Earthquake Geology: A tool for seismic Hazard Assessment
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Lecture – 53
Earthquake Geology: A tool for seismic Hazard Assessment

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Welcome back. So, in last lectures we discuss about the landforms mainly the fluvial and the coastal and we ended with this slide. So, it were talking about the lagoons and lagoons are basically the enclosed land form protected by barrier beaches. Now, one more thing which I would like to mention here is that we see mostly we considered that we will have a beaches mostly comprised of sand, but in some locations we also have the beaches comprise by gravel and this depends on the sediment supply from the mainland.

So, mainly in the tropical regions you will find mostly the beaches with comprising of sand whereas in the glacial terrain close to the ocean then you will have the beaches comprised of gravel. So, the freshwater rivers drains into them and develop a short of an wetland or we can say marshes because this enclosure enclosed landform are the features along the coast will not have much of the water, saline water coming in, but during the higher high tides it may show this act as an brackish water body also.

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Along with that, we also will come across the cover of mangrove forest and mangroves are also helps in protecting the coastal erosion. And it has like it was experienced that in 2000 during 2004 tsunami that those areas which will having thick mangrove cover along the coast were not been affected by the tsunami waves much actually. So, this is again and very important landscape, which if we protect then we are getting sort of safeguard from the tsunami hazard.

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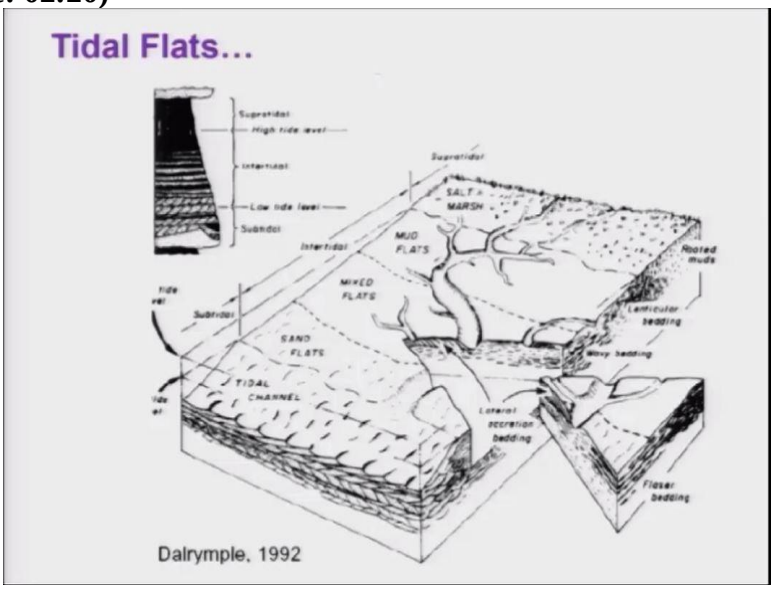

And tidal flats, mostly what we will see is close to the shorelines and the deposits mainly we will see by very thin laminations of the sediments as well as some cross bedded structures within that. So, you have the travel from the ocean side towards the beach or towards the main mainland side and you will find that we have an super tidal areas where slightly comparatively deeper water

will be there and then we have intertidal areas and we have them. The intertidal areas also will comprise of the mud flats.

So most mostly, we will see the defined deposits here, mixed deposits here in terms of the grain size, whereas mostly we will see the sandy material in the super tidal areas. So, the tidal flats are mostly related like its formation is related to the tidal waves in the region.

