Elements of Ocean Engineering
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Lecture - 3
Physical Oceanography – II

The origin of the Greek word Oceanography, and it all started with this word oceanographers.

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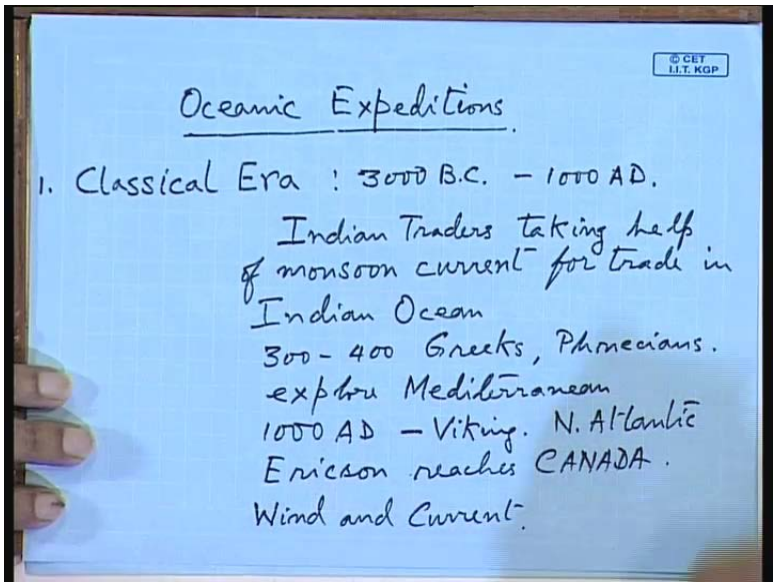

So, now coming to the time, so briefly around this mentioning this may be for your knowledge. So, this was with the start oceanic expeditions first we have the classical era, so this is from 3000 B C, 2000 A D, so this timing the long timing intervals 4000 years it all started in our country on the Indian traders taking help of monsoon current. So, this is the beginning of oceanography that mankind's started using ocean currents, remove shifts for trade in Indian ocean.

So, let means we were a maritime nation even at 2000 B C, so this was the origin, so after this there are subsequent expeditions in the classical era determining the first one, I am telling you is classical era. So, after this the Greeks they came, so 300 to 400 B C these started exploring the Mediterranean, Greeks, Phoenicians and in 1000 A D you have Vikings north Atlantic. So, this is your nioxin deal advancement of ocean now here most of these expeditions involved utilization of current and at the time of course, ships

were not diesel power. So, wind and current with the for most propelling power for ships wind and current, so this is the classical era after this you come to the pre challenger era.

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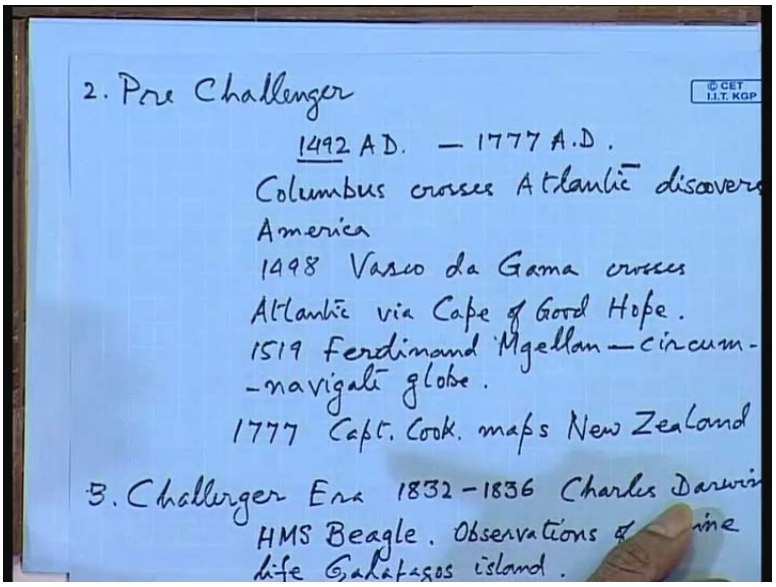

Now, challenger we will come to this challenger era there you find this challenger actually name of a ship. So, this is your pre challenger area this is from 1498 92 rather 1490 C R 1492 A D this 1777, and here actually lot of discoveries were made during this era the prime one being Columbus 1492 A D. So, this was in 1492 A D, now here Columbus was giving the machine of actually finding the root in indies that is your east indies.

