Geomorphic Processes: Landforms and Landscapes

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Lecture - 1
Introduction to Geomorphic Processes:
Landforms and Landscape
(Part 1)

Very warm welcome to all of you. So, this time, I am offering a new course and I hope that all students who have registered for this course will enjoy this course. So, mainly these courses related to the studying of morphology of the landscape and the processes. So, this course title is geometric processes, landforms and landscape. So, mainly will be dealing with the different types of line forms in this course likewise fluvial those are related to the riverine landforms, then Aeolian landforms, mainly the landforms which we see in desert.

Glacial landforms in the glacial areas or the higher altitude regions and how the landscape got sculptured on the earth's surface. So, this will also include the internal and external processes to some extent. We will also discuss about the plate tectonics, which definitely talks about the internal processes. So, let broadly see the course content what we are going to cover in this particular course.

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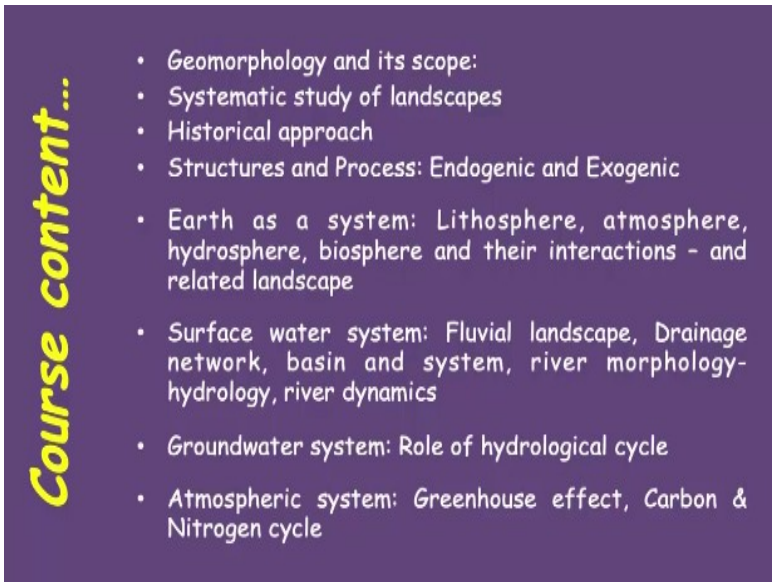

So, geomorphology and its scope, how the geomorphology will be helpful in understanding the overall processes and the landscape evolution will talk in this and what are the different type of geometric processes that also will talk or discuss during the course as we go further in

this course. Then, as I told the different processes which are responsible for sculpturing different landforms. So, we need to have a detailed study of systematic landscape study or we can say that systematic study of the landscapes.

Then, we will also look at the historical approach. On the historical approach, basically we talk in terms of the landscape evolution, that how the landscape evolved since several decades ago or maybe in 1000 years or more than that. So, those are we are going to talk about the historical records, and in particularly if you talk about the historical approach, the landscape changes which have occurred in few decades or maybe in 1000 years or so, where we can go back into the record or we can look at into the landscape signatures, which can tell us about the changes in the landscape.

Then we are going to talk about structure and processes, as I told the internal and external processes or we can say endogenic or exogenic processes. Then, we will talk about the earth as a system because the internal and external processes are to some extent interconnected and even within earth as a whole system, it comprises many small systems together. So, we will talk about in this earth as a system and we will talk about lithosphere, atmosphere, hydrosphere, biosphere, but this part, we are going to emphasize little less on this.

Then, we will talk about the surface water system, mainly the landscape. Here, we will talk about the drainage network, basin and systems, river morphology, hydrology and river dynamics. This part we are going to cover a lot because day-to-day we come across or we are very close to this landscape. So, we will discuss little more in detail about this landscape, mainly the surface water system. Then, we will talk about groundwater system, role of hydrological cycle, atmospheric system, greenhouse effect, carbon and nitrogen cycle, we will talk about this.

