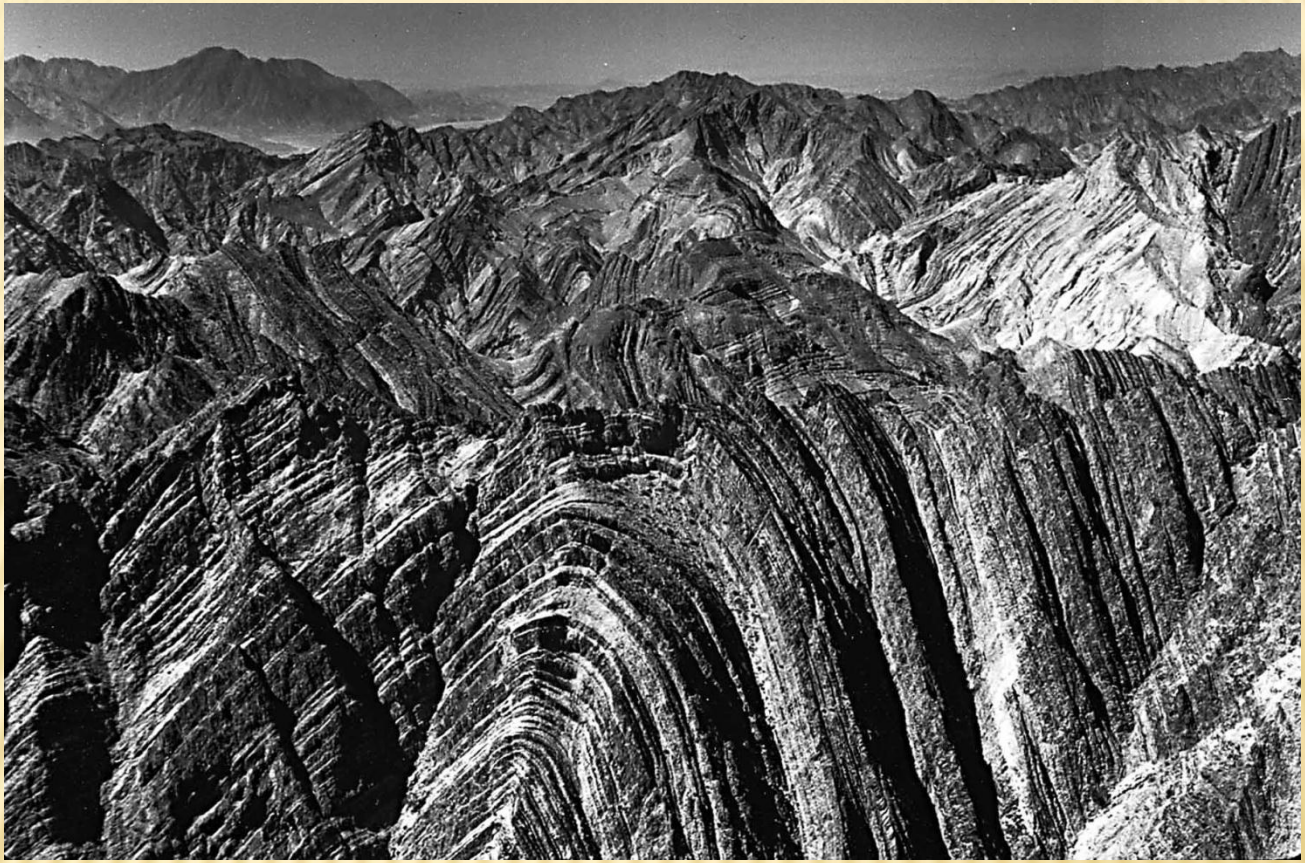


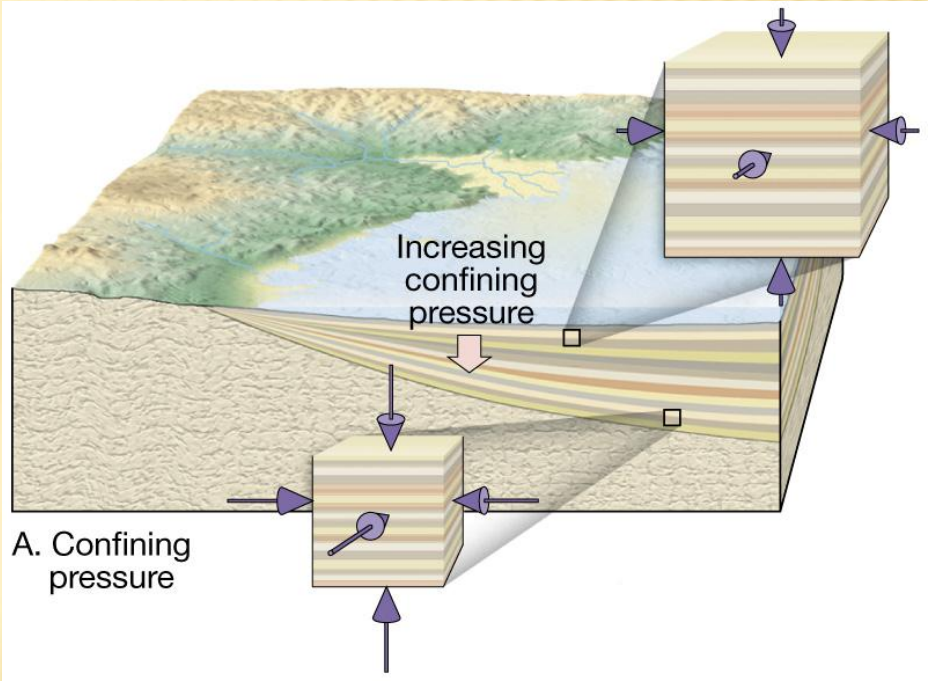
UNIT 10

MOUNTAIN BUILDING AND EVOLUTION OF CONTINENTS

ROCK DEFORMATION

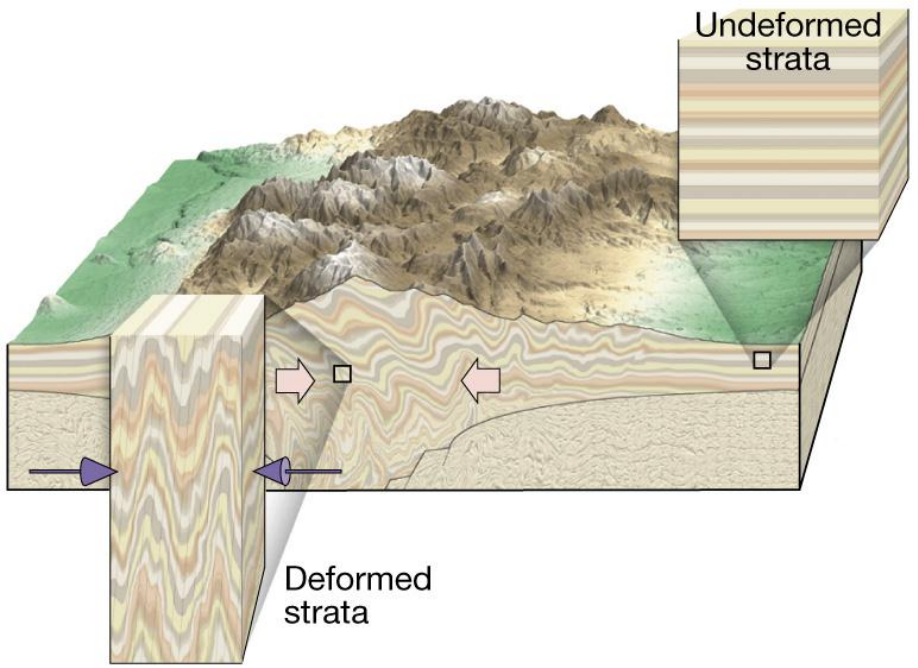
STRESS

- Tectonic forces exert different types of stress on rocks in different geologic environments.
- The first, called **confining stress** or **confining pressure**, occurs when rock or sediment is buried.
- Confining pressure merely compresses rocks but does not distort them, because the compressive force acts equally in all directions



ROCK DEFORMATION

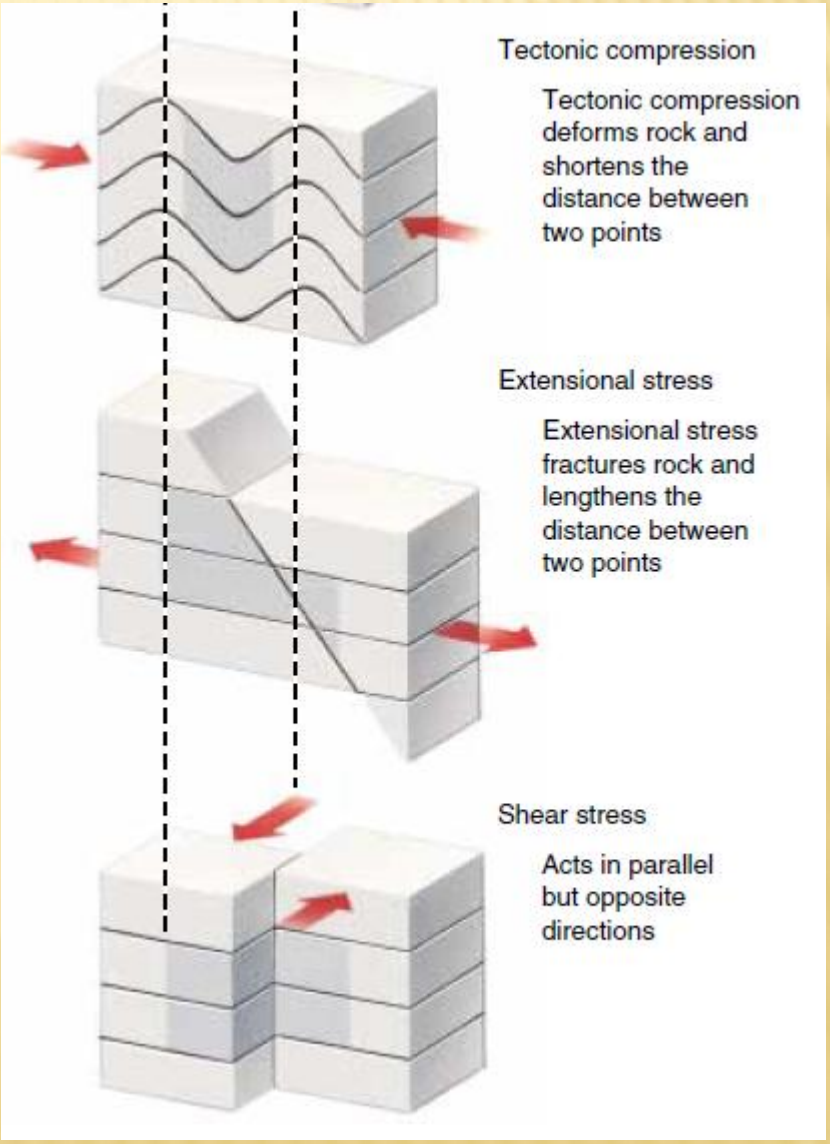
- STRESS
- In contrast **directed stress or directed pressure**, acts only in one direction.
- Tectonic processes create three types of directed stress.



ROCK DEFORMATION

DIRECTED PRESSURE

- Compressive stress is common in convergent plate boundaries,where two plates converge and the rock.
- Extensional stress (often called tensional stress) pulls rock apart and is the opposite of tectonic compression Rocks at a divergent plate boundary stretch and pull apart because they are subject to extensional stress.
- Shear stress acts in parallel but opposite directions. Shearing deforms rock by causing one part of a rock mass to slide past the other part, as in a transform fault or a transform plate boundary.



ROCK DEFORMATION

STRAIN

- **Strain** is the deformation produced by stress.
- Deformation can be of two types

1. **Elastic deformation**: An elastically deformed rock springs back to its original size and shape when the stress is removed.
2. **Plastic deformation** :During plastic deformation, a rock deforms like putty and retains its new shape.

- Once the substance/rock has reached the limit of plastic deformation, it breaks or ruptures. This is known as the **brittle deformation**.

