

Photogeology In Terrain Evaluation (Part-1)
Prof. Javed N Malik
Department of Earth Sciences
Indian Institute of Technology, Kanpur

Lecture – 13
Drainage Basins and Their Features

Hello everyone, welcome back. So, this was the a last slide where we were discussing about that how you can identify and map, the meanders on a satellite data.

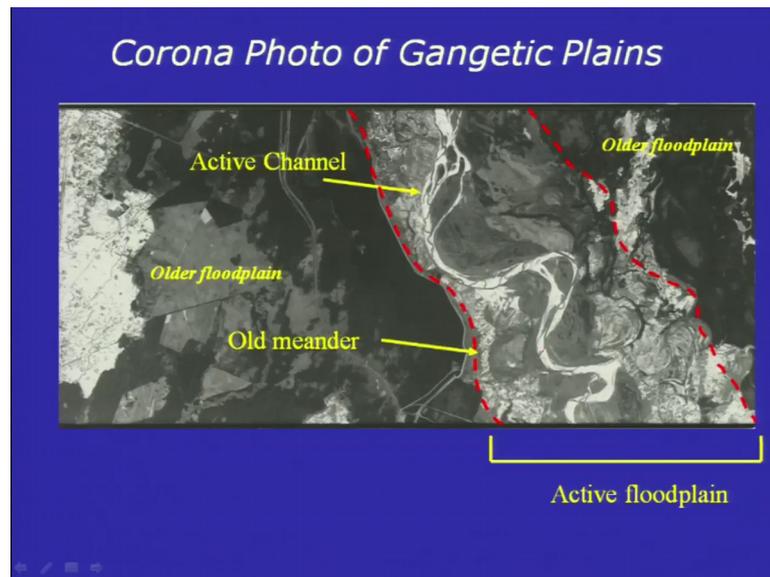
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And what was the importance of a mapping, why we want to map such meanders because meanders the outer sides will have erosion and this portion will keep on migrating like that ok. So, the time will come it will merge with this. So, here we discuss about that over the period if this erosion is not stopped, then this channel will merge with this one. So, that was the point.

Now, moving ahead in this course and you must have also learned few things while doing the labs and we will try to put few more labs on the drainage pattern which we are going to talk today. So, let us move ahead.

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Now if you look at this is a satellite photograph from a Indo Gangetic plain, and what we see here is again this is a panchromatic image, taken by the Corona mission and here we again see the variation of a gray color, or the tonal variation of gray color. And you can easily make out the active channels here as well as the boundary of the valley, as well as the older alluvial plains, or you can say the floodplain areas of that particular channel.

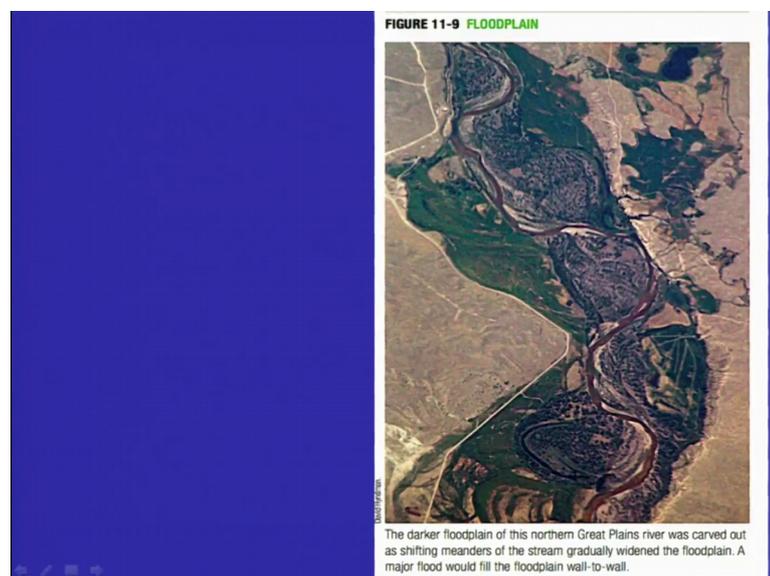
So, if you look at here, you have a major stream which is flowing like this which is when marked in whitish portion and small channels are seen here. If you see on the left-hand side, what you see is some dark tone features which are very much similar to the present-day channel. So, these are old cutoff channels which we can say the paleochannels of how of this particular river. Similarly, you can mark few more features which are indicative of the paleochannels. Paleochannels means the channel which is the present channel flowed along this path in the past.