But, eventually he is handed the west co that is the Atlantic, now after this actually 1492 was Vasco da Gama. So, those of you are interested they can go back and read historical advent of oceanography, there you will find lot of expeditions and till even now people have gone to this saving expeditions you will find. So, Vasco da Gama crosses atlantics this was discover cape of good hope, so this 1519 you have Ferdinand Magellan.

Now, he was the first man to circum navigate the globe 1777 captain cook maps New Zealand. So, this is your pre challenger era after this the challenger era comes, so in the pre challenger era you have the primary it was the ocean expeditions, and the challenger era you find this is from 1832 that is with the advancement of more and more knowledge about the ocean. Scientific discoveries started during this time this was read by a man

gentleman he was called Charles Darwin, most of heard about this name who was synonymous with the evaluation of the race.

So, this Charles Darwin shared with this ship called HMS beagle, so HMS means majesties ship majesties ship; that means, it was sponsored by the UK government Britisionary. So, Britisionary started your scientific observations, so this is observations of marine, so this oceanic expeditions the prime importance was to correct of course, the foreign expeditions of these were funded by the governments of the countries.

On the main purpose of this government was to establish their rule in distant banks. And at the same time of course, scientific studies between meg. So, observations of marine right, so this was origin of life you may have lot of discoveries. Around this island this is called Galapagos Island, now all this were funded by the British name you was the HMS is majesty ship, so it was the Britisionary coming the feature now.

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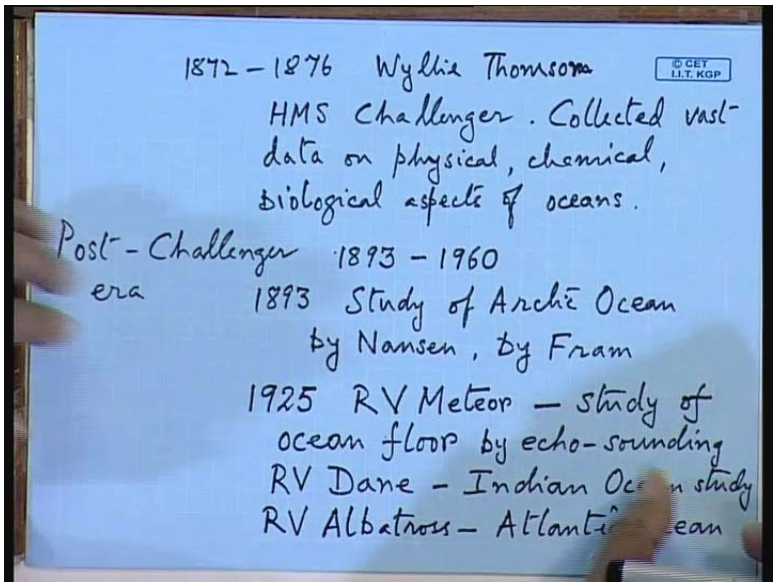

So, they were trying to go to all the distance line, so after this is you find 18 the same challenger era is going 1872-1876 you have Wyllie Thomson. So, at the British at that time there were superior ship builders, so all this oceanic expeditions you have to have a strong ship, in order to concur all the stomps whether all the stomps goods ability and also British the reason why they are able to concur. So, many countries were because fundamental area very strong may be, so this is the starting point.

