Natural Hazards
Prof. Javed N Malik
Department of Earth Sciences
Indian Institute of Technology, Kanpur

Lecture – 25
Valcano & Related Hazard Part I

So, welcome back. This is a new topic where we are going to talk about, and the volcanoes and related hazard.

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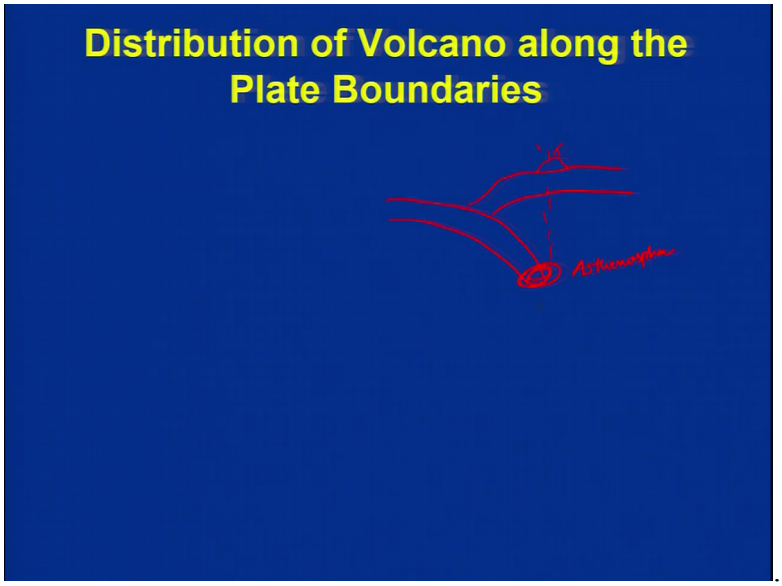

Now, if you refer the couple of slides from the previous lectures from plate tectonics and all that we very briefly talked about the distribution of volcanoes along the plate boundary. And this is very typical or that wherever there is an one plate sub ducting below another one, you will find the volcanic features. But if we are not having any plate sub ducting with respect to one another than you would not be able to see such feature.

So, for example, if you are having in plate sub ducting below that is here either you talk this is mostly the ocean to oceanic plate, and the over writing plate could be an oceanic plate or the continental plate, then as soon as this material or the plate portion reaches the asthenosphere. It will start melting and then this will result into the formation of volcanoes on the surface. So, if you look at the overall configuration of; I hope you note it down, but you can just put up in this one.

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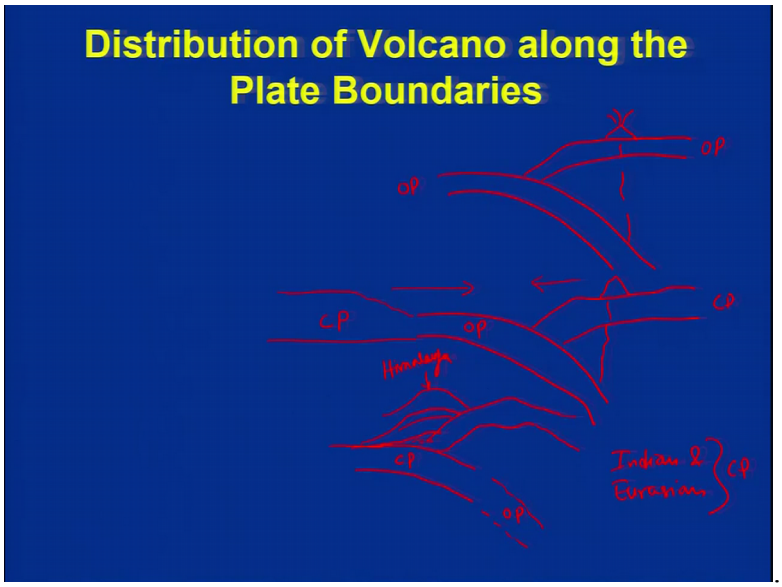

So, this is one plate moving below the another one so, the melting I will result into the; the formation of some volcanoes on the surface, if this plate is no more subtracting that is in the case of you are having this an oceanic plate here and this is also an oceanic plate, but if you are having an configuration of like oceanic plate subducting below the continental one. So, this continental plate and this one is here oceanic plate, then you will have the volcanic eruptions on the continental plate side, but as soon as if either you are having in continental plate which is adjacent to this one and if it reaches because this is moving and this is riding over.

