**Coastal geomorphology**

* **A coast is a zone where the land and sea over lap and interact.**
* **A coast can either be gentle or steep, sandy or rocky.**
* **A coast is a zone of contact between the water body and the mainland.**
* **A coast is also a large mass of main land surrounding the sea.**
* **In east Africa, coasts are along the lakes and along the Indian Ocean.**

**Waves**

* **These are defined as oscillations/ripples/disturbances on the surface of the water caused by winds blowing across it vibrations from moving water vesselstectonic processes among others.**
* **When the wind blows over the water, there is friction between the water and the wind. Energy is transferred from the wind to the water and forms the wave which normally moves along in the direction of the wind.**
* **Waves can also be generated by tectonics movements such earth quakes that move under the sea, large whales, submarines, volcanic eruptions etc.**
* **Waves are the chief agents of marine erosion, transportation and deposition along the coast.**
* **Each wave has a swash and back wash effect.**
* **The forward movement of a wave is known as the swash and it is usually more powerful when the wave breaks and retreats and then the back wash is formed.**
* **Waves can be constructive or destructive.**
* **Constructive waves are ripples /disturbances that are characterized by a strong swash force(forward carrying force of a wave) and a weak back wash force.**
* **Constructive waves are more depositional and thus tend to accumulate materials at the coast (aggraded) to form wave depositional landforms.**
* **Waves which are constructive lead to deposition and its associated Landforms**
* **. Waves can also be destructive leading to erosion and its associated landforms or features.**
* **Destructive waves are oscillations that are associated with a strong back wash force and a weak swash force**
* **.destructive waves are more erosional than depositional hence scrap(degrade)the coast leading to marine erosional land forms**
* **Marine erosion refers to the mechanism by which the destructive waves through their processes scrap, scour ,detach materials from the coast leading to its modification to form various land forms**

**Landforms resulting from wave erosion or formed by wave erosion.**

* **Waves are very effective agents of erosion and wave erosion occurs through the following processes;**
* **Hydraulic action, Abrasion, Attrition, Solution**
* **Hydraulic action. This refers to the process by which a water wave uses its powerful action (force) to compress air into the coastal rock joints leading to their break down.**
* **When a wave hits for cliff at the coast with great force, it compresses the air in the joints and cracks in the Cliff. When the wave retreats, this pressure is released**

**Explosively.**

* **When this pressure release action is repeated, the rock is stressed, cracks are then enlarged and pieces begin to fall off the cliff.**
* **Abrasion .This refers to the process by which materials carried by a destructive wave are used as a grinding tool to scrap , detach rock particles from the coast.**
* **It occurs when the rock particles that have been broken off by hydraulic action are thrown by the waves at the cliff. They erode it at the base leading to undercutting of the cliff.**

**Attrition This refers to the process by which eroded materials tend to collide thus reducing in size to be easily carried by a moving wave**

* **It occurs when the rock fragments and pebbles are knocked against each other in the water and become smaller and more easily removed.**

**Solution. This refers to the process by which a destructive wave uses its solvent action to dissolve mineral components(soluble components) in the coastal rocks that are carried away in solution form.**

* **It occurs in soluble rocks such as limestone is dissolved and washed away. However, no visible rock fragments are left.**
* **All these processes together produce landforms which include cliffs, caves, good etc. as explained below.**

**A Cliff**

* **It's a steep slope or rock face along the sea or coast**
* **It stands prominently above high tides**

**.**

* **It might be 400m in height or quite below.**
* **Cliffs may either be vertical or slanting.**
* **The formation of cliffs depends on the nature of rocks, their stratification and jointedness, their resistance to erosion and their homogeneity or heterogeneity**
* **n. Cliffs are formed by destructive waves that attack a gently sloping land towards the sea or lake resulting into the formation of notches.**
* **These notches or cuts are created by waves through the processes of wave erosion like hydraulic action or abrasion.**
* **. continuous wave erosion, results into the collapse and retreat of gently sloping**

**Rock leaving behind a steep rock surface along the sea or lake.**

**Best examples of cliffs in east Africa include fort Jesus near Mombasa, port Garaza at kasenyi on the shores of Lake Victoria.**

**Illustration**

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**Wave cut platforms.**

* **This refers to a gently sloping bench like rock sloping seaward formed at the base of the Cliff.**
* **They form between low and high water tides**
* **. It's formed as a result of continuous destructive wave attack on the cliff.**
* **This results into development of a notch at the base of a cliff which enlarges further.**
* **Continuous action of waves enlarge the notch causing gradual undermining of the cliff**
* **These waves force the cliff to collapse and slowly retreat. This results into the creation of wave cut benches through the grinding action of materials swept back and forth by the breaking waves.**
* **These benches are finally enlarged into gently sloping platforms at the base of a cliff called wave cut platforms**
* **e.g. at Tiwi beech in Kenya and the oceanic hotel at Mombasa was built on wave cut platforms**

