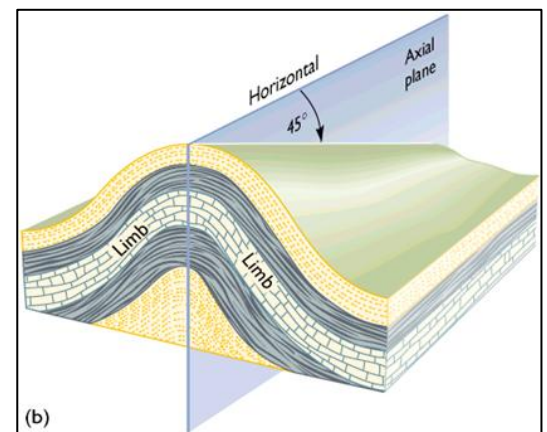
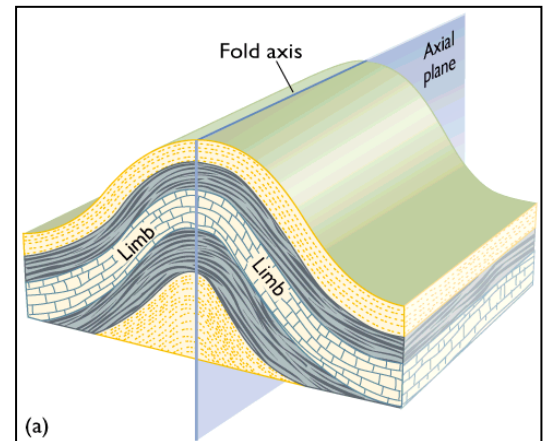
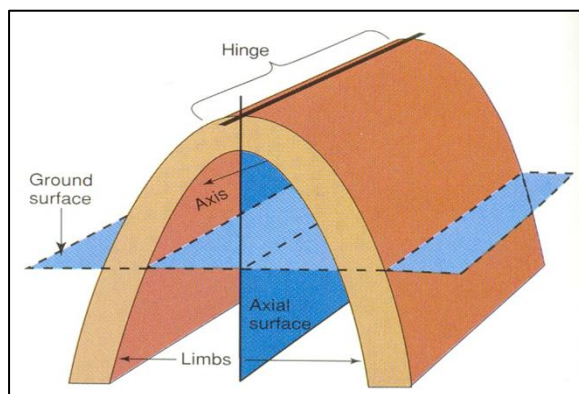


Fold:

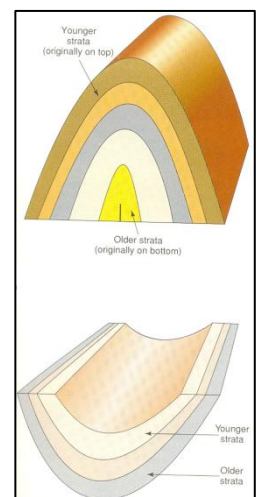
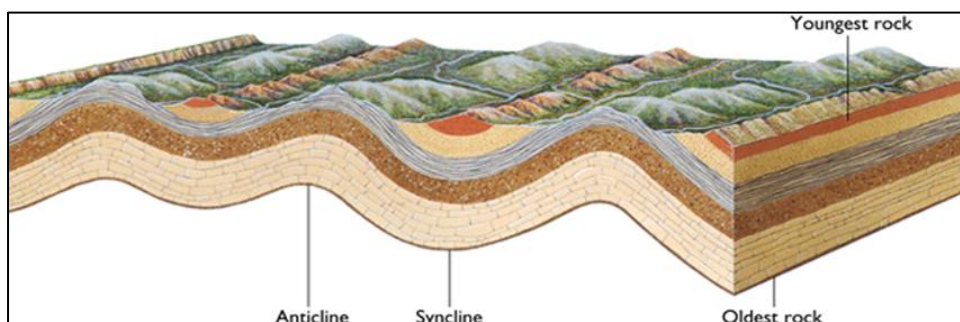
- A fold is a bend or wrinkle of rock layers or foliation; folds form as a sequence of ductile deformation.
- Folding is the processes by which crustal forces deform an area of crust so that layers of rocks are pushed into folds.

