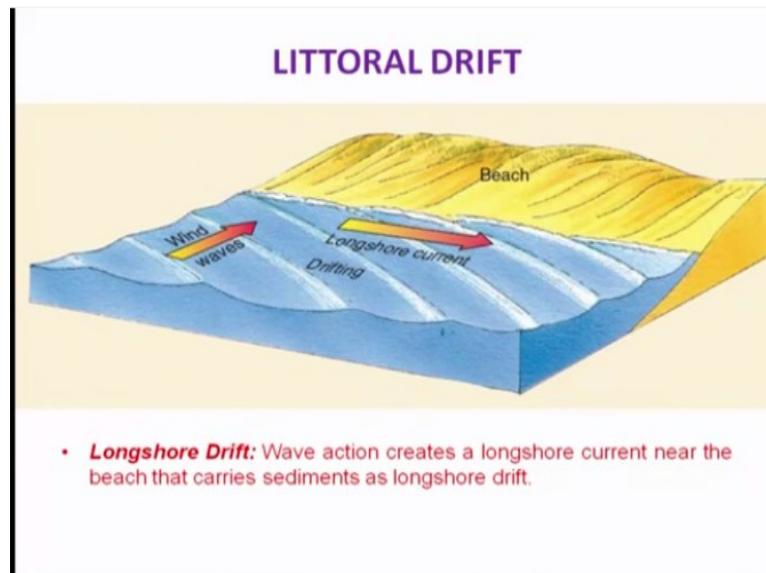


Geomorphic Processes: Landforms and Landscapes
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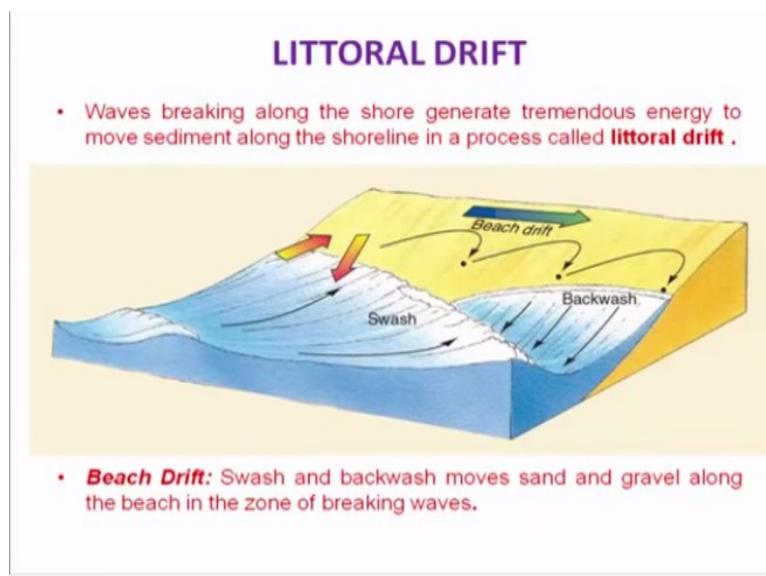
Lecture – 32
Coastal Processes and Landforms (Part II)

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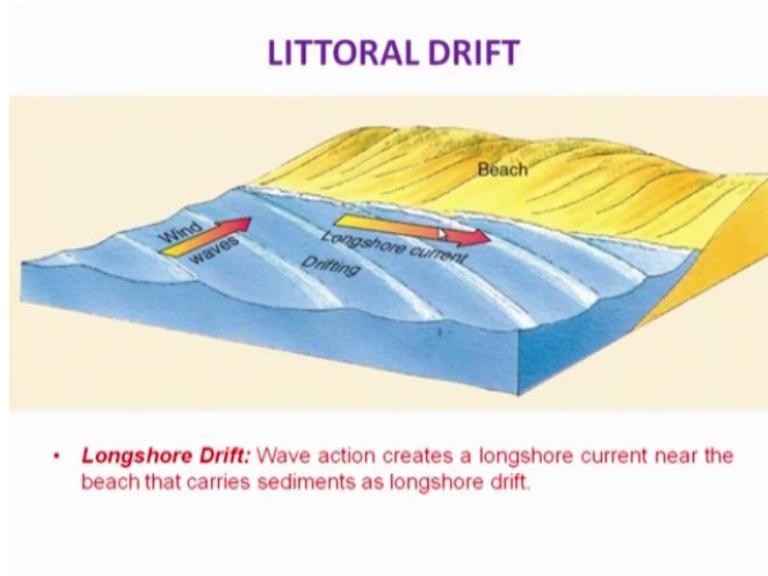
So, welcome back, so more on the lateral drift, so again the based on the configuration of the coastal region and the wave action, this is what we term as an long shore drift. So, here the wave action creates a long shore current near the beach that carries the sediments as long drift.