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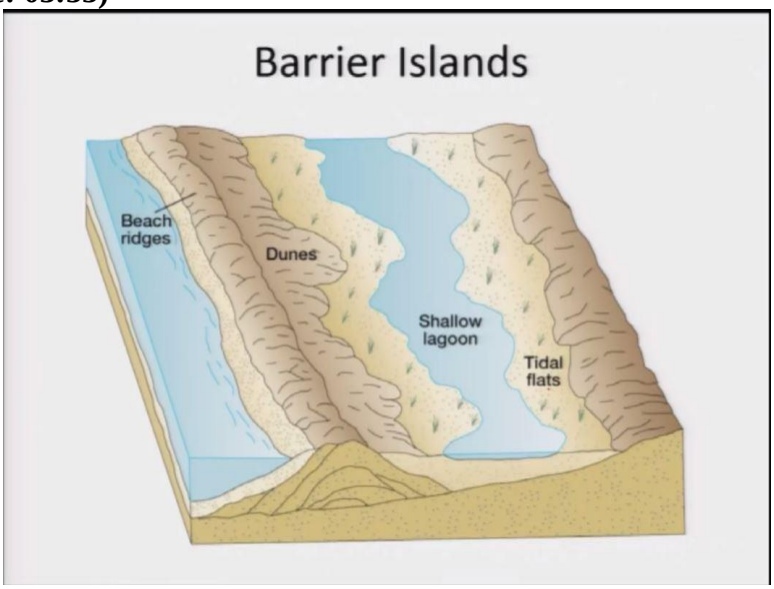

Like we also had some discretion about the dunes that they will be seen along the coastline. And the dune formation of course, is related to the alien activity along the coastline, where we mostly see the well sorted material getting deposited because of the wind action and in along some costs if you have dunes, again they plays an important role in controlling the erosion of the coastal region. So, if again we have the enclosure like what we see the beach ridge or the dunes, then the shallower part of the behind the beach ridge or the dunes will be a shallow lagoon and then we will have the tidal flats.

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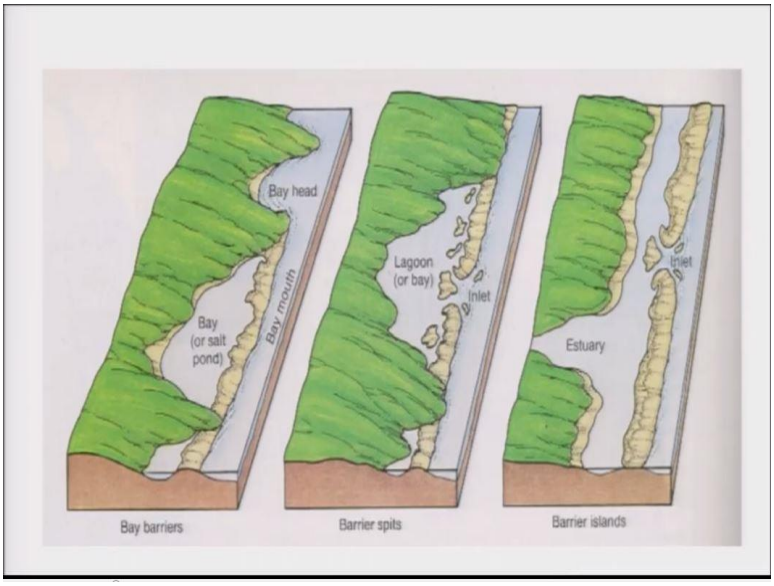

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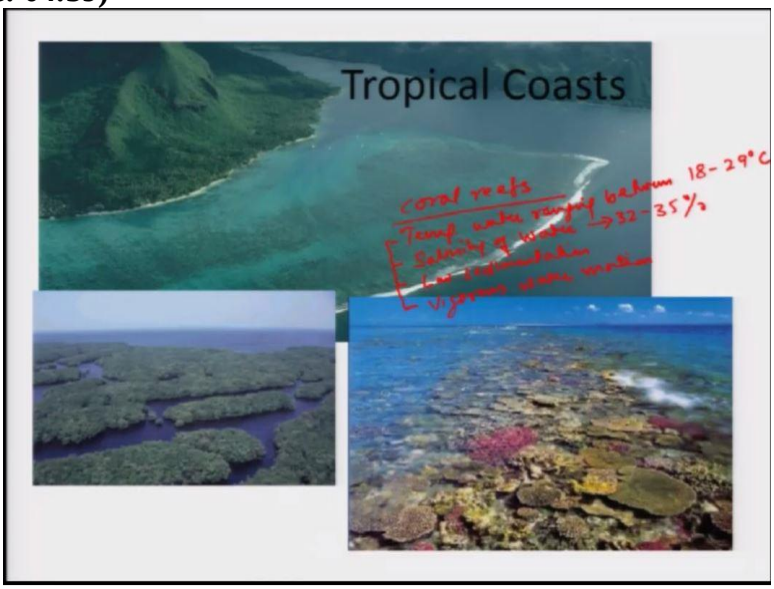

