Photogeology in Terrain Evaluation (Part – 2)
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Lecture - 13
Photo Interpretations: Coastal and Fluvial Landforms - 1

Welcome back. So in the previous lecture, we discussed about that how we can identify the subsurface lithology or structures based on the surface morphology okay.

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Now let us see some examples of landforms which are either related to the coastal erosion or the Aeolian that is wind action and as well as the water action that is in fluvial landforms okay. So we have couple of satellite photographs or aerial photographs which are been taken at various point and by ours as well as by others so we will try to explain you based on that how we can identify the different landforms okay.

Now the first photograph which you see on this screen is from Andaman and this was taken from helicopter and if you try to see that this is an oblique photograph where you can see the horizon as well as the land okay. So I am not going to go into detail of that which we have already talked in the previous part at Photogeology 1. What do you see here actually this was taken after 2004 Sumatra-Andaman earthquake?

And this was along the west coast of Andaman, so the interesting part was that this area got uplifted. So it emerged during the earthquake or by the earthquake it was uplifted. So the

landforms what you see here as a geologists or scientists you will immediately pick up a very typical formation here and the sandstone bodies okay or maybe you can say these all sedimentary structures.

So what do you see here is very beautiful folds okay so you can easily make out this. Over here I will just put a line here so this goes like that, so you have a folded sequence here. Now if you look at here what you see the boundary is I am putting here. Now this is an area where the water is not inundating yet okay. This is a portion of the coral reef. This coral reef was emerged at the time of the earthquake okay.

And then third landform which you see here is this bright power portion okay which is encircling this small island. Now this is what we call is the beach. Now the point here was that usually the water comes up to somewhere over here during the high tide and then recede somewhere over here during the low tide but now the water has receded up to this point here that is what has been shown here.

So anyways these are the things which like land level change happened during 2004 earthquake but the landforms which you can demarcate from this are quite distinct okay.

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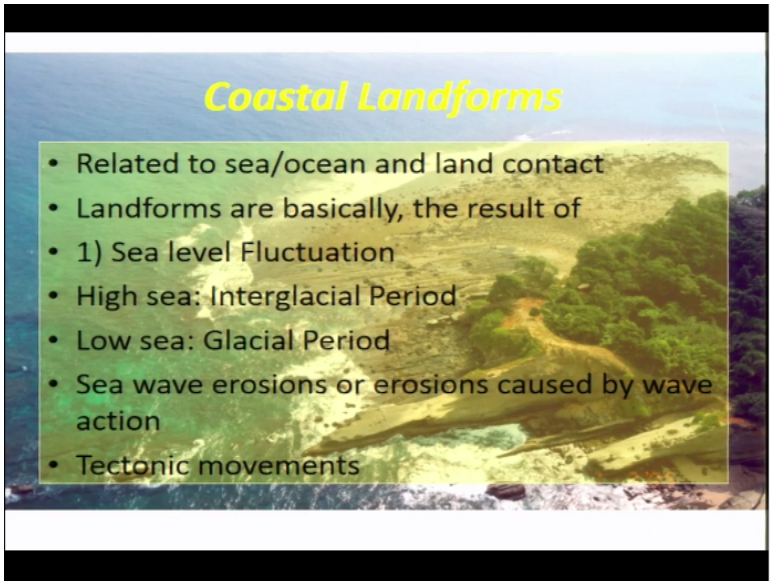

Now coastal landforms will talk in few slides about the coastal landforms. They are related to sea and land contact okay. So they are close to the sea and land contact or ocean or land contact you will see. Landforms are basically the result of one the sea level fluctuations

because if you say that the sea level has gone down then you will be able to see the land okay. If it has gone up, then you will see the submerged area okay.

Now they are been related to the high sea if we say that then it is an interglacial period okay. So we have lot of melting of ice and all that and then glaciers and then water is poured more into the ocean and you have the volume changes okay and it start inundating more and more areas okay and then low sea level. Then, we have glacial period where you will have reduced volume of water and you see more land emerged out of that okay.

And then sea wave erosion is one of the common factor mainly the wave actions will result into the formation of different landforms as well as the deposition of the material along the coast will also result into the formation of different landforms and different environment in that particular area and of course the last is the tectonic movements okay. So plate motions can also result into the formation of different coastal landforms along the periphery okay where you have an ocean and land contact.