Parts of a Fold:

- The two sides of a fold are the limbs.
- **Axial Plane:** an imaginary surface that divides a fold as symmetrically as possible.
- **Fold Axis:** The line made by the length-wise intersection of the axial plane with the beds (also defined as the direction around which the fold is curved).
- **Plunging Fold:** Fold with a non-horizontal fold axis.
- The **Hinge** is the most sharply curved part of the fold.

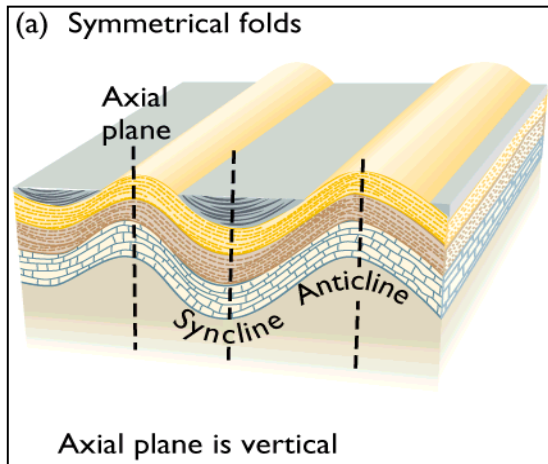
**Types of folds:**

1. **Anticline:** A convex-upward fold whose core contains the stratigraphically older rocks.
2. **Syncline:** A concave-upward fold whose core contains the stratigraphically younger rocks.



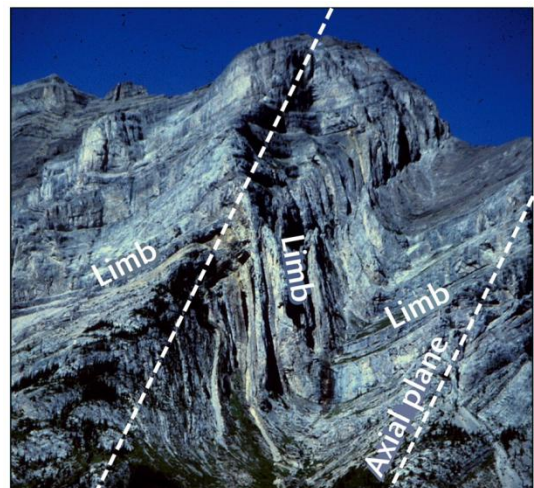
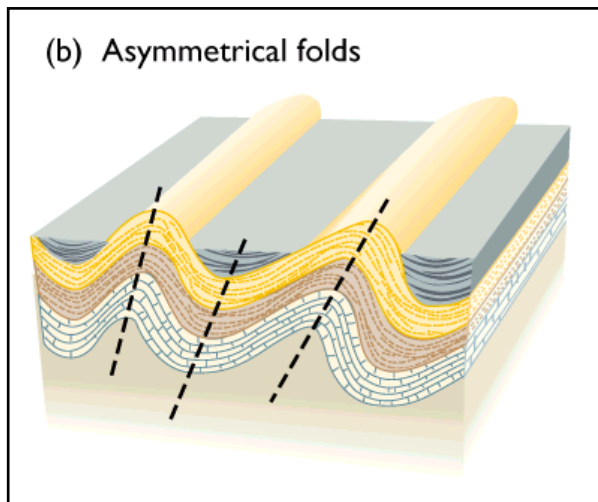
A. Symmetrical Folds:

The fold which have vertical axial plane.