Now, this Thomson he is started his expeditions is HMS challenger from which we derive the name this challenger era. So, he collected vast data physical, chemical and biological aspects, so what we find is that the previous that is in your pre challenger era, the primary focus was discovery of new lands. And trade that is trade was mainly collect by the Indian rather than that time we use be called east Indians, even in the coast of this lot of trade was going in around Malaysia, Indonesia and the certain part of Indian.

So, next we find after this civility trade was going on in the Mediterranean, now coming to the challenger era you have the British started mentioning out for discovery of the new land that is Columbus of course, I think you was Columbus Vasco Da Gama where compare to the Spain etcetera. So, the other country started venturing out the prime aim was this country is to said their ((Refer Time: 12:52)) the US and west indies. So, that was the prime aim, but eventually we started scientific expeditions in the challenger era.

Now, after this that is after the challenger era we have the ship that is HMS challenger venturing out, now after this you have the post challenger era. So, this is the chronological development of these subject of oceanography, now this from the period 1893 to that is 1960. So, 1893 was the arctic ocean by this gentle man called Nansen, so the non regions have now started exploring the arctic, so first the privacy their Vikings there are from the damnation, the Vikings are called by the people inhabiting Denmark and Narvey.

They will started exploring because the navated the arctic continent, they are started they discovered Canada. So, then now they are started go investigation and the arctic ocean, so the lesson was by frame this was the ship, so this was in 1893 now after this; that means, the ships where becoming more and more stronger RV meteor. So, in 1925 you have the research Vesar called RV meteor, now this was I do not know which country sponsored in, but how we it was by the Europeans.

So, this first study of ocean floor, ocean floor was first studied by the 1925 by RV meteor. So, by process called echo sounding that is mankind started use of sound to be ocean, so this was first experiment on what is called bottom profiling then of course, this is going on then you have RV Dane Indian ocean, RV albatross Atlantic ocean. So; that means, from 1925 on words of course, you have the powered vessels for tried to that the 1893 mostly it was done by selling ships, which used the wing as well as the ocean

currents for we prospering power. But, after these mechanize pre sells and more robust where coming into wing, and the development of knowledge research basis where commission. So, this is till the post challenger era and the advancement of technology was still taking place after that, so 1960, so this have told you from 1893 to 1960.

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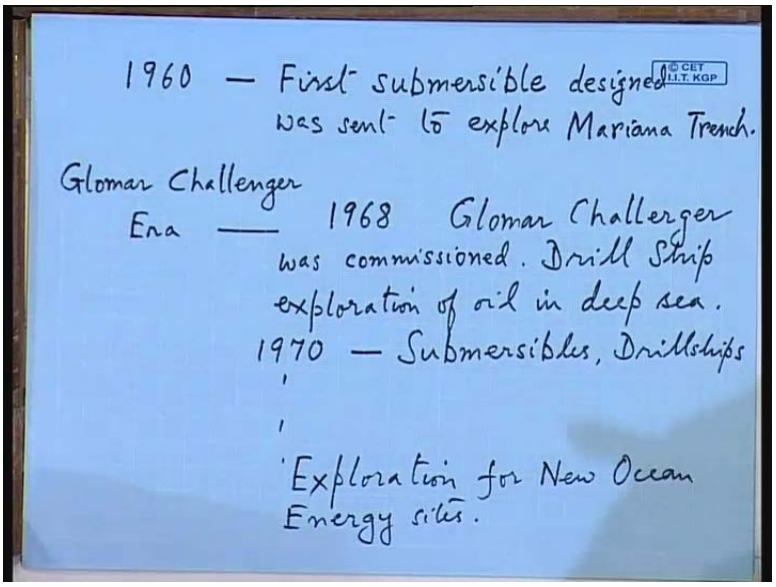

The US first design what is called submersible, first submersible was a design, so by this time lot of knowledge has been acquired on the functioning of submarines. But, submarines at the that is by 1960 already too war was have been fought, and lot of knowledge was gathered on submarine design, but submarines unable to go to large depths. So, a few kilometers down on the debate, so it has to be submersible where to take care of that now this first submersible was sent a to explore Mariana trench.