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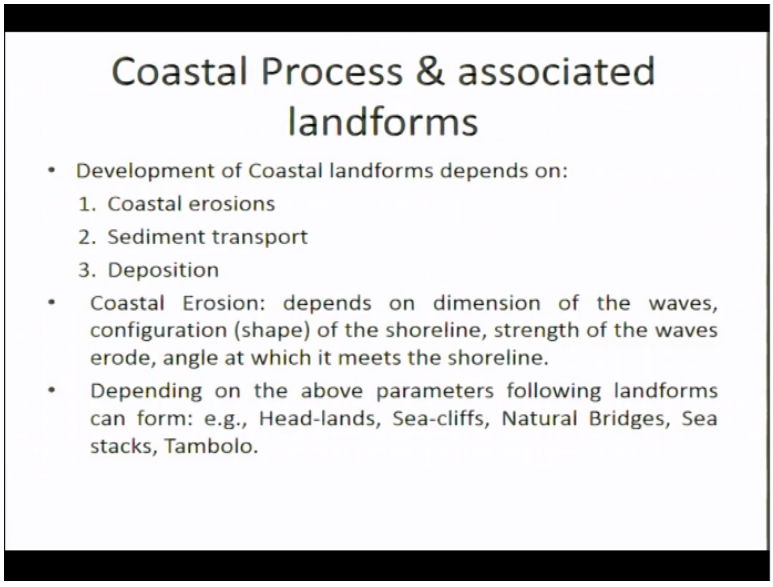

So the coastal processes and associated landforms if you take okay, so development of coastal landforms depends on one, the coastal erosion, second is sediment transport and deposition. So coastal erosion mainly depends on dimension of waves okay, how high are the waves and what is the tidal range in that area okay. Configuration of the shoreline that is the morphology of the shoreline will also play an important role.

Because not everywhere you will be able to see that similar landforms are formed okay. It will vary somewhere you will see the cliffs okay along the coastline, somewhere you would not be able to see that, somewhere you will be able to see in development of beautiful beach and somewhere not okay. So that depends on the configuration of the shoreline, strength of the waves to erode okay, angle at which it meets the shoreline okay.

So these are few things which are very important and let me tell you that these all points which have been given here at least few okay like if you say like dimension of waves, configuration of the shoreline, strength of the waves, these are also important at the time of that from where the Tsunami is going to come and how it will hit, what will be the angle of the Tsunami that is the directivity of the Tsunami coming and hitting the shoreline okay.

Now depending on the above parameters following landforms will be seen like for example headlands, sea-cliffs, natural bridges, sea stacks and your tombolos okay.

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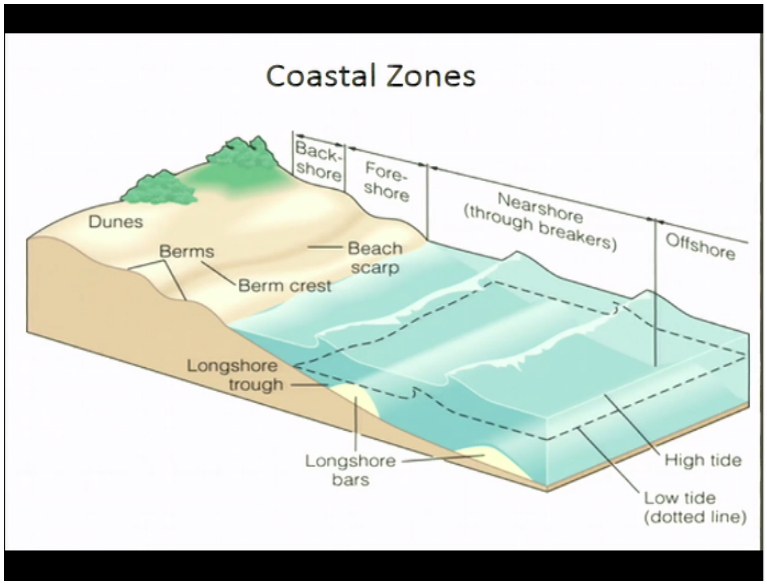

So if you take right from the land part towards the ocean then you have different geomorphic forms here okay what we can see the back-shore here okay and then you have the coastal dunes or you can say the berms. Coastal dunes are here and then you have the berms here and then you have beaches and scarps here okay. Then, get into the deeper part you have long trough and all that.

But mostly what we are interested is this one okay, so we may have in this area like beach, dunes okay and beach ridges, lagoons, back marsh, spit. So how these landforms look like okay and how they are formed. We will discuss little bit of that part okay.

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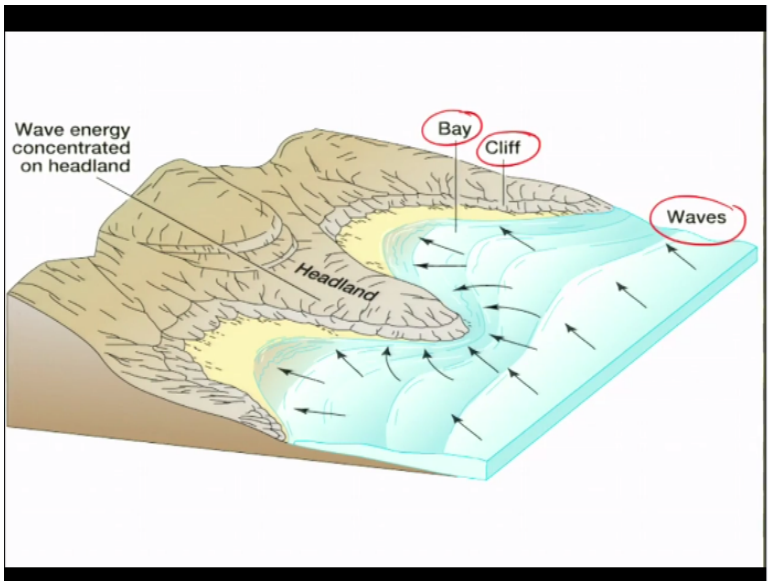

A very typical arc shape erosion okay will lead into the formation of your headlands. Now these headlands are typically seen where you are having the rocky areas okay, otherwise you will not be able to see such landforms and then again a very circular or arc shaped landform which has been from adjacent to that we term that as Bay area's okay.