**illustration**

**Bays**

* **.a bay refers to an area of the water body projecting into the adjacent land**
* **A bay is formed as a result of wave erosion ,as destructive waves attack the coast made up of alternating hard and soft rocks.**
* **Destructive waves through processes of attrition, hydraulic action, solution among others attack the coast eroding soft rocks causing extension of the sea into the adjacent land forming a bay.**
* **Best examples can be found at Sango bay, Murchison bay, the Napoleon Gulf on Lake Victoria and Watamu and Malindi bays in Kenya.**
* **A larger bay is referred to as a gulf for example napoleon gulf at masese fish landing site on the shores of lake victoria**

**Illustration**

**Headland .This refers to a large extended piece of land projecting into the water body**

* **A head land is formed when destructive waves attack the coast progressively by solution, abrasion, hydraulic action among others.**
* **Coast made up of alternating hard and soft rocks, waves erode the softer rocks existing side by side of hard rock.**
* **When the softer rocks are removed the remnant extended piece of land is formed known as a headland.**
* **Head land is also referred to as a natural pier/peninsular**
* **A peninsular is an elongated headland**
* **Examples of head lands include Entebbe peninsular, buwanga and nakasunda head land along kasenyi fish landing site, numerous headlands in Mombasa**

**Illustration**

**Caves**

* **Caves are holes or Cylindrical tunnels that are dug into the coast/cliff.**
* **They develop from waves that enlarge an initial line of weakness in the rock especially along joints, and bedding plains.**
* **The breaking waves through the processes of abrasion and hydraulic action compress the air in the crevices, joints and holes within the cliff face.**
* **When the water retreats, the air expands rapidly.**
* **This expansion and compression loosens the rocks and enlarges the cracks which later results into the formation of cylindrical tunnels called caves.**
* **For example numerous caves are found at kasenyi fish landing site, Entebbe peninsular .among others**

**Illustration**

**A blow hole/ gloup. This refers to a vertical shaft that connects the roof of a cave to the cliff top**.

It is formed when continuous destructive waves attack the former cave enlarging it vertically to form a shaft (out let) that protrudes on to the cliff top

* Destructive waves through processes of abrasion ,hydraulic action, solution among others erode aggressively the softer rocks in the cave hence prolong it to form a vertical shaft connecting the roof of a cave to the cliff top
* This is referred to as the blow hole/gloup for example numerous blow holes at kasenyi fish landing site, Entebbe peninsular ,along the indented coastline of mombasa

Illustration

**A geo. Th**i**s refers to a narrow steep sided inlet that projects into the coast/ cliff.**

* A geo formed when destructive waves through their processes of Abrasion ,attrition ,solution continuously attack the blow hole leading to its eventual collapse
* The collapse of the blow hole results into the formation of a narrow steep sided in let extending into the coast known as a geo
* Examples of geos are found along malindi , kilindini harbor in Kenya along the Indian ocean

**Illustration**

**Arch**

* An arch is a bridge like feature found above the cave.
* It's formed when a cave is curved into the side of the headlands or where the caves develop on either side if a headland and they alternately join
* Caves develop as a result of continuous destructive attacks of waves on either sides of headland.
* These caves developing from either sides meet forming a bridge like feature on top of a headland called an Arch.
* Arch are evident at Entebbe peninsular, vasco dagama pillar in malindi

**Illustration**

**Stack. Ths refers to isolated rock pillar that is completely detached from the mainland.**

**A stack is formed when continuous wave erosion through processes of abrasion, attrition and hydraulic action attack the arch.**

**Continuous wave erosion results into total collapse/coalesce of the arch forming an isolated rock pillar known as a stack**

**Examples of stacks are found at kasenyi fish landing site ,at Mombasa, dar-es-salaam**

**Illustration**

**Stumps .These refer to residual rock pillars. they are also referred to as reduced stacks**

* They are formed as a result of continuous wave erosion through processes of abrasion , attrition, solution along the already formed stack.
* This results into reduction of the size of the stack thus forming a stump.
* St**umps** are visible during low tides .Various stumps are found at kasenyi fish landing site, masese fish landing site on the shores of lake Victoria in Uganda, numerous stumps at the coast of east Africa in Mombasa dar-es-salaam

**Illustration**