So, I will give you the depth this is called Mariana trench, this is a deepest trench only ocean flow. Now, after this you have what is the Glomar challenger era, so mankind is inquisitive about what is happening because the surface of the water, surface of the sea. So, from 1960 on words you will find when lot of knowledge has been develop from submarine design that is the bases started going deeper and deeper down into the ocean flow.

And same time after 1960 that is around this 1968 to 1970 what had happened was the oil shop first send it is waves across the world that is the oil the arums they formed a oil cotton. Because, was the south Vestavia war and because of this lot of what is called in

your impediments where put forward on export of oil to the developing countries, so from this you will find 1968 is either development of another era of development of ship building, trying to that you have 1960, 1970 you will find small ships.

And people start to going deeper and deeper down from 1960 to 1970 onwards you will find the development of ship building took, in the larger category of that is U L C C V L C C were been produced. And at the same time the oil was faced by an oil cotton giving by this Arab countries, so what the US started doing they invented or they build another ship, which is called Glomar challenger. So, during this period exploration for your oil fields began with the US honest because of the energy crises.

And it was again you know as far as the research is concerned the US is always before in the four fronts, and they had a good may be also. So, this Glomar challenger was commissioned, now what was this Glomar challenger, so this is primary the year drill ship. So, the first drill ship was design by the US, so this was for exploration of oil in deep sea, so during this time crises has it the developed countries. So, there is hunting for oil, so this was the Glomar challenger era.

So, after this the development still taking place 1970's you will find lot many submersible and drill ship where coming to being. Now, the submersible are primary intended for maintenance of your under sea green pipe lines or giving rises you under see offshore oil instauration. So, this over is there till now it is going on, and then now we are still in the Glomar challenger era, so after this you will find exploration for new ocean energy sites. So, this is now we presents scenario, now after this I will give you this is the short the development of the period of development for oceanography.

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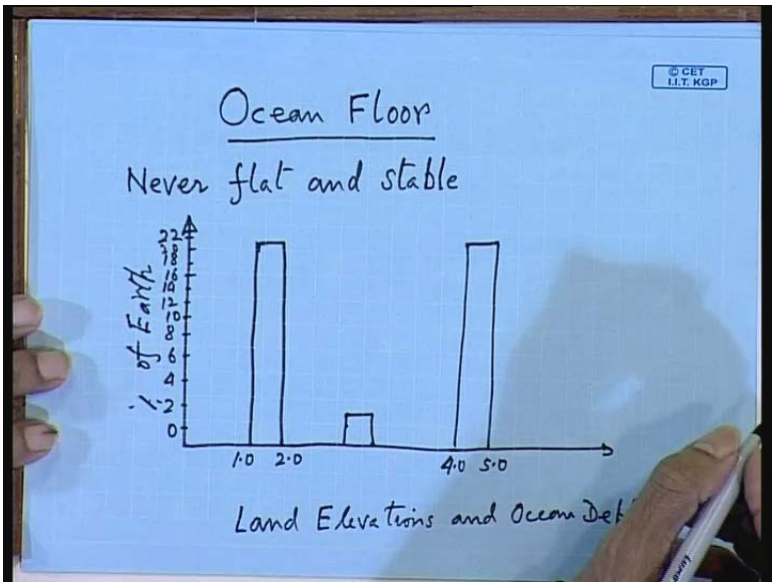

Now, coming to the bottom topography that is the nature of the ocean floor, now all of you must be aware of what is happening on the surface of the see that is the webs the nature of the webs. So, level architects and ocean engineers they have to be due to learn the mechanics of the webs, but what is happening on the ocean floor, so and if you design all in fix structure which has foundation of the ocean floor, like the drill ship or jack up etcetera.