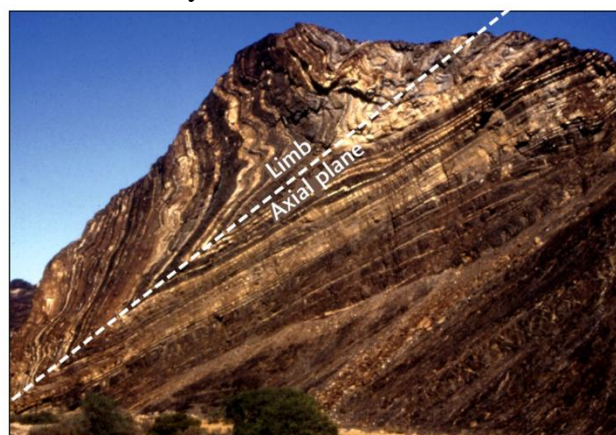
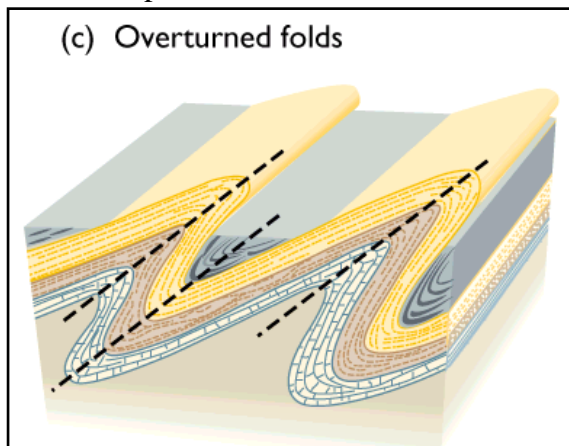
B. Asymmetrical Folds:

Beds in one limb dip more steeply than those in the others.



C. Overturned Folds:

Both limbs dip in same direction but one limb has been tilted beyond vertical.

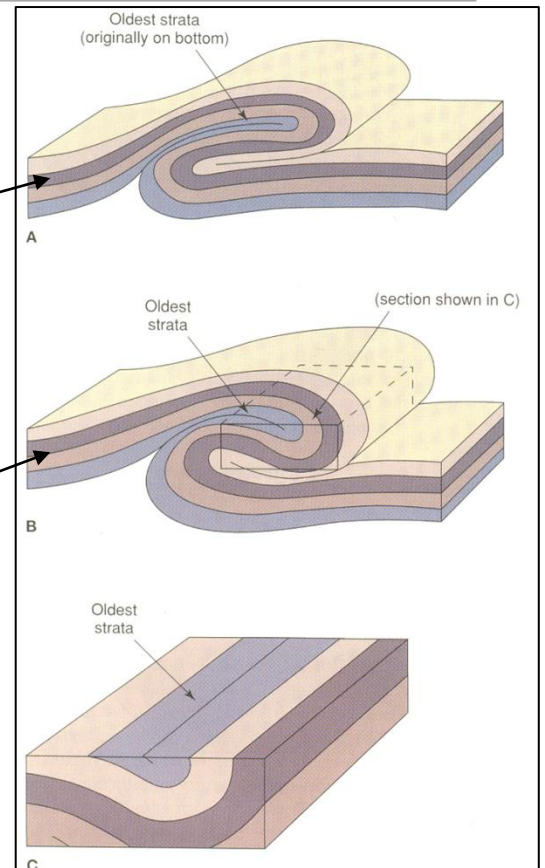


- **Recumbent fold** – A fold in which the axial plane is close to horizontal.

Recumbent fold

- **Overtured fold** – The extreme of a recumbent fold, in which the axial plane is tilted past the horizontal.