So, if we interpret this what we are looking at this is your active channel, which is a present-day channel which is carrying the water. Whereas, this area what we look at are the older meanders. And if you put the boundary based on the tonal variations, you can put two boundaries on either side, which marks your active floodplain. So, this indicates that no doubt this is an old meander, but still the river will migrate or shift within this floodplain region. So, this hence we can mark this is an active

floodplain ok. Whereas, the either side of this portion that is away from the channel you are having the older floodplains ok.

So, most of the settlements you will find there they are over here in the older floodplains; Now we will see in coming slides, that what are these older floodplains and how they are been marked ok and what are the terminologies which have been used for this. So, on either side you are having older floodplain and this portion is your active floodplain and the present-day channel. So, based on the tonal variations you will also be able to pick up fluvial land forms as well as fluvial geomorphic features ok.

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So, another photograph which shows very similar feature this is not from India, but from us you have a major channel which is flowing here this is a present day, channel at the same time you are also having the older meanders and the green patch which you see here is you can easily remarked the active floodplain.

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Terraces

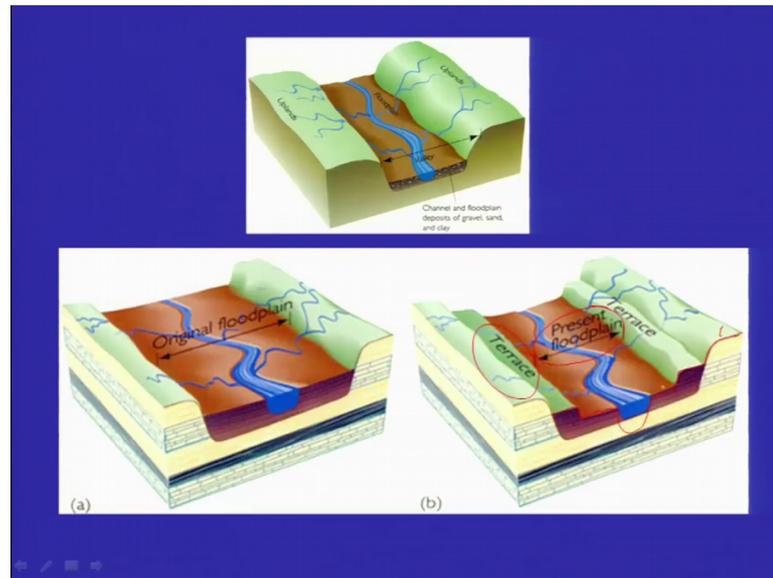
- Terraces represent older abandoned floodplains
- They mark an older relative high water level
- Marked by steps (tread) + scarp along the valleys



Now, this what I was talking about that, usually the older floodplains will occur in journal at the higher elevations ok and these are termed as terraces. So, what are terraces? Terraces represent older abundant floodplains. They mark an older relative high-water level; that means, at some point of time the river float on that plane or a on that plane ok.

But now it is abundant. It is marked by steps or scarp along the valleys ok. So, if you take the cross section, and if you are having you mark this as an present day valley. You can be able to see something like this ok. So, this is your older floodplain, and this is your younger floodplain and this we demarcate as terraces. So, what is been talked here that is it is stepped like. So, this is a step like features ok and this you will see, we will show you some examples from field photographs also, that how this type of terraces looks ok.

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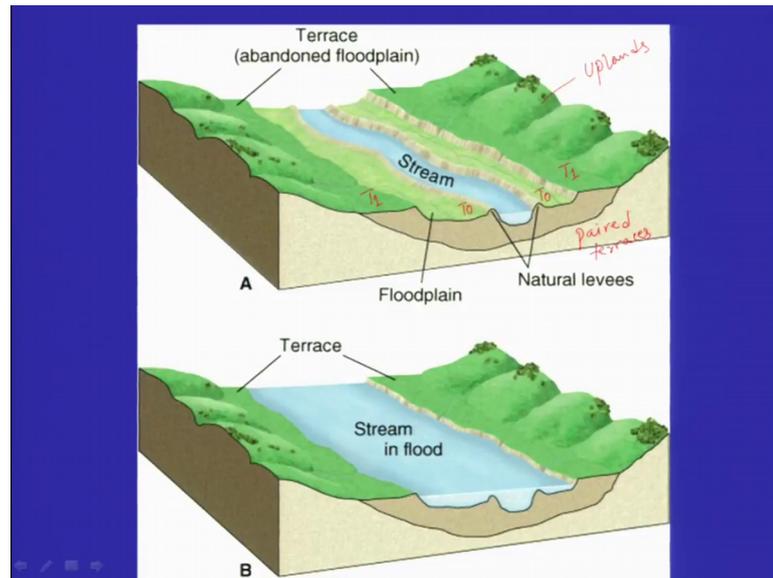


So, this is an sketch which shows the channel, and an active floodplain here whereas, these are the uplands.