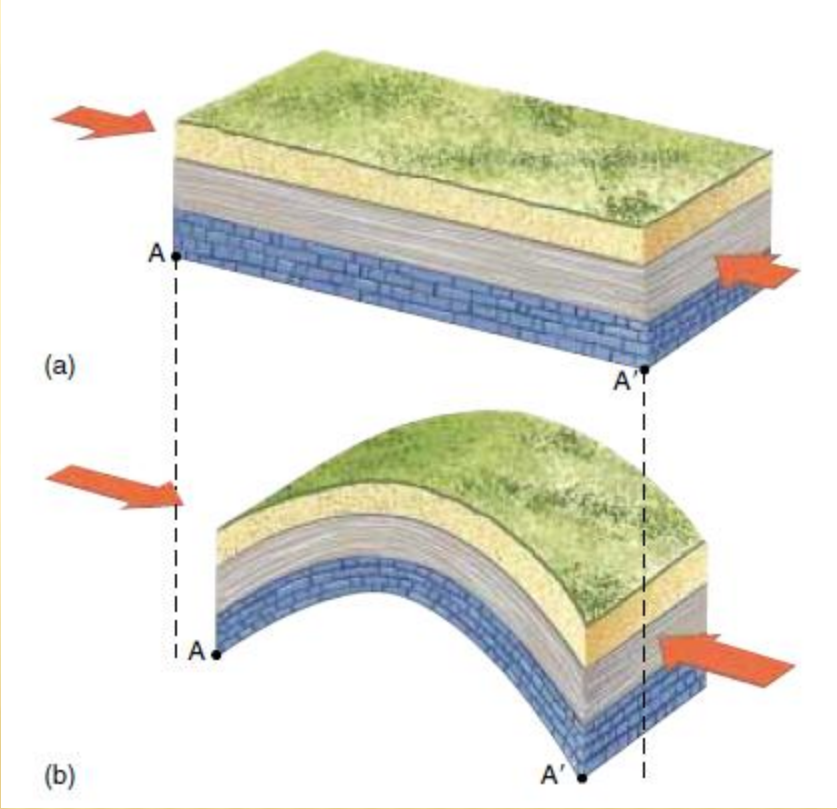
GEOLOGICAL STRUCTURES

- A **geologic structure** is any feature produced by rock deformation.
- Tectonic forces create three types of geologic structures: **folds, faults, and joint**.
- A **fold** is a bend in rock. Some folded rocks display little or no fracturing, indicating that the rocks deformed in a plastic manner. In other cases, folding occurs by a combination of plastic deformation and brittle fracture. Folds formed in this manner exhibit many tiny fractures

GEOLOGICAL STRUCTURES

FOLDS

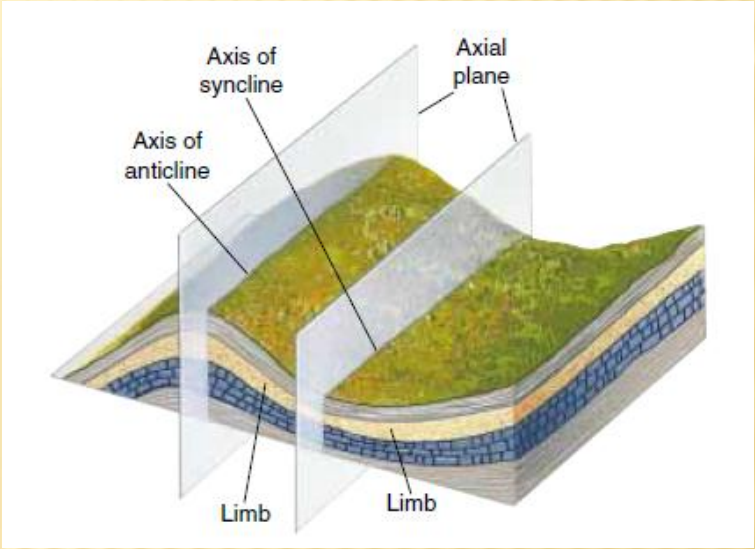
- Folding usually results from compressive stress. For example, tightly folded rocks in the Himalayas indicate that the region was subjected to compressive stress.
- Folding always shortens the horizontal distances in rock.

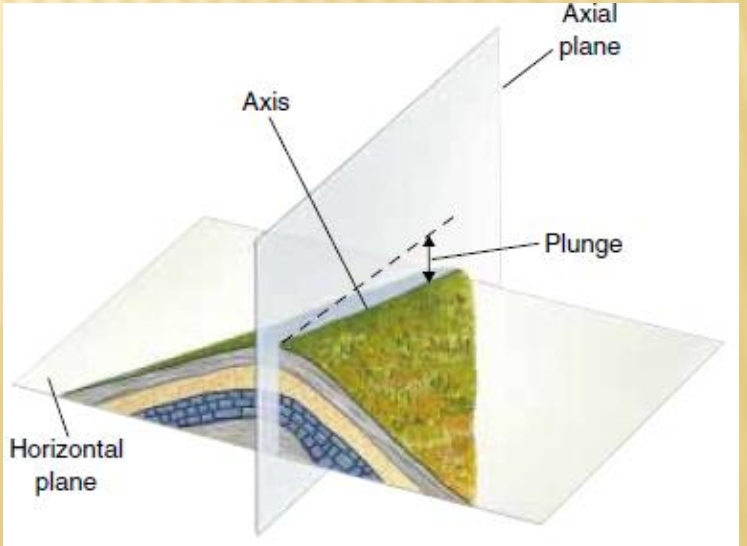


GEOLOGICAL STRUCTURES

PARTS OF A FOLD

- The sides of a fold are called the **limbs.**
- A line dividing the two limbs of a fold and running along the crest of an anticline or the trough of a syncline is the **fold axis.**
- The **axial plane** is an imaginary plane that runs through the axis and divides a fold as symmetrically as possible into two halves.