So if you are having the rocky coastline then you may be able to see depending again on the energy of the waves and how the waves are hitting the coastline you will be able to see the cliffy banks or sea-cliffs. Then, if you are having the circular crescent-shaped erosion that will be giving you the Bay area's and between two ways you will have head-lands okay. Now can we see such features on surface?

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So this is an example here okay fine. So you see a very clear-cut and not exactly the Bay area but very small crescent shape here and over here also okay and then you have a headland. So this you have this on the surface here and this is the cliff so this is again an oblique aerial photograph which was taken after the 2004 Sumatra-Andaman earthquake okay.

And this area which you see right now okay is an area which got emerged during the earthquake okay. So earlier water used to come up to this point but now it is up to here only okay fine. So this is the area got what we say uplifted. So this is an example of the headlands okay.

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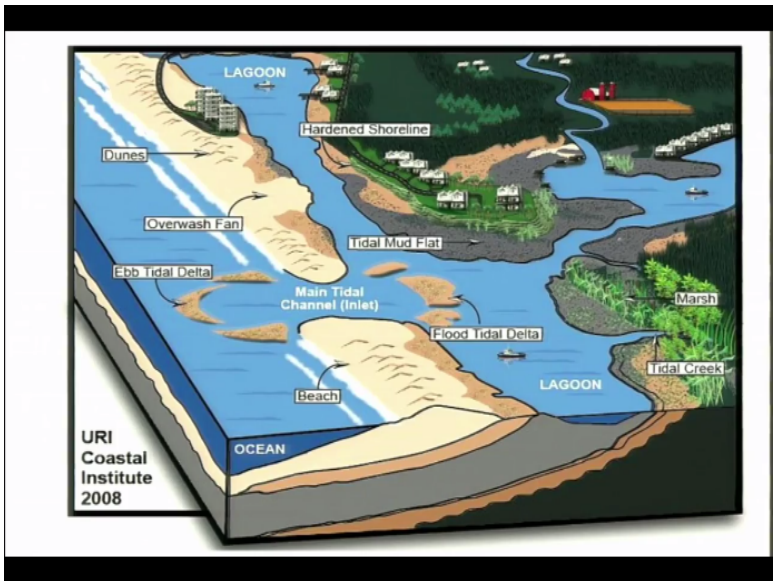

Now there are many other related environments which you will come across close to the coastal regions okay. For example, you will have a most common tidal flats okay, which have

been seen where the tidal flats mainly will have a tendency of getting inundated during the high tides and will be composed of very fine deposits okay. So mainly we can also say mud flats okay. Then depending on the configuration of the shoreline, you may have the formation of dunes okay or we also often term this as beach ridges okay.

So you have coastal dunes which will protect the inner part of the coastal area okay and that protected areas are termed as lagoons okay. Now lagoons will have a two-way like supply of water. You have marine water getting in during a high tide as well as you are having the water coming from the rivers okay. So that is the fresh water as well so you have something like what we call the brackish environment okay.

So lagoons will be quiet areas mostly and we will have different environment than the ocean okay fine. So here you will see what for example it may be at or above main sea level okay. Then, we have like marshy areas again that will form behind the beach ridges okay or due to the coastal dunes okay. So marsh areas will also be associated with that.

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An another erosive landforms which you will come across yes of course this is but will be a bit difficult to identify from the satellite photo if you are having orthophotographs but if you are taking oblique aerial photographs, you will be able to pick up such erosions okay. So these are the natural bridges and arcs which are commonly seen. There is an example from Australia okay.

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It is again another example of Natural Bridge which is in formed okay.

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And then you have headlands as well as the platforms okay erosional platforms which have been seen.