Overtured fold



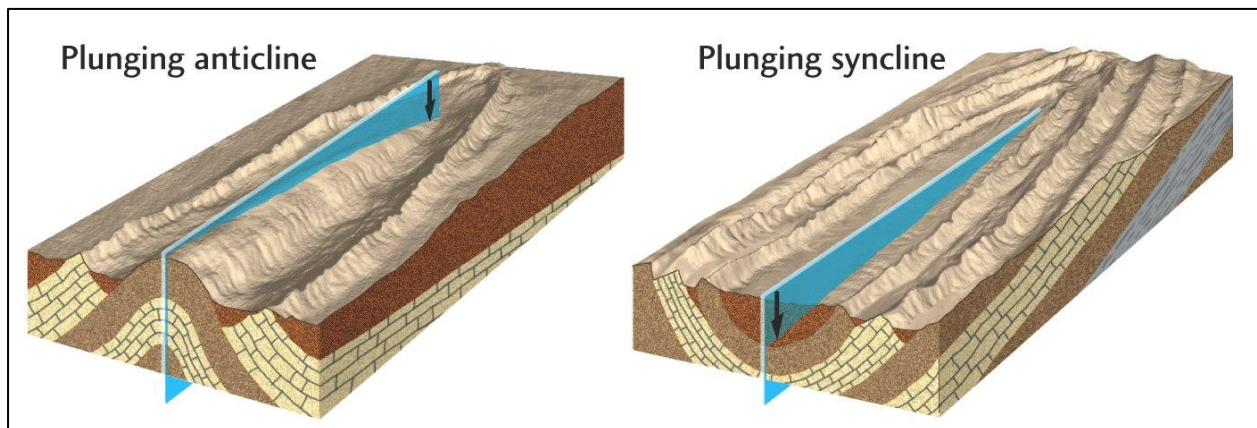
Erosion of the overturned anticline reveals a synformal structure, but the relative ages of the rocks are inconsistent with a syncline.

D. Plunging Folds

Most folds eventually dive below the surface, but the exposed rocks show a distinct relationship for each type of plunging fold.

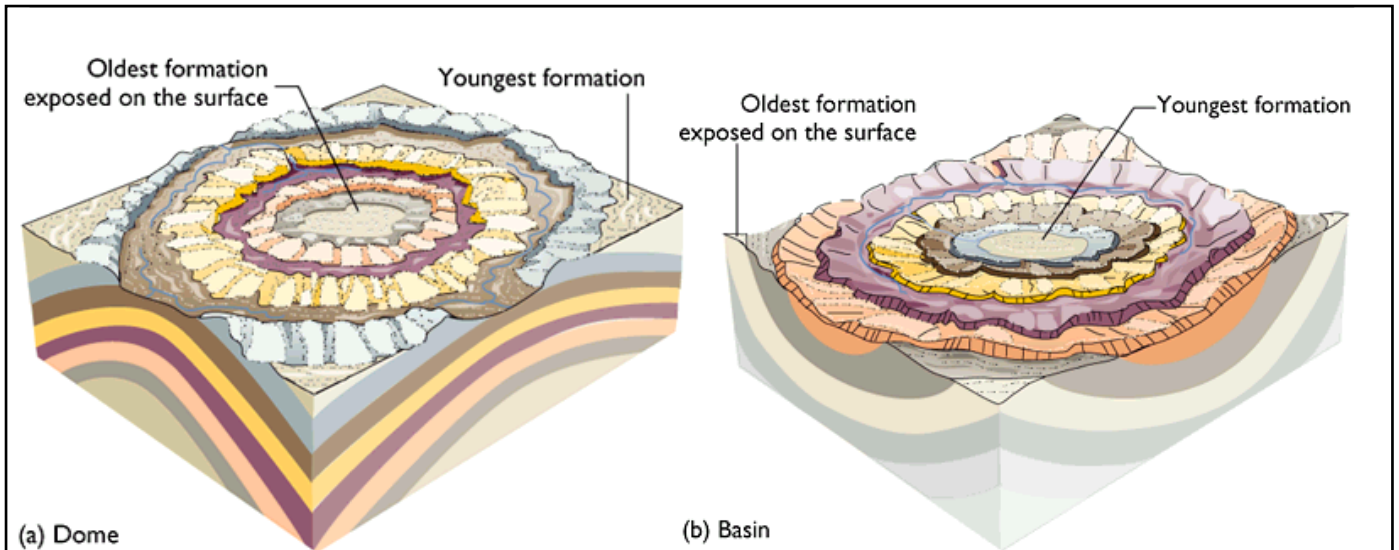
Plunging Anticlines: “Point” in down direction; oldest rocks in the middle.

Plunging Synclines: Point in up direction; youngest rocks in the middle.



Domes and Basins:

- A dome is a broad circular anticlinal structure, with the beds dipping radially away from a central point.
- A basin is a broad circular synclinal structure with the beds dipping toward a central point.



