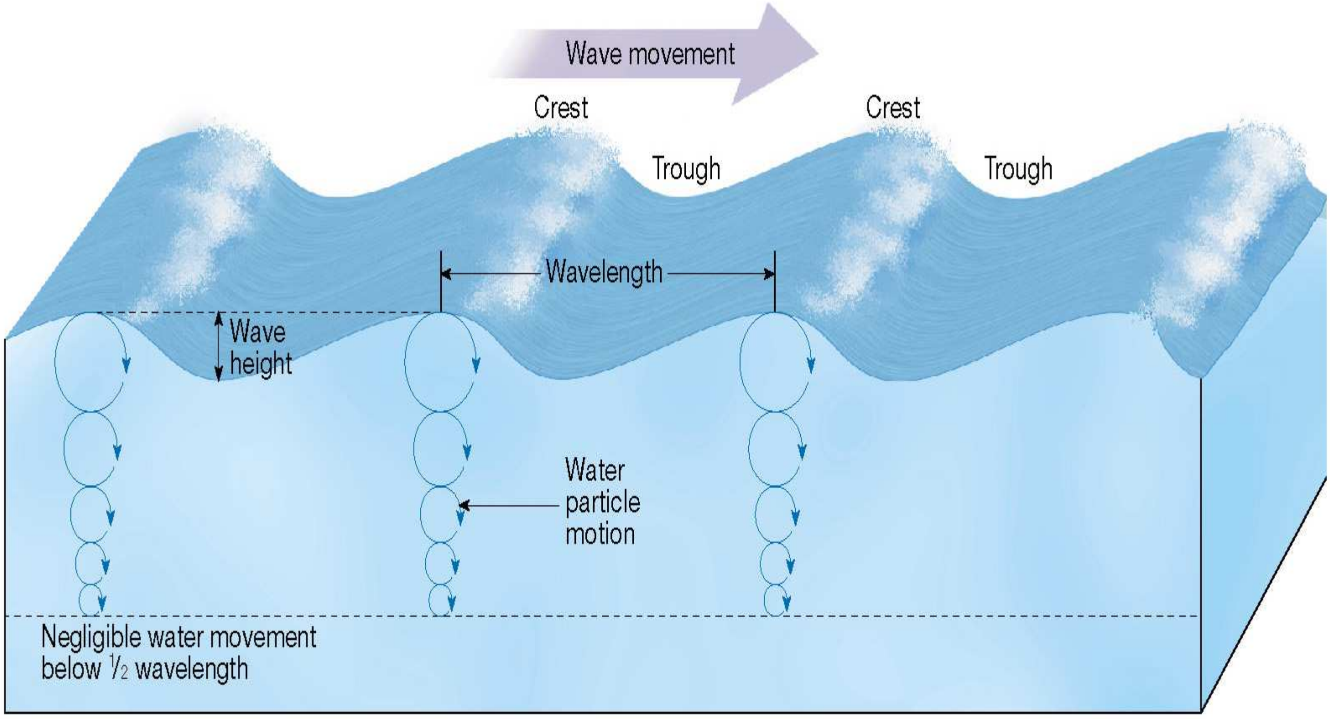
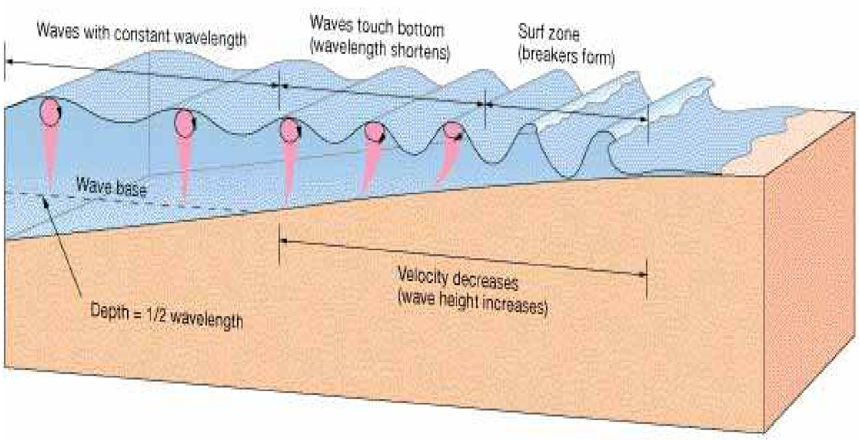
COASTAL SYSTEMS

WAVE ENERGY

- The energy of a wave determines its ability to erode and transport material on the coast
- Wave energy depends on the fetch, the distance the wind has blown the wave
- Wind strength and wind duration also affect wave energy
- Wavelength and wave height are measures of the energy of waves
- Waves break when the water gets shallower towards the shoreline
- Waves break at the plunge point to deliver their energy onto the shore



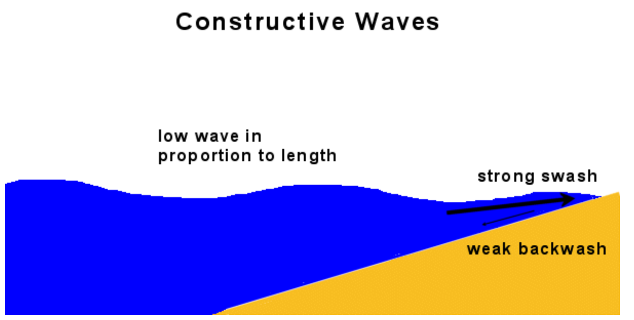


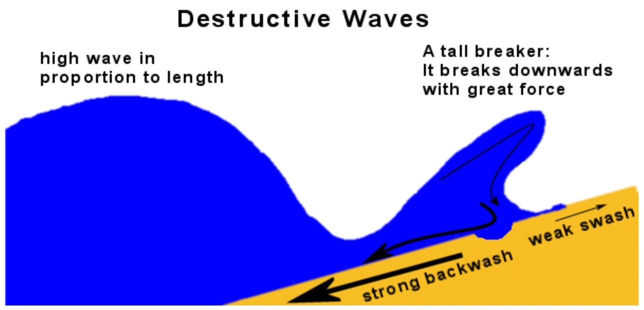
Use the information on this page to explain what happens to a wave when it breaks on the shoreline