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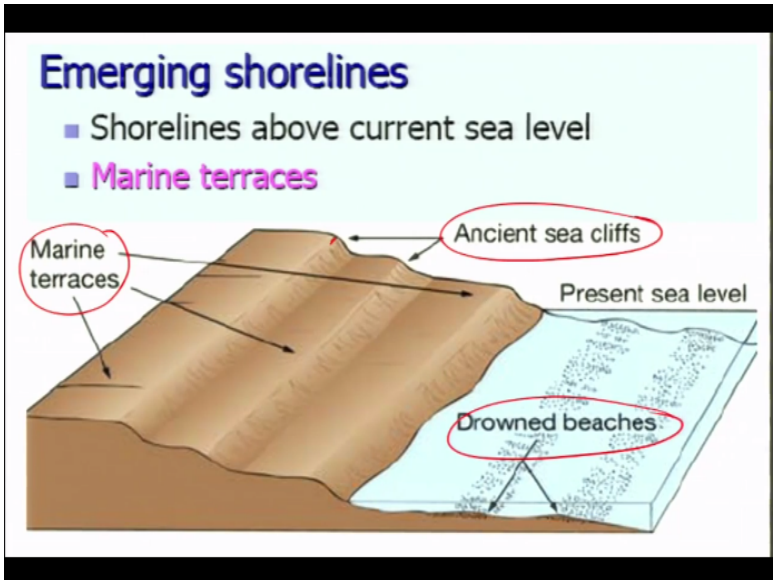

Now as I told that if there is an either the tectonic movements which will uplift the area or there is a sea level fall or rise okay. Now these phenomena or the process will result into the formation of terraces okay. So you will have flat steps okay which are been formed because of the change in the sea level. So what does it indicate? This step over this point it indicates the ancient sea cliffs okay.

And the present sea cliff is this one, so this is the present sea cliff and these are all ancient sea cliffs okay. So what does this tell us that at one point of time, the sea was up to this okay similar to what we see now here okay and suppose the sea level falls then we may have another step coming up here okay fine. So this also indicates that these landforms what we call Marine terraces okay are the indicative of ancient sea levels okay.

Now along with that as I told that either the sea level goes up or down, we may also come across some drowned beaches okay. Now can we see this from the satellite data? To some extent, yes of course we will be able to mark this okay. Let us see few examples of that if possible.

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So these are the sea cliffs, you are having all flat lands here in the top here and these are all sea cliffs you can see okay. Now if you are having similar multiple higher terraces or this then you can easily talk about that these are the Paleo or the ancient sea cliffs or the terraces okay.

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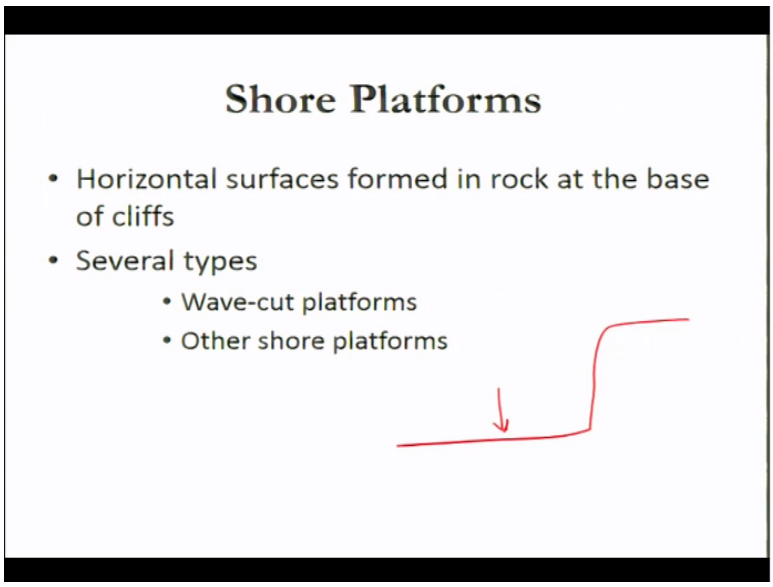

Now shore platforms are the horizontal surfaces formed in rock at the base of the cliff okay. So you have for example a rocky cliff coming like that and then you have a shore platform okay. So the shore platforms or the wave-cut platforms are the erosive platforms at the (()) (16:24) of the present sea level okay.

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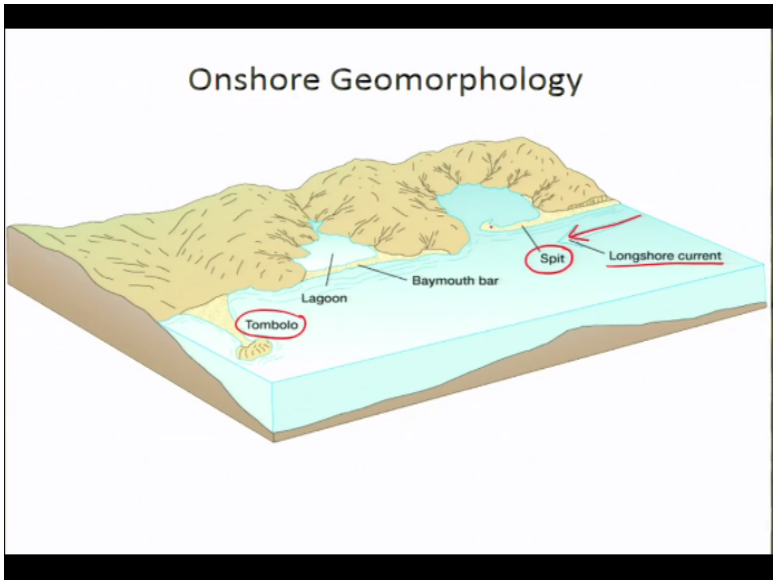

This is what we were talking about and this is a typical of tombolo and lagoons as I was talking about that it will be enclosed to some extent. This also is partially a lagoon okay but if it has been covered or protected by sand dune or the beach dune okay then you will be able to see the similar feature. Then, you have a spit okay. Now spits will form which will be a function of your longshore currents.

