rock, such as granite, placed in front of landforms to absorb and reflect wave energy.
  - Pros:** Material is deposited.
  - Cons:** They are expensive to build. Boulders need to be transported long distances (e.g. from Norway).
- 3. Gabions** – Wire cages filled with boulders used as coastal defences.
  - Pros:** They are cheaper and easier than many other management strategies.
  - Cons:** The wire cages corrode over time. Can be considered to be ugly structures.
- 4. Groynes** – Large wooden barriers built out into the sea to catch sand and material being moved along the beach by the sea via longshore drift.
  - Pros:** Material transported by longshore drift is trapped.
  - Cons:** They can be costly and cause greater erosion downdrift.

Soft Engineering

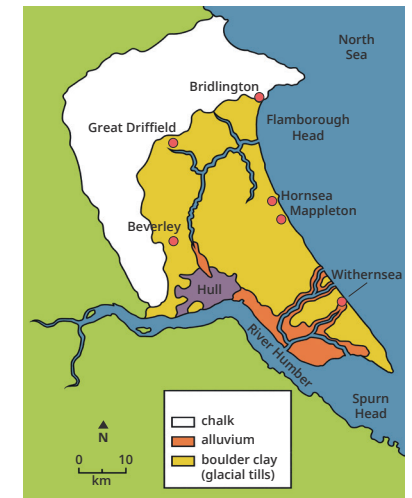
- 1. Beach Nourishment and Reprofiling** – Sand and shingle are dredged from offshore and added to the beach to make it larger and more effective at absorbing wave energy.
  - Pros:** This creates wider beaches which reduces erosion and flooding.
  - Cons:** Constant maintenance is needed, especially after extreme weather/high tides.
- 2. Dune Regeneration** – The process which aims to strengthen sand dunes and protect them from excessive coastal retreat. Marram grass is planted to stabilise the sand. Fences may be used to keep people off newly-planted areas.
  - Pros:** They provide a barrier between land and sea.
  - Cons:** This is often limited to small areas as nourishment is expensive.
- 3. Managed Retreat (Coastal Realignment)** – The controlled and intentional removal of defences to allow areas of land to flood and erode naturally. This process often creates wetland areas or saltmarshes.
  - Pros:** This is a cheap and easy option. No maintenance is needed. Prevents erosion and flooding elsewhere.
  - Cons:** Salt can alter ecosystems. Land and buildings will be lost – compensation cost could be high.

An Example of a Coastal Management Scheme in the UK: The Holderness Coast

The Reasons for Management

- The Holderness Coast is made of soft boulder clay, eroding at an average rate of 1.5-2.5 metres a year. The Golden Sands Chalet Park cliffs, Hollym near Withernsea, have retreated by more than 122 metres in 25 years. In some places, erosion has been even more dramatic.
- 26 villages mentioned in the Domesday Book have been lost to the sea along the Holderness Coast.
- Prevailing winds and longshore drift in the North Sea erode and transport material downdrift, exposing cliffs to further erosion.
- To protect settlements (e.g. Withernsea with over 6000 inhabitants) and infrastructure (e.g. B1242 road near Mappleton).

Holderness Geological Map



The Management Strategy

- Withernsea is a popular tourist town. Over the last 100 years, various sea defences have been built at Withernsea. The sea defences include a sea wall (costing over £6.3 million) and rock armour to protect the promenade. Wooden groynes over one century old were also replaced.
- In 1991, a £2 million scheme at Mappleton placed granite blocks (rock armour) at the cliffs' base to reduce erosion. Two rock groynes were also built on the beach to trap sediment. The groynes create a more expansive beach which prevents the waves from reaching the cliff.

The Resulting Effects and Conflicts

- Groynes built to trap sediment on Withernsea's beach also protect the cliffs from erosion. The effectiveness of the groynes leads to a lack of sediment depositing at the Golden Sands Chalet Park (south of Withernsea) and the loss of land.
- Mappleton village and the B1242 have both been protected. However, the area south of the sea defences has faced increased erosion (from an average of 1.7m a year to 3.3m a year). Farmland to the south of Mappleton has been lost, including the complete loss of Cowden Farm and Grange Farm.