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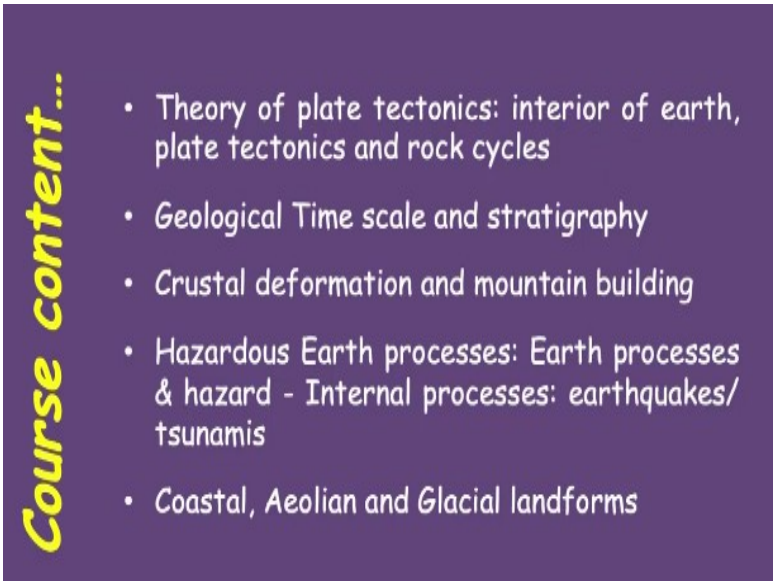

Further, we will talk about the theory of plate tectonics, interior of earth, plate tectonics and the relation between the rock cycle, then geological time scale and stratigraphy, crustal deformation and mountain building. Then finally, we are going to get into the earth processes and hazard, how hazardous are the earth processes, we are going to talk about that, and the different processes again here which has hazardous are internal as well as external, so we are going to talk about those processes. Then coastal, Aeolian and glacial landforms.

Now, whatever the course content has been given here, in these 2 slides, we are not going to follow very strictly the steps or the contents which have been highlighted, it will come as and when the topics we are going to cover. So, do not worry about the strict bullets, which have been given in the course content.

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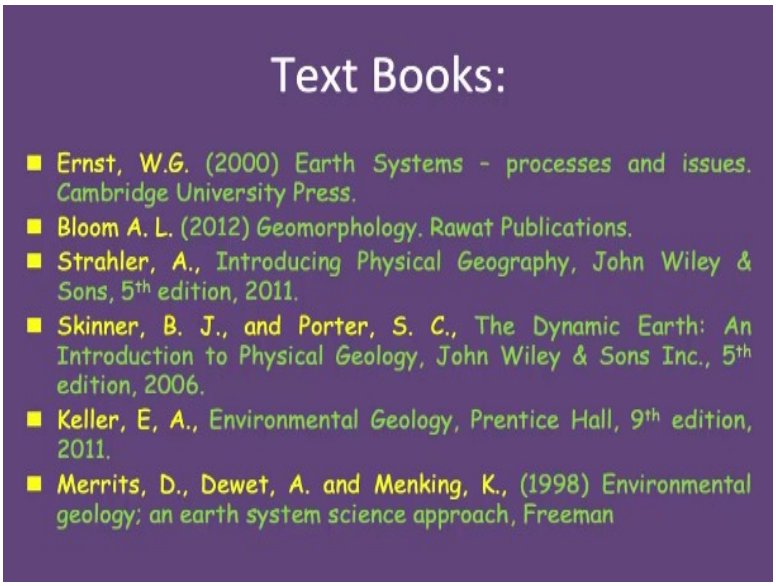

Now, if you wish, you can refer to a couple of textbooks which are referenced here like Earth systems processes and issues; Bloom text **(( )) (06:42)** Geomorphology; Strahler, Introduction of Physical Geography; Skinner and Porter, the Dynamic of Earth; Keller, Environmental Geology; and Merrits et al, Environmental geology. So, these are few books which are recommended, if you want you can refer these books.