So, you have to know we ocean floor catalytic, now ocean floor you will find it is not never flat and unstable. So, this the first characteristic is never flat and stable, now all though gather knowledge about ocean floor, the expeditions was in the research which took that research based RV Dane and all that in 1925 we have started finding out the nature of the ocean floor. Now, here you find first let me give you before we going to this the evaluation of the ocean floor. So, this is best given by a histogram, so this is the coverage of the earth, the depths of the ocean and the elevations on the end. Now, the highest elevation on land is what mount Everest is the height 40 meters I will come back to this diagram later on.

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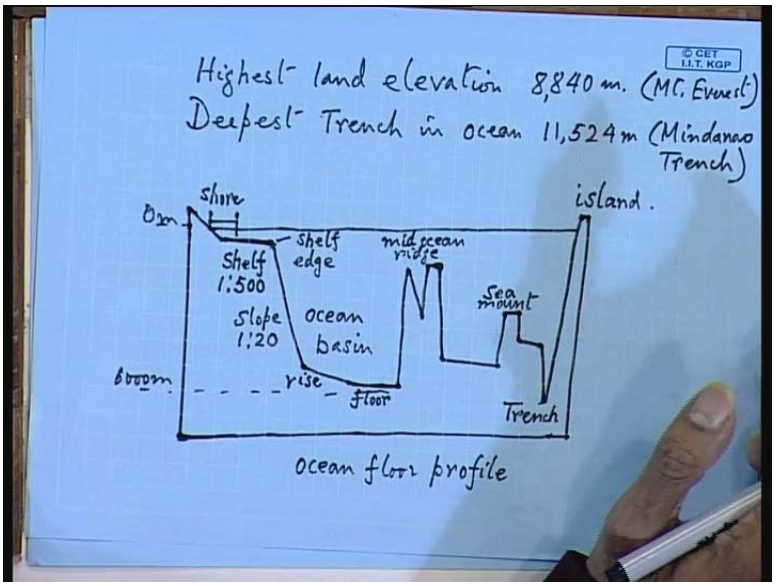

Now, you will find this is the very surprising thing that the highest land elevation, this is 8840 meters. And deepest trench we have Mariana trench I think here it is and maintain on deepest trench this is 11,524 meter, so which is more challenging going up mount Everest and downing deep down in the name of this trench is Mindanao, this is the Mindanao trench, so this is in the pacific ocean.

Now, coming back to this diagram you will find the elevations in the ocean if we start that is this diagram is to here. So, this is around after this actually the draw it properly, so after this you have design kilometers, land elevations and ocean depths, now here you will find between 4 and 5 kilometer you have the maximum percentage of the earth. So, here I not just do not drawing the full diagram this is takes lot of time, so here you will get this is 4 to 5 kilometers.

So, 22 percent of the earth is covered at the ocean by 4 to 5 kilometers depth or the that land you will find, the maximum coverage is 20 percent of the earth is covered by land elevations from 1 to 2 kilometers. So, this is these tracking different, so that means, if you do any ocean activity or ocean engineering activity you have to think about 4 to 5 kilometers depths whereas, most of land you will find land elevations will occur between 1 and 2 kilometers of distance from the sea level.

So, this is the reality now coming to the ocean flow I told you that ocean flow is never flat and stable. So, here is a diagram you will find of course, the scales are on the

horizontal scale is larger the vertical scale or other than the vertical scale is let me draw the figure. Now, if you take a cross section of the sea bed you will find you are going to the sea front that is the land slops towards the beach, so this is called a shelf.

Now, slope is 1 is to 500 that is if you go 500 meters around the slope, the depression is 1 meter you go down by 1 meter, so that is called the slope. Now, here actually the land is modified by sea action, so this region is called shore, so I will give you the detail description you just see the profile. So, this is your continental shelf slope 1 is to 500 your most of your activity taking place, now after this you will find this slope to increases and the increases very, very large where is t increasing the slope and this is 1 is to slope is 1 is to 20.