So if we consider this at longshore currents which are flowing in this direction will result into the formation of spits or in very longitudinal linear beach or dunes again depends on the configuration of your coast okay because of your currents are coming and directly hitting like that and it will not allow you to form this type of features that is what we call spit okay. So this is highly dependent on the coastal configuration as well as the direction of your long currents okay how they are formed okay.

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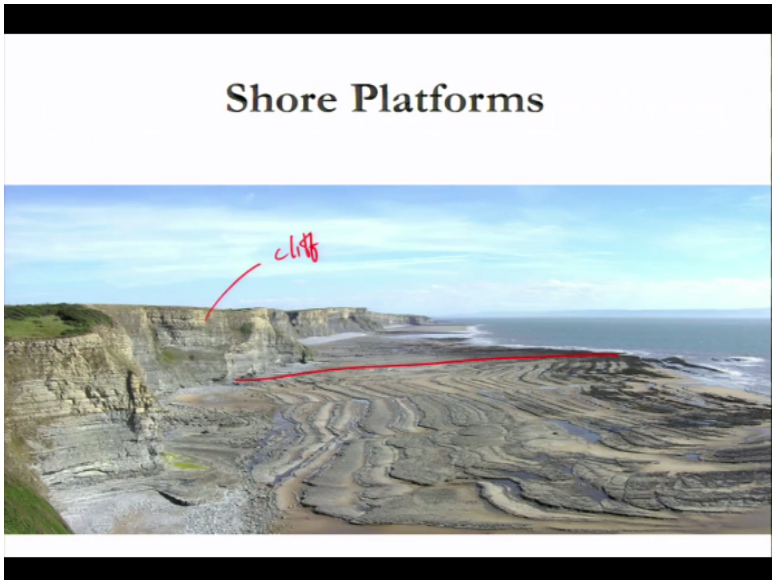

So spit just keep in mind this one will see some example of that. So shore platforms as we discussed we have cliffs here. These are your cliffs and in front of that you have a flat area okay. So this is your shore platform or wave-cut platform also we can say it okay.

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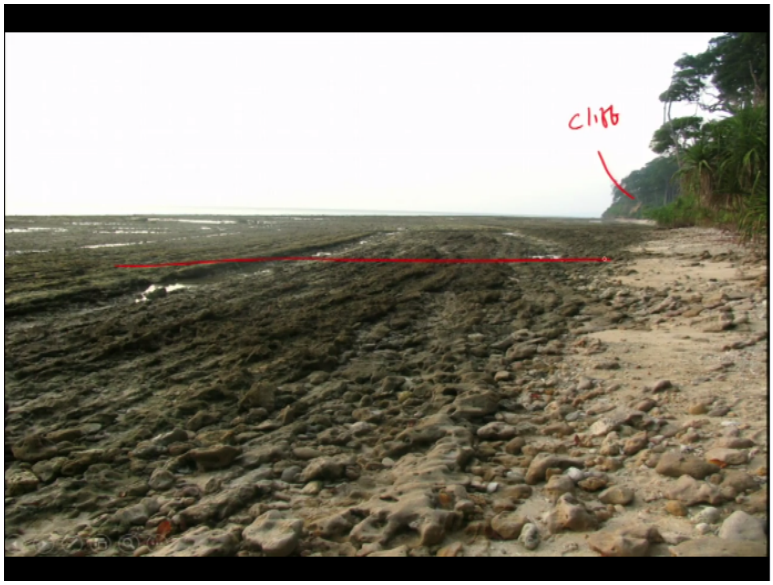

This is an example from Andaman. So we have a typical sedimentary rock sequence which you can pick up. So we have a cliff here and this is your wave-cut platform.

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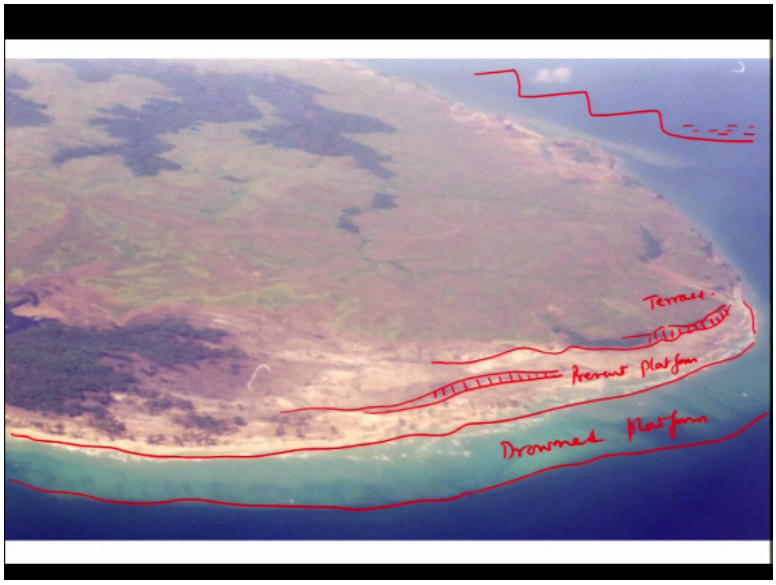

