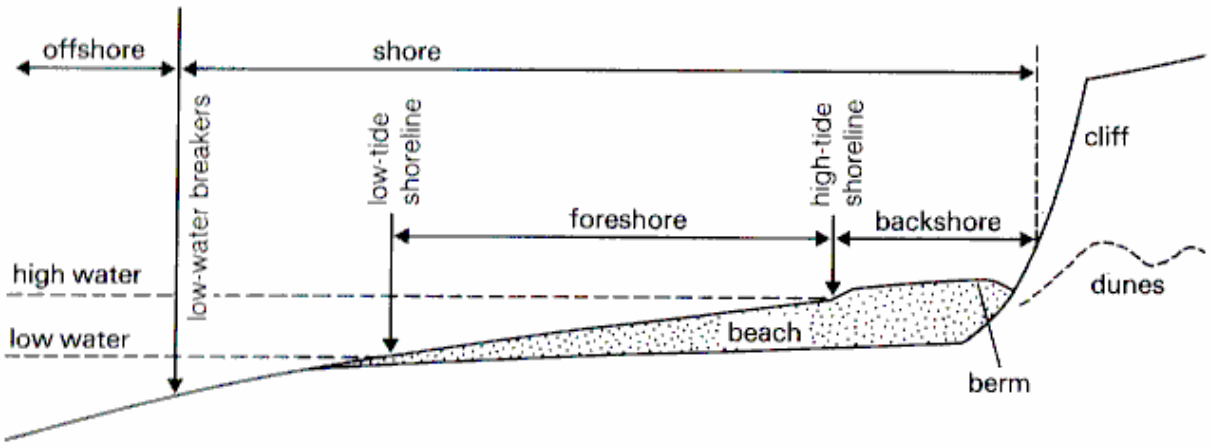
AS Geography 1.3 Coastal Environments *Student Notes*

The coast is a narrow overlap zone between the land and the sea. The sea is the main source of energy in the coastal system and the land is the main source of rock material and sediments from river processes, glacial processes, and slope processes (including weathering and mass movements). Waves and tides are used to divide the coast into distinctive zones. Examples in these notes are taken from a range of locations, particularly the North Devon and the Dorset coasts.

The zonation of the coast

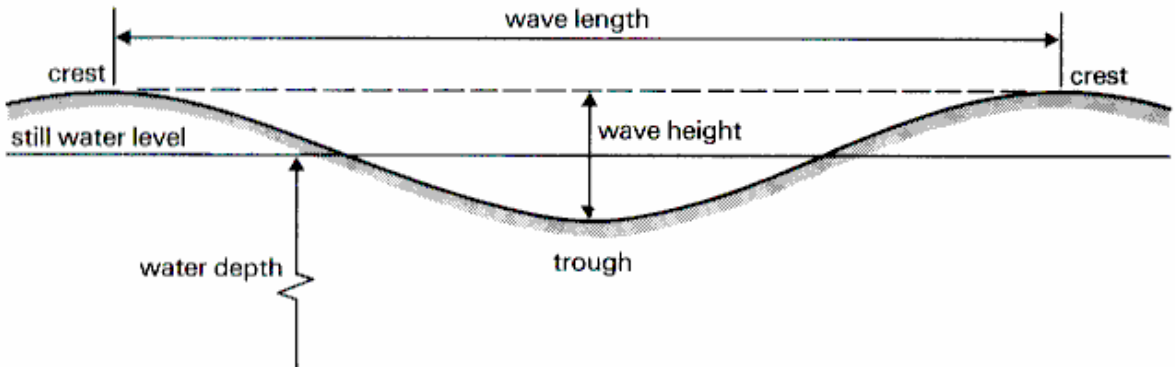


The energy source for most coastal erosion and transportation is from waves and to a much lesser extent, tides.

Waves.

Wind blowing across a smooth water surface wills experience some friction with the surface. This creates small pressure differences and eddies which instigate small ripples.

