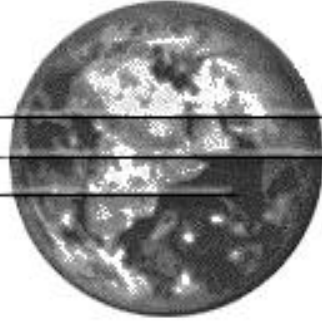


Geoscience 101

The Solid Earth



Lecture 8

M-W-F November 8, 10
T-R November 9

Folding and Faulting CHAPTER 10

This is only an outline of the lecture. You will need to go to class to fill in the outline, although much of the relevant information is also in the text.

ROCK DEFORMATION: FOLDS AND FAULTS

STRIKE AND DIP

We can describe the orientation of sedimentary beds, whether they are horizontal or not, by their strike and dip.

We can use the strike and dip of the beds to help describe folded or tilted rocks.

Strike is the direction of a horizontal line drawn on the surface of the bed.

If the bed is horizontal, we can draw this line in any orientation. If it is not, only one orientation is possible.

Dip is the direction water would run across the surface of the bed (without valleys being carved in it).

Dip has a compass direction which is at a right angle to the strike direction.

Dip also has an angle of incination: the amount of tilt from horizontal.

WHY ROCKS FAULT OR FOLD

Rocks deform when stresses on them are stronger in some directions than in others.

Both folds and faults are caused by directed pressure.

Folds usually form when pressure in one lateral direction is greater than either pressure in the other lateral direction or vertical pressure.

Faults can form by directed pressure that is greatest in any direction.

FOLDING VS FAULTING

What factors favor folding over faulting?

High temperature favors folding.

High confining pressure favors folding.

Both of these conditions are found in the lower crust.

Another factor is the composition of the rock.

Mafic rock is stronger, therefore more brittle, and is more likely to fault.

Felsic rock and sedimentary rock are weaker, and fold more easily.

TYPES OF FOLDS

Most folds are similar to the effect you get by pushing on each end of a piece of paper lying on a table:

You get a series of upfolds and downfolds, which geologists call anticlines and synclines

A line along the top of a fold is called its fold axis. The fold axis lies in the axial plane, which is an imaginary plane that bisects the fold.

If the fold plunges, the fold axis will point downward in one direction.

DOMES AND BASINS

These aren't a series of ridges. They are more or less symmetrical all around, like a bowl or an inverted bowl.

Domes are commonly the result of a pluton pushing up the overlying sedimentary rock.

Basins are often the result of accumulation of a large amount of sediment, which presses down on the underlying layers of rock.

FAULTS

A fault may occur whenever pressure in one direction is significantly different than pressure in another direction, that is whenever there is directed pressure, and the rocks are brittle.

Brittleness may be caused by low temperatures, low pressures, or strong rocks.

Strongest pressure in any direction --up/down, east/west, or north/south --may cause faulting.

Different kinds of faults form in response to different arrangements of maximum and minimum pressure directions.

HANGING WALL AND FOOT WALL

Faults in which movement is up on one side and down on the other are called Dip Slip Faults, because they move in the dip direction.

Dip slip faults are not vertical.

If a fault is not vertical, it has a hanging wall and a foot wall.

The hanging wall is the side on which the rock overhangs the fault plane.

The footwall underlies the fault plane.

[A miner following a fault because of its mineral deposits, would stand on the foot wall and hang his lantern from the hanging wall.]

TYPES OF FAULTS

1. Normal dip slip faults

Normal faults form when pressure is greatest vertically. That is, gravitational pressure is greater than the forces holding the rock from the side.

This occurs at mid-ocean ridges, where two plates are pulling apart, and in other locations, such as the Great Basin of the United States, where the crust is extending.

In normal fault, the hanging wall goes down. When this happens, it also slides away from the footwall. This allows extension of the Earth's crust.

2. Reverse dip slip Faults

Reverse Faults form when pressure from one lateral direction is greatest, and vertical pressure (gravitational pressure) is least. This is common at convergent plate boundaries.

Reverse faults are common in the Himalaya, where India is converging with Asia. Also, a subduction zone plate boundary is a giant reverse fault.

In a reverse fault, the hanging wall goes up, pushed by strong forces from the sides.

3. Strike Slip Faults

Strike Slip Faults move in the strike direction --that is, horizontally. The rock on one side moves past the rock on the other side.

Strike Slip Faults form when the greatest pressure difference is between two horizontal directions, and gravitational pressure is intermediate.

The San Andreas Fault is a strike slip fault, as are many other faults in California.

Strike Slip Faults may be Left Lateral or Right Lateral. The San Andreas is Right Lateral.

THE SAN ANDREAS FAULT

The San Andreas Fault forms a plate boundary between the Pacific Plate and the North American Plate.

Los Angeles is on the Pacific Plate, and San Francisco is on the North American Plate.

These two plates are moving past each other. Neither is subducting under the other, nor are they diverging (at this boundary).