So, this is an example which shows that how the, barrier Bay Beach progressively allow the formation of the enclosure of the bay area or the lagoon. So, this is typical of the tropical coast again, the photograph which you see here is one we were talking about the mangroves and other is the coral reefs. So, coral reefs again will be seen in the areas where you have warmer climate. And it needs typical of 18 degrees to look something like 29 degrees of temperature.

And it needs sharp and clear waters clear and shallow waters for the for its survival and of course the corals never grow if they are exposed to the environment they always remains within the tidal levels. This photograph which you see is again what we have discussed about the mangroves

mostly in the tropical regions we will see the, mangrove areas along with that the most important feature which will come across will be the, coral reefs.

And this coral reefs usually has been seen where you have the temperature of the waters ranging between or you can say between yes between 18 to 29 degrees centigrade and then the salinity of the waters ranges from like 32 to 35%. Now this usually we will come across in the regions where we are having warmer waters and in cold regions you may not come across the way much the formation of the coral reefs. And also it requires and condition that the sedimentation should be very low so, low sedimentation.

And then you have a vigorous motion. So of the waters or the circulation should be high here. So these are a few conditions which will favor the development or the evolution of the coral reefs. So we will see the example of coral micro atolls with respect to what we will try to identify the signature in terms of the tectonics.

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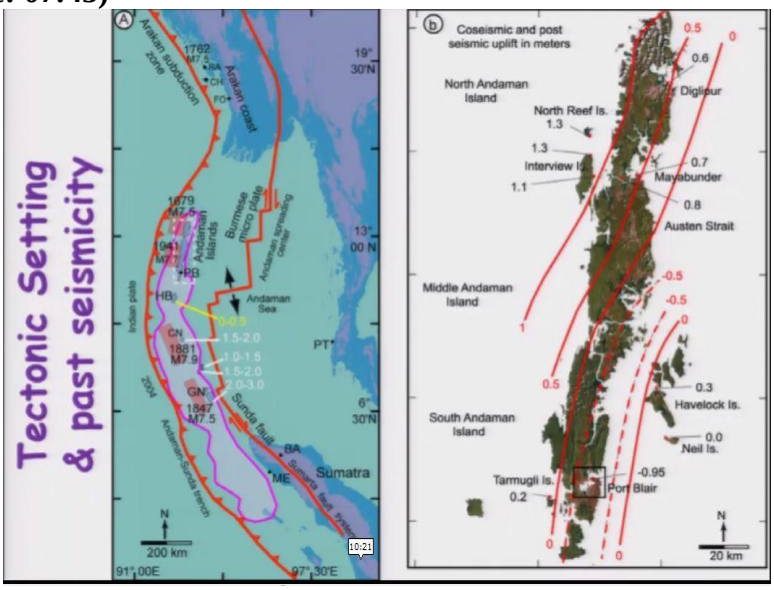

So, coming to this again, I will quickly move on this I have already explained about the Andaman Island and we see the coral reefs in this area and big micro travels here even we will able to see the corals for this whole island what is the Neil Island and Havelock Island Neil Island is completely comprised of corals and uplifted coral terraces. And this whole portion, we have rock cliffs of the oldest rocks sections, but along with this, we have we see on the periphery, the development of coral reefs.

