Coastal Processes & Features

Waves

Waves are caused by wind blowing over a stretch of water.

Energy is transferred from wind to water and causes the water to begin to move in a circular motion. This wave of pure energy keeps going across the ocean until it meets a coastline. The distance of unbroken ocean over which a wave has gathered up energy is known as the *'fetch'*. The larger the fetch the longer the wave.

At the coast line the wave begins to slow down due to friction with the land and to fall forward into a breaking wave. It then goes up the beach as *swash* and rolls back down the beach as *backwash*. It is the strength of the swash compared to the backwash that determines whether a coast will erode or not.

If the wave is long and low with a strong swash then the wave will be *constructive*

If the wave is short and steep with a strong backwash then the wave will be *destructive*

Coastlines are dynamic - always changing. Some coastlines erode whilst others are being built up. This is due to the changing energy of the waves (due to fetch and wind speed) and the material the coast is made from.

Coastal Processes - C.A.S.H

(C) Corrasion	When wind hits the coast it throws sand and pebbles against the cliff face; these knock off small parts of the cliff and cause undercutting, also known as abrasion.
(A) Attrition	Particles being transported by sea hit against one another, reducing their size and making them more rounded - just like in rivers.
(S) Solution	Seawater can dissolve away the rocks from the seabed or cliffs. This process is especially effective on limestone coasts and can create spectacular caves. Also known as corrosion.

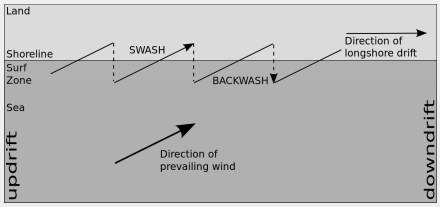
Coastal Processes - C.A.S.H (cont)

(H) Hydraulic Action	i.e. power of the sea. Can physically wash away soft rocks like boulder clay; hundreds of tonnes of seawater can hit coast under storm conditions. Air can also be trapped in small cracks within cliffs when waves break against it. Compressed air can widen cracks leading to sections of cliffs breaking away.

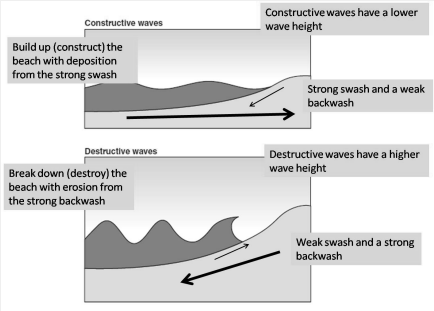
Transportation - Long Shore Drift

Waves approaching at an angle will rush up the beach in the direction of the wave crest, but roll down the beach by gravity. This means that little by little material is moved sideways on the beach. This is called long shore drift.

Diagram of Longshore Drift



Deposition



Erosion Landforms

Cliffs & Wave Cut Platforms **Caves, Arches & Stacks**

Erosion Landforms (cont)

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.

Caves, arches, stacks and stumps are erosional features that are commonly found on a headland.

- The process repeats. The cliff continues to retreat.

They form when the following happens:

A wave cut platform forms when the following occurs:

- Cracks are widened in the headland through the erosional processes of hydraulic action and abrasion.

- The sea attacks the base of the cliff between the high and low water mark.

- As the waves continue to grind away at the crack, it begins to open up to form a cave.

- 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.

- The cave becomes larger and eventually breaks through the headland to form an arch.

- As the notch increases in size, the cliff becomes unstable and collapses, leading to the retreat of the cliff face.

- The base of the arch continually becomes wider through further erosion, until its roof becomes too heavy and collapses into the sea. This leaves a stack (an isolated column of rock).

- The backwash carries away the eroded material, leaving a wave-cut platform.

- The stack is undercut at the base until it collapses to form a stump.

Diagram of a Cliff & Wave Cut Platform

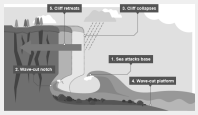
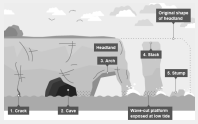


Diagram of Caves, Arches & Stacks



Deposition Landforms

Beaches

A beach is a coastal landform created by deposition.

Constructive waves form beaches as they deposit materials.

Shingle beaches are much steeper than sandy beaches as the energy of a wave is reduced because the large particle size allows percol-ation, therefore the backwash is not very powerful and a steep beach is created.

Spits

A spit is a beach that extend out from the mainland into the sea. They are a coastal landform formed by deposition.