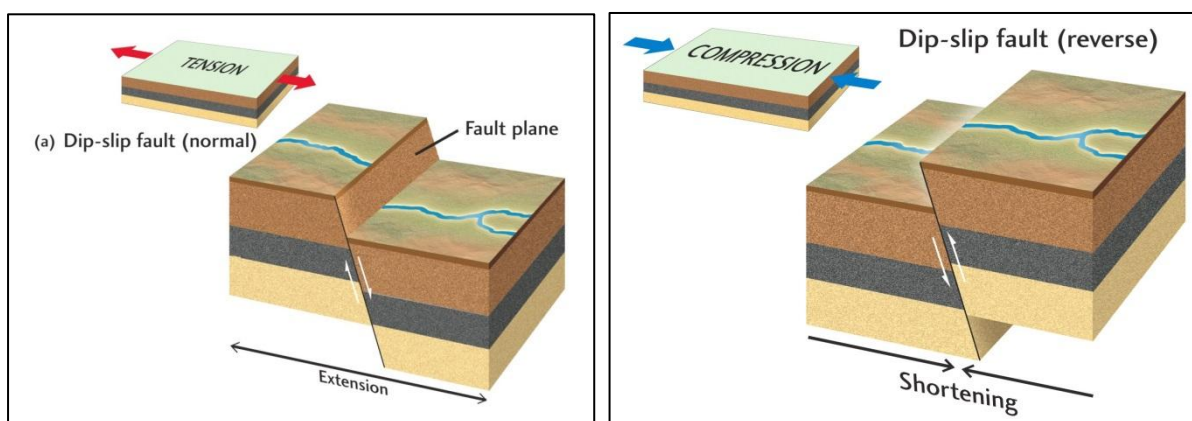
Faults:

A planar or gently curved fracture or fracture zone in the Earth's crust across which there has been relative displacement of the two blocks of rock parallel to the fracture.

Fault types:

1. Dip Slip Faults: involve relative movement of the formation up or down the dip of the fault plane;

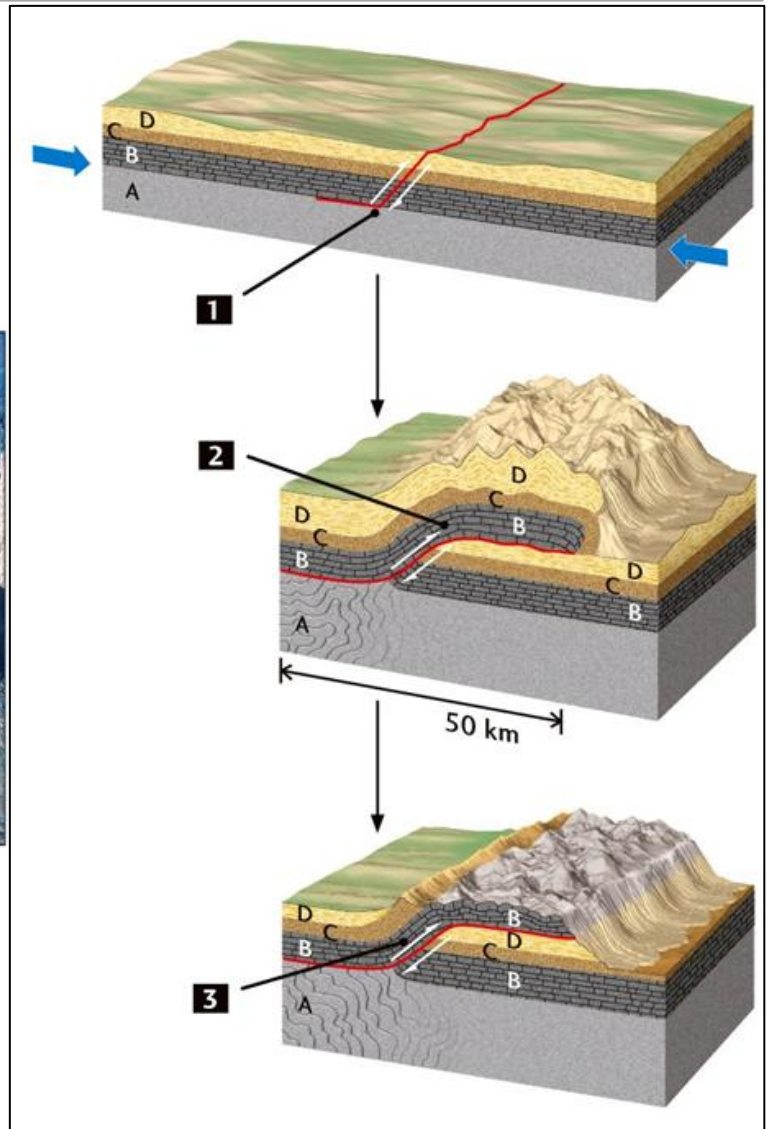
- a. **Normal faults:** the rocks above the fault plane move down in relation to the rocks below the fault plane (Extensional)
- b. **Reverse faults:** the rocks above the fault plane move up in relation to the rocks below the fault plane (Compression)