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So, we have seen in the previous one, this is your beach drift where you have the swash and the backwash.

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Whereas, in the long drift you have the currents which carries the sediments as long shore drift along the beach.

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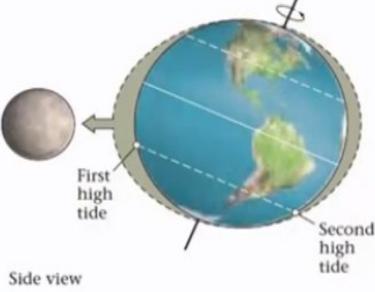
And the third one is your, the littoral drift where the beach; where beach and the long shore drift carries and move sediments parallel to the shore similar to what you were looking at the long shore drift and this process will result into extending the beach into the shallow waters of a bay area. So, this the beach drift and the long drift or the long shore drifts as we were looking at here, this is the beach drift and the long shore drift.

So, both of them are experienced in a region then they will result into the extension of the beach into the shallow water and such formation of the land form which will also result in the formation of an enclosed area which you can term as a bay area and this land form which will be an extending beach in shallow water is termed as spit. This is a combination of the beach and long shore drift that is what we are looking at the littoral drift.

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Factors affect the timing and magnitude of tides include:

- **Tilt of the Earth's axis:** the Earth-Moon system, a given point passes between a high part of one bulge during one part of the day, and through a lower part of the other bulge during another part of the day, so the **two high tides at the given point are not the same size**.
- **The Moon's orbit:** The moon progresses in its 28-day orbit around the Earth in the same direction as the Earth rotates. High tides arrive 50 minutes later each day because of the difference between the time it takes for Earth to spin on its axis, and the time it takes for the Moon to orbit the Earth.



Now, as we have been talking about that the waves will play an important role, so the factors affecting the timing and the magnitude of the waves, so we are having the magnitude in terms of the height of the tidal waves. So, mostly the tilt of the earth axis and the rotation of or you can say the moon's orbit will play an important role. So, what it says that the earth and the moon system; a given point passes between a high part of one bulge during one part of the day.

And through a lower part of the other bulge during another part of the day, so this is what has been shown here, so one part of the day in with respect to the bulge of the earth whereas, the second part of the day during the are the another portion of the bulge here. Now, this bulge is which have been shown here are not the same and the tides will be created when the moon passes through this region around the earth along the orbit.

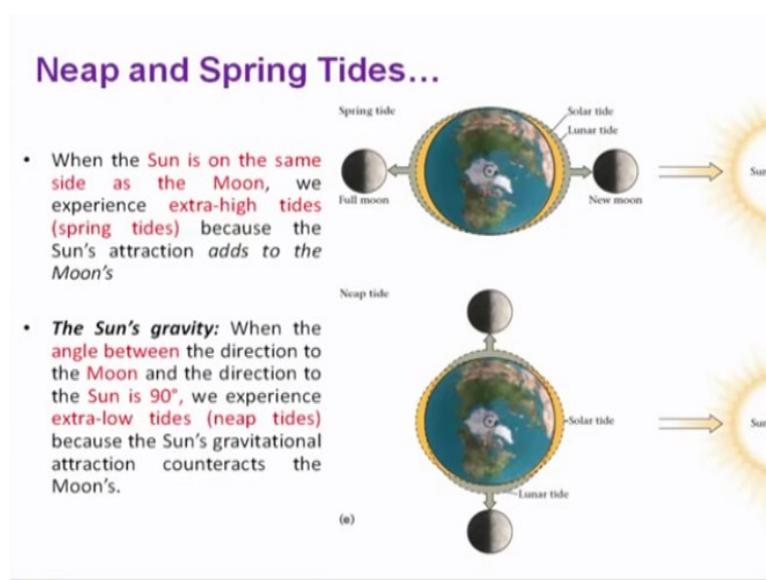
So, what happens is that when the high part of the one bulge and the lower part of the another bulge during the part that is the during the day, two high tides at a given point are not the same, so the height of the waves will vary, we need to keep in mind this part that wave heights are not the same at each and every location on the earth that is along the coastal lines.

