Geomorphic Processes: Landforms and Landscapes
Prof. Javed N. Malik
Department of Civil Engineering
Indian Institute of Technology – Kanpur

Lecture – 28
Glacial Landforms (Part I)

So welcome back, now today we will quickly look at the tectonic geomorphology part of Northwest Himalaya and then move to the new topic glacial landforms. Due to shortage of time we would not be able to cover the portion of the Kutch region but if possible in future we will try to cover that part in new course. So this portion of course as I told that such evidence or signatures are very common in ongoing deformational areas or wherever we see the thrust and fold built region.

So we that part of Kutch we will cover in the next course if possible. So let us go ahead of course I would like to say here that if time permits we will try to cover the Kutch part otherwise we will cover in the next one.

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So let us go ahead with the Northwest Himalaya. So Northwest Himalaya the evidence we found of a deflection of drainage because of tectonism was along the Himalayan frontal thrust in the frontal part of the Himalaya near Hajipur. This is the village and based on the name of the village we also named the fault which was the newly identified as Hajipur fault.

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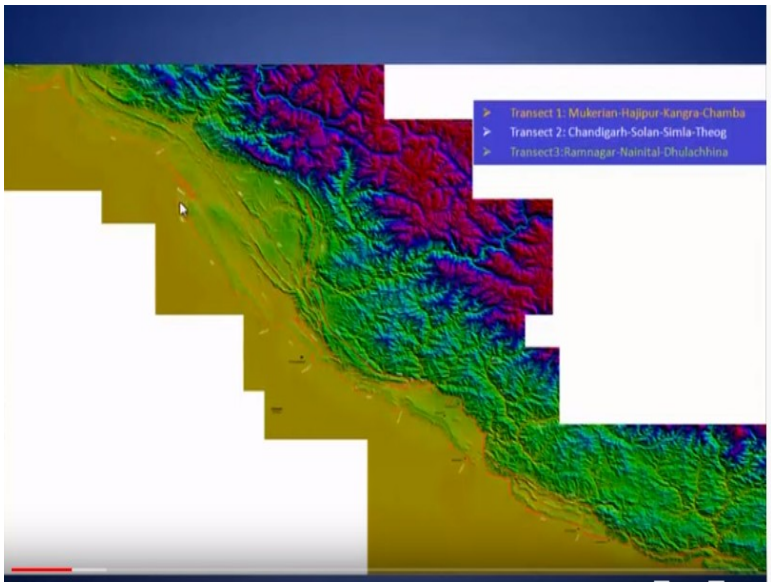

So this area lies over here that is an exit of Beas River and the Himalayan frontal thrust runs through this one and so I will show the close up of this one and then we will be able to understand more of this. This area was Transect 1.

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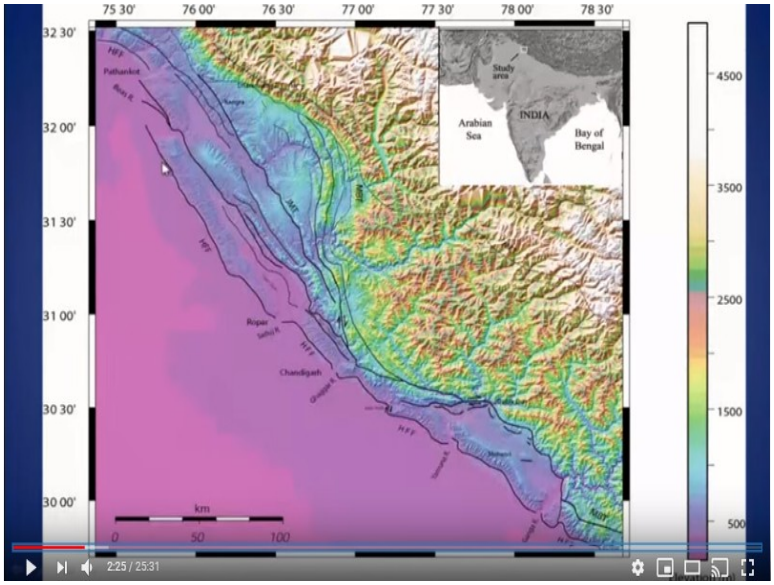

So this is the exit of the Beas river and Himalayan frontal thrust runs along this southern flank of Janauri anticline which has been shown here. We have already discussed this part in the drainage about the 100 kilometre long anticline which was formed because of the linkage of 2 segments the Southern segment and Northern segment and still it is propagating towards North West along

the along the strike and resulting into deflection of the Beas and so this is the portion we are going to talk.