So, when this to meet that is in continental and then continent another situation what we have it. So, this is the broken oceanic plate here and this is the continental plate. So, both will try to shut often collide with each other and result into the mountains ok, but this is very much similar to what is we have discussed in the scenario between the Indian plate and your Eurasian plate, where both of this for your continental plates. And the result what we see is the Himalaya. So, this thing you should keep in mind when you are talking about the location or the distribution of volcanoes.

So, if you look at the distribution with respect to the plate tectonics or the plate tectonic boundaries, then you will find that most of the not most, but all the volcanic eruptions which are active or dormant, they are along the plate boundaries.

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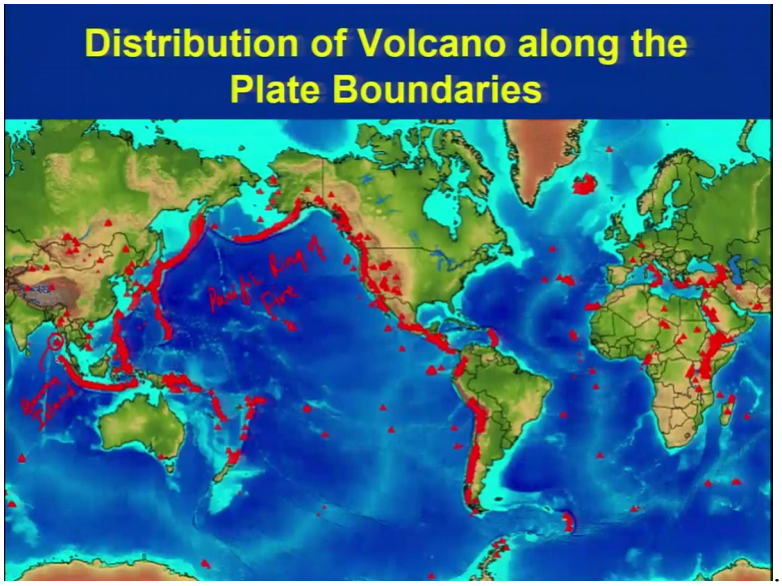

And whenever wherever or wherever there is no oceanic plate subducting below like in the case of the Himalayas here, we have both are your continental plates. But here we have still the oceanic plate subducting below the oceanic and partly plate here both are oceanic, here also we have the oceanic plate subducting below the continental plate.

So, we see the volcanic eruptions on the continental side and very good example if you look at is from the this region. This is what we call the pacific ring our fire. So, this portion is wint unders pacific ring of fire where we see a very beautiful distribution of volcanoes, we have one in India and this one is here this is known as Baron Ireland and then we have series of active volcanoes which are sitting along the Sumatra arc.

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So, volcanoes mainly what we describe is typically a cone shaped hill or mountain formed at a vent from which molten rocks, that is the magma or the magmatic gases reaches the earth's surface and erupt. So, this is an basic example and the backdrop of the photograph you can see the cone shape hill or the mountain and from the center that is your wind through which either the gases or the molten rocks that is what we call magma has been poured out.

So, once the magma reaches the surface it is termed as lava then the flow starts. So the, the flow which you see here some; some locations are the lava flow.

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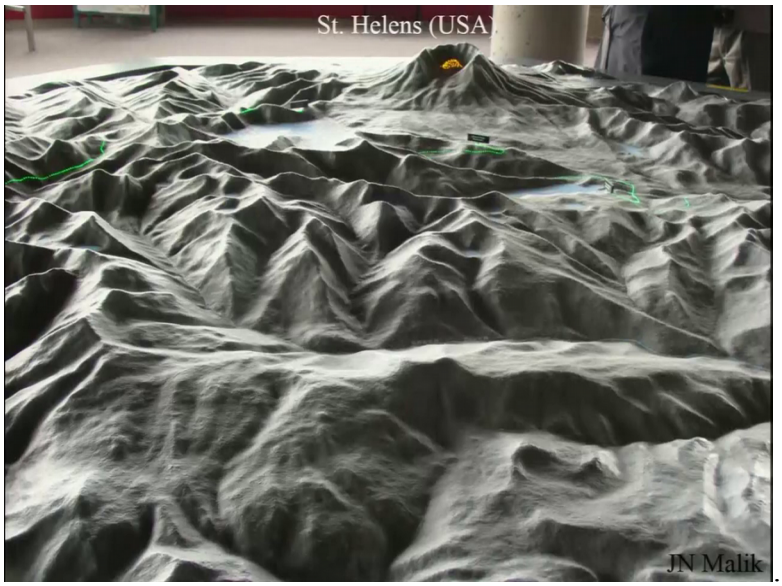