Basic terms used in the description of waves

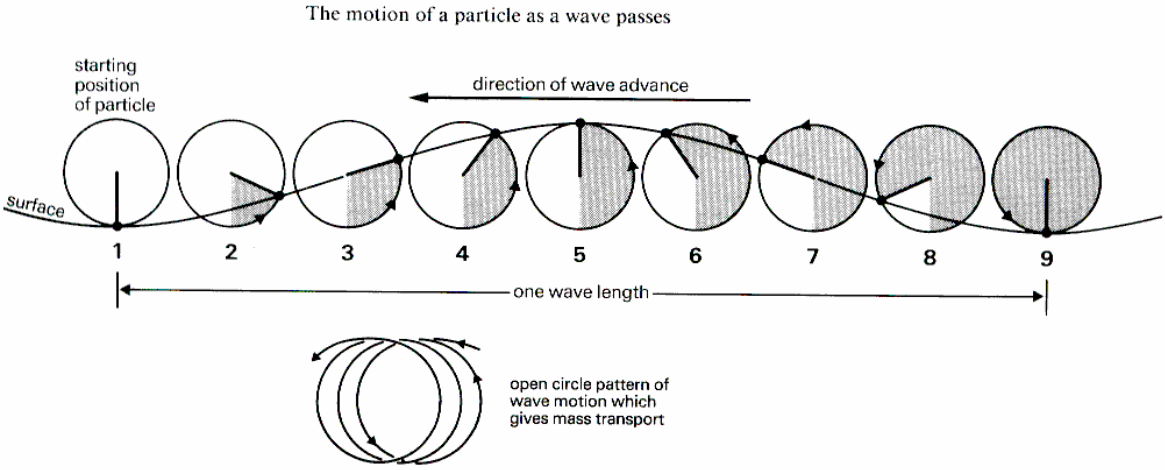


As the wind continues to blow the ripples grow into waves. A wind blowing at 50km/h for 30 hours will generate waves with a height of about 6m.

Fetch. The potential distance of open water over which a wave can travel is called its fetch. The largest waves occur where the fetch is at its greatest, for example at Hartland Quay in North Devon where the fetch is over 2,800 km whereas the Norfolk coast has a fetch of less than 200km.On both the North Devon and the Dorset coast, the fetch varies considerably depending on the orientation of the coast.

Swell Waves and Sea Waves. Waves can exist where there is little or no wind. These have been generated elsewhere and have travelled away from their place of origin. These are lower, flatter waves called swell waves. Sea waves, which are usually steeper, are generated by local storms.

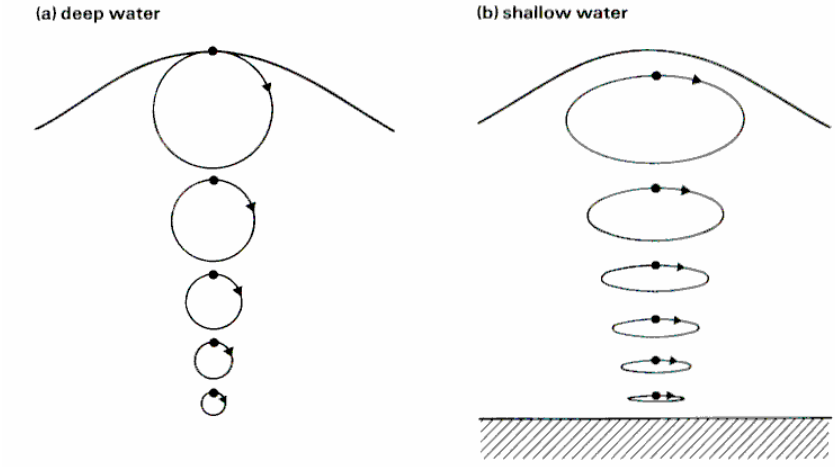
The Motion of Waves. Objects that float in water describe a circular motion as a wave passes. This demonstrates how, although the wave may move thousands of miles, transmitting its energy, the water particles do not move far. In reality, there is some forward motion called *mass transport*, but it is very small in relation to the velocity and movement of the wave.



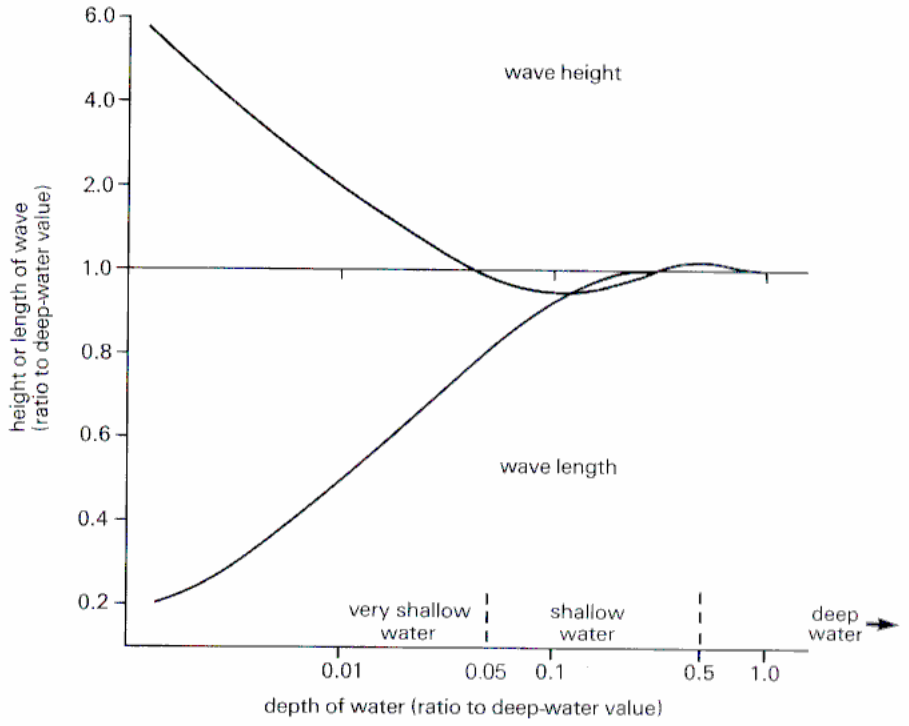
The Wave Period. This is the time taken for successive wave crests to pass a fixed point. Local waves will usually have a period of 5-8 seconds. Swell waves may have periods of up to 20 seconds.