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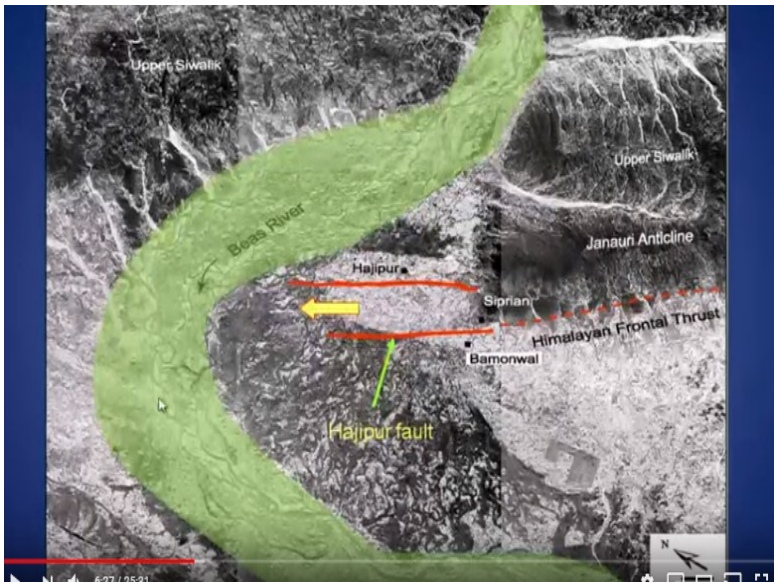

So if you see this there is a high resolution satellite photograph which shows the Himalayan frontal thrust coming here flanking the Southern ocean of the Janauri anticline and then you have a very prominent tonal variation which has been seen here a tongue shape and this tongue shape is a portion uplifted portion. Because of the propagation of fault and a related fold in this region and this was one of the reason which was responsible for forcing the Beas river to take this course.

Now this was one of the kind of fall or the fault and fold belt where we can also predict that in which direction the next rupture will take place. So, the earlier flow of Beas was close to the range here and we can also see some signature of value banks in this region. Then then the fall propagated and allowed or forced the channel to flow through this part because of the propagation of the; or the faults and related fold and then finally further propagation falls the channel to flow and take the present course.

Now the question which one can ask that if this is one of the mighty river which has a catchment area in higher Himalayas and then why it was unable to cross this uplift or the fold which was

growing or developing in this region because of multiple displacements with caused even also the earthquakes.

So the reason is that the channel was not having that much of power or energy to cross across this more than 15 or 15 meters high or 20 meter high landform which was been formed and one another reason which can be given here is that the tectonic moment along this fault was quite fast in terms of time I do not say that it was occurring every day but in terms of time. The time gap was very less between the events and the channel which used to flow was not having that much of energy because of the climatic conditions also to cross.

So it was unable to cope up the uplift here hence it was forced to shift the side. So now present channel which we see is marked with the green a portion green colour which indicates the present flow because of the propagation which was of the fault and fold and next one it will further go towards this side in next displacement

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So this is one of the best example which exists now without having understanding of the landforms tectonic landforms as I told that the constructions have been done. So this is an canal which has been a which takes the water from the reservoir which has been built in this region. This photograph is older old photograph before the construction of the dam there is a Beas dam at Talwada.

So now this area falls under a reservoir so what they have done is they have taken the water from here cross this area and then siphon out the water again back to the channel. So that what you see in the new or the newer version of the satellite data and since they got 2 steps because if I draw a cross section here across this one then this portion is higher. This is there is a step along the fault and this is down and then there is another step prolonged before this is down.