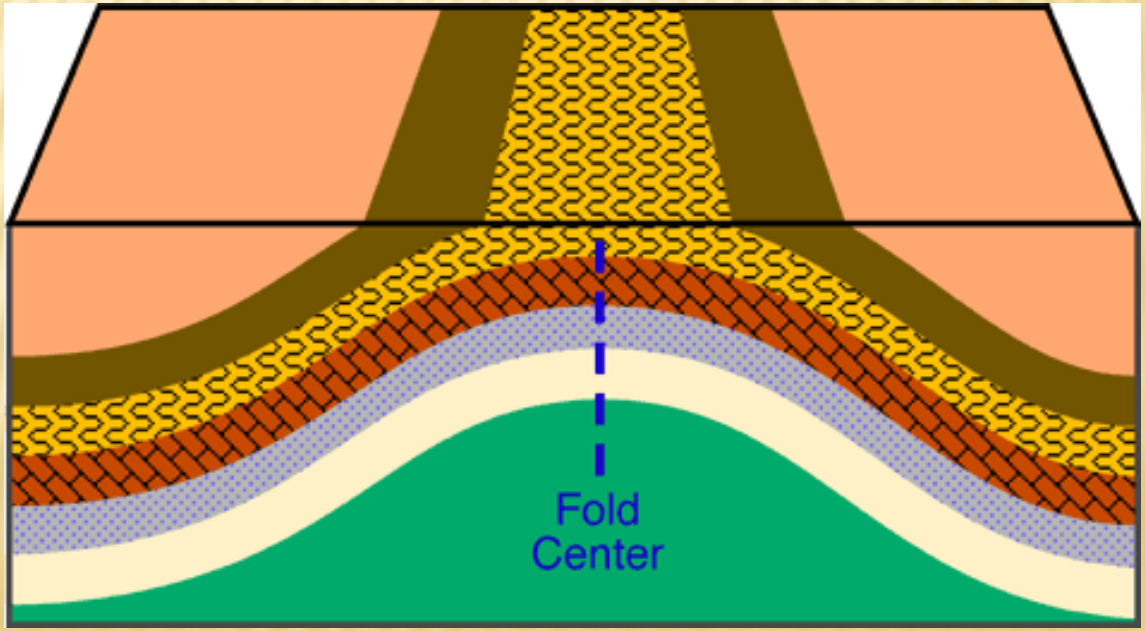




GEOLOGICAL STRUCTURES

TYPES OF FOLDS

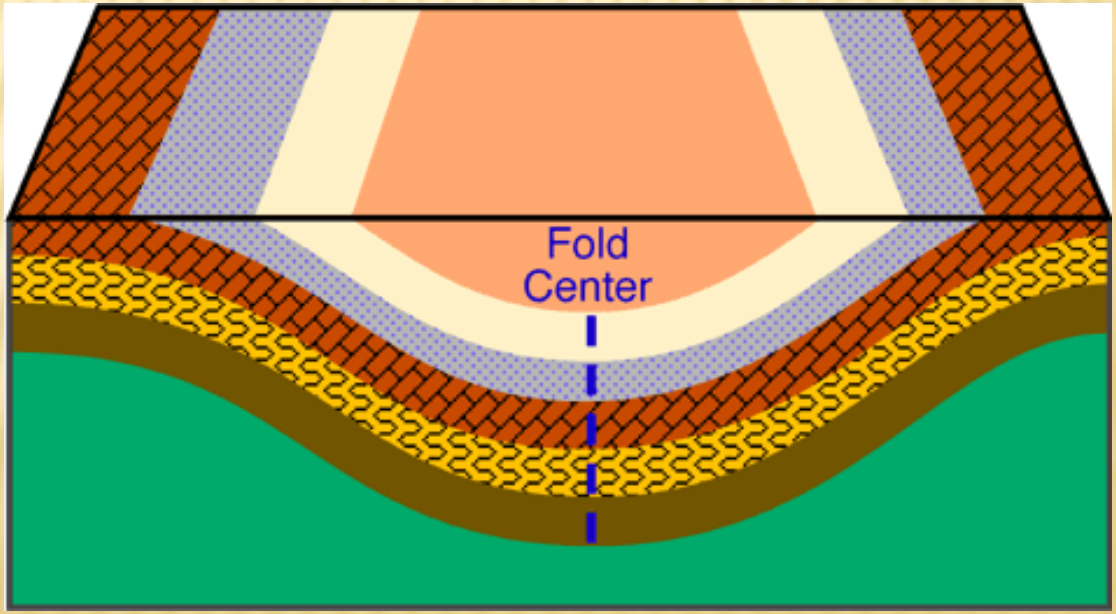
- An **anticline** is a convex up fold in which the limbs of the fold dip away from each other. The oldest rocks lie in the center of the fold



GEOLOGICAL STRUCTURES

TYPES OF FOLDS

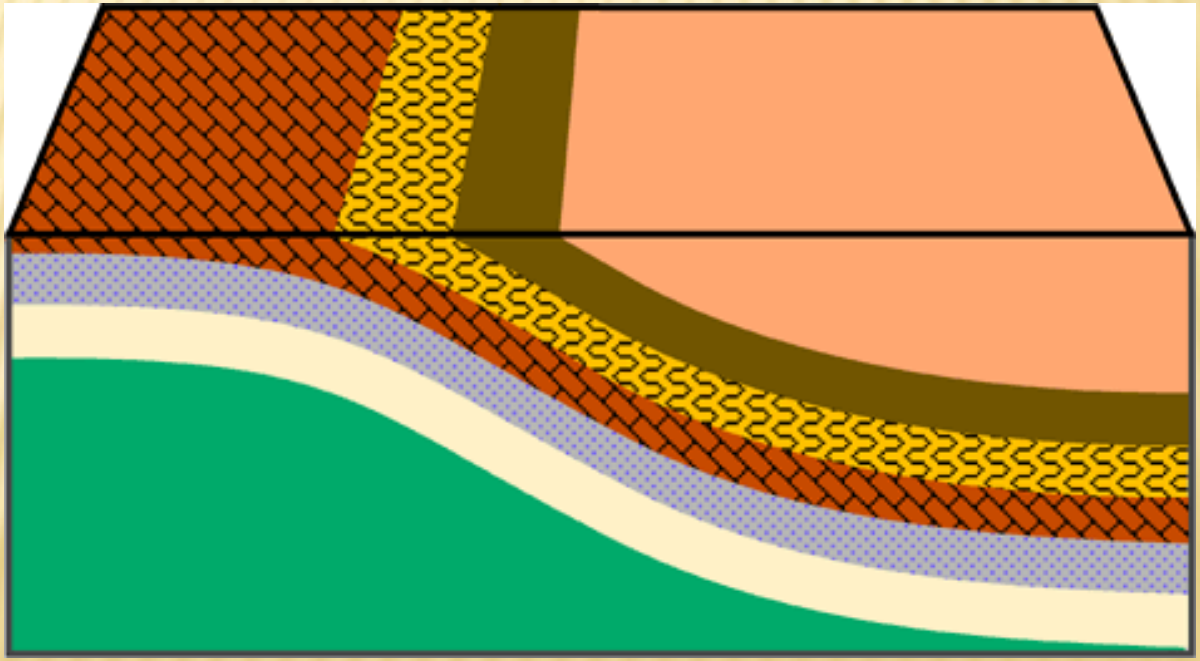
- In a **syncline** the limbs of the fold dip towards each other. The youngest beds are in the center of the fold