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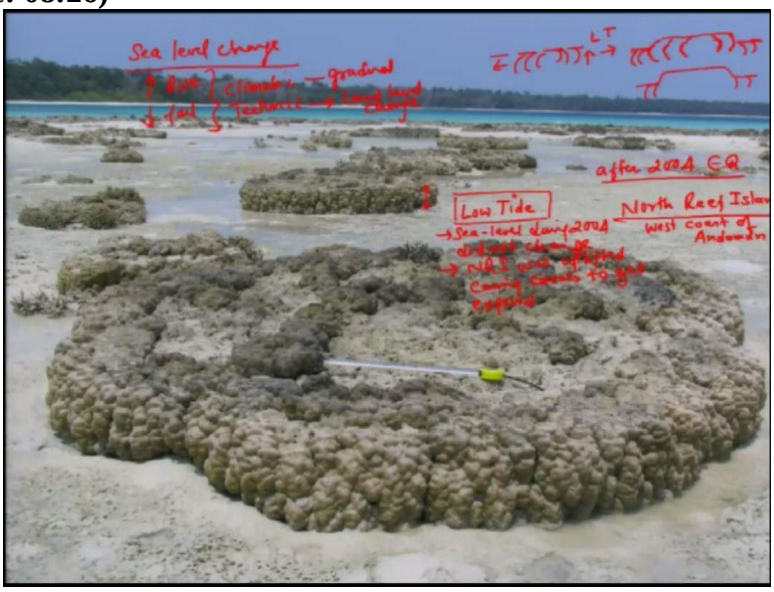

So, coming to this, this is a photograph from Neil Island, which I was showing here, not Neil Island, this is a North Reef Island so; this photograph was next paragraph is from here in North Reef Island and this is located on the West coast of Andaman. Now, what you see here is not as I was mentioning that there are a few factors which are required for the growth of the corals and the corals exposed even during the low tidal levels, they will be they will remain within the survival water level.

Now, this photograph was taken after the 2004 earthquake and does indicate that these corals are getting exposed during low tide which should not be the case in normal conditions. So, this clearly suggests the might there was some influence which resulted into the change in the water level and the but the water level that is the sea level during 2004 did not change. So, if this was not the case then what was the reason for the corals getting exposed?

So, the reason here was that this island is not reef island was uplifted causing corals to get exposed if such corals are exposed and they will die, so the next slide, we will talk about that how coral grows and what are the signatures we can infer from the corals if they are tectonic signatures or if they are the in the sea level change. Now, as I was talking about that you have like this is the lowest water level the corals will keep growing laterally from the center to and vertically up.

And it will try to teach lower low type they may be exposed, but we can say that over tight level. So, they will try to remain up to that. So, they will keep going in upward as well as laterally. But when they are exposed suppose this we expose this coral I am putting a section here now, the water level has come down here. Then what will happen that it will keep growing like this. So, it will further grow like that, but this portion which will which got exposed this one this will die.

So, when you put on the feature if you see if you connect this all so, you will be able to see something like this. So, you will have the coral shape will be something like that. We have to be careful when we are interpreting looking to the coral structures, but of course, corals are very sensitive to climate change. So, if there is an lowering of sea level or rising of sea level. So, basically we if we say that sea level change then either we say the sea level rise or sea level fall.

Now, this if it is climatic then it will be gradual. But if it is tectonic then during tectonic the sea level never falls, but it is because of the land level change. So, this will get recorded and the growth pattern of the corals.