So; obviously, here you cannot build any of full structure, so of code structure we want to build it has to be around near the coast of the fix structure, there is in the continental shelf slope of 1 is to 500. Now, in these 1 is to 12 slope what is happening, so there we more mud's slide in this season because of instability of the ocean flow, so slope is 1 is to 20. Now, after this if you go write the towards the bottom there will be this is called a rise, where the slope sort of decreases from 1 is to 20.

Student: Sir, what is the slope area called?

Slope area.

Student: 1 is to 20 slope focus was very high.

This is called to slope one, there is pre have to called a shelf, so this region that I have to drawn that is this one is the shelf or you can after that or you can say that this is a continental shelf, and after the slope suddenly because this corner region is there is a large amount of wave and current particularly wave activities enormous here. So, after this you have a continental slope, the average slope that has to given is 1 is to 20, and then again there is a rise in the slope or sorry there is a decree in the slope, and this is called a continental rise and after that you have a flat region.

So, this is your ocean slope this is called a floor slope, now suddenly you will find a mid ocean bridge coming like this up on the ocean floor. So, the bottom of the ocean is never flat it is harrier profile of course, the vertical dimensions have been exited horizontal end

flat portion. So, this is called a mid ocean ridge, so what is happening the mid ocean bridge is actually you will find it is separating two water bodies, and this is your trench. Now, what is this is called an island, so; that means, your water surface is somewhere here.

So, this is your ocean floor profile, so; that means, you can see near the coast, so these are your land mass this is your land, and this is your water body, so; that means, there is restriction on the circulation of water. So, deep ocean currents are barrier face barrier at reach sea mounts, sea mounts are relatively smaller in height, but your mid ocean ridge, write the one you have in the Atlantic that is your there is the particular name for that is a huge ridge, which is by setting Atlantic ocean. So, this is called a ocean basin whether you have your wash basin you have ocean basin, where a large mass of a water is circulating. And mid ocean ridge is and sea mounts are acting as barriers to the current.

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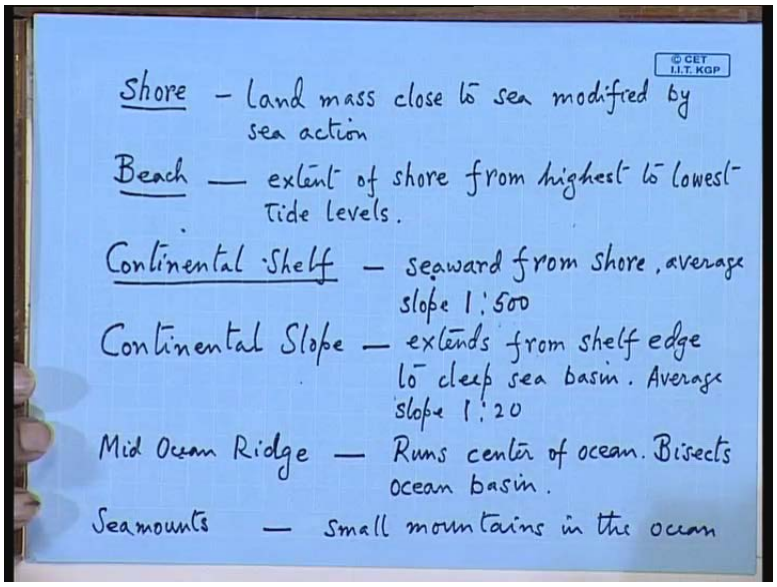

So, this is the bottom profile and for definition you can write shore, what is the definition of a shore land mass close to sea modified by sea action that is the definition of a shore, and shore and beach more this similar nomenclature. Now, beach you write extent of shore from what, which portion you call beach extent of shore from highest to lowest tide. So; that means, the beach was shore that is they are more influenced by tides, and the other portion other than the diagram I told you that is where there is a change in the slope that is because of wave action. So, primarily you find that the shore beach they are

modified by tide, tide are variations and wave actions, so these are the primarily dynamical influence is to your coast line.