So, the moon's orbit; the moon progresses in its 28th day orbit around the Earth in same direction as the Earth rotates, so the rotation is in the same direction, high tides arrives 50 minutes later each day because of the difference between the time it takes for earth to spin on its axis and the time it takes the moon to spin to the orbit or to orbit the Sun actually, so the time difference of the rotation or the movement will affect the entire arrival of the waves, the high tide basically.

So, these are the 2 important factors which will affect the tidal height and timing, so the timing and the magnitude will be affected because one is the tilt that is with the tilt of the earth axis and the rotation and its relation with the rotation of the moon and its orbit, so when the moon's orbit again will affect, so the moon progresses in its 28th day orbit around the Earth in same direction as the Earth rotates.

High tides arrives 50 minutes later each day because of; this is because of the difference between the time it takes for earth to spin on its axis, so the earth spin on its axis and the time it takes for the moon to orbit the Earth.

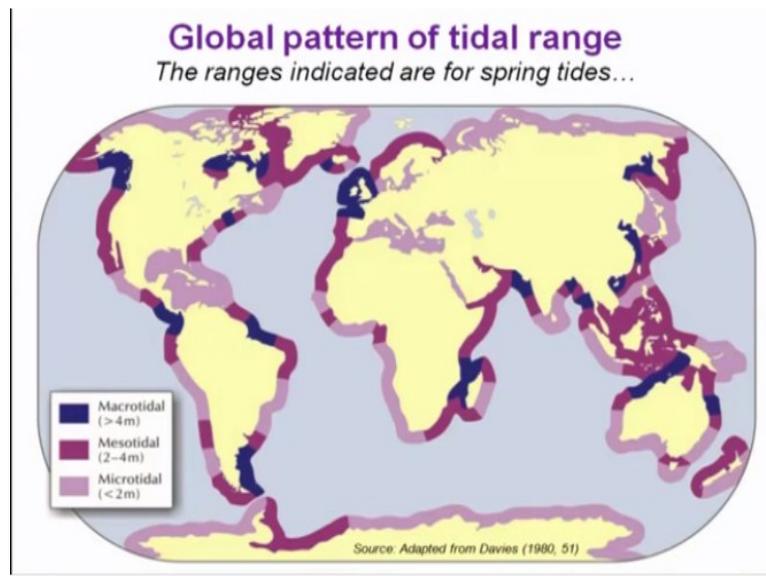
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Now, another because of this combination and because of the location of the Sun and the moon, what we see is the extreme tides and this are termed as spring tides and neap tides. So, when the Sun is on the same side as the moon, so if you are having the Sun and the Moon are on the same side, when the Sun is on the same side of the Moon, we experience extra-large tides.

So, these tides that we experience are because the Sun's attraction adds to the Moon's and this is termed as a spring tide and this Sun gravity is another factor when the angle between the direction of the Moon and the direction of the Sun is 90 degrees, so if the direction is like; the angle is almost 90 degrees, then we say that at this point and the relation between these two will result into the neap tide.

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And this is because of the gravitational attraction counteracts the Moon's, so these are few things or the parameters which are; which plays an important role in generating the global pattern of tidal ranges. So, different location depending on the relation between the location of the Sun and Moon as well as the and with respect to the Earth and the configuration or the location of the oceans and the configuration of the coastline what we see is different tidal levels.

So, here the tidal range indicates are the spring tides, so you have the blue ones; the blue patches are being shown are the macro tidal ranges or the spring tides, it is greater than 4 meters of height, meso tidal is 2 to 4 meter and micro tidal less than 2 meters.

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Coastal Process & associated landforms

- Coastal landforms depends on
 1. Coastal erosions
 2. Transportation
 3. Deposition
- Coastal Erosion: dependant on dimension of the waves, configuration (shape) of the shoreline, strength of the waves erode, angle at which it meets the shoreline.
- Depending on the above parameters following landforms can form,
- Headlands, sea-cliffs, natural bridges, sea stacks, tambolo.

Coastal process and associated landforms; so coastal landforms depends on the coastal erosion, transportation of the sediments eroded, deposition, coastal erosion dependent on dimension of the waves, configuration of the or the shape of the shoreline, strength of the wave eroded an angle at which it meets the shoreline, so this is what we were talking about that the coastal configuration is extremely important.