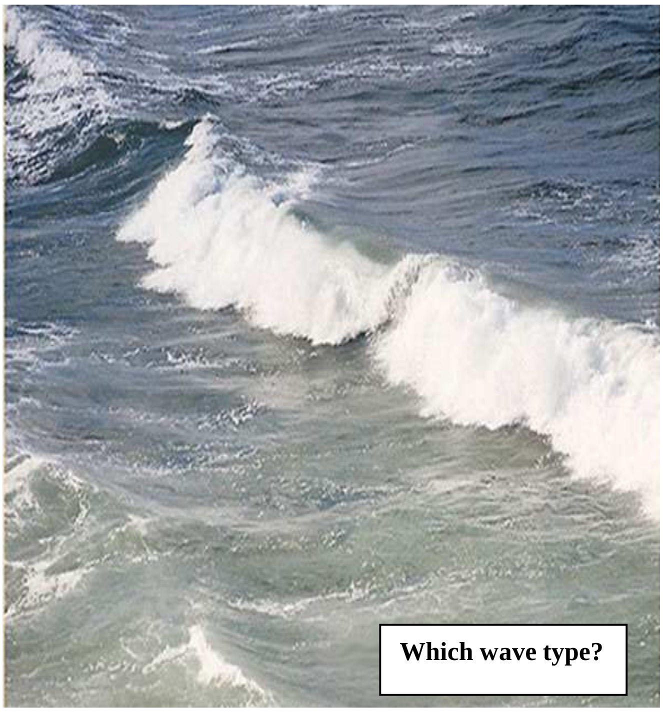
COASTAL SYSTEMS

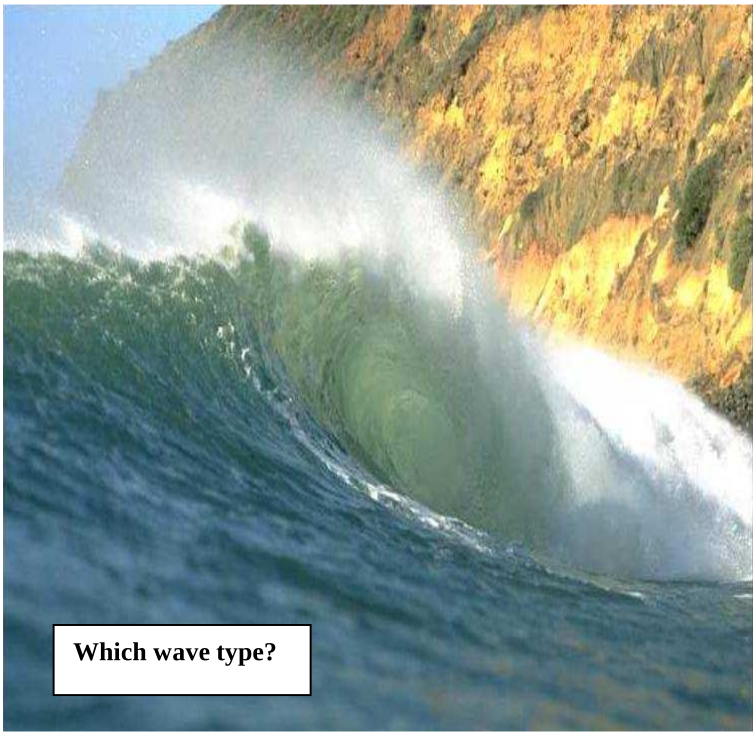
CONSTRUCTIVE AND DESTRUCTIVE WAVES

- Constructive waves cause deposition on the coast and destructive waves cause erosion
- Constructive waves have a strong swash, whereas destructive waves have a more powerful backwash
- Constructive waves are low energy waves with a low wave height
- Destructive waves are high energy waves with a higher wave height
- Constructive waves break infrequently, whereas destructive waves break 10-15 times per minute
- Destructive waves are plunging waves , constructive waves are spilling waves









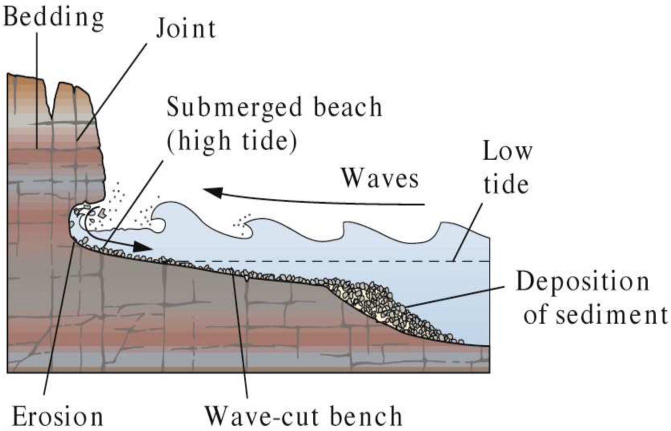
Put the following labels on the correct wave photograph:

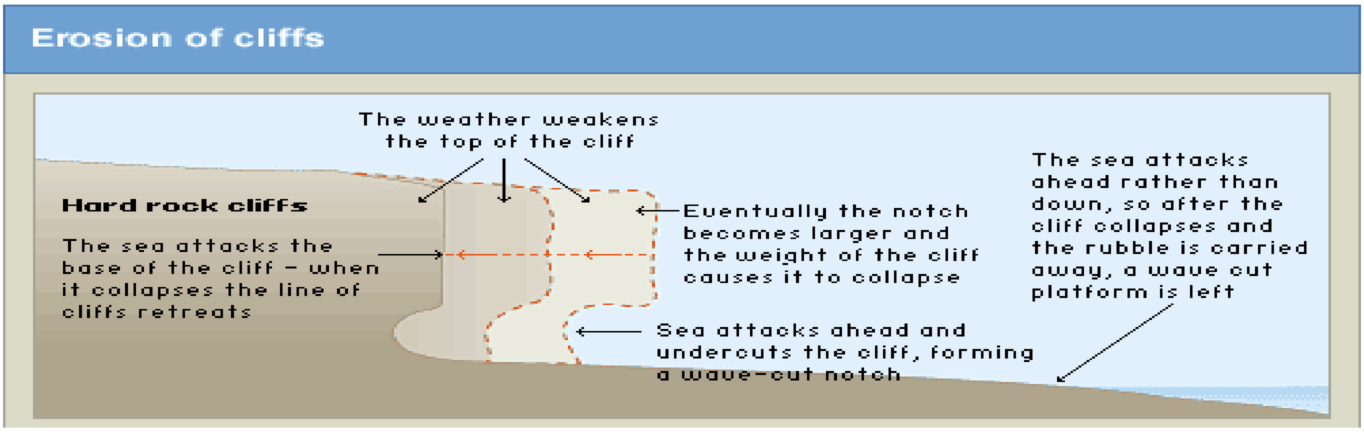
PLUNGING WAVE
SPILLING WAVE
CONSTRUCTIVE WAVE
DESTRUCTIVE WAVE
EROSIVE WAVE
DEPOSITIONAL WAVE
STRONG SWASH
STRONG BACKWASH
FEW WAVES PER MINUTE
MANY WAVES PER MINUTE
LOW ENERGY WAVE
HIGH ENERGY WAVE