But in terms of the terraces, you will be able to see like something like this ok. So, you have the uplands and the terrace here. So, what does it indicate? That originally this was the valley and river have capability to erode on either side. So, it will keep on widening the channel, how the floodplain areas ok. But because of the change in the base level, it may be because of the ongoing tectonic deformation or because of the eustatic sea level change. So, when this area is incised or eroded, the older floodplains are been left out and those are the abundant floodplains termed as terraces.

And this area, which is marked here is your present-day floodplain. Time will come quite possibly it will incise again here and the channel will flow something somewhere here, and you will have this another terrace ok. So, in section if you see you may have 2 terraces. So, this is an upland here, and this is the older terrace, and this one will be the younger terrace ok.

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So, this is another example, which has been shown here. So, you have abandoned terraces these are the uplands here, you have uplands, these are the terraces. So, if we mark usually what we do is, that youngest terrace we mark as we usually mark as T 0, but you can have your own classification, and then say T 1 ok.

And here also you are having T 0, and this is here T 1. And this also we term this type of terraces. We term this as an paired terraces. So, again, what we see here is, that T 1 is your older terrace or abandoned floodplain and T 0 is your younger floodplain. We will see what exactly we mean by the natural levees in the next slide and this is also important sometime, we see the natural levees developed along the channel. And in some locations this type of features are artificially created. To protect the floodplain areas, that is the young floodplain area.

So, if you look at the section here, I will definitely talk when we are talking in coming slides, but here also it is very clear, if you see the section here, what you see is that this is slightly elevated and then going down here ok. So, this blocks the overflow of the stream to this area; which is definitely in terms of elevation, lesser than this point as compared to this one ok. So, this is higher this is a lower here. So, these are the term as natural levees.

When stream is over flooding that is the bank full flow is there and then you consider that the stream is in the flooding state. Then this younger terraces or the younger floodplain will surely be inundated, which has been shown in this figure ok.

So, this type of mapping which you can extensively do using high resolution satellite data prepare, a detailed fluvial geomorphic map, will help in also designating the areas which will be affected by floods ok, or during the peak flood flooding conditions.

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Now, rivers and related landforms we have considered and we have learned that we have meandering rivers we have point bars, we have braided rivers we have braid bars, we have terraces, but natural landscape if you look at this is what we have ok.

So, we have floodplains, where the active channel is meandering and it has an capability to migrate from one place to another place, within the active floodplain. Landscape after construction because most of the population if you look at or the civilizations in even if you take the ancient civilizations, you will find that they are very much aligned along the major rivers or on the riverbanks ok. So, nowadays what we intend to do is that of course, we like to use the floodplains because of varied reasons and one or two main reasons are that we need water we need a fertile land, and this floodplains are the most suitable areas ok, to have that.

So, if you want to have the settlements close to the river, and you want at that same time you want to protect them from the floods ok. So, what has been done is very common construction of levees, and these are artificial levees ok. So, what you have done? You have channelized the flow, within this area only ok. You are not allowing the water to flow over this. So, you create and we slightly elevated, embankment along the channel which is termed as levees, and you allow the people to stay here ok and also, you can allow the people to do farming. Otherwise this will be the situation that a river will keep on migrating within the floodplain that is an active floodplain.