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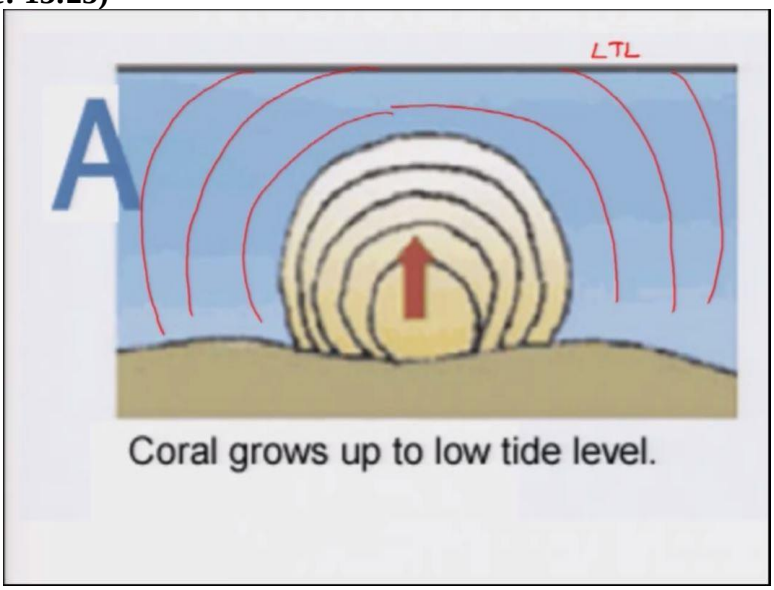

So, coral grows up to low tide level. So, it will try to reach up to this, this is low tide level then it will try to reach up to this and keep progressing on a lateral side so, it will keep going further like that then it will keep extending lateral side but it will never grow about the low tide level.

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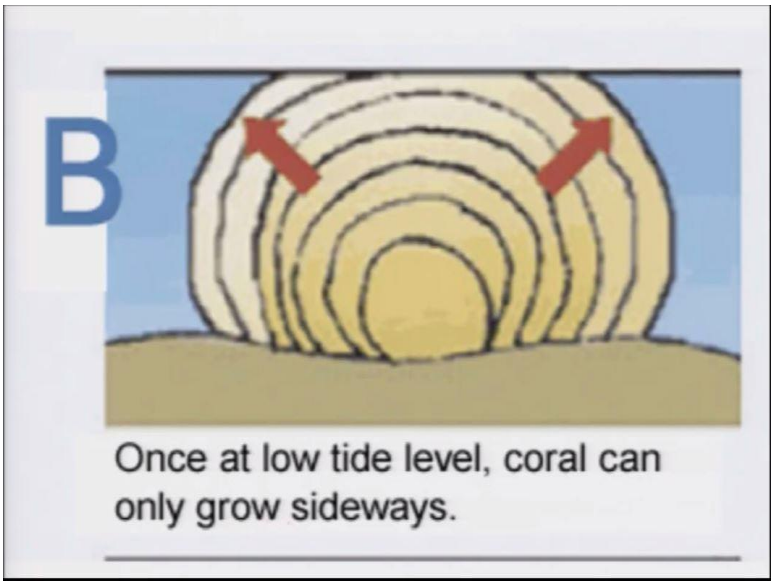

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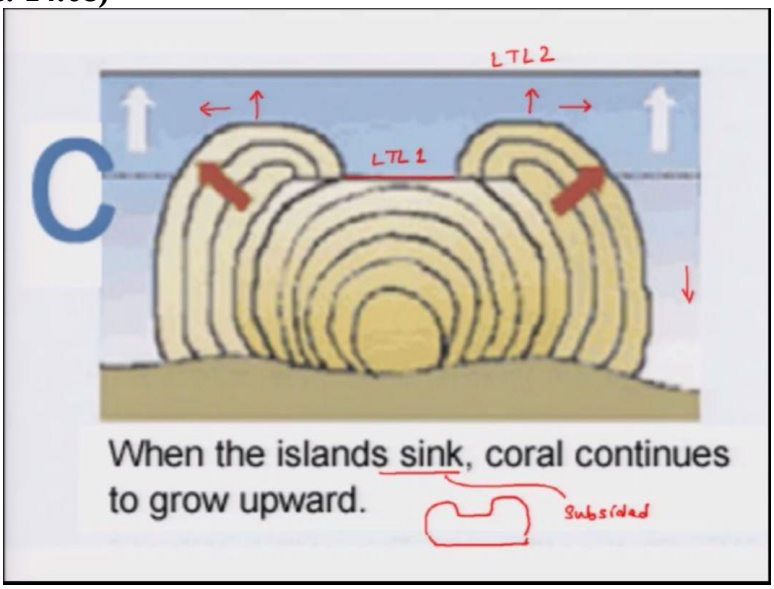