Now as I was talking about that can we identify the marine terraces okay? So marine terraces are what we call is the ancient cliffs okay. So this is the present one, this one is an older and this one is here okay and some places we will also be able to see the drowned beaches okay. So if you carefully see this photograph what we see is that this slightly whitish portion here which I can demarcate okay which goes like that here the boundary I am putting.

I am putting a very rough boundary okay. Now this is my drowned platform okay. This one here which goes from here like this, this is your present wave-cut platform and this is your higher surface. I am drawing this here and this is your cliff actually. So this becomes my terrace. So this again from Andaman oblique aerial photograph and we were able to fix up multiple terraces okay. There is also one terrace here which goes here.

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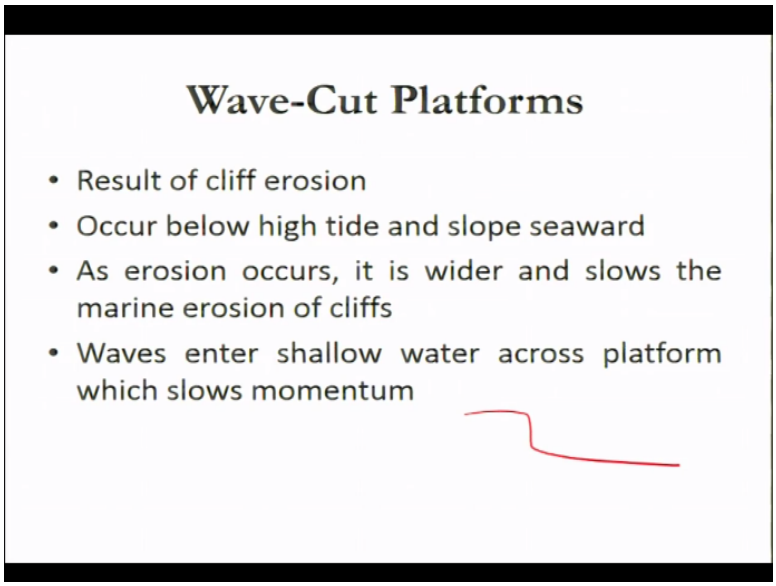

Now coming to the wave-cut platforms, the result of cliff erosion because of the result of the cliff erosion, it will occur below high tide okay and slope seaward. So it will be something like that okay. So it will be sloping like this okay, below high tide okay. So suppose your high tide is coming right up to this, so we will say okay fine, this is below the high tide because it will go long towards the ocean okay fine.

As erosion occurs, it is wider and shows the marine erosion of cliffs okay. Waves enter shallow waters across platform which slows the moment okay fine.

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So there is another example of the wave-cut platform which you can see okay. You have cliff and then the erosion which has been taking place by the present day waves.

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Similarly, here you have the wave-cut platform as well as the beach, you can see over here.

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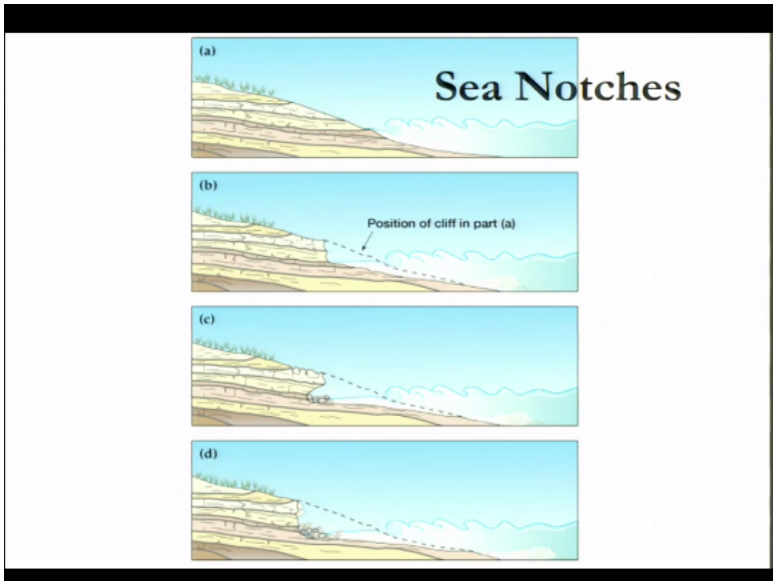

Now this is a very important portion, the formation of sea notches but if you again you take an oblique aerial photographs you will be able to pick up the sea notches but if you are having orthophotographs it will be a bit difficult okay. So see notches again are the erosional landforms resulted because of the wave action and mostly will be seen where you have the rocky shorelines.