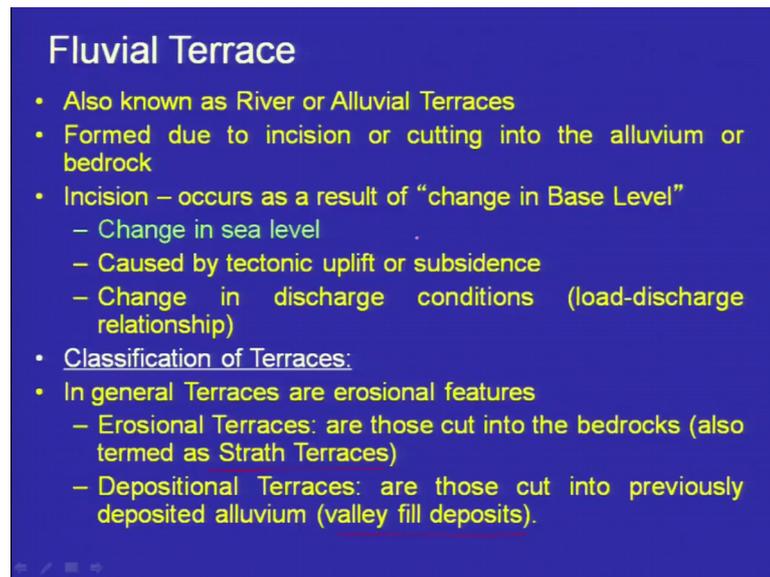
And the if you allow the people without having this protection, then you are exposing people to a flood hazards.

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So, advantage of natural levees or artificial levees if you look at this is what we see ok, fine. Now this shows levees was constructed here ok and this is the photograph which has been from the area of Mississippi river, and you can see this one that this is a levee which isn't constructed along the channel. And this area still remains as in protected area ok. Flooding is there in surrounding, but this area is still protected. That is how you can try to reduce the hazard in terms of the floods or area is getting affected from flood.

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Fluvial Terrace

- Also known as River or Alluvial Terraces
- Formed due to incision or cutting into the alluvium or bedrock
- Incision – occurs as a result of “change in Base Level”
 - Change in sea level
 - Caused by tectonic uplift or subsidence
 - Change in discharge conditions (load-discharge relationship)
- Classification of Terraces:
- In general Terraces are erosional features
 - Erosional Terraces: are those cut into the bedrocks (also termed as Strath Terraces)
 - Depositional Terraces: are those cut into previously deposited alluvium (valley fill deposits).

Now, coming back to fluvial terraces, they are also known as a river or alluvial terraces, formed due to incision or cutting into the alluvial plains or the alluvial material or bedrock. Incision occurs as a result of change in base level. So, base level as I told is either your local base level. Suppose, you are having a major stream flowing like that ok and there is an smaller streams joining here. Now for this stream, there is a smaller tributaries ok, which are joining the trunk stream. The base level for this will be the major channel or trunk stream.

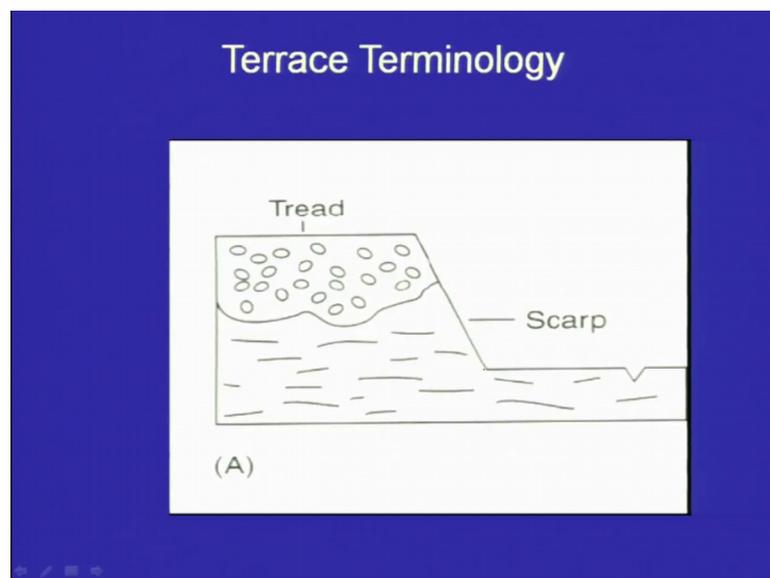
And for this, you have supposed this for a channel major one is going and meeting if it goes and meet the ocean, then this is the base level of this channel. So, if this base level changes, it will affect the complete drainage basin. If suppose you will use the sea level ok, that is the sea level fall. Then the channel will incise, but if you rise the sea level, then the channel will agreed in the upstream ok. So, base level will play an important role in terms of the incision or we say a gradation ok. So, change in base level can be caused by tectonic uplift or subsidence, change in discharge conditions, again the load discharge a relationship. Further if you classify based on the incision and deposition part you can classify the terraces into 2 categories.