Depending on the above parameters, following landforms can be seen; headlands, sea cliffs, natural bridges, sea stacks and tombolo.

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Coastal Landforms...

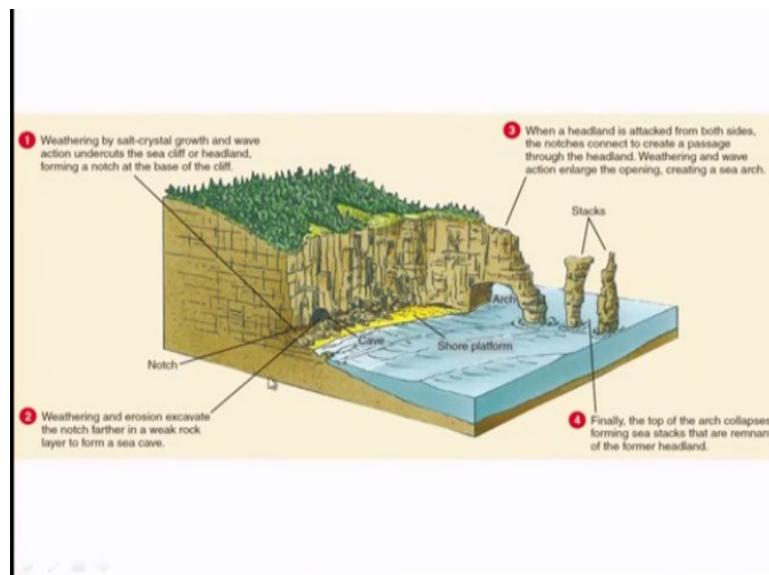
Erosional Coastal Landforms

- | | |
|----------------------|---------------------------|
| 1. Sea Cliffs | 2. Shore Platform |
| 3. Notch | 4. Sea Arch |
| 5. Cave | 6. Marine terraces |
| 7. Stacks | 8. Wave-cut Bench |

So, let us see a few examples of the erosional coastal landforms, what we have a sea cliff and second is shore platform, notches and sea arch, caves and marine terraces, stacks and wave-cut benches, so these are few examples of erosional coastal landforms and as we discussed in

the previous slide that these all landforms are again dependent on the wave action and then configuration of the coastal areas.

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So, this shows the example of the; these are the sea cliffs because of the erosion again, this is an erosional land form, caves are also in erosion landforms and the sea notches are also the erosion landforms and stakes which are isolated, so if you see one by one, so what you have here is the; this part, these are the weathering by salt crystals growth and wave action undercuts the sea cliffs or headlands forming notches.

So, these are the typical sea notches and such notches are can also be formed because of the wave action, this we will see in the next coming slides and then second is the weathering an erosion excavate the notches furthest in a weak rocks to form sea caves, so on the Earth's surface or the land area not yet if we are talking about the this dissolution activity, then such caves are been seen mostly in the limestone areas.

But in the coastal region also, we see the solution activity and the formation of caves inland or on the onshore side and that could be related to the weathering that is in dissolution activities or by the erosion close to the coastal regions and the third would we see the headlands, so headlands is attacked from both sides the notches connects and to create a passage and this passages are what we say is the sea arch's.

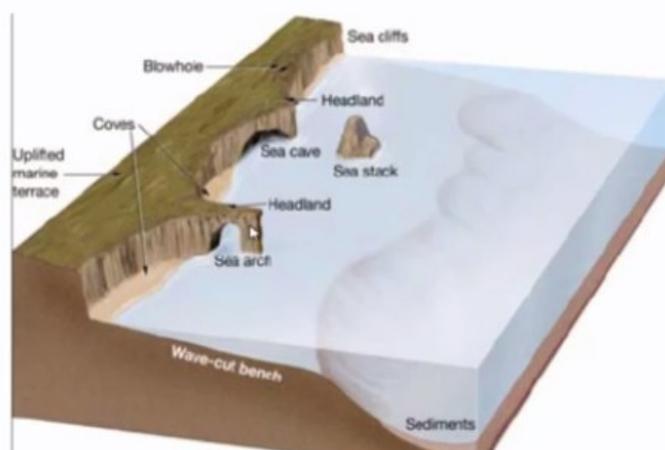
And stacks are again, the left outs so finally, the top of the arc collapses, so if this collapse this portion, then what you will see is the formation of the left out of this pillar like column like structure and this have been termed as sea stacks.