So 2 steps there have got which was in very good elevation change naturally and that was because of the; or the faulting. So they constructed 2 hydropower stations on this because of the topographic difference which helped them to have an very good flow because of the gradient variation. So this was been done the closeup of this you can see here so this thin line here which has been which I am moving my cursor is the active fault. This side is down this is up and the hydro power stations are being constructed right on that. This side is up this is down.

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So now the hazard related to this if this breaks because of course this portion this side that is the North-eastern side will be uplifted this will be down. So this canal which is almost like around 50 feet high and more than 100 meters wide. So that will result into the flooding in the low lying areas.

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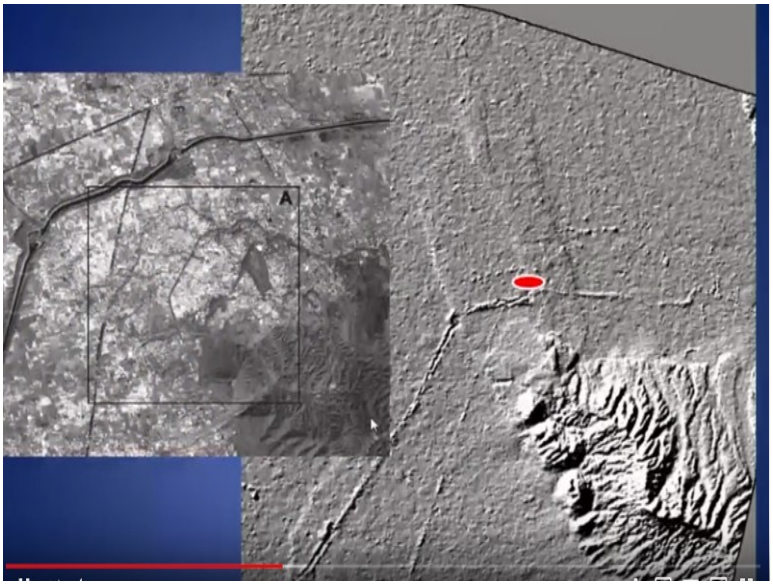

So this will be one of the reasons so I will just quickly show you a couple of examples what we have done.

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So this is one of the scar.

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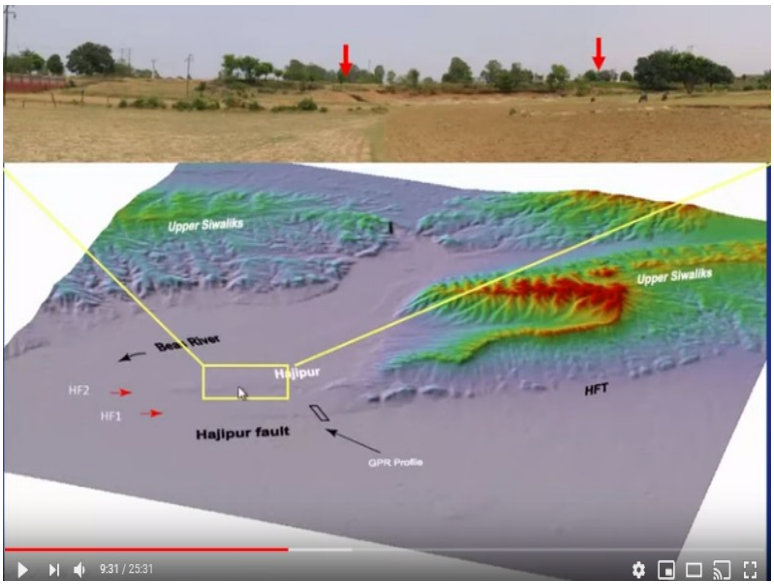

Which has been seen here so this is down this is up and very light change in the tonal variation marks the existence of the fault time. So this is the deformation what we found.

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Across the trenches which we dug and folded deposits and this is the way we do the; or identify the signatures of uphold earthquake. So now we are going to start with a new topic on the glacier landforms then we will also talk about the alien and forms related to the wind action and then the coastal one or maybe we can we can switch over between the glacial and then we will have coastal and then evaluate.