And next you have the continental shelf, now here you will find most of the fix of shore structure look at in the continental shelf, this is seaward from shore average slope you write 1 is to 500. Now, after the continental shelf you have continental slope, continental word has been given because it is near to your land mass of the continental. So, that is called continental slope use the civil remember the average slope, so this extends from shelf edge. So, what is the shelf edge to deep sea basin, so average slope is 1 is to 20 average slope is 1 is to 20, so in this diagram I have already marked what is your basin. So, the deep sea basin, and this point is called a shelf edge is the age of your table.

So, that is the shelf edge and deeper down you have the ocean basin, now this height average you can write the maximum you can always be around say 0 meter sea level. So, this can be assign 6000 meters, I am not talking about the Mindanao trench, but in average depth of the ocean is around 6 kilometers. So; that means, any floating flat form you would design if you want to lift oil from ocean basin that you have to design your conductor pipe on varying riser.

You have a length of more than 6 kilometers, 6 kilometers will be arcade upon by or your wave action current and your portion floor dynamics. So, this is the definition congenital slope, now next you have a mid ocean ridge, now mid ocean ridge by definition rums central at the center of the rums centre of the ocean. So, what does is it do a mid ocean ridge bisects ocean basin, so it basically devised a large ocean basin into two parts. The you have a mid Atlantic ridge there is addition either usually by setting the Atlantic ocean, so this is called mid ocean.

And next you have sea mounts, sea mounts you can see in the diagram small mountains in the ocean. Now, your mid ocean ridge actually there length is quite large that are in sea mount, sea mount you will find it is more local particular place you will find a certain some there is a elevation that is a mid ocean ridge more just like a wall separating basins.

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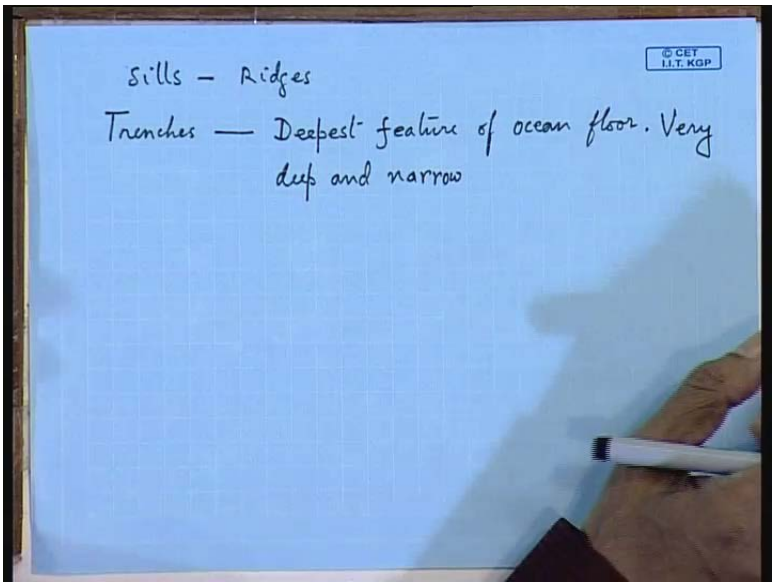

So, this have to be careful when your studying the nature of the ocean currents, now since ridges are more is the same since nothing but ridges which I already defined next is your trench. Now, I think one lecture is probably over, so what is the definition of a trenches, it is the deepest feature of the ocean floor, so how do you define a trench. So, trench is defined as very deep and narrow, so in the diagram that trench that I have drawn and that of course, the dimensions are this ridge this is very small compare to the depth. So, you would not have much maneuverings space in this region, if you go down by new region R O V deepest trench you are not having maneuverings space and you can get stuff, so this is the end of this I think your description of the oceans.