Now, I will start within one example from US that is Saint Mount Helens and this was an well studied or well observed volcanic eruption which took place or which in the volcanic eruption took place in 1980 also. And later also, but the most important part was that they monitored this volcanic cone and how it progressed and until it erupted finally

So, this is an a digital elevation model which has been created using the topography of that region and how well it was been studied and that we will I will just show up in couple of slides.

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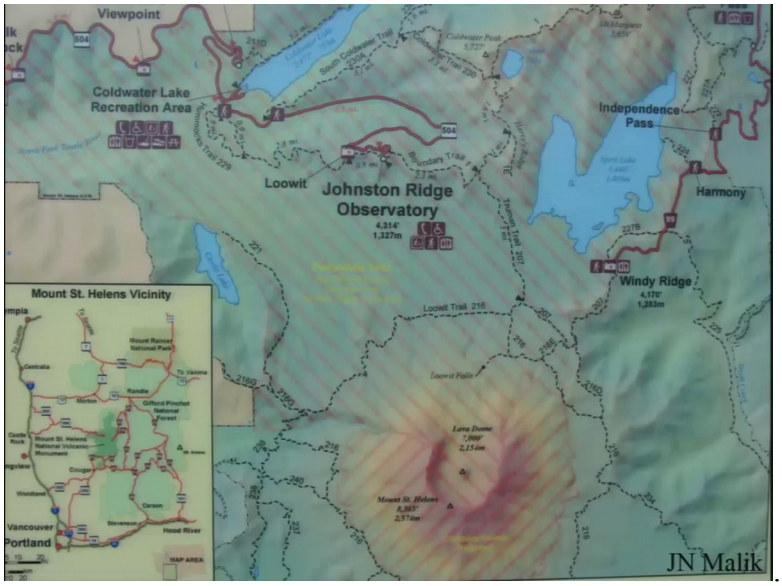

So, the previous slide which I was showing was looking this side of the dome, and this is the Mount Saint Helens the height is almost like 2074 meter. So, it is quite high the summit and the observations where been made by a geologist who got killed during the eruption; his name was doctor Johnston and this observatory. Now I was been has been named after him, it is known as Johnston ridge observatory. So, he was sitting on the top hill for here and then watching and photographing all the moment of the structure, and he got killed. The reason was I will come to the now to that in the next slides.

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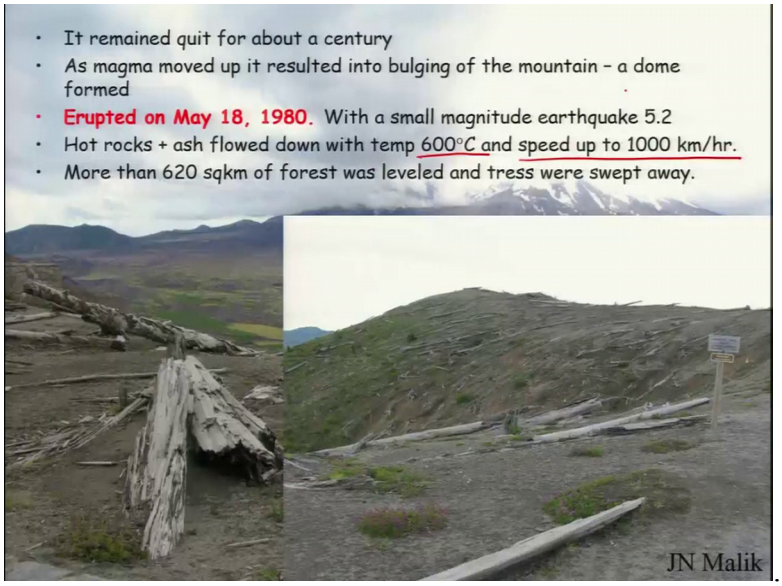

So, this is a picture from the same observatory which shows the depression here, what we call crater and this was been formed when the portion or the top portion of the cone was totally blown up. Now what they have done is that they have preserved the complete the incident ok. That happened at that time and you can see even in some locations the logs which got buried or where blown up because of this eruption. And if you carefully see this the this almost 2700 meters high hill is capped by eyes or the snow.