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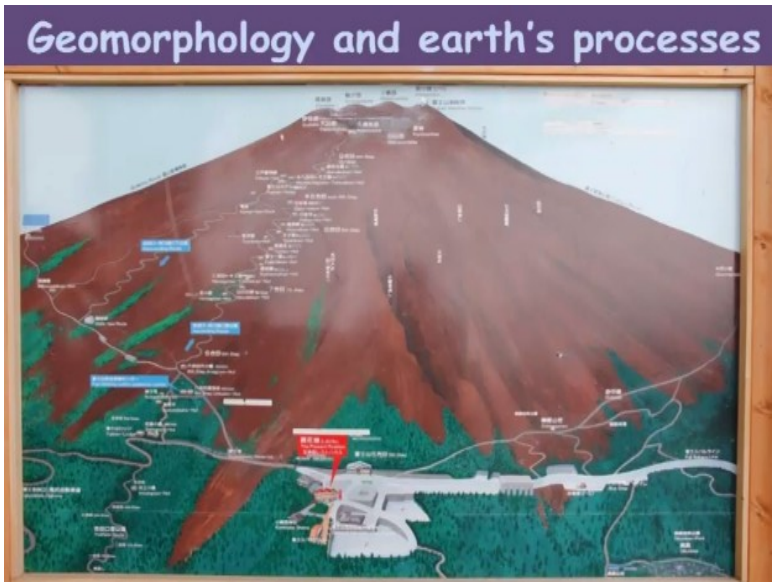

Now, geomorphology and earth processes. Basically, we what we do in these type of studies is mainly we relate the landscape and the processes. Now, the picture which has been shown here is a sketch of volcano. So, the process, which is involved here is internal process related to the plate tectonics, which has resulted into the eruption of lava on the surface and the feature for the morphology for three caught on the surface is a hillock or a mountain with a crater. So, these are the geomorphology, the morphology of the surface for the landscape. This is a picture of Fuji volcano in Japan.

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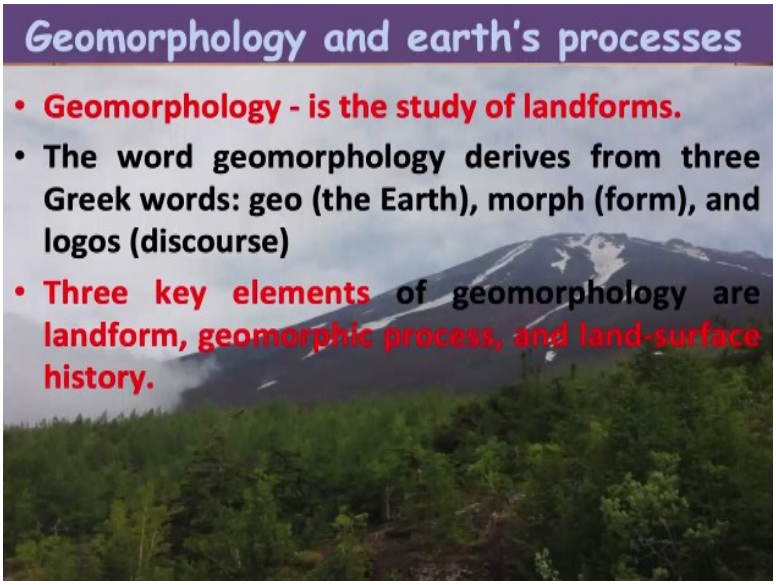

Now, further, geomorphology as we have discussed is a study of land forms or the landscape. The word geomorphology derives from 3 Greek words: geo, morph and logos where geo is the earth, morph is the form and logos is the discourse. Three key elements of geomorphology further as I have been discussing about that we study landforms, history of geomorphic processes, and then land surface history.

As we were talking about the picture here, based on the morphology of the lava flows or the morphology of the Fuji mountain, one can easily make out that how basically the lava flows were taken place in the past or how the eruptions were taken place in the past. Geomorphology on earth surfaces processes we can take basically what we do is in this type of studies, we try to study the landscape and try to understand the processes which are related to this.

Now, this picture is of Fuji mountain, which shows the one internal process basically, which is involved here is related to the plate tectonics, where the eruption of volcano has given rise to the hillock shape or the mountain and crater which has been seen in the center of the top of the mountain. So, this is one thing and even based on the morphology of the mountain, one can easily make out the different timing of the flows of the lava on these, whenever the lava flows to place, one can easily make out the older and the younger flows in the region. So, basically what we see this is the picture of Mount Fuji.

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Further, the 2 complementary main brands of geomorphology are one is the historical geomorphology where we get back into the history of the landscape of evolution process, geomorphology what were the processes which were involved because possibly the process which is operating right now might not have operated in the past. So that also one can easily identify based on the historical geomorphology.