GEOLOGICAL STRUCTURES

TYPES OF FOLDS

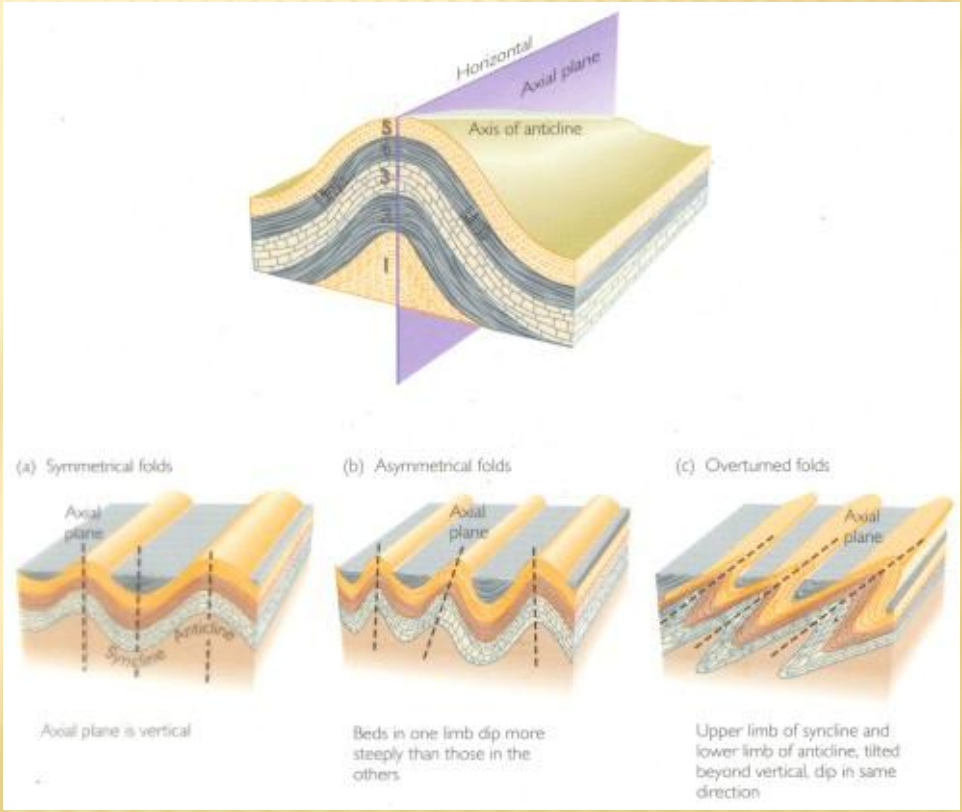
- A special type of fold with only one limb is a **monocline.**



GEOLOGICAL STRUCTURES

TYPES OF FOLDS

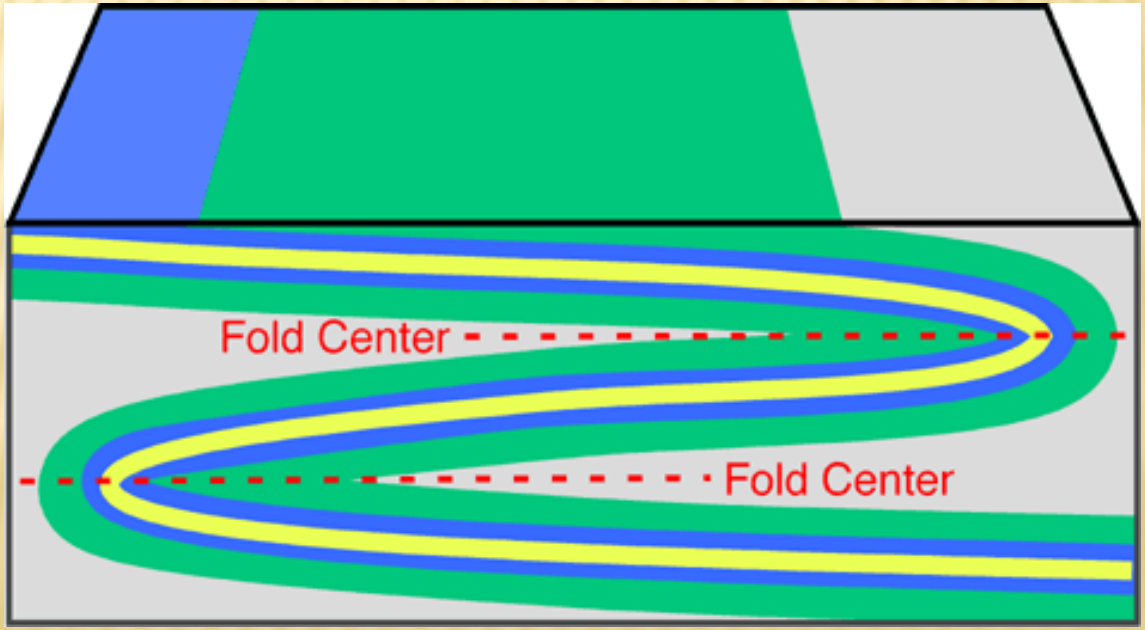
- A **symmetrical fold** is one in which the axial plane is vertical.
- An **asymmetrical fold** is one in which the axial plane is inclined.
- In an **overturned fold**, the beds dip in the same direction on both sides of the axial plane.