Otherwise it will be difficult to have such notches okay and this also indicates the range of the tides okay. So the range of the tides that is the plus point is your high tide and this is your low tide and then center of the crest will be your mean tide okay.

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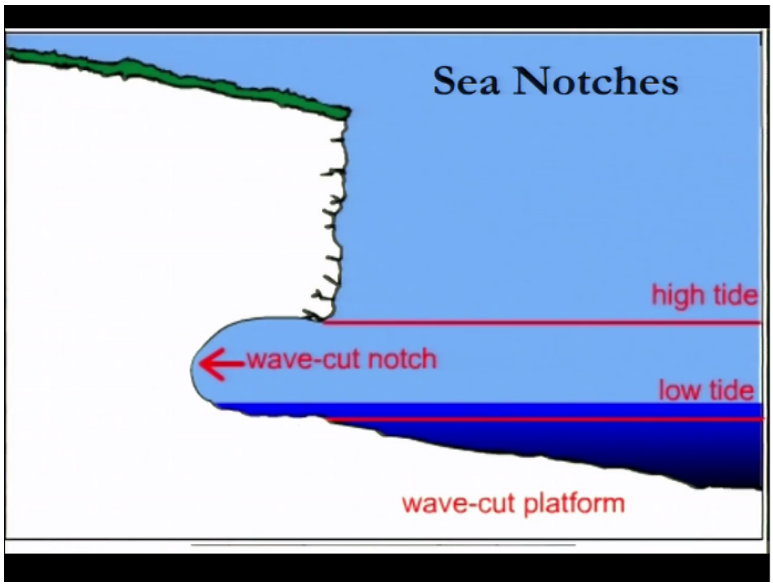

So this is what has been shown here okay fine and you have a high tide here, we have a low tide and this is the portion which you will have the mean tide okay. So this shows the tidal range but suppose the notch goes like that okay fine then it is difficult to say that this is the tidal range okay. So it may be a shot of what we call the cumulative notch which has been formed because of multiple phases of erosion okay.

When I say multiple phases of erosion means that I will show in the next slide okay that because this notch will indicate your present-day sea level okay.

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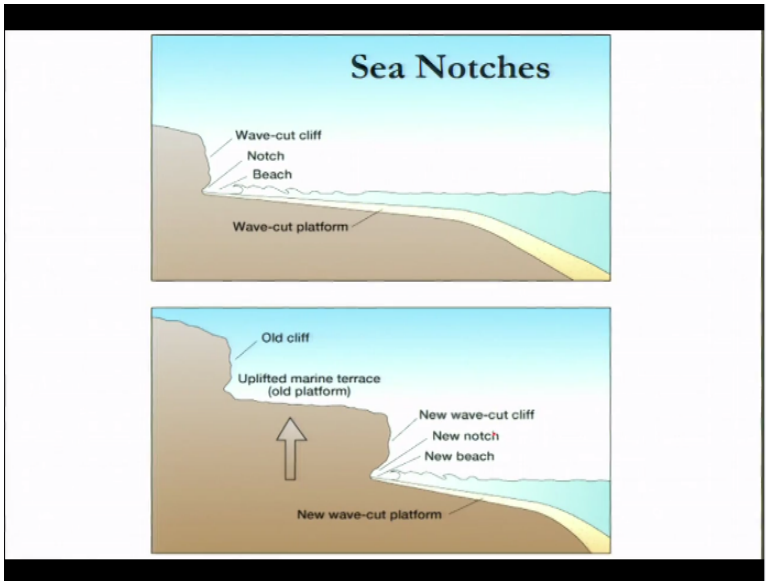

Now suppose you are having such notches sitting at the higher platforms okay which we can call as marine terrace as well as the old platforms and then we have the sea notch okay. So the previous sea level was over here and then you were having this, you can say the high tide, this was low tide okay and then you had formation of the sea notch here. Subsequently, the sea level has reduced okay or has fallen down and what you see is the present-day new wave cut platform which is sloping towards the ocean.

And then you have a new notch which is coming up okay as well as the new wave-cut cliff okay. So wave-cut cliff, sea notches, wave-cut platforms you will be only coming across where we are having the rocky shorelines okay.