In general, terraces are erosional features, erosional terraces are those which cuts into or formed when there is an cutting on to the on the bedrock ok. They are also termed as strath terraces. Then we have depositional terraces are those cut into previously

deposited alluvium. And this type of terraces we term this as an channel fill deposits. Anyways I am giving those terminologies, because when you do the mapping using satellite data, you may classify the whole area if you are putting in terms of the fluvial landforms. You can classify that as an terraces, but that is not the ultimate end. You may have to go in fuel and check few locations. At that time, you will have to do this the classification of the terraces whether it is an erosional terrace or is a it is an depositional terrace.

So, you can use this understanding and knowledge at that time. And also, the reason why we were talking about this, whole thing is not we need to understand that how those terraces or the landforms were formed ok.

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So, this is an simple way of terrace terminology. So, we have an typical step like feature you can call this platform as a thread and this is a scarf ok. So, you have the erosional feature here.

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Now, this is a great example from one of the tributary in the foothill zones of north. And the rocks which you see here that the different color are all Siwalik rocks ok, upper Siwaliks. And you see on the top here, this portion ok. This line which I am marking the top here is loose alluvium.

Whereas this one complete here up to this one is your bed rock, and this is your alluvium. So, what does this suggest? And what does this indicate? If when we see the say that this is an alluvium here, this is clearly indicating and this is a floodplain of this present stream or river. This also suggests; that at this point or this elevation this height the river flowed in the past ok. But now the river is flowing here this is a present-day channel. So, how it came to this level again? And if you ask the that what is the height is almost like 10 to 15 meters or maybe more ok.

So, this height is almost like 10 to 15 meters or nearby, that and the present-day river is flowing here, but what we see is that there is a deposit thick; deposit which are fluvial deposits ok. So, they have got deposited, when river used to flow at this level ok. But now it has incised. So, this is what we see here is the total incision. So, this is an incised valley, or you can say incised bank. So, this 10 to 15 meters incision took place in last 10 thousand years or so and why it happened and this is not very far from the Indo-Gangetic plain.

The reason is that the Himalaya is rising; that means, we say there is an uplift because day by day Himalaya is rising it is not it does not remain within constant height or elevation ok. So, this is the clear-cut example that the base level change happened or it was because of the base level change. So, these are a few examples which are indicative of the incised valleys; which again when you see or try to look at the satellite data from the hilly regions or the areas you will find deep incision ok. And that also you can mark on your photographs, and put it in your interpretations.

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Same photograph from that area.

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Now, coming to the another same location, a younger terrace this is an older terrace here. So, this flat surface is your terrace and on the other side of the river, now next photograph I am showing is from the side ok. So, the river is; so, this is your left bank this is in right bank. So, in the right bank, what we observed was a younger terrace. Again, very much similar, you are having on the top, these are all fluvial deposits, and at the base again you are having. So, the base you are having the bedrock ok. So, this is again example of a strat terrace.

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Another example of that so, you are having bedrock here, and on the top, you are having fluvial deposit scheme.

So, this were this is a younger terrace ok. So, in previous slides we are talking about T 0 and T 1 terraces. So, for this will be your T 0 terrace, and on the other side this will be your T 1, further up here in the previous slide which I was showing ok.

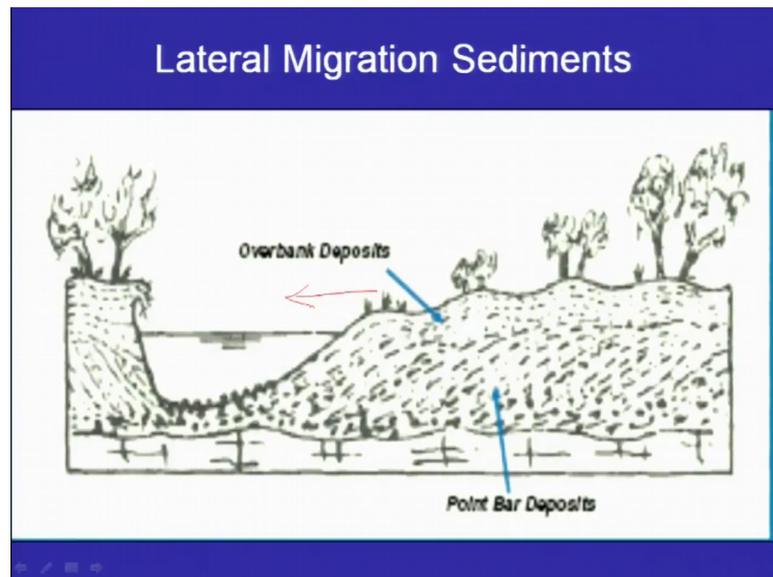
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So, this is an example of T 0 terrace, how it looks like in field? But this incision, if you draw a profile here, you will be able to see something like this ok and you are coming back here like this, and then you go, and further here you are having another terrace ok. So, you have terrace here, and then you are having over here also.