GEOLOGICAL STRUCTURES

TYPES OF FOLDS

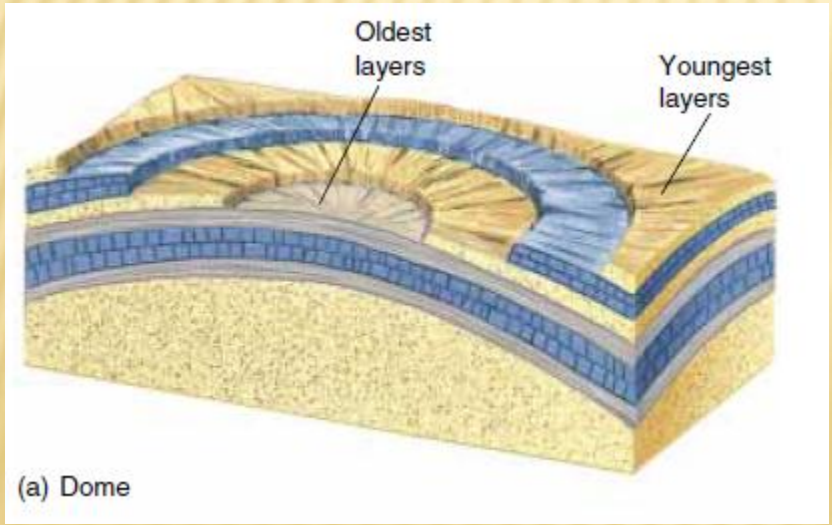
- In a **recumbent fold** the axial plane is horizontal and the limbs of the fold are parallel to each other.

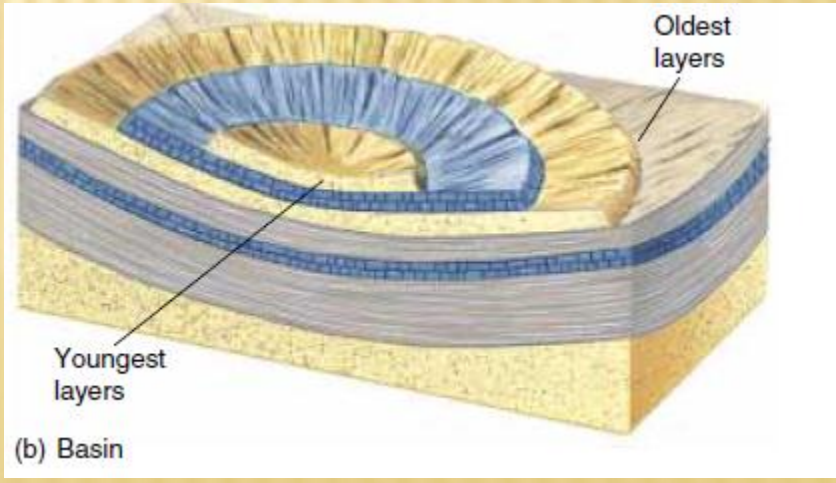


GEOLOGICAL STRUCTURES

- A circular or elliptical anticlinal structure is called a **dome**. The layer dips away from the center of a dome in all directions.

- A circular or elliptical synclinal structure is called a **basin**. The layer dips towards the center of the basin in all directions.

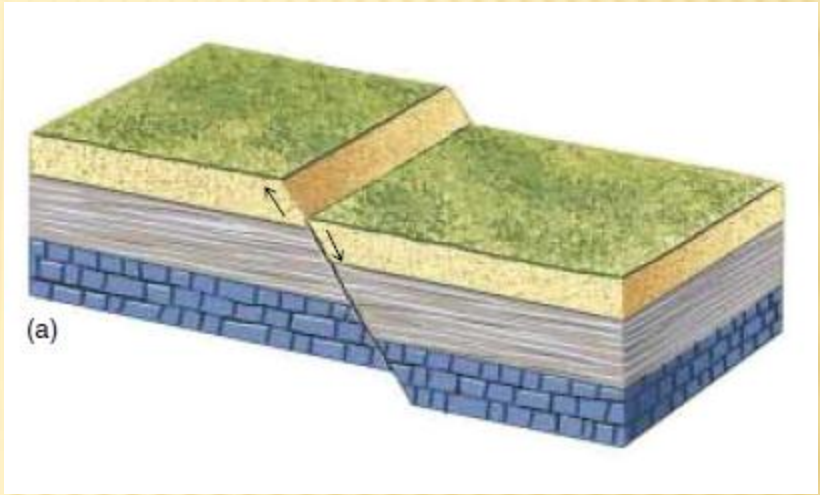


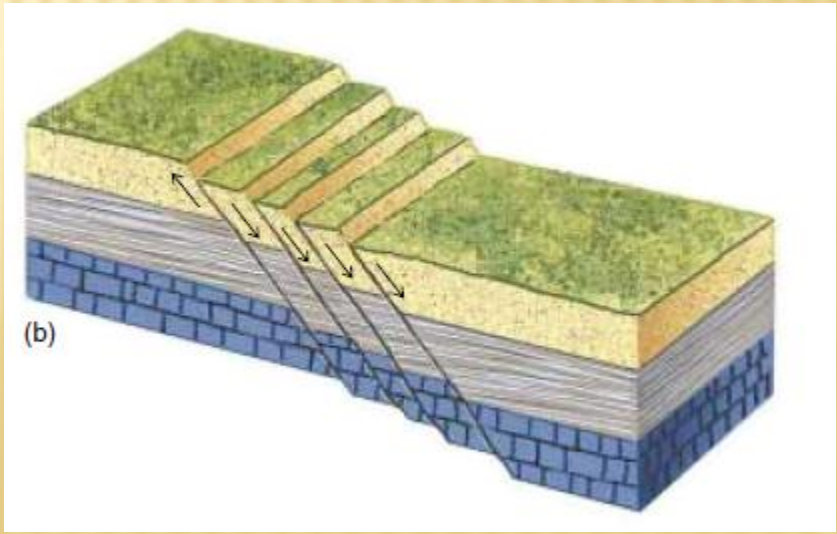


GEOLOGICAL STRUCTURES

FAULTS

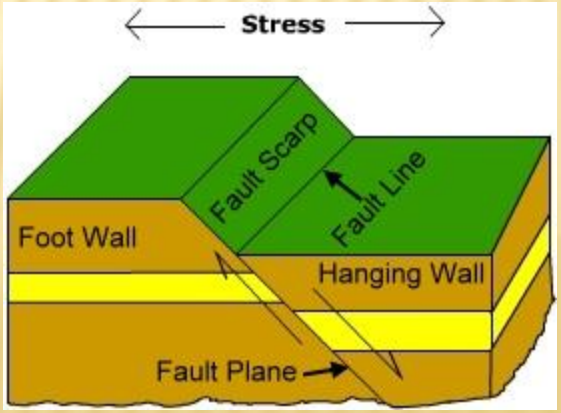
- A **fault** is a fracture along which rock on one side has moved relative to rock on the other side.
- **Slip** is the distance that rocks on opposite sides of a fault have moved.
- Some faults are a single fracture in rock; others consist of numerous closely spaced fractures called a **fault zone.**