Other brands includes applied geomorphology, tectonic geomorphology, so these are the further 2 processes which helps in identifying the deformation history of the surfaces or the formation of a different landforms due to tectonic activities. Applied geomorphology mainly is where we can use the geomorphological information in our day-to-day engineering projects. So that is in part of the applied geomorphology. Then comes the submarine geomorphology, planetary geomorphology and climatic geomorphology.

We are not going to touch upon the submarine, planetary and climatic geomorphology, but we will definitely look at the tectonic geomorphology and finally when we are talking about the hazards, we will be able to understand the importance of the applied geomorphology. Now geomorphology has engaged in methodological debates. Now, the debate is that whether the processes which operated in the past are going to operate in the future or not and can we correlate the past processes with the ongoing present processes.

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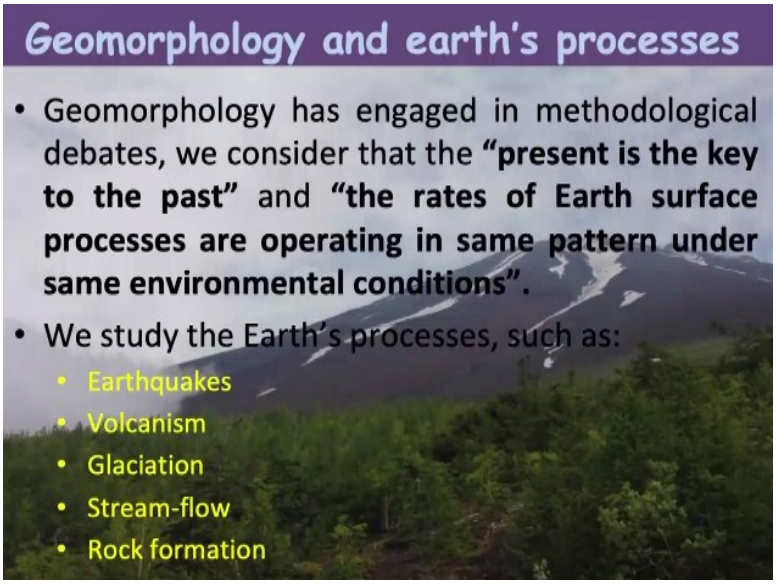

So, if you look at this, it says the geomorphology has engaged in methodological debates, we consider that the present is the key to the past. So, what we do here is that we see the processes which are operating today will also help us in understanding the processes which operated in the past because nobody was present there, only during the historical time people were there and the historical chronicles talks about the processes which were operated in the past during the historic times, we can judge it.

But processes which were operated maybe 10000, 5000 years back where very less record was available or very lest record is available right now, we can look at the present process which are going on and try to understand the processes which operated in the past. So that what how it comes the present is the key to the past, and in further, the rate of earth surface processes and operating further as we were talking about the present is the key to the past, the rate of hurt surface processes are operating in same pattern and the same environmental condition.

So, this is particularly the debate which is going on or engaged in the methodology of the geomorphology. So, we say that present is the key to the past and we also consider that the earth processes, which are operating today have operated in the past also under the same environmental conditions. So, basically we study the earth processes such as earthquakes, volcanism, glacier, stream flow, and rock formations.

So, these are the processes if you study and try to understand the process which are operated at present or during the recent past, you can get back into the history of all these processes,

you can even judge the signature of the recent earthquakes which are preserved or which are available on the landforms can be seen or identified as a signature in the form of the landforms or even the signature in the stratigraphic sections, even same as the volcanoes, same as the glacial, stream flows through your landforms we can identify and the rock formation also.

Now, we have been talking about basically the identification of the landforms and importance of the landforms which we study and try to understand their processes which are operated to sculpture these landforms.

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Now, the picture which has been shown here is from the frontal hills of Himalaya, those are Shivaliks, and this is on one of the river which flows across the folded mountain chain of Himalayas, the Cherokee river and the section which I am showing is the left bank of Cherokee river and the river can be seen in the front over here and you can see the folded mountains at the backdrop and in the foreground, you see a flat channel flowing and the section or the cliff which shows the folded beds of rocks.