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Glacial landforms indicative of land from landscape change during geological past. Now as I discussed in the beginning that we will try to emphasize more on the fluvial landscape than on the other landscape. The reason was that our day to day life and most of the settlements if we see or we have found in during the geological past or historical past were governed or maybe were forced to stay close to the major fluvial systems and even they were forced to leave or vacate the area because of the changing course.

Now glacial landforms are also important for us because looking in terms of the climate change and all that because of the retreat of glaciers or maybe the aggradation degradation part If you are taking and if you are talking about retreat of glacier because of the climate change then we should have we should know the boundaries how the glaciers are retreating. Also it helps us in understanding that in past until which location the glacial extended.

So that is also an important reason for this and even we can we go back into the history or we can go back in in the past geological time and try to see that how inflation fluctuated because of the change in climate. So whether what we see now like global warming is the only reason for the retreat of glaciers or this cycle was been observed or experienced in the past. Also because of the various reasons.

And one of the reason that we have we have covered in one of the topic where I was talking about the change in the obliquity, eccentricity that is what we talked in the Milankovitch theory. So that is also one of the reasons of change in the climate or maybe the glacial and interglacial cycles. So we have a signature of glacial that is cold and warm periods which we term as inter glacial and right now are the period in which we are is inter glacial period.

So this happened in the past the cycles were experienced in the past but how fast there is a change which has been triggered by the global climate change. So global warming has added to the or exaggerated the glacial retreat in most of the regions where we are having the ice caps or ice cap mountains or it is just what we experienced in the past. The similar way it is taking place so we will see some landscapes and the landforms which have been developed all or carved by the glacial the snow moment or the ice moment.

And how they are been examined we will try to learn in this lectures So glacial landforms indicative of landscape change during geological past. So this beautiful picture which you see here is from Himalayas higher Himalayas which are taken from Kangada Valley.

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So glacial environment basically what we see is nothing but we are talking about the cryosphere So consist of total earths frozen water that includes ice and snow present in the atmosphere in lakes and rivers in ocean or on land and under the earth surface. So this is the basic definition of

cryosphere and a glacier is a thick ice mass that forms above the snow line over 100 of or 1000 of years.

So whatever the thick pile of ice mass above the snow which we see or in glaciers or in the glacial environment is not the result of a few years it got deposited over thousands of years in the area. So, one is class fear and the glacial environment.

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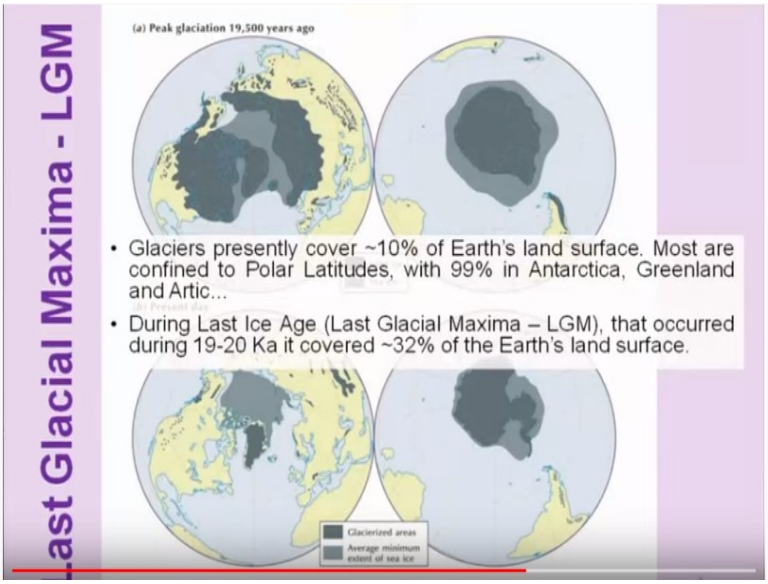

Now if, we look at the peak glaciation during 19500 years ago and what is the present condition? So this 2 figures if you compare will clearly indicate that the glacial area which was been covered during 19000 or 20000 years back was much larger as compared to what we see today in both the regions. So if you look at this once your so last glacial maximum we say LGM and the area which had been shown here is the polar latitudes that is Antarctica and Greenland and Arctic.