COASTAL SYSTEMS

CLIFF RECESSION

- Cliffs are attacked by 2 sets of processes, wave erosion at the base and sub-aerial processes higher up
- Weathering and mass movement are the processes attacking the upper cliff
- Wave erosion between the high and low water marks forms a wave cut notch at the base of the cliff
- This undercutting leads to cliff collapse and the cliff recedes or moves back
- As the cliff recedes a wave cut bench/platform or abrasion platform is produced in front of the cliff
- A wave built terrace of deposited material is formed and some beach debris may cover the platform





On the photograph opposite label the following to show that you understand cliff recession:

WAVE CUT NOTCH

WAVE CUT PLATFORM

DIRECTION OF RECESSION

WAVE EROSION

SUB-AERIAL PROCESSES

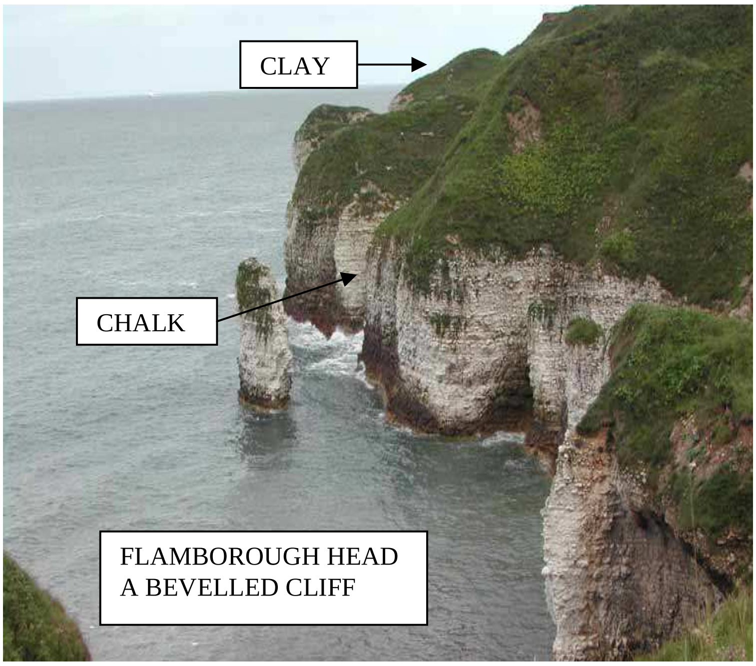
UNDERCUTTING

BEACH MATERIAL ON PLATFORM

COASTAL SYSTEMS

CLIFF TYPES

- The steepness of a cliff is determined by the balance between wave erosion and sub-aerial processes
- Rocks resistant to weathering and erosion form steep cliffs, soft rocks like clay form gentle cliffs
- Where the rock strata are horizontal a steep vertical cliff is formed
- Rock strata dipping seawards form an unstable overhanging cliff
- Rock strata dipping landwards form a gentler sloping stable cliff
- Two differing rock types as at Flamborough Head (clay above chalk) form a bevelled cliff



FLAMBOROUGH HEAD
A BEVELLED CLIFF

Use the information on this page to explain why the form of cliffs varies so much:

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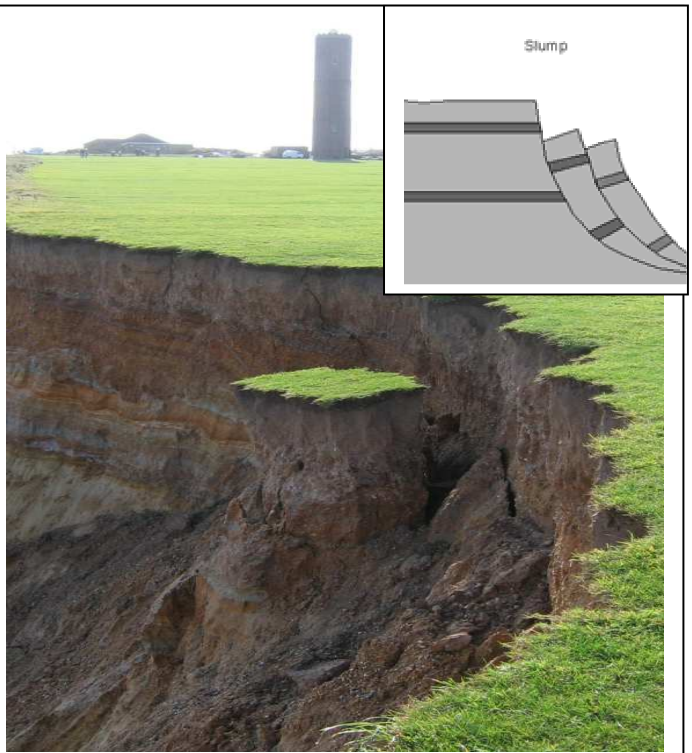
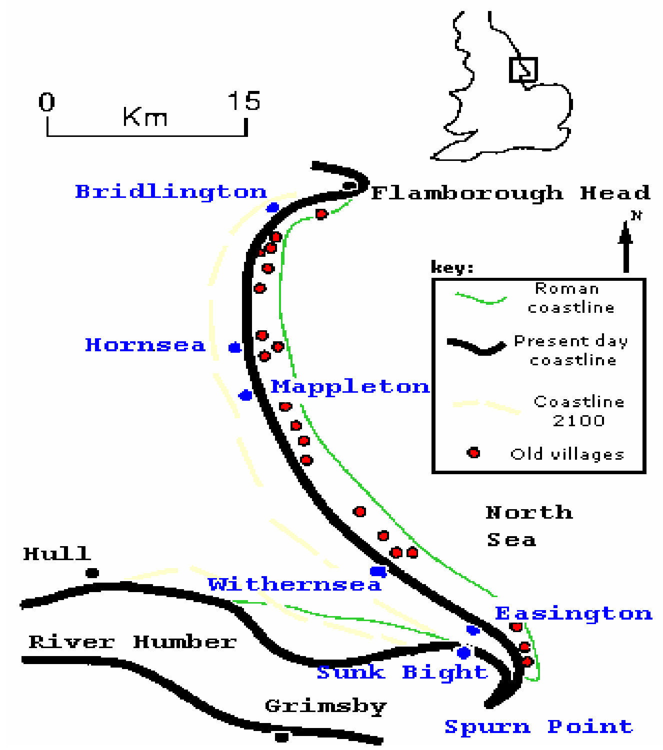
COASTAL SYSTEMS