So, in snow cover mountain. So, its remind quite for about its eventually remain quite actually for about a century [FL]. So, if you; if you look at the top of this mountain what you see is they are covered with this is covered with snow and this plays an very important role, I mean in terms of like creating a lava flow. Because when the lava flows or comes out from the vent and drops on the on the snow covered peak and that will result into the mud flow or the lava flow.

So, this volcano it remained quiet for about the century nothing was happening as magma boot it resulted into bulging of mountain. So, in the center here, there was a dome or a bulge which were been formed looking. So, and it directed in 1980 on May 18 with a small magnitude of earthquake 5.2. Hot rocks plus ash flowed down with an temperature of almost 600 degree centigrade and the speed was almost 1000 kilometer per hour.

So, more than what the airplane flies, and this the material which was been poured onto the surface through the wind that is the rock rocks plus ash very high temperature it melted the; the snow cover here. And that resulted into a lava flow or like in mud; mud flows more than 600 square kilometer of forest was completely leveled and the trees were swept away. Because of the speed as well as the high temperature, the trees the forest area was completely leveled.

So, this is what it is been preserved. Now this is in part of a national park which shows the lightning power lined up or the oriented tree trunks. So, tree trunks which are it shows this is the direction in which there are flowed. So, lot of tourists they come and visit this area and still they can even watch and see the dome where or the crater where the domel effect has been seen as again the magma is rising and that crater.

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So, they have an observatory with a key constantly keep on monitoring the earthquakes the micro earthquakes. So, if suppose they; they get an indication that the multiple

earthquake micro earthquakes are occurring then they can indicate or suggest that there is an movement of magma into the vent.

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So, at present when, when I visited this area and this is the dome which you can see which is coming up in the crater. So, this one crater here you have and within this the center part is bulging up. So, the time will come this will again erupt. So, what they are doing they are constantly watching it.

So, they know that how, how it is growing. So, if there is an sudden growth which has been seen here of this portion then they can issue the warning that there will be an eruption very soon there is a close up of that.

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And this was like from 2004 to 2006 renewed activity was observed, where this part was again uplifted because of the magma getting into this.

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So, volcanoes again can be also defined can be defined as a gap in the earth crust through which the molten rocks or the magma comes onto the surface. It is a conical mountain formed around the vent through which molten mass comes out to the surface.

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So, as we were talking about that the volcanoes and related hazard, there are few historical events which are been listed and this data has been taken from the MIT Press Cambridge which talks about the worldwide volcanic eruptions which were deadly or devastating. So, the; the list on the in this table on the left hand side shows the volcanoes and the cities now which they affected the year in which they were erupted and what was the effect in brief.

So, one is which one is was deadliest one was I am not going to talk all, but yes of course, few we will just discuss and try to understand that what was the effect the quantum of effect because of the volcanic eruptions. So, this is innately Vesuvius it occurred in AD 79 destroyed Pompeii city, and the area and killed almost 16000 people. And it says that city was buried by volcanic activities and then rediscovered in 1595.

So, until then they were they were not away even aware that there was such an deadly volcanic eruption which killed almost 16000 people and then city was completely buried under the volcanic ash and the day breeze. Then another one was which also affected the climate ok, and this was from Indonesia tambora eruption was in 1815 killed almost 10000 people and 18000 people who have been affected producing a global cooling where a complete year was without summer.

So, you can understand that even if you are sitting away from the location of the volcanic eruption. If the volcanic eruption is a very severe then it can result in to the global

climate change or the global climatic effect also, but if the volcanic eruption is very frequent in most of the areas then of course, it will in total affect the climate then there is Krakatau Indonesia tremendous explosion more than 36000 people were killed and that was because of the tsunami.

Because since we have this volcanoes few of the volcanoes which are located close to the ocean. If you are having an configuration of oceanic, oceanic sub duction. So, if you have oceanic plate sub ducting below. So, you have an ocean here if there is an eruption here it will affect the nearby area and result into the landslide massive landslide which can result into the disturbance of your water column as it was experienced during the decent earthquake and volcanic eruption the same from Krakatau. Then Mount Pelée, eruption of 1902 chase the ash flow killed 30000 people in a matter of minutes.