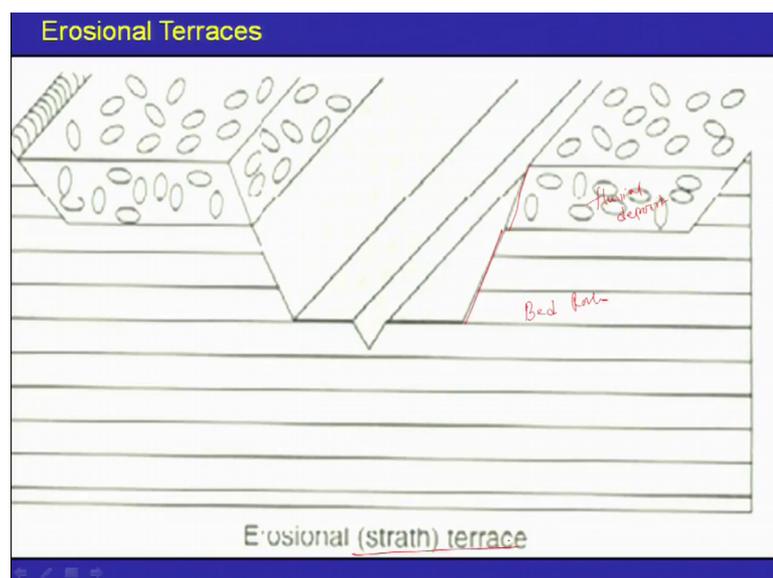
These are more or less at the same height, but due to the photograph, you can see you are able to see like that ok.

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So, let us move ahead. So, this is just to explain about the (Refer Time: 26:13) meanders will take place or the meanders will shift laterally ok. So, this portion, we will have the deeper part and this will keep on eroding. Whereas, this portion will keep on have what we have at deposition, who are here and this will keep on migrating in this direction. And this was the case which we were looking at the Hamirpur region.

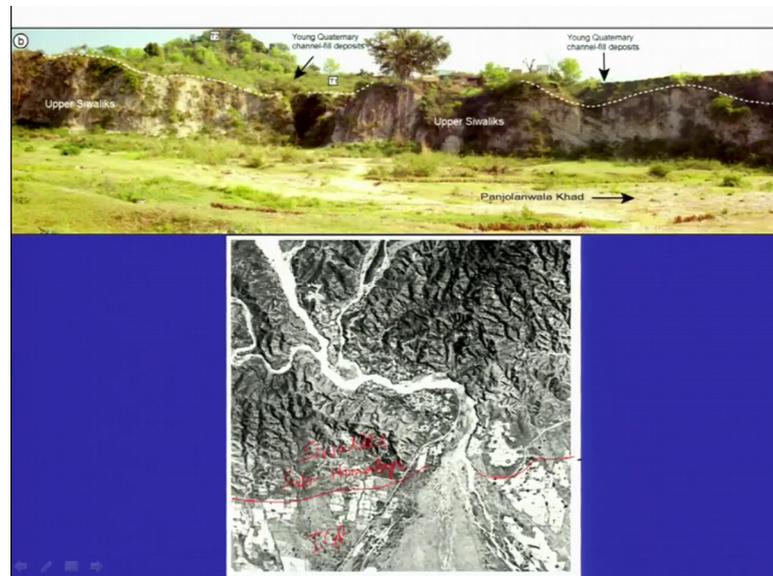
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And just to show the example of like erosional terrace, their strath terrace; so, you are having this horizontal lines indicates your bedrock. And this is your fluvial deposit. So,

since it has in size, the fluvial as well as the bedrock else we are terming this as an strath terrace or erosional terrace.

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Some of the best example close to the emollient front. So, this is the boundary between the siwaliks. So, this is an indo gangetic plane you are having and this is your siwaliks or you can say sub Himalayas. I will just explain that what we are able to see here ok. So, as I told that we will see this, the details of that what we are able to interpret from the satellite data in the field photograph. We will continue in the next one.

Thank you so much.