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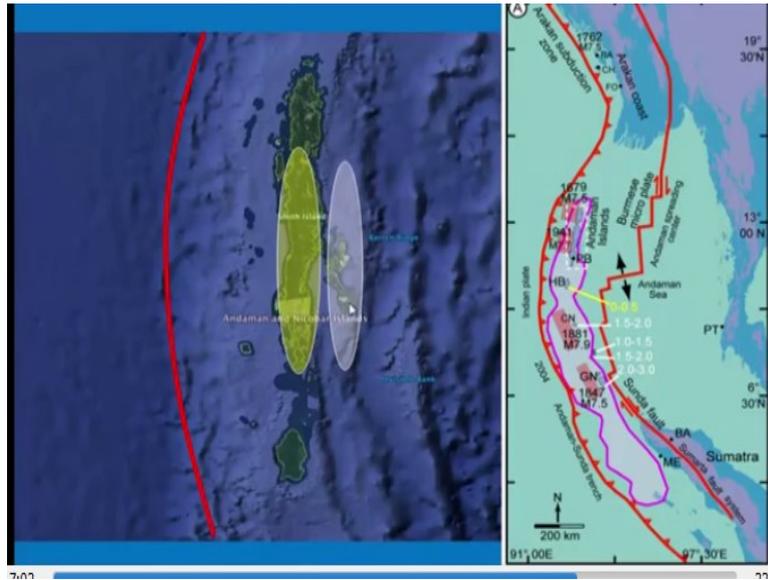
So, this is an example of sea cliffs and the sea stacks, so earlier probably there was an arc here, sea arc which is collapsed and resulted into the isolated columns which are standing in this form of stacks, so you have sea cliffs and these are all stacks.

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Again, the same sketch with showing multiple examples of arc, headlands, sea caves and sea stacks and cliffs.

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And this was because of the 2004 Sumatra Andaman earthquake, so coming to this part; this shows the trench and the location of Andaman Island and the deformation zone over here there is an Google picture, so this is the trench area and this portion what we see has been shown here, so you have the uplifted or the growing island here and then further another bunch of violence which are sitting away from this.

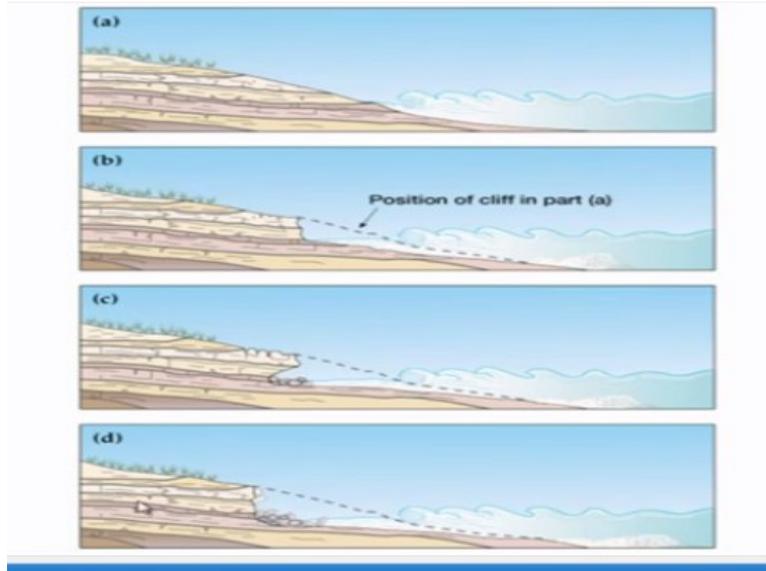
So, these both of them they got affected in a different pattern, so we will see the example from this 2.

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So, the sea notches in this region were the western portion, so what we saw here we will discuss quickly.