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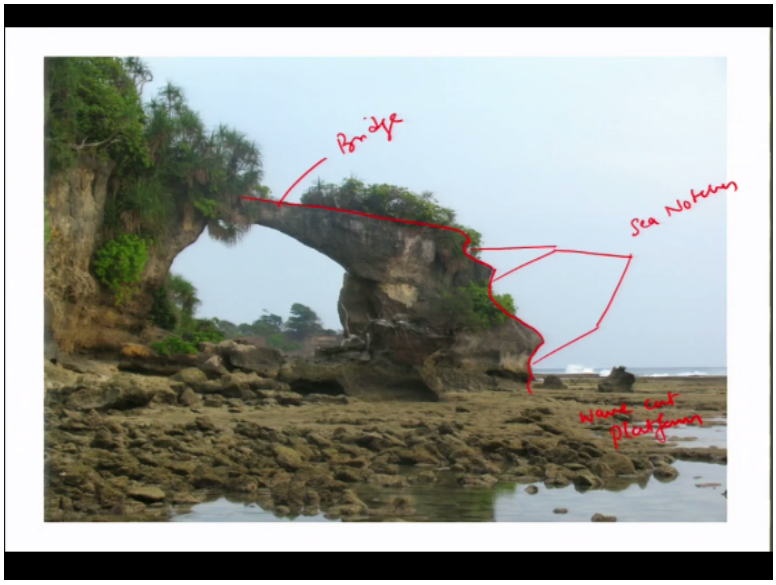

This is a beautiful example from Andaman which shows you three typical landforms okay, so one is your bridge then you have sea notches and wave-cut platform. So this is a present day wave-cut platform and then present day notch is sitting over here okay and these are all older sea notches. So this was the platform and this is notch, this is the platform and this is notch okay and this portion is your bridge.

So keep in mind all these landforms and when you are doing the satellite data interpretation of the coastal regions as I told that you may come across such landforms okay like for example I am emphasizing on the point that see notches you may not be able to identify but along some coastlines okay again depending on the type or the configuration of the shoreline you may come across such features okay.

For example, this you will not be able to see where you are having totally flat shorelines. You need to have the rocky shorelines for having such features okay. So in some cases along the coastlines, you may come across this depending on at what type of shoreline you are looking at okay.

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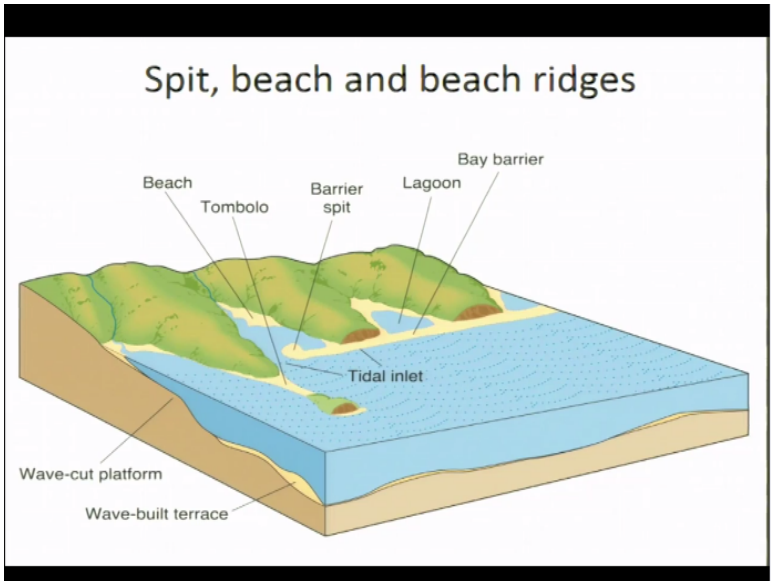

Again similar examples of spit and lagoons and barriers.

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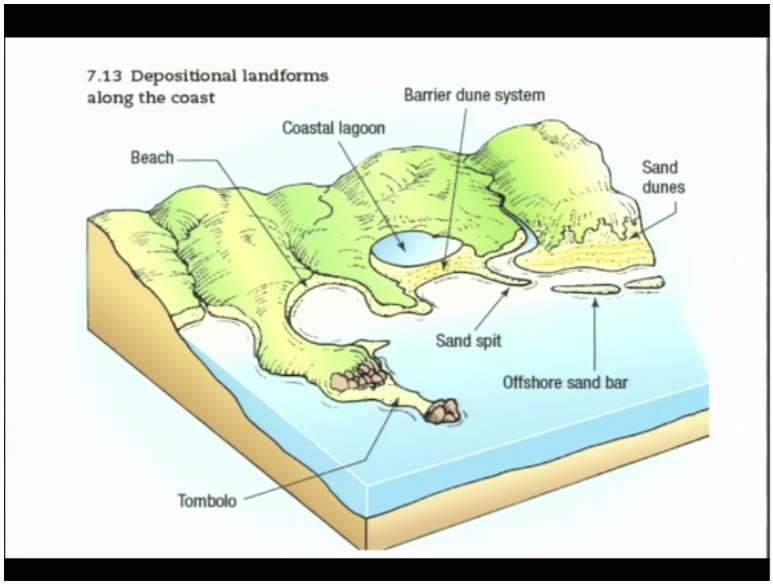

Some more cartoon showing depositional and erosional landforms. So I will stop here and we will continue again in the next lecture. Thank you so much.