GEOLOGICAL STRUCTURES

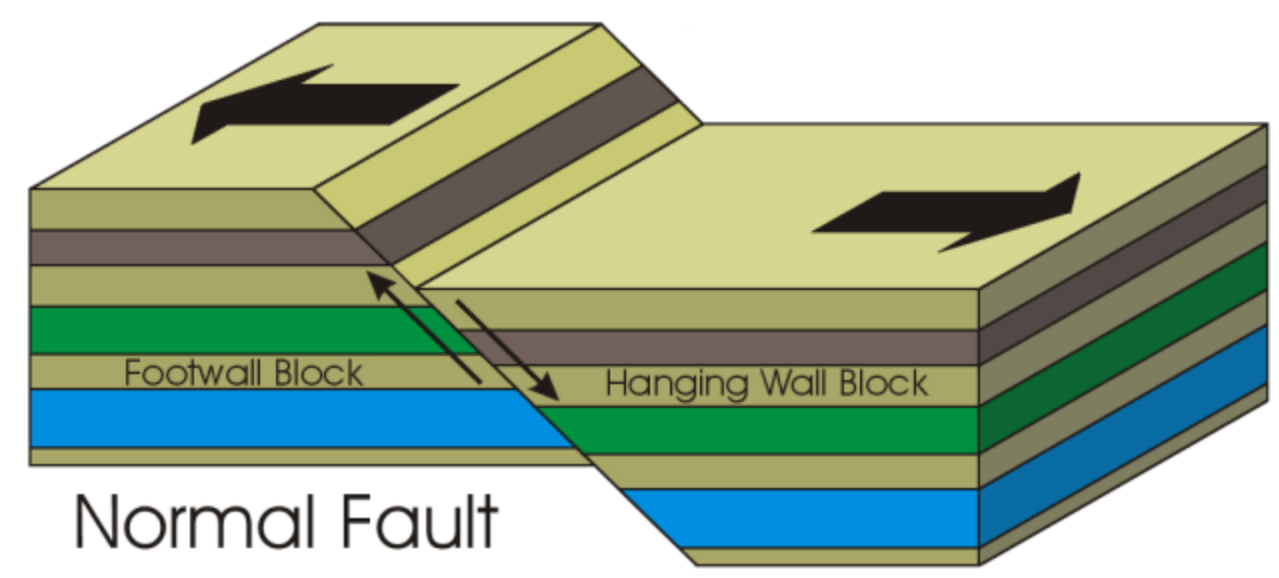
- The two sides of a non-vertical fault are known as the **hanging wall** and **footwall**.
- By definition, the hanging wall occurs above the fault and the footwall occurs below the fault.
- **Fault Plane** is the plane along which the rock or crustal material has fractured.



GEOLOGICAL STRUCTURES

Normal Fault

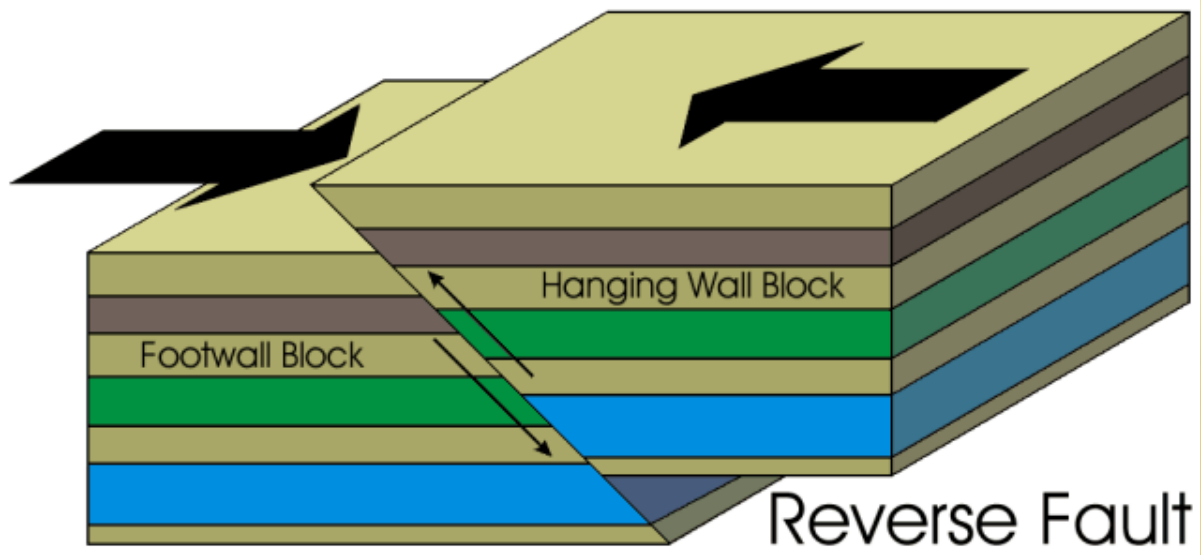
- Hanging wall moves down relative to footwall.
- Caused by horizontal tension stress.
- Results in extension.



GEOLOGICAL STRUCTURES

Reverse Fault

- Hanging wall moves up relative to footwall.
- Caused by compressive stress.
- Results in shortening.
- Fault plane is oriented between 30 and 90 degrees (measured from horizontal).