Now, when we basically go into the field, we try to map all what we see in terms of the landforms and try to understand the processes. So as I was talking about the volcano, Fuji mountain, so looking at the Fuji mountain, you can talk about the landforms for the landscape like you have mountains, you have crater, and the process which has been operated to develop that hill or the hillock or the mountain is basically the volcanic eruption and tectonic deformation related to plate tectonics.

So plate motions and the collision between the two plates basically has resulted into the formation which we see on the left bank of Cherokee river or in Himalayas basically.

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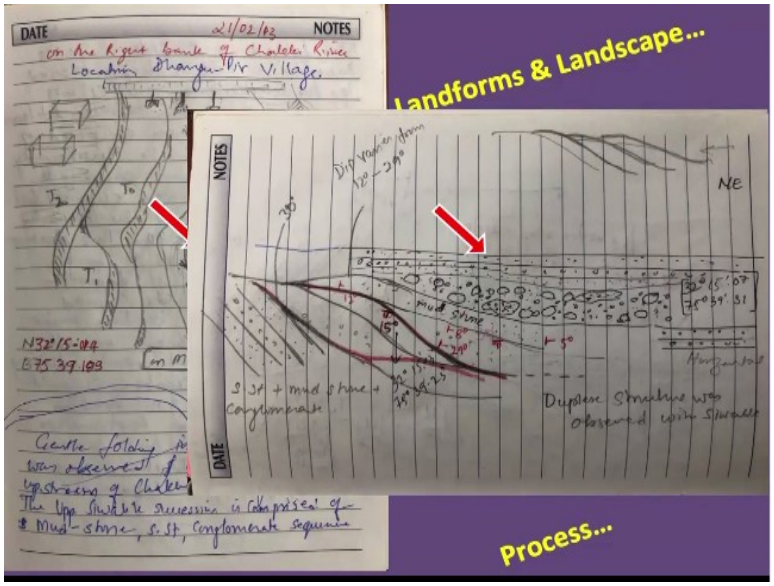

So what we did was, it has been sheets can be seen here basically is the folded rocks, which I have sketched basically over here, so you can see the folded rocks which had been shown as a folds and at the backdrop, you see hills. So this whole was being prepared, which talks about the tectonic deformation, signatures of the ongoing the deformation between the two plates, Eurasian plate and the Indian plate and the frontal most deformed mountain chain, so landform and landscape and then second is along the cliff, we also come across some signatures, which are indicative of past fluvial activities.

So, again this talk about the processes. So, one can easily make out the land forms, and based on the sediment records, one can also talk about the process. So here, one can argue that what we see is the sediment records in the cliff, but this sediment record indicate that they were deposited under a particular process and this process is related to fluvial activity, even one can talk about whether the process was calm or it was turbulent. So, here what you see is basically a small channel or we can say the channel trough, so indicating that the previous channel flowed across this one.

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So now next, first look at the planet Earth. If you take an overall sense, then let us go back into the history or at the time of the birth of the earth or before that. So what were the processes which were involved?

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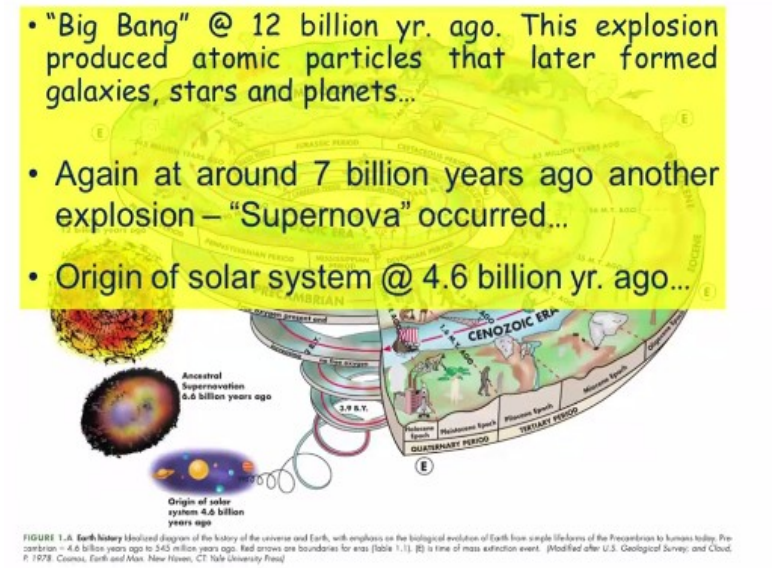

So of course, there is a hypothesis, but this hypothesis, we all believe, is that the first Big Bang, which came up at around 12 billion years ago. This explosion produced atomic particles that later formed galaxy, stars and planet. Then second one was the Supernova which was at around 7 billion years back, and then finally, what we see is the origin of solar system at around 4.6 billion years ago and that is a time when the earth was born.