c. Thrust Faults:

- Low angle reverse fault, $<45^\circ$
- Large lateral displacement
- Repeated sequences

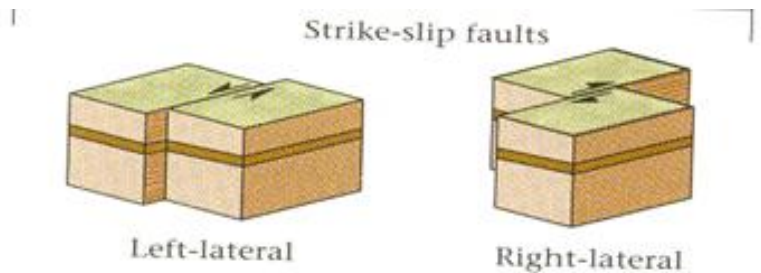
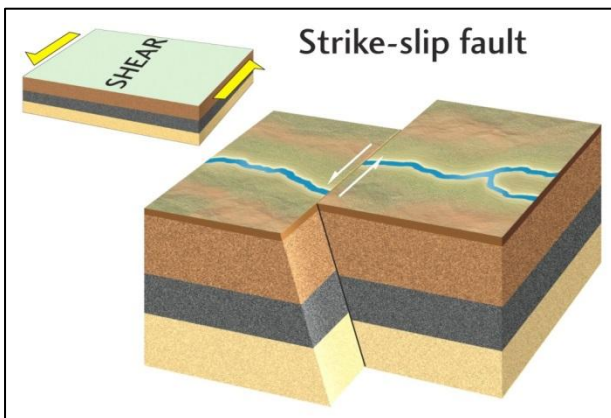
Keystone thrust fault, southern Nevada



2. Strike-Slip Faults

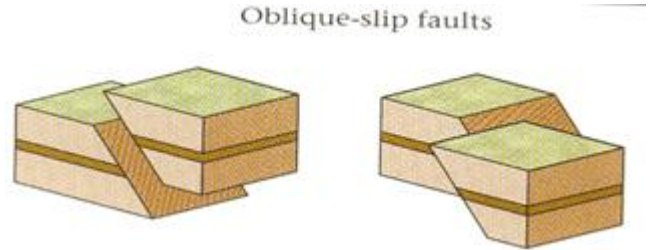
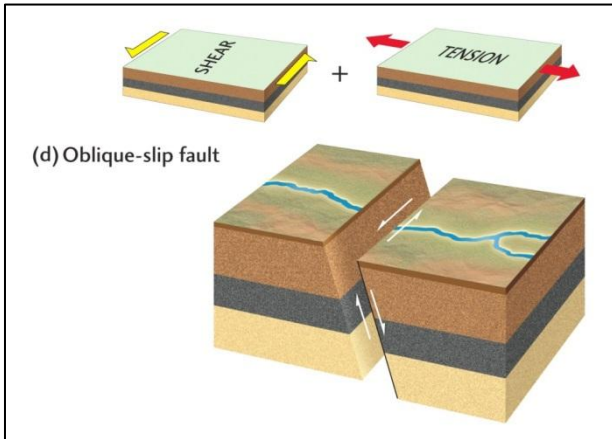
A strike-slip fault involves relative movement of the formation parallel to the strike of the fault (shearing);

