

Welcome students. This session is about Folds Part 3 module number 8. Outline is concept of plunge and refolding of rocks. Learning outcomes students will be able to differentiate between a plunging and non plunging fold, identify a plunging fold in the field and identify refolded rocks.

Here to understand what is plunge, we need to draw or look upon a block diagram that consists of several planes. The attitude of the hinge of a fold is defined by two measurements. The bearing or strike of its horizontal projection and the plunge. In this figure FD is the hinge line. This line happens to be the hinge line. Of all the possible vertical planes only ADFG consists of the line FD. The intersection of this plane with the horizontal plane ABCD is the line AD. The line AD is the horizontal projection of FD. In this figure the line AD bears northwest. You can have a look at this like this directions, so the line AD bears northwest and this is therefore the bearing of the horizontal projection of FD. So the horizontal projection of this FD over this plane is AD. Now the plunge of FD is this angle which is P, which is the angle between AD and FD measured in the vertical plane ADFG. So we have FD as the hinge then we have a horizontal plane as ABCD and this AD is the horizontal projection of FD. The angle between this FD and AD forms the plunge of the fold. So plunge of the folds. Although larger, plunging folds cannot be directly observed, they are easily recognized from the outcrop pattern. Here we are seeing a horizontal hinge of a fold. This is horizontal hinge of a fold. Now this is a cross section, but when we see an aerial pattern we look at this non plunging fold here so the beds on the opposite limbs strike parallel to each other. They do not converge. So here the bed strike in dip in this direction, here the beds dip in this direction whereas here they dip towards the other beds here dip towards the other beds hence the hinge line lies here. The hinge line is horizontal. When we look at this particular fold here, the hinge line is here, which is an inclined line hinge line is inclined. Hence the aerial photograph will look like a cone, two cones. So plunging fold and the map pattern the beds converge and the formations have a zigzag pattern. Hence the pattern could be like this in a zigzag fashion. Here these are the Maps of plunging folds. The beds on the opposite limbs strike towards each other and the formations converge. This shows a plunging anticline and this shows a plunging syncline. So in the anticline oldest formation is at the center and in the anticline sorry syncline youngest formation is at the center. The actual trace of fold connects the points where on the map each bed shows maximum curvature, so this is the axial plane that connects maximum curvature.

These are plunging folds at Ramthal, Karnataka, wherein this is a fold. This is axial plane like this and the beds dip into the screen. The beds dip into the screen inside so the hinge line comes outside the screen. Hence these are plunging folds. Now the plunge of folds or plunge does not remain constant and can also reverse. We will see them in these images. In a the anticline with axial trace is trending in northeast direction, so this is the northeast direction. The fold plunges 10 degrees to northeast, so this is the direction in which the folds plunge. The value of the plunge is zero in the center, and here the strata on the opposite limbs are parallel in strike in the southwestern corner, the anticline plunges 15 degrees SW. Hence the plunge the plunging direction is in this way, and the plunging direction is in this corner. The hinge line is this way. Hence it dips in both the directions. Doubly plunging fold is the one that reverses its direction of a plunge within the limits of the area under discussion. Most folds are doubly plunging. So the Dome is an anticlinal uplift that has no distinct trend. Hence here the beds dip in this direction. Here the beds dip in this direction. Here the beds dip in this direction and hear the beds dip in the opposite direction. The oldest formation is in the center, youngest formation is on the outside. A basin is exactly

opposite, where youngest formation is in the center, oldest is on the outside and the beds dip towards each other. Now we will see a refolding. A refolding is always possible. Like for a situation where the sedimentary beds were deposited horizontally in a basin later on due to tectonic movements, these sedimentary beds were folded. Now for quite some time this folding happened and stayed there for a few millions of years and then again the same area was subjected to forces in the same direction in a stronger manner. So when the folded beds are again subjected to compressive stresses in the same directions, the folds get tighter and they again experience folding. This particular phenomenon is called as refolding of rocks. Now folds may be refolded. Now in this figure a vertical isoclinal fold has been refolded so first we had an isoclinal fold like this where the bed dip in the same direction in equally or in different directions. Now this fold was had formed earlier with this compressive stresses. Now the same fold again was subjected to compressive stresses in this direction. So the fold got refolded in this fashion. So the axial plane of the earlier fold had got refolded, and a new axial plane formed. So the new axial plane is now inclined, so we have a fold which is like this and then it is again folded and we have a fold which is like this. So we have this axial plane forming in this axial plane. In this figure we have this fold that has been refolded along another axial plane, so this happens to be F1 and this axis happens to be F2, so this folds being refolded. So reclined fold is the one in which the axis plunge directly down the dip of the axial surface. Many reclined folds form when steeply dipping beds are subjected to shearing parallel to the strike of the beds. We have another situation of a fold. So we have this fold with an axial plane this way this particular surface is the erosional surface. This part is extrapolated so these are younger rocks and these are older rocks. Fold A appears to be an anticline and fold B appears to be a syncline that is here, so this appears to be an anticline, but it is also possible for it to be a refolded fold. Now this is possible if extensive field work is undertaken and same petrology and sedimentary beds are mapped over a wide areas where in a number of observations and number of readings could be taken and this is a way to find out whether the same bed is repeated elsewhere. So it could be related to this particular fold here. So this can be refolded wherein this is the axial plane of an earlier fold and a newly formed fold has axial plane that is vertical, so folds A & B is not an anticline or syncline, but antiform and synform must be used where the age of the stratigraphic succession is unknown. So if this is not known, older and younger rocks, then the term antiform and synform is used.

These are the references.

Thank you.