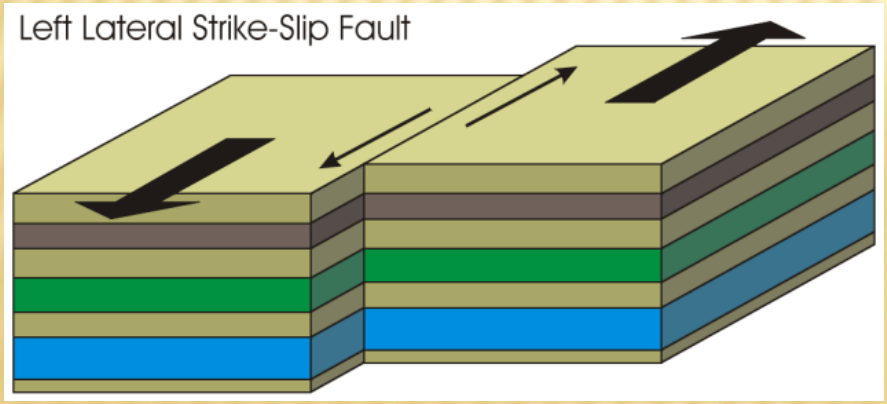


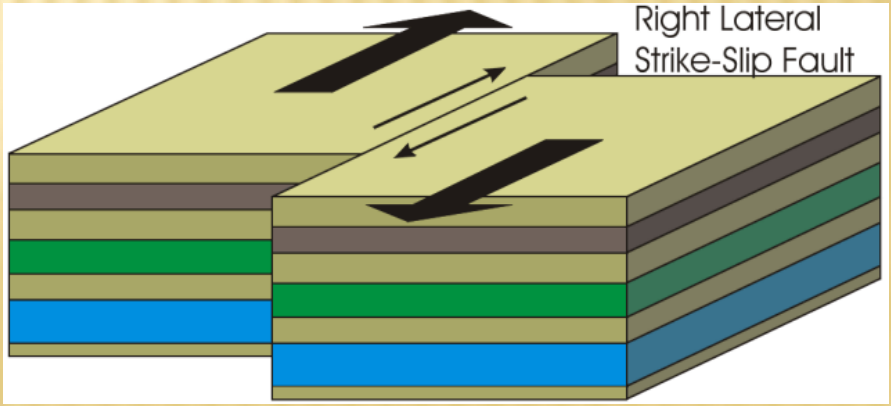
GEOLOGICAL STRUCTURES

Strike-Slip Faults

- A strike–slip fault is one in which the fracture is vertical, or nearly so, and rocks on opposite sides of the fracture move horizontally past each other.

- A transform plate boundary is a strike–slip fault

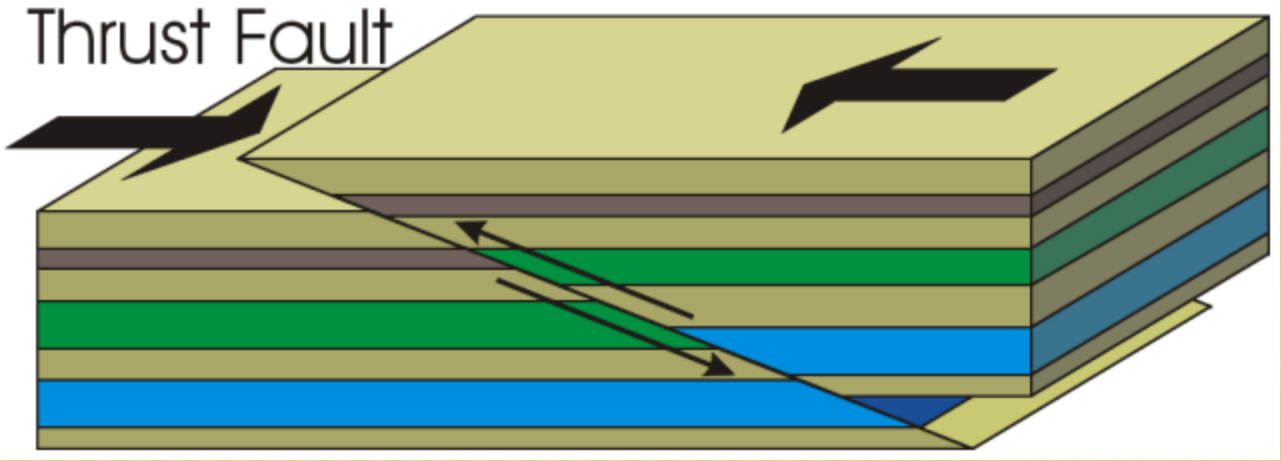




GEOLOGICAL STRUCTURES

Thrust Fault

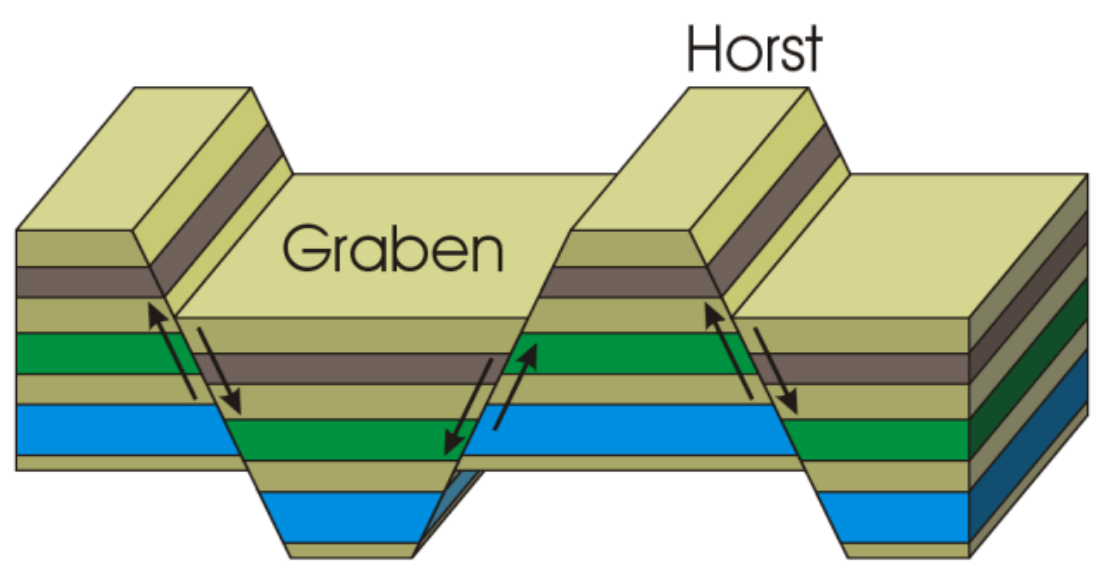
- A thrust fault is a special type of reverse fault that is nearly horizontal
- Fault plane is at less than 30 degrees



GEOLOGICAL STRUCTURES

Horsts and Grabens

- Horsts are up thrown blocks bounded on either side by non-parallel normal faults.
- Grabens are downthrown blocks bounded on either side by non-parallel normal faults.



GEOLOGICAL STRUCTURES

JOINTS

- A joint is a fracture in rock and is therefore similar to a fault except that in a joint rocks on either side of the fracture have not moved