COASTAL EROSION : HOLDERNESS

- Destructive waves and rising sea level have caused large scale erosion of the Holderness coast
- The coastline has receded between 1.6 and 2 km since Roman times
- The coast is made of boulder clay (glacial till) which is soft and easily eroded
- The lack of a large sand beach and no groynes to hold the sand allow waves to attack the cliff base
- Sub-aerial processes of weathering and mass movement affect the upper cliff
- Landslides, landslips, mudflows and rotational slips are all common in the soft boulder clay

Boulder clay / Till



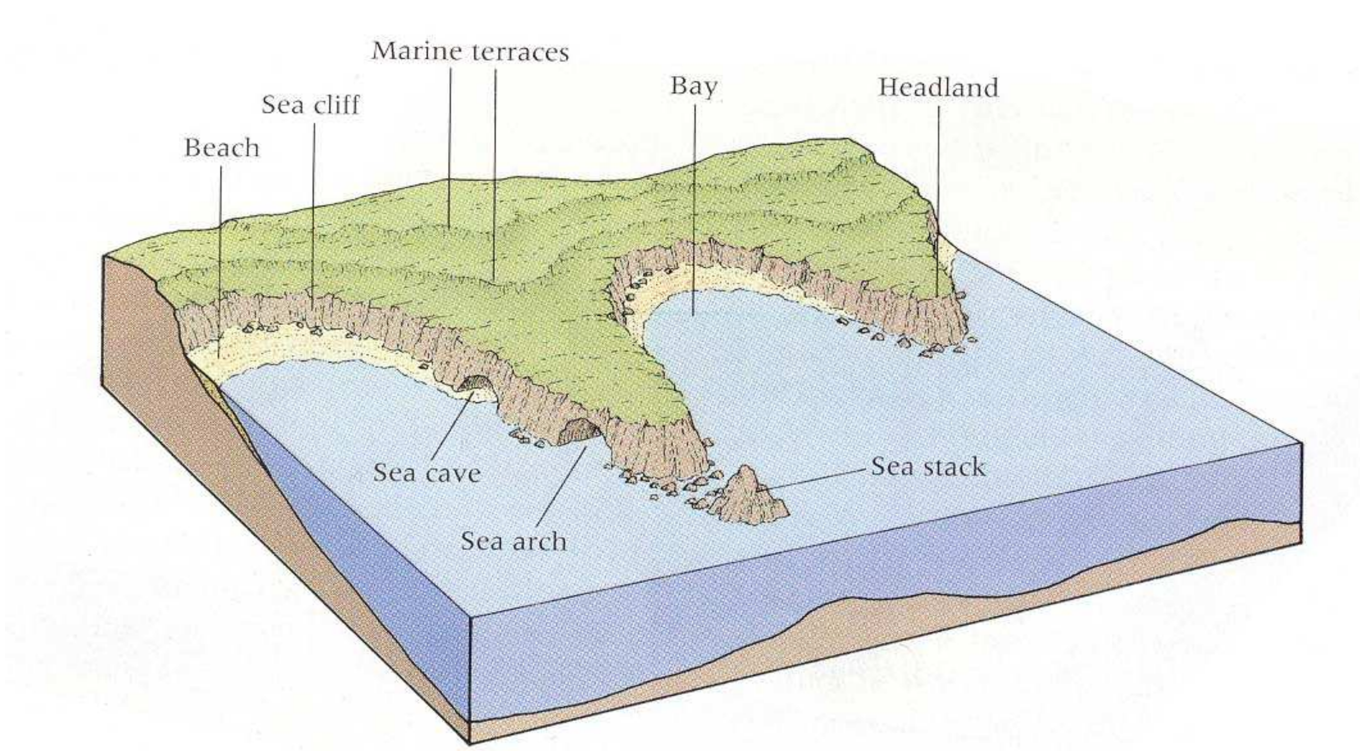


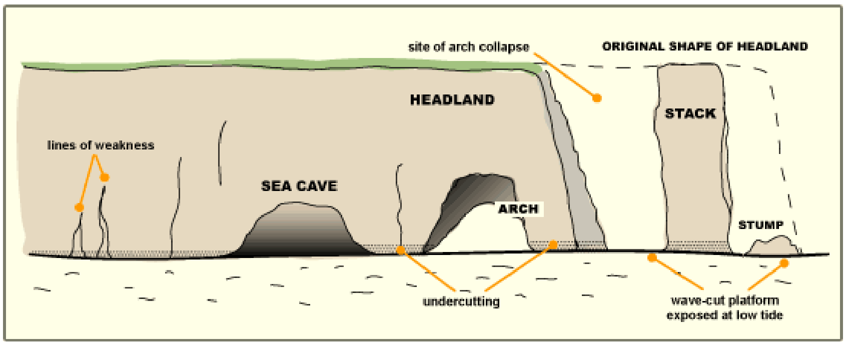
Use the information on this page to explain why the Holderness coast is receding so rapidly:

COASTAL SYSTEMS

CAVES, ARCHES, STACKS AND STUMPS

- Wave erosion is concentrated on headlands by wave refraction
- A weakness caused by a fault or a major joint is eroded by the waves
- Erosion on a weak spot will form a cave, a passage or tunnel in the lower cliff
- When two caves meet across a headland a natural arch is formed
- Waves and weathering may cause an arch to collapse to leave sea stack, which erodes to leave a stump
- All of these features are found in the chalk cliffs of Flamborough Head in Yorkshire





Use the information on this page to write a description and explanation of caves, arches, stacks and stumps:

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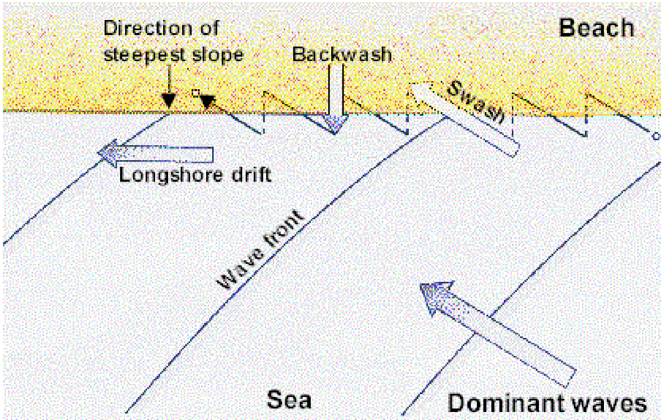
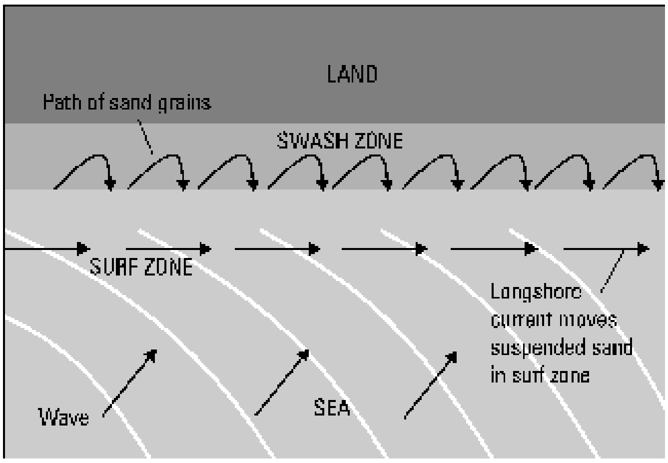
COASTAL SYSTEMS

LONGSHORE DRIFT

- Material is moved along the coast by the process of longshore drift
- The direction of the dominant wave approach determines the direction of longshore drift
- The direction of the wind, especially the prevailing wind determines the wave approach
- When waves break at an angle the swash carries material up the beach at an angle
- At the top of the beach the wave has lost its energy and the backwash returns at 90 degrees
- This zig-zag movement of longshore drift can be prevented by groynes to build up the beach





Describe and explain how longshore drift moves beach material along the coast:

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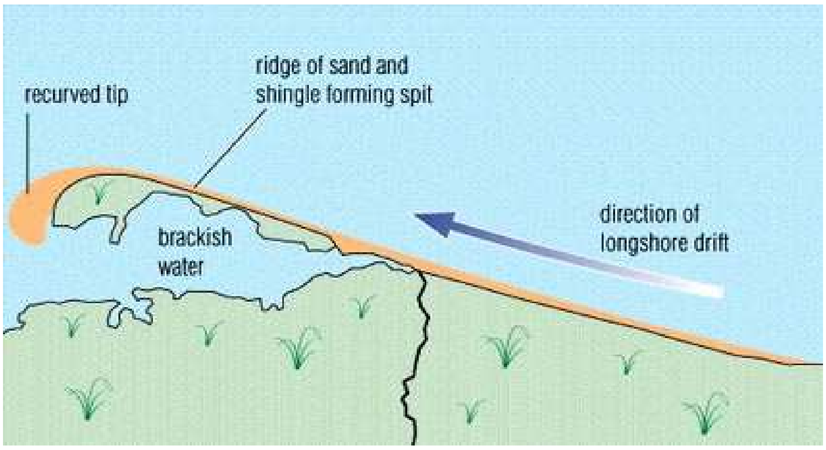
Show the direction of longshore drift with an arrow in **both** photographs

COASTAL SYSTEMS

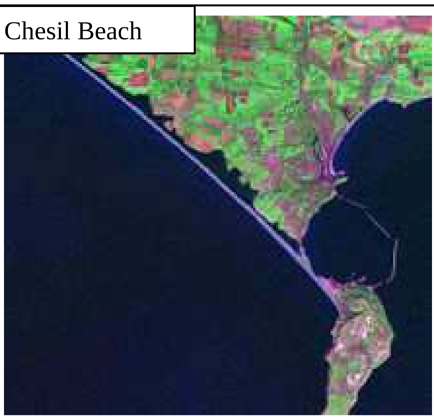
FEATURES OF LONGSHORE DRIFT AND DEPOSITION

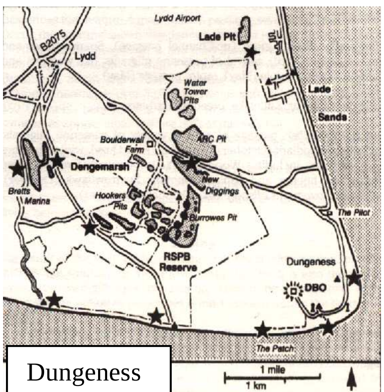
- Longshore drift will move beach material along the coast until a bay or estuary is reached
- The beach material will build out to form a spit or a bar if it reaches the other side
- In the calm water to the rear of the spit fine silt and clay are deposited forming a salt marsh
- A bar will enclose a salt water lagoon in which a salt marsh may also form
- When a beach builds out to join an island to the mainland a tombolo such as Chesil Beach forms
- Longshore drift in 2 directions will form a cuspate foreland such as Dungeness on the south coast

Spurn Head/Point



Chesil Beach





Dungeness

Use the information on this page to write a description and explanation of beaches formed by longshore drift:

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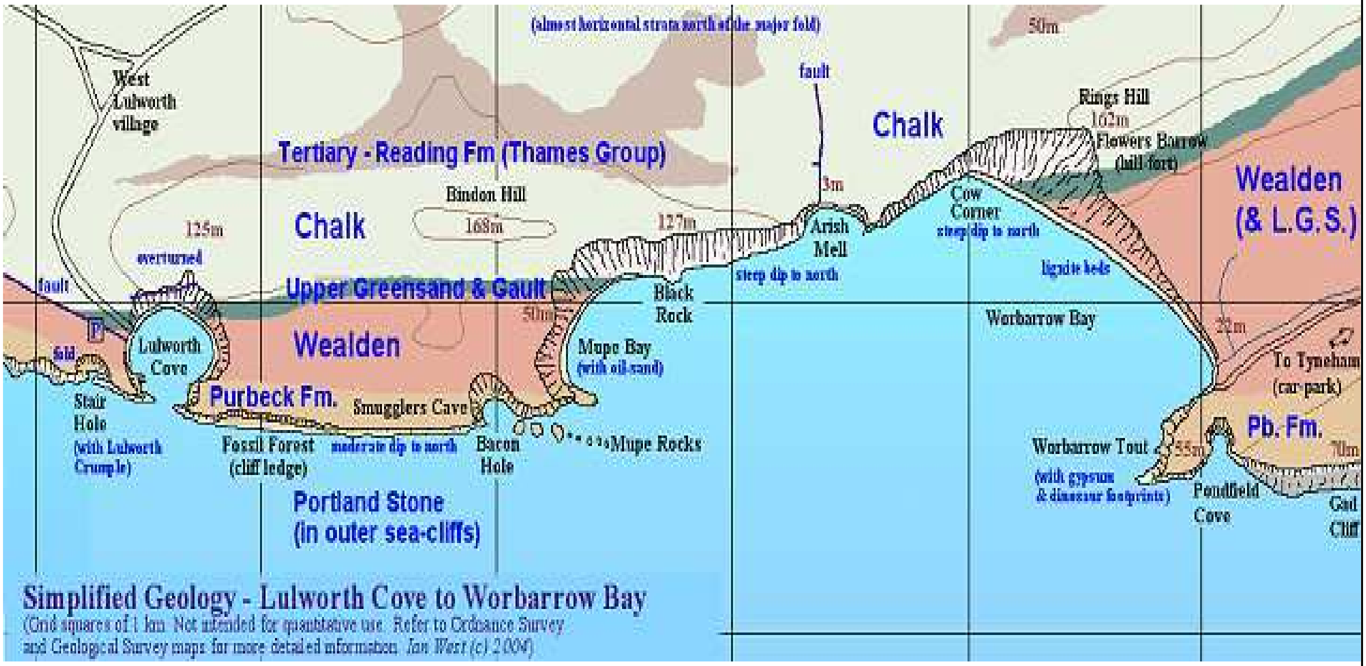
COASTAL SYSTEMS

CONCORDANT COASTLINE

- A Concordant coastline is found where the rocks and relief trend parallel to the coast
- A weakness in the outer band of hard rock may be eroded to form a small inlet
- Once the waves erode through to the softer rocks to the rear a cove with a narrow entrance is seen
- Further erosion leads to the formation of a large bay backed by cliffs of a resistant rock like chalk
- Stacks and stumps may mark the original position of the outer band of hard or resistant rock
- The Dorset coast around Lulworth Cove and Mupe and Warbarrow Bays illustrates this well



Use the information on this page to write a description and explanation of a Concordant coastline:

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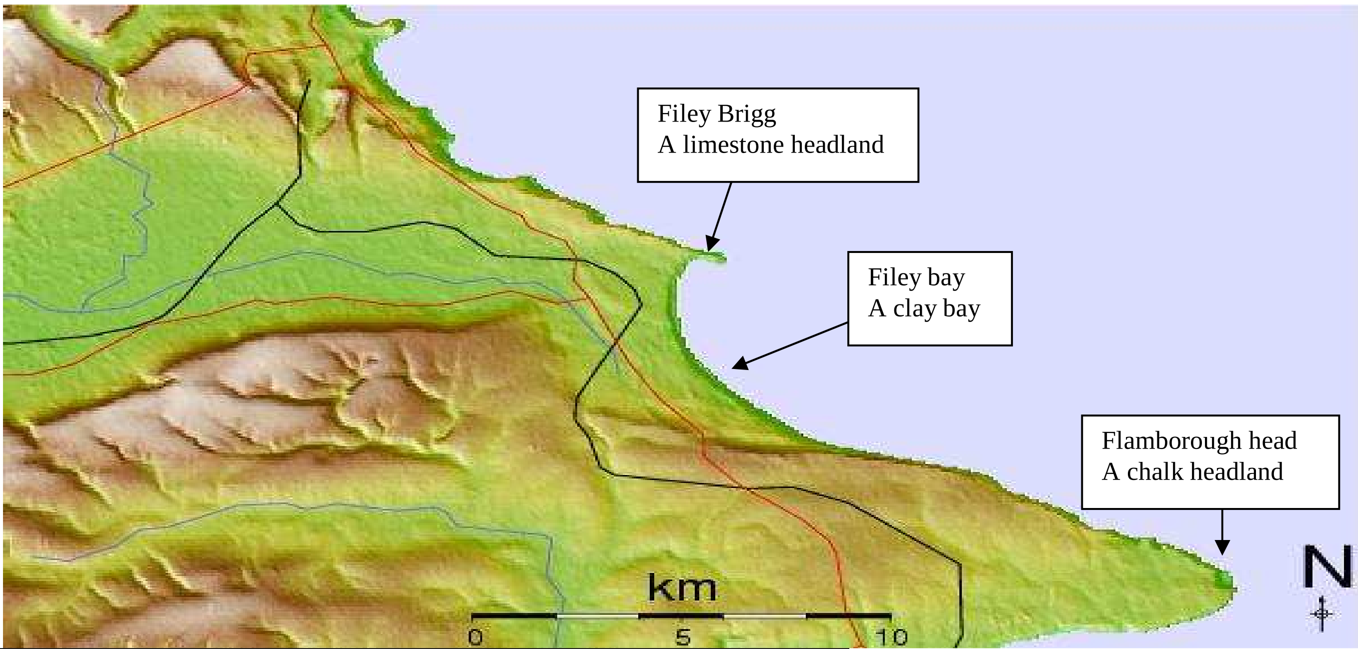
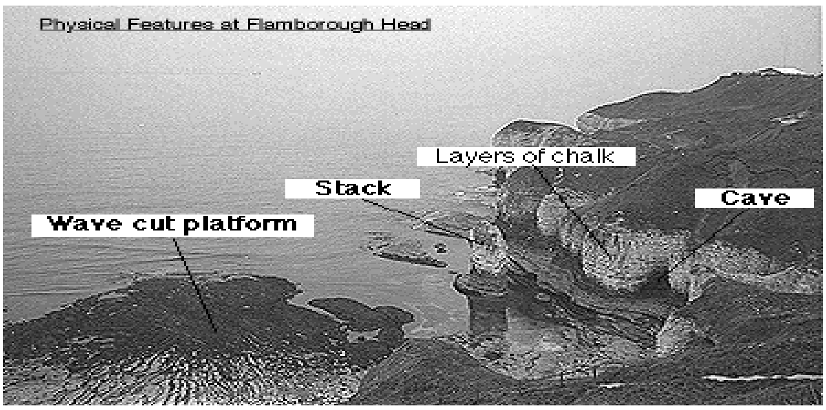
COASTAL SYSTEMS