Spits require a constant supply of sand (or other material from erosion further up the coast), longshore drift operating most of the time, a coastline with a sudden change in direction to leave a sheltered bay area and quite shallow sea to form.

A spit forms when waves hit the shore at an angle, moving material along the beach due to LSD. This happens because although the sand goes up the beach at an angle in the swash, it moves straight back down the beach in the backwash.

The end of a spit has a hooked/curved end due to waves changing direction. This is called a headland. A salt marsh may also form.

Sustainable Management of Coasts

Coastal Land Use

Climate Change

Making need for coastal defences pressing issue. Needed for example because the world bank estimates a 1m rise in sea levels would flood half of Bangladesh's rice fields and force the migration of millions of people.

Tourism

60% of Majora's gross national product comes from tourism centred around beaches. In Dubai they have gone as far as creating more beach front space by building an artificial island off the coastline like Palm Islands.

Fishing

The fishing industry is important in both MEDCs and LEDCs. The FAO estimates that over 100 million tonnes of fish are caught from the wild each year and provide for 10-12% of the world's population. 90% of those employed in fisheries are working in small scale operations in developing countries.

Industry/Ports

Coastal areas suitable for locating a port. Ports are important today as ever due to the increase in global trade. Large container ships cross the world carrying up to 19,000 standard containers. In 2015 the world's largest container ship, made in China, the 'CSCL Globe' docked in the port of Felixstowe, UK.

Why do we need to protect coasts?

Just over half the worlds population, around 3.2 billion, live within 20km of the sea. The use of shoreline has a direct and significant impact on coastal waters. These areas are vulnerable to rising sea levels or coastal erosion, large numbers of people inhabit these areas and are thus at risk. By 2025 it is estimated that 6 billion will live in coastal areas.

Coastal Management Strategies

	Seawalls
Description	Look like tall concrete walls built at the back of beaches, may have curved shape to deflect erosive energy.
Advantages	Can be economically acceptable, protects many people, can reflect wave energy
Disadv-antages	Expensive to build (£10mil per km), need constant maintainence, need very deep foundation, cause erosion elsewhere.
	Gabions
Description	Metal cage measuring 1m by 1m, built on site from 6 metal sides that are filled with local rocks.
Advantages	Low cost, wave energy absorbed, deflects sea energy
Disadv-antages	Not long term; rust quickly and can be damaged by storms, eyesore.
	Gryones
Description	Made of wood and look like low fences stretching seawards out on beaches at intervals
Advantages	Tourist attraction, slow down LSD, saves beaches
Disadv-antages	Reduce public access, can cause extra erosion, unattractive, expensive: £5000 per m, wooden ones erode quickly
	Beach Nourishment
Description	Sand is dredged from seabed and added to eroded beach
Advantages	Cheaper than groynes, receives significant economic returns (tourism), softer (supports beach)
Disadv-antages	Needs regular maintenance, erode faster, still expensive, short term, £1mil per mile.

Case Study - Newcastle, Co. Down

Sustainable means meeting the needs of today without compromising the needs of future generations. Sustainable development at the coast means implementing hard and soft engineering methods to protect local areas.

Newcastle is located in County Down, in the South East of Northern Ireland. It is a coastal town, one hour away from the Capital, Belfast.

The sand from the 8km of beach originally came from the last ice age, carried by glaciers from Dundrum, 15,000 years ago. This means there is no ways of replacing a sand, a finite source and no new sand can make management hard.

Gryones

(+) Wooden gryones cheaper, (-) Have decayed.

Gabions

(+) More sustainable than sea wall and rock armour, slowly dissipate energy, replaced in 2006. (-) Not sustainable, first set badly decayed, cheaper.

Rock Armour

(+) Effective and environmentally friendly (-) Unsustainable, reduces sediment supply for Murlough Bay

Sea Walls

(+) £10mil per kilometre, effective, curved meaning wave will return design. (-) Severe storm in 2002 washed old sea wall away, was rebuilt and extended by 1m for £4mil. Increased erosion North of Shima River.

Beach nourishment and new gryones are being considered for the future of Newcastle's coast.

The methods currently employed at Newcastle are not sustainable as it is no longer a naturally fuctioning beach. Professor Derek Jackson notes that sea walls that reflect waves will gradually erode away once stable beaches. Comments on lack of sustainability in Northern Ireland given background of sea level rises made.

Keywords

- Sustainable
- Sustainable Coast
- Wave
- Longshore Drift
- Corrasion (abrasion)
- Attrition
- Solution
- Hydraulic Action
- Hard Engineering
- Gryone
- Gabion
- Seawall
- Rock Armour
- Soft Engineering