So, once at low tide level corals can only grow sideways again so, it will keep going sideways. Now, if there is uncertain change for example, when the island sinks so, what happens is again it will try to grow up. So, this was the last so, we can say the low tide level 1 and this is now the low tide level 2. So, what has happened again it will start growing towards the low tide level 2 and also it will grow laterally.

So, if you have a sudden change then you will be able you will come across this typical feature so, you will have something like so, this is an indicative of the sinking that means your area has

subsided. So, when the area subsided, then the water level was the same inundate more and then the corals will grow upward as well as lateral.

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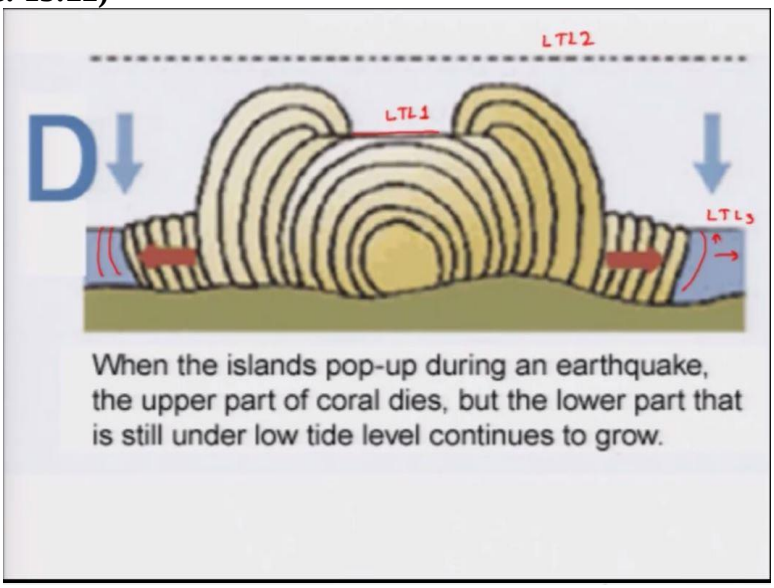

So when the island pops up what happens? So same pattern will be followed, but when it pops up again, it will, try to, so this was the we can say that this was here a low tide level 1 this was low title level 2, and now you are having the low tide level 3. So, this is the new 1. So, again the corals will start growing from here. So it will, of course, try to reach upward and then try to progressing towards the lateral side.

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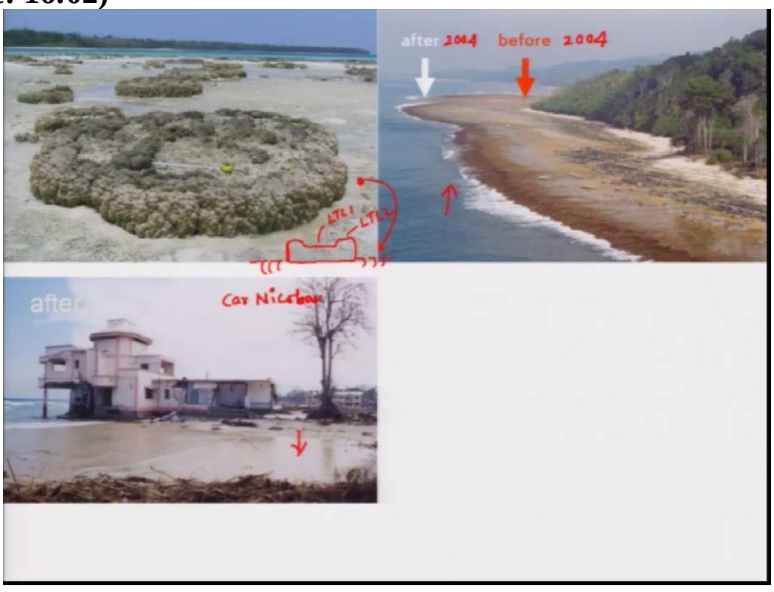