DISCORDANT COASTLINE

- A Discordant coastline is found where the rocks and relief trend at right angles to the coast
- The resistant rocks are not eroded a great deal and form a headland
- Less resistant rocks are more easily eroded to form bays
- The Yorkshire coast at Flamborough and Filey has headlands of chalk and limestone
- A beach forms in Filey bay eroded in softer clay between the two headlands
- Waves form cliffs, caves, arches and stacks on the headland, but deposition occurs in the bay





Use the information on this page to write a description and explanation of a Discordant coastline:

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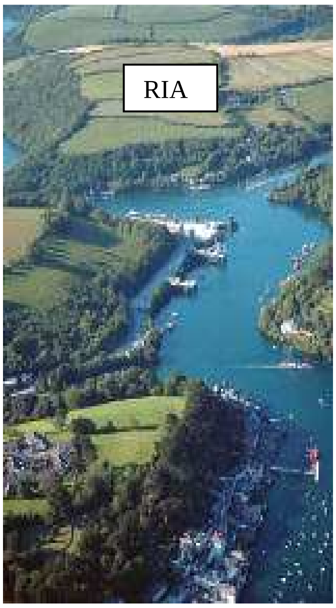
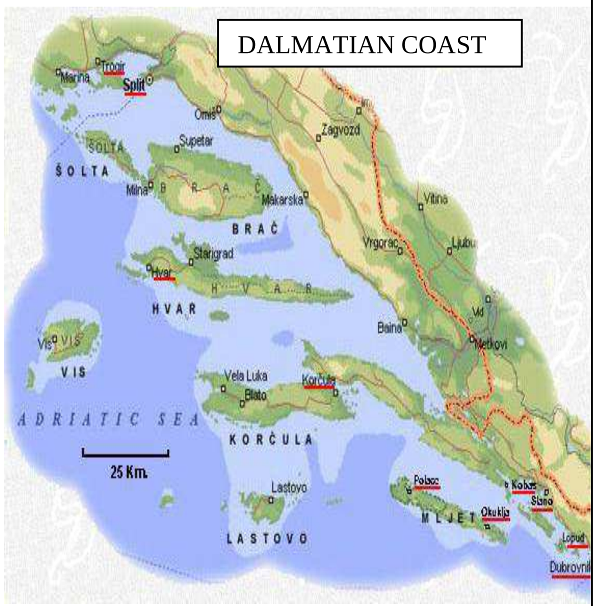
COASTAL SYSTEMS

CHANGING SEA LEVEL : SUBMERGENCE

- Emergent Coastlines are caused by a relative rise in sea level
- This could be due to a rise in the actual sea level or a fall in the level of the land
- The main effect of submergence is to flood the lowland areas adjacent to the coast
- A drowned upland river valley is a Ria or Atlantic coast and a drowned flood plain is an estuary
- Submergence of a coast where hills trend parallel gives a Dalmatian coast of long, narrow islands
- A submerged steep-sided glacial valley gives a straight deep inlet called a fjord or fiord





Use the information on this page to write a description and explanation of the features of submergence:

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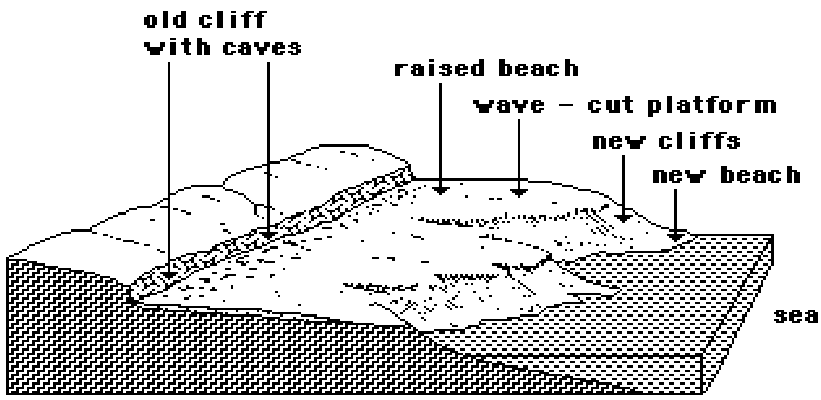
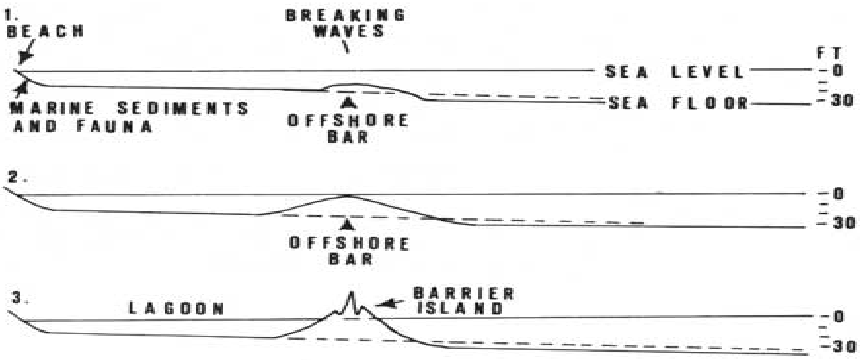
COASTAL SYSTEMS

CHANGING SEA LEVEL : EMERGENCE

- Emergent coastlines are caused by a relative fall in sea level
- This could be the sea level actually falling or a rise in the level of the land
- The most obvious feature is a raised beach that indicates the old sea level
- The raised beach may have old beach sediments on it and there may be a raised cliff line
- Emergent coastlines may also have gently sloping coastal plains such as the Carolinas in the USA
- Gently sloping coastlines may cause the formation of offshore bars like Cape Hatteras in the USA





Use the information on this page to write about the formation of raised beaches and offshore bars