So, you can understand the impact that how fast the flow was the ash flow was with off within tremendous velocity which killed almost like 30000 people. Then we take the Billerica from Chile the eruption was 1964 64 it forced almost 30000 people to evacuate their homes. Then we have mount Saint Helens in Washington Dc 1980 debris avalanche which I was showing in the previous photographs the Johnston ridge and all that a lateral blast and mudflows this mud flow is here what we are talking about if you have the magma plus snow till result into lahar flows.

So, this happened now very interesting the eruption was very deadly only 57 people were been killed. The reason was this area is sparsely habitable and these scientists how the geologist who was killed in this eruption, he was able to at least send his last voice on radio saying that it is coming its coming. But he never thought that the volcanic eruption taking place here, and he is sitting somewhere far away in the ridge well the flow will come right up to this for its ok.

But the flow was. So, fast that it swept this whole area. And when the tourists visit this area they are even they can listen to or hear the voice or they watch the movie of this eruption. Then there is again and Filipino earthquake Mount Pinatubo 1991 tremendous explosion ash flow, mud flow combined with a typhoon. So, this was an additional added effect of typhoon killed more than 740 people, several 1000 peoples where been evacuated then again another one is in Chile 2008 almost 5000 people were evacuated.

Now what we see now from these events here, that slowly we are getting into the process of evacuation.

So, in the starting if you see the 79 ad event people were killed people were not unable to understand the phenomena, but later if you see most of the earthquakes what we are able to learn is that people will been warned and people will been asked to evacuate the locations. So, this is what we learn from this topic that yes we have slowly as there is a development in science, advancement in science we are learning more and more about the volcanic eruptions and the processes, and we are trying to reduce the effect to the people and the property. Then this one is from Iceland 2010.

Now, this was the event which put large amount of ash in atmosphere, which disrupted the air travel in united kingdom as well as in northern Europe for several weeks because no flight was been allowed to take off or land in this region. So, this was one of the devastating one of course, not many people got affected because of this.

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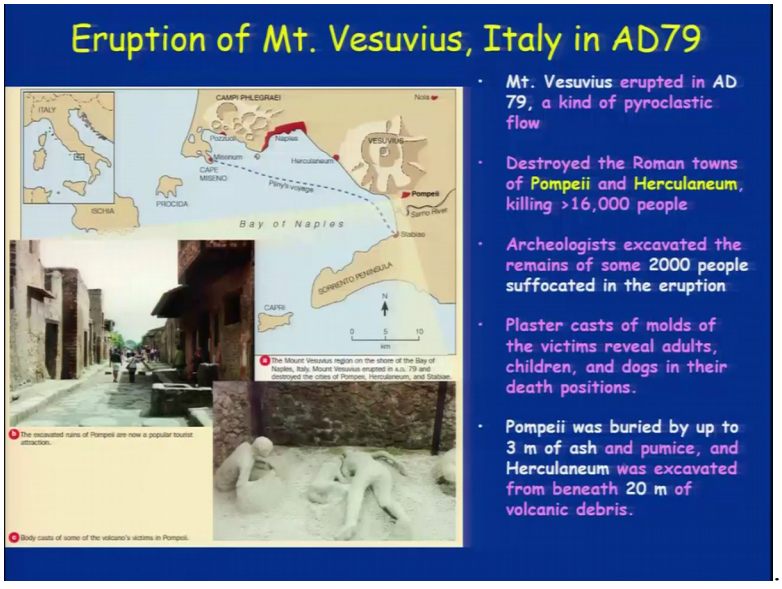

So, eruption of Mount Vesuvius Italy in ad79 so Mount Vesuvius eruption a kind of pyroclastic flow.

So, we it includes the rock fragments as well as the ash destroyed the Rome town Pompeii and Herculaneum killing almost or more than 16000 people, archaeologists excavated the remains of some 2000 people suffocated in this eruption or because of this

eruption. So, what they found was the victims plasters with a plaster cast when the adults children's dogs and in the dead position. Another important point which one can note down here that they even did not get time to move out from this place the flow was so fast.

So, Pompeii was buried by up to 3 meter of ash, the 3 meter of ash is more than enough to cover the complete city and we mean to do to keep it hidden from the from the people which was later excavated and they came to know in 15000 AD also. So, I will stop here and we will continue in the next lecture.

Thank you.