So, if you look at this one then what we have is that we have the growth of the coral here and then this is the earlier portion of tide level. And then there is an coral indication that there was the area subsided. Anyway this we will discuss when we are talking about we will see we will try to talk if possible about this one, but this is an indication of see if I have to draw from the profile here and it clearly indicates something like this. So, it goes like that. And then you have this shape here.

So, this is the, low tide level 1 and this was growing until 2004 it was low tide level 2. Now, what will happen because the low tide is over here that is the desk round? Now, the corals will start growing like that. So, as I told that this area caught up lifted the again the photograph, which was taken after 2004 Sumatra and Andaman earthquake on the West Coast which indicates that the and the water we use to come up to this location where we see the formation of beach before that before 2004 and this is after 2004.

So, the area got uplifted, there was no change in the sea level. So, how the environment can change over the time this is photograph which we took after the 2004 earthquake and Car Nicobar so what we see here is that there is an inspection bungalow of the Army Headquarters in Car Nicobar which is exposed to the wave action here. But before that, this used to remain it used have an 100 meter wide beach here, which now sits in water. So that means this area was subsided. So, since we were talking about that the wave action can result into the development of beach as well as beach ridge.

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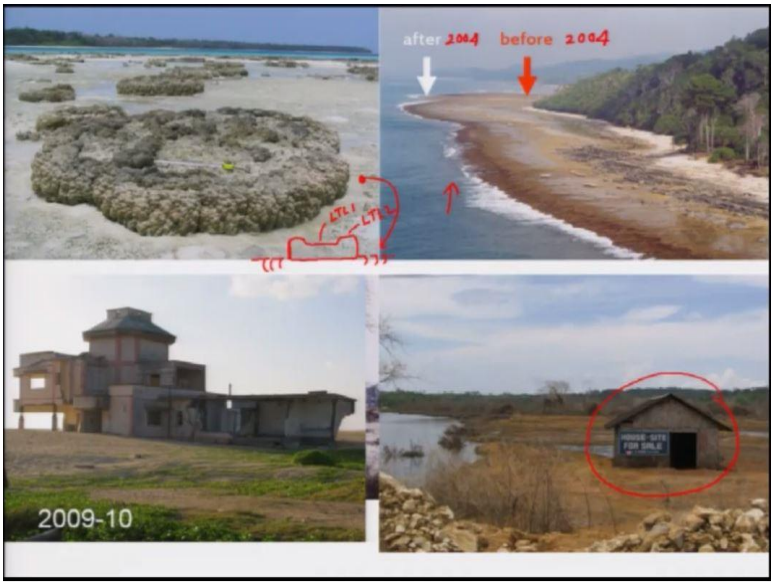

So what we saw after a couple of years ago, so this was the photograph which we took in 2009 or so or maybe 11. I am not really sure but what we see here is that because of the day tidal waves coming in going back the beach which has started developing in this area, whereas in the earlier case there is no beaches because the beach was far away from this structure. So this was yes of course it was in 2009. So the previous one was 2004 this one is 2004 and this one is 2009.

So, again there is an a signature of the area near Port Blair where the area subsided and the land price went down. So you can see this hot sitting here saying that house sites for sale but nobody is interested because the area is getting inundated even during the low tide.