- A **right-lateral** strike-slip fault is one where the block viewed on the other side of the fault moves right relative to the observer.
- A **left-lateral** strike-slip fault is one where the block viewed on the other side of the fault moves left relative to the observer.



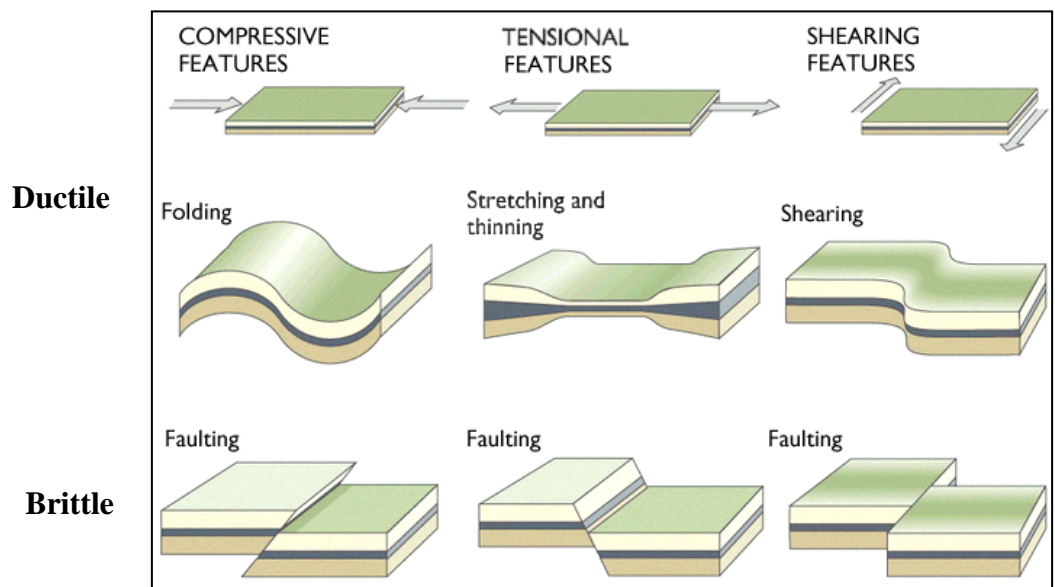
3. Oblique-slip fault

An oblique-slip fault involves both strike-slip and dip-slip movement. Two types of oblique-slip faults, on which sliding takes place diagonally along the surface.



Forces causing deformation:

- **Compressive force:** pushes rocks together (shortening, squeezing)
- **Tensional force:** pulls rocks apart (stretching)
- **Shearing force:** tears a rock by pushing one portion in one direction and the other portion in another.



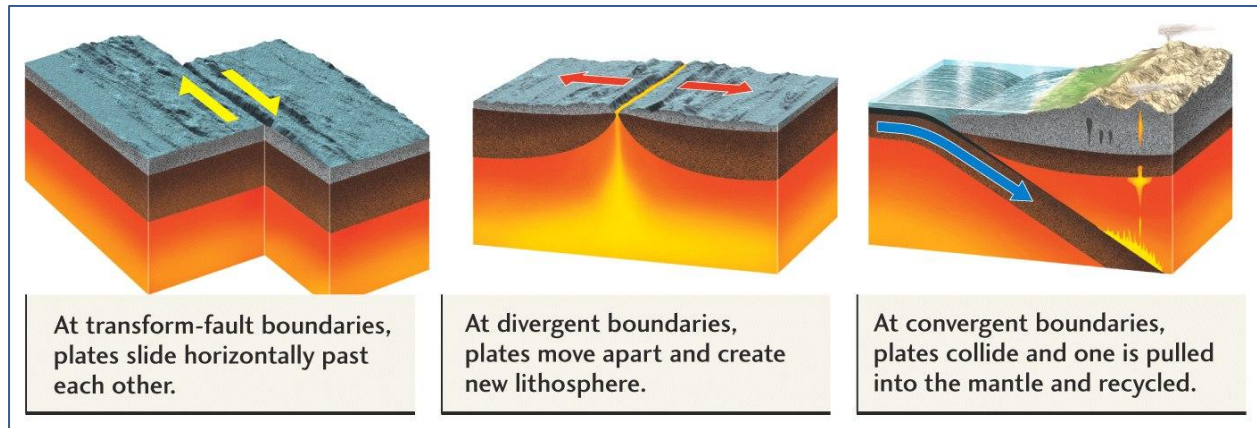
Brittle: Minor internal strains, catastrophic break. e.g. Bending glass at room temperature.