So glaciers presently covers almost like 10% of Earths land surface most are confined to polar latitudes with 99% in Antarctica, Greenland and the Arctic and what you see the figure below is the present day. So you can clearly make out that large amount of glaciers have been melted during last ice age that is your last glacial Maxima which occurred around 19000 to 20000 kilo years.

The area which was covered as shown in the above figures was around 35% of the Earths land surface. So today only 10% of the Earths land surface glaciers covers the area where during the last glacial maximum 19 to 20000 years ago it covered much larger area around 30%.

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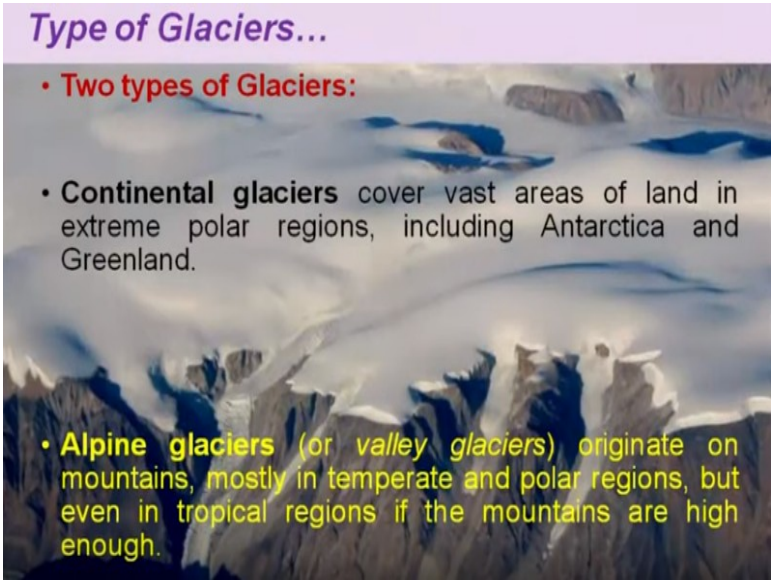

Now type of glaciers if you look at then we have two types of glaciers one is your continental glaciers and another is Alpine glaciers. So continental glaciers covers vast area of land and these are the glaciers which are been seen in polar region including Antarctica and Greenland. So basically they are not having much of the topography. So these are again it depends on the latitude and the elevation where it occurs and the climate.

Whereas the Alpine type glaciers are also termed as Valley glaciers originates on mountains mostly in temperate and polar regions. But even in tropical regions if the mountains are higher enough. So these ice caps or glaciers accumulation of snow is highly dependent on the elevation. So if you look at the basic difference in the continental glaciers and the Alpine glaciers one is the Alpine glaciers are seen in mountainous terrain whereas the continent with glaciers are on almost like flat terrains. So this we will see in the next slide.

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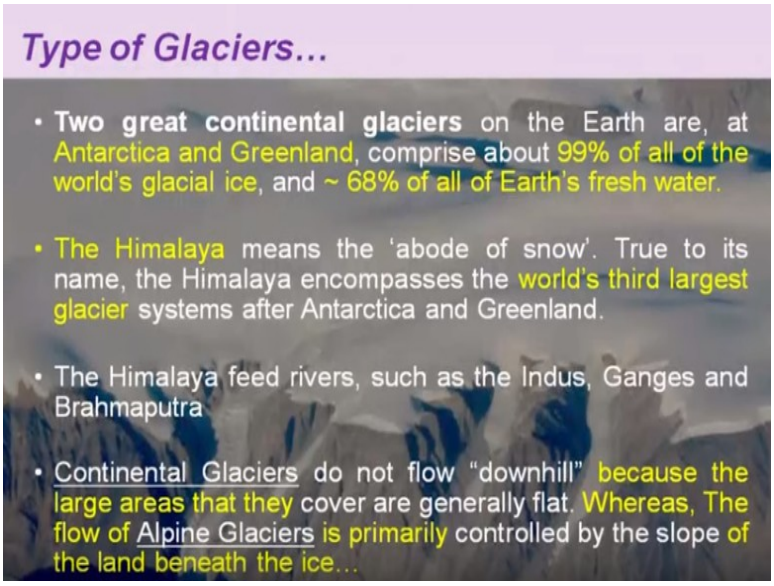

So two great continental glaciers on earth are the Antarctica and Greenland comprise about 99% of all the worlds glacial ice and about 68% of all odes freshwater. The Himalaya which is also termed as abode of snow true to its name the Himalaya encompasses the world's third largest glaciers system after Antartica and Greenland. The Himalayas feed rivers such as Indus, Ganges and Brahmaputra these are the most like major rivers and coming to the continental glaciers they do not flow down Hill because the large areas that they cover are generally flat.