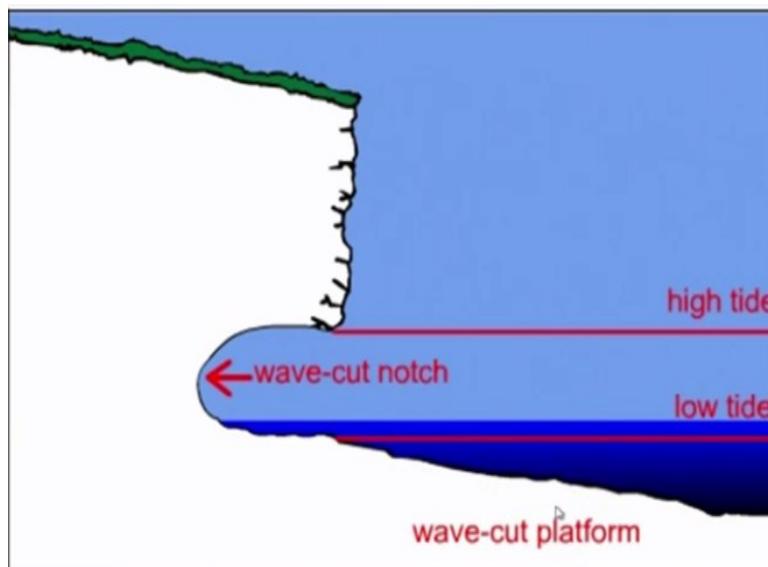
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So, this are the usually, the sea notches normally performed because of the erosion, so weathering as well as erosion and the coastal zones will result into the formation of sea notches, so the wave action which will come and meet the land part and if you are having the land area is rocky area, then you will have the erosion, so the cliffs will formed and that same cliff over the time will be eroded in a form of subsets arc which has been shown here.

And that will result into the formation of sea notches and of course, further erosion will also collapse the hanging part portion here, as it has been shown in this figure D and again the sea cliffs were formed and then further erosion will take place.

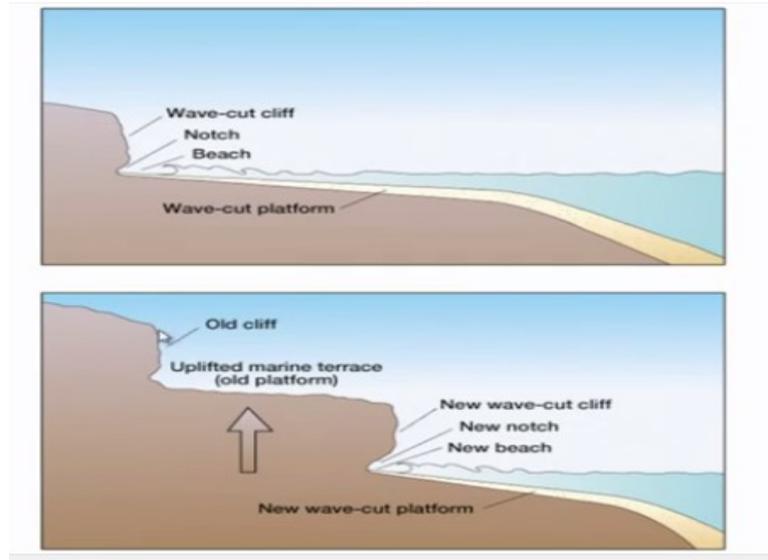
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So, what we have is the sea cliff here and the constant erosion of the by the wave where you can see this portion is your, the low water line or the low tide level and this portion of erosion

is the high water or high tide part, so high tide reaches up to this one and this remains the mean sea or the mean tidal level and this is low one, so it got the; the low tide keep on eroding this portion, high tide keep on eroding this portion.

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So, this arc shape or C is a form is formed because of the erosion and the bottom portion here what we see is termed as wave cut platforms. So, suppose such evidence of the cliff; the wave cut cliff, sea notch and has been seen in such a fashion where we have the one platform and we have the present platform here and we have one oldest cliff and the sea notch and the younger cliff and the sea notch.

So, this clearly indicates that this was the portion which experienced the paleo sea level or the ancient sea level was up to this place, so this is an older wave cut platform and presently wave cut platform is this one. So, this can also be correlated either with the tectonic uplift where the land has moved up and the sea level will remain the same or the sea level fall because of the eustatic sea or these variations or this eustatic sea level which has climatic conditions because of the fluctuating climate.

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So, this is one of the prominent landforms which are seen along the coastal zones now, this portion as I was talking about from Andaman, so this is the island; Neel Island which is located on the eastern side of the main Andaman and very beautiful island and (()) (20:58) I was talking about that if you go to Andaman or if get in chance to go to Andaman, I think it is one of the worth place to visit.

Because it has a wealth of information and textbook examples of the coastal landforms and also it preserves the history of the tectonic movement which has occurred along the Andaman Sumatra subduction zone, we will try to discuss this in detail in the next lecture and I try to wind up this one here and see you in the next lecture, thank you so much.