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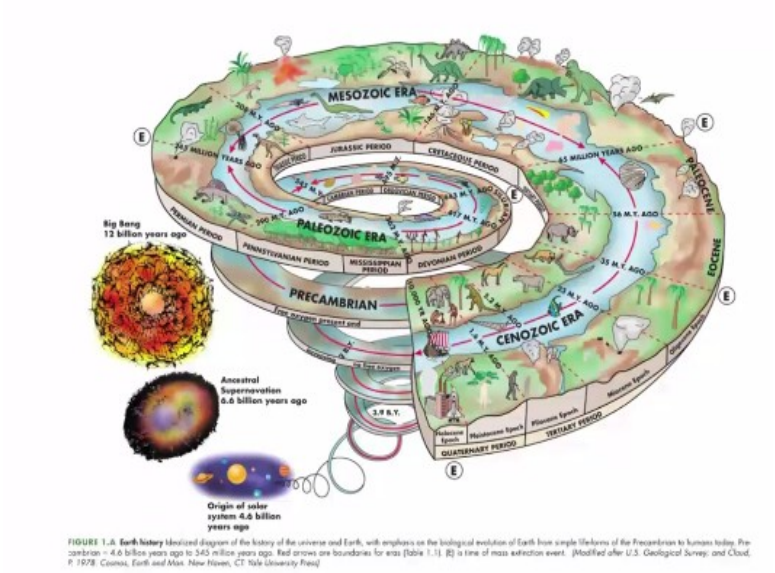

Now, if you look at the spiral figure here, it shows the period, the epoch and the era, this is geological timescale, which we talked about, and it started with 4.6 billion years ago and it shows until the present, that is the ongoing period, quaternary period, and we are in Holocene period epoch. The Holocene epoch is not so old, it is just is 10,000 years from present and this was the time when a lot of changes or the climatic changes took place and even in Pliocene epoch, the climatic changes took place.

So, quaternary period is very important for us and most important is the Holocene epoch. So, this is the just slight background of the origin of earth, further, we will look into the details of the origin of earth and how different layers of the earth were formed and so on, and some details about the prominent landforms, which exists on the earth we will talk about.

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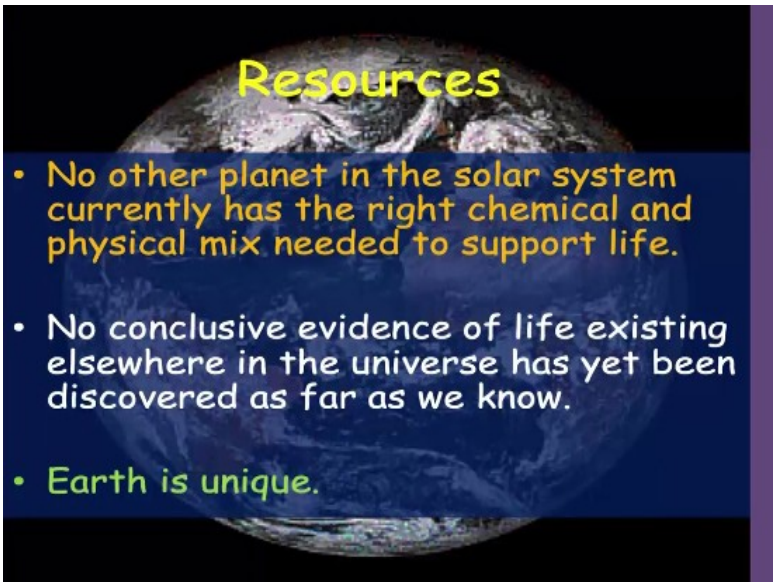

So, this is how we look our planet. Then further, we all know that no other planet in the solar system currently has the right chemical and physical mix needed to support life. So, this is the only one which exists and still we do not have the conclusive evidence of life existing elsewhere in the universe has yet been discovered, so we have not discovered until now. So, in that sense, Earth is a unique planet, which sustain or support the life.