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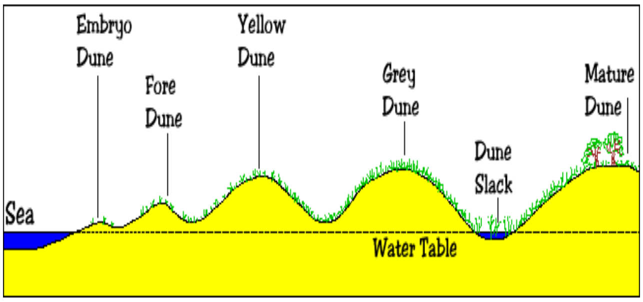
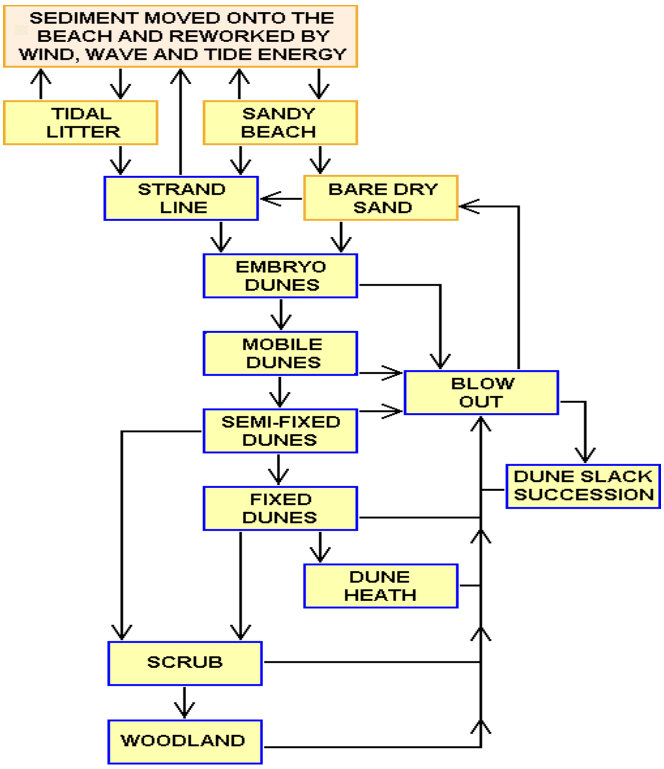
COASTAL SYSTEMS

SAND DUNES

- Sand dunes are an example of a coastal ecosystem, where plants interact with a special environment
- The sand is blown by saltation to the back of the beach at low tide to form embryo dunes
- In time the amount and diversity of vegetation increases in a succession from front to back of the dunes
- During this succession the first pioneer plants like marram grass need to survive dry, harsh conditions
- Later as a soil develops ground cover and plant diversity (biodiversity) increase
- At the back of the dunes and at the end of the succession a deciduous woodland will have developed





Use the information on this page to describe and explain the formation and changes that occur in a sand dune succession:

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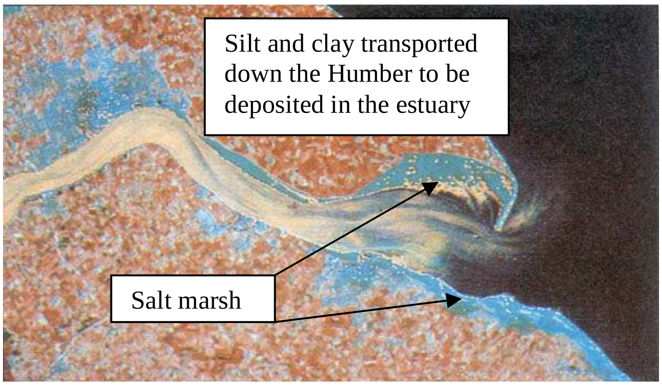
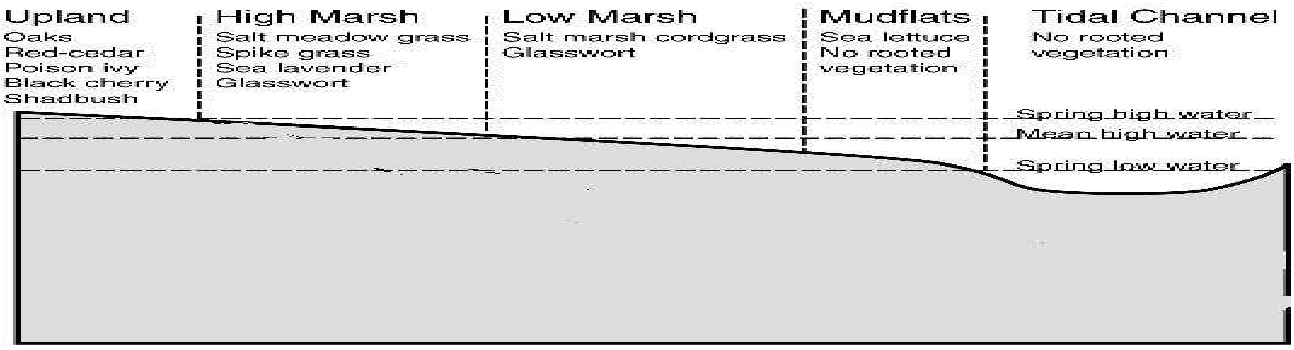
COASTAL SYSTEMS

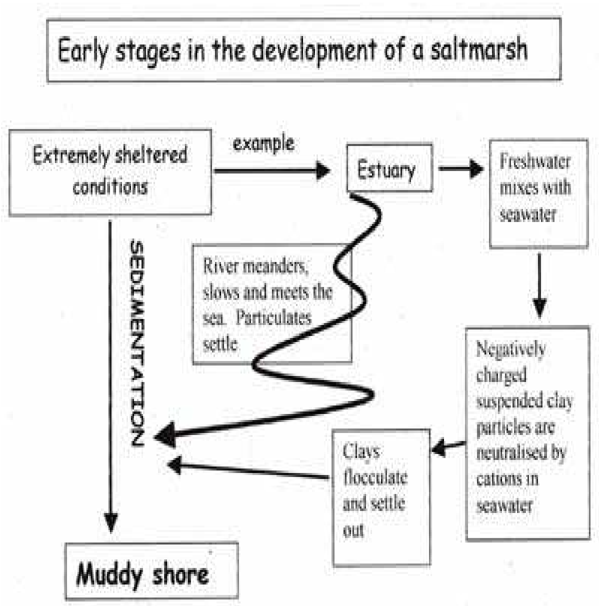
SALT MARSH

- A salt marsh is an example of a coastal ecosystem, where plants interact with a special environment
- Fine silt and clay carried to the coast by suspension will settle in the calm water in an estuary or delta
- The mudflats are colonised by salt tolerating plants called halophytes such as Spartina and Salicornia
- These plants aid the sedimentation of silt and flocculation causes clay particles to settle
- In time, as sediment builds up, the salt marsh has greater plant cover/diversity and its level is raised
- Eventually it is raised above the level of all but the very highest tides and a deciduous woodland forms



IDEALISED CROSS SECTION OF A MARSH TO SHOW SUCCESSION





Use the information on this page to describe and explain the formation and changes that occur in a salt marsh succession:

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