So this is one of the major differences between continental glaciers and Alpine glaciers. So where is the Alpine? The flow of the Alpine glacier is primarily controlled by the slope of land beneath the ice that is mountains So mountains basically are responsible for providing the slope whereas in terms of the continental glaciers they are mostly on the flat ground. So there is no downhill movement.

Whereas in the Alpine glacier there is downhill movement of the basic differences is this and due to the difference of the landscape where this continental land the Alpine glaciers are found the landforms or the landscape which will be carved by this 2 type of glaciers will vary and that what we will try to look at and try to understand.

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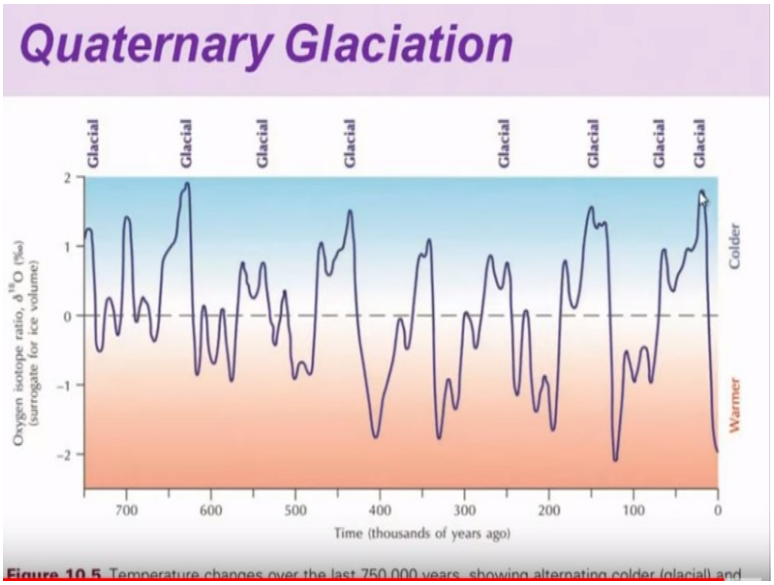

Figure 10.5 Temperature changes over the last 750,000 years, showing alternating colder (glacial) and

So, coming to this part here as I was talking about that we had a number of glacial and interglacial cycles in the past. So it should not be as surprising to all of us that the glaciers are retreating it will happen because of the reasons which we have discussed the obliquity, eccentricity and rotation of axis and everything that will that is going to happen. But the only worry is that whether that process has been triggered a little bit faster because of the anthropogenic activity.

So, if you see this curves which are been shown here based on the oxygen isotope ratio; delta 18 O along the Y axis and the time thousands of year ago. So 700, 1000 years ago and then it shows till present. So what we see here is present we are having the warmers this shows warmer climate which is marked by the pinkish or reddish tone and coders are marked by blueish one. So the peaks which you see on the upper portion with respect to the 0 line shows all glacial periods and then the peaks down are showing all interrelation of warmer periods.

S0 even if you take this here around 100,50,1000 years back the climate was very much similar to what we see today and we just passed having the glacial climate and that was around 15 or maybe the same what we were talking about 19 to 20000 years back that was the last glacial maxima. So this point is showing the last glacial maxima and after that the temperatures have increased and we have entered into the warmer climate.

So with this note I will stop here and we will continue again with the glacial landforms and whatever we have discussed about the continental glaciers and Alpine glaciers and then we have we discussed about the (()) (24:46) and then the interglacial and glacial cycles Please keep this in mind and let us meet in the next lecture. Thank you so much.