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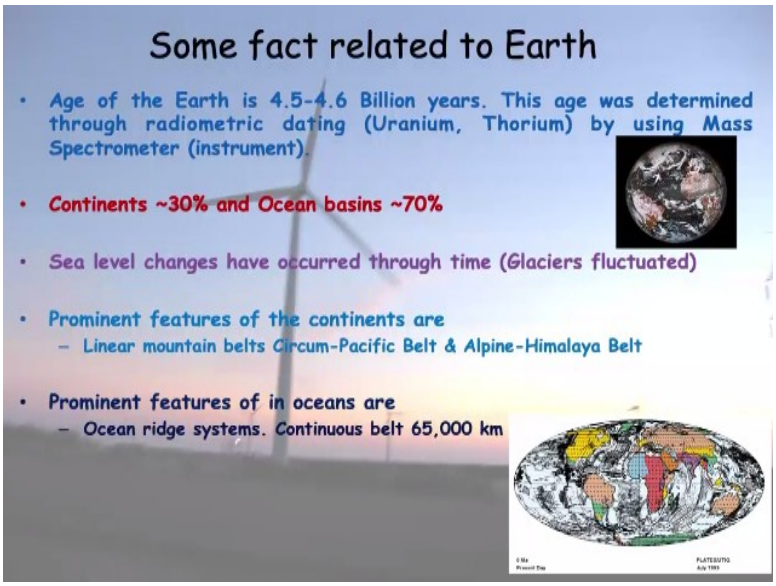

Some facts related to earth worth if you look at then the age of the earth is 4.5 to 4.6 billion years. Now, this age was determined through radiometric dating, basically the uranium, thorium dating by using mass spectrometer. Further, we have 30% of continent and rest of the 70% is occupied by ocean basins. Sea level changes have occurred through time, where glaciers are fluctuated and resulted into the changes in the landforms and the landscape.

Prominent features of the continents are the linear mountain belt Circum-Pacific belt or the Alpine mountain or the Alpine-Himalayan belt, which is one of the prominent one on the surface. Then prominent feature in ocean is the ocean ridge system which covers almost 65,000 kilometers.

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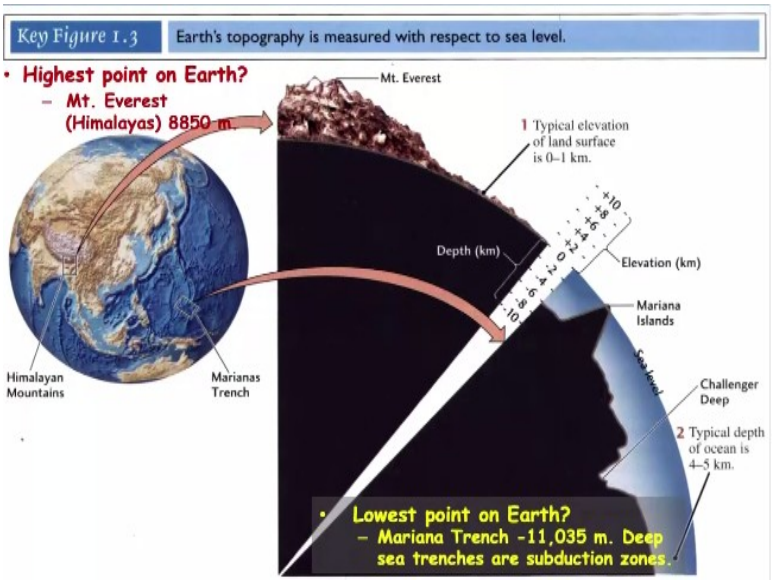

Then further, the deepest and the tallest point on the earth's surface. First we will see the tallest one, is the Everest with an height of around 8850 meters and then the deepest is 11,035 meters is the Mariana Trench. So, these are some of the prominent topography, which exists on the earth. So, we will stop here and we will continue in the next lecture.

Thank you so much.