Wave Energy. This is partly **potential energy**, resulting from the height of the wave and partly **kinetic energy** caused by the wave's movement.

Waves in Shallow Water. The circular motion of water as a wave passes decreases with depth. Below a depth equivalent to one wavelength, there is very little motion. As the depth falls below half a wavelength, friction with the seabed slows down the wave and changes its characteristics. The circular motion become elliptical and its lower path slows down, wavelength decreases and wave height increases, increasing the steepness of the wave. This is a process of **wave refraction**. Waves appear to catch one another up. Beyond a gradient in 1 in 7, the wave crest loses its stability and topples forward: the wave breaks.



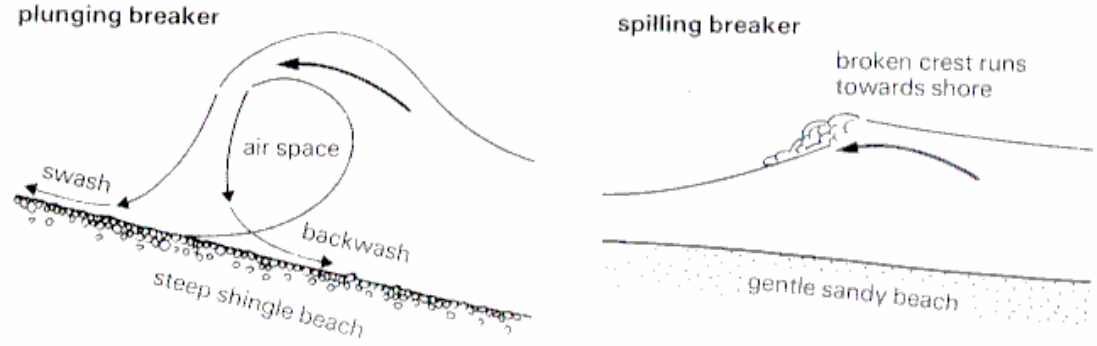
Changes in the dimensions of waves entering shallow water.



Breaking waves. As the wave breaks, the water rushes forward translating the potential energy of the wave into kinetic energy. Waves break in a number of ways. In ***Plunging breakers*** the crest rolls forward and downward, temporarily enclosing an air space. Such waves are common on steep shingle beaches when waves are slow moving. The ***swash***, or up-beach component is less important than the ***backwash*** or down-beach component. Such waves are often classified as **destructive waves** as sediments may be moved from the foreshore. Destructive waves dominate the coast at Warren Bay at Hartland Quay in North Devon.

In ***spilling breakers***, the ***swash*** is directed up the beach so it will be stronger than the ***backwash***. Such waves are sometimes classified as **constructive waves**. Constructive waves dominate in more sheltered locations such as Swanage Bay in Dorset.

Plunging and spilling breakers



Tides.

Tides are oscillations in the sea surface caused by the gravitational pull of the moon and sun. In the UK there are two high tides every 12 hours 25 minutes. Spring tides occur when the moon and sun are in line and are the highest and lowest tides (they occur just after the new moon and the full moon). Neap tides occur when sun and moon are at right angles and display a small range (they occur just after each first and third quarter moon). The tidal range can vary spatially. Britain has particularly high tides (we have a macrotidal coast). The impact of tides can be accentuated by

changes in atmospheric pressure and wind direction. Under low pressure, there will be a small rise in sea level (a surge). Wind can also accentuate the height of the tide.

Tides can lead to strong currents, which can scour and remove or redeposit sediments in estuaries or other tidal environments. Tides can also increase the effectiveness of wave processes. Most coastal erosion, for example, takes place at high tide when waves can easily reach the base of cliffs.