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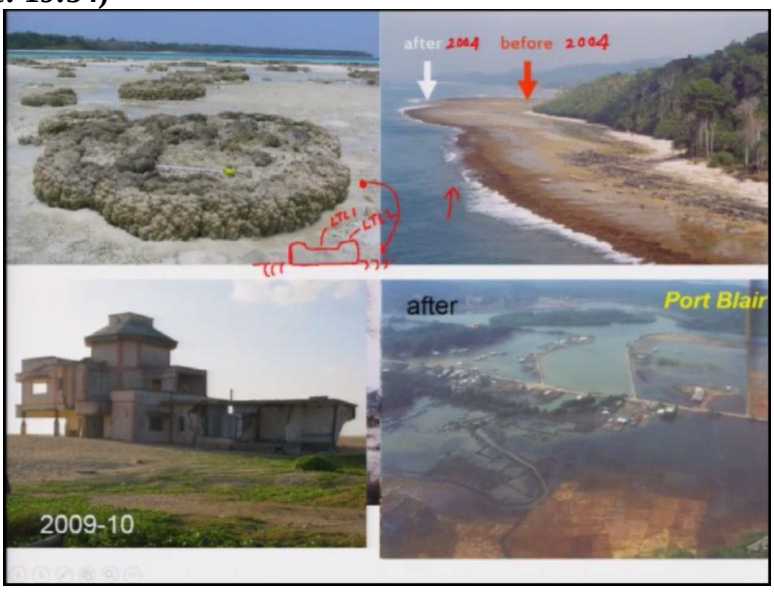

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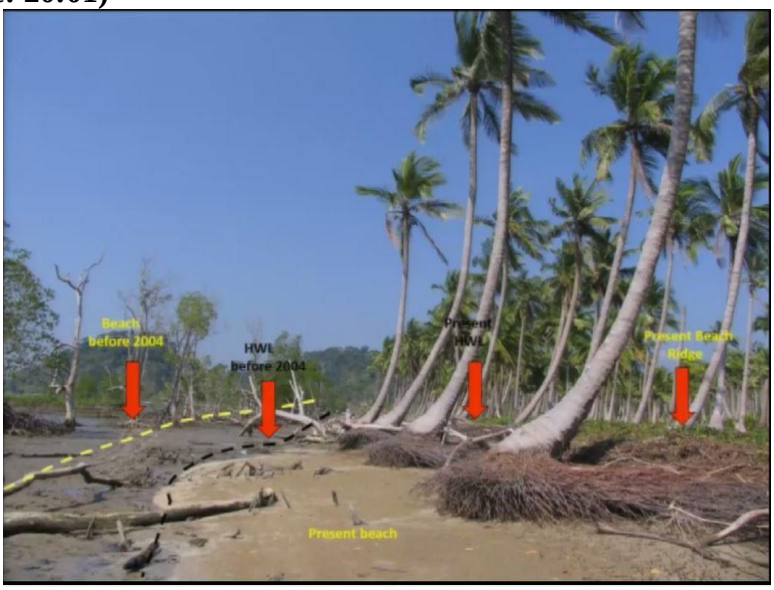

So there is the situation there in the Port Blair this was around after the after 2004 earthquake. Another indication of subsidence is from the Collinpur beach, where we see that the coconut plantation which normally never be seen sitting on the beach are subjected to erosion. So with the help of the local people and our understanding of the landforms what we figured out was that this was the, extent of the beach before 2004.

And now it is here and that means the beach, the development has moved towards land that means the area subsided here. And so this was the highest water level before 2004 so, mainly what the; it was reaching up to this point during the high tide. And now, what we see is the present high water line is up to this one. So water is getting in and hence this whole area is getting eroded. So this is a present beach here and this is the so, always behind the beach towards the land, he will find the development of the beach ridge. So, I will stop here, and we will continue in the next lecture. Thank you so much