Ductile: Smooth, continuous plastic deformation. e.g. slowly bending a copper wire.

Compression: Action of oppositely directed forces acting towards each other at the same time.

Tension: Action of coinciding and oppositely directed forces acting away from each other.

Shear: Action of coinciding and oppositely directed forces acting parallel to each other across a surface.



Shearing

Tensional

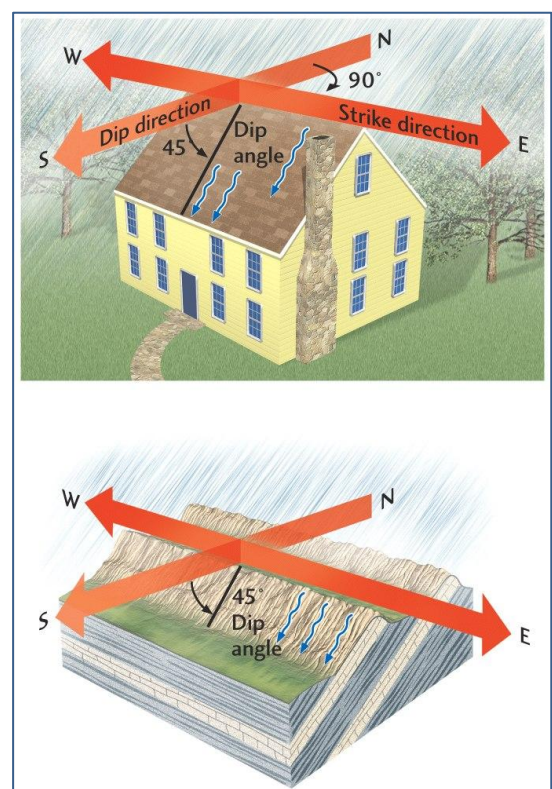
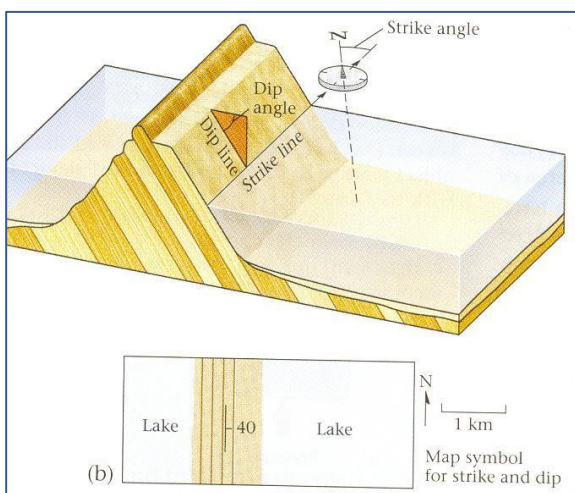
Compressive

Strike and Dip:

The orientation of rocks is recorded using *strike and dip*.

- **Strike:** The direction of the intersection of a rock layer with a horizontal surface
 - Expressed as a compass direction.
- **Dip:** Measured at right angles to strike is the angle at which the bed inclines from the horizontal.
 - Expressed as both an angle, and a dip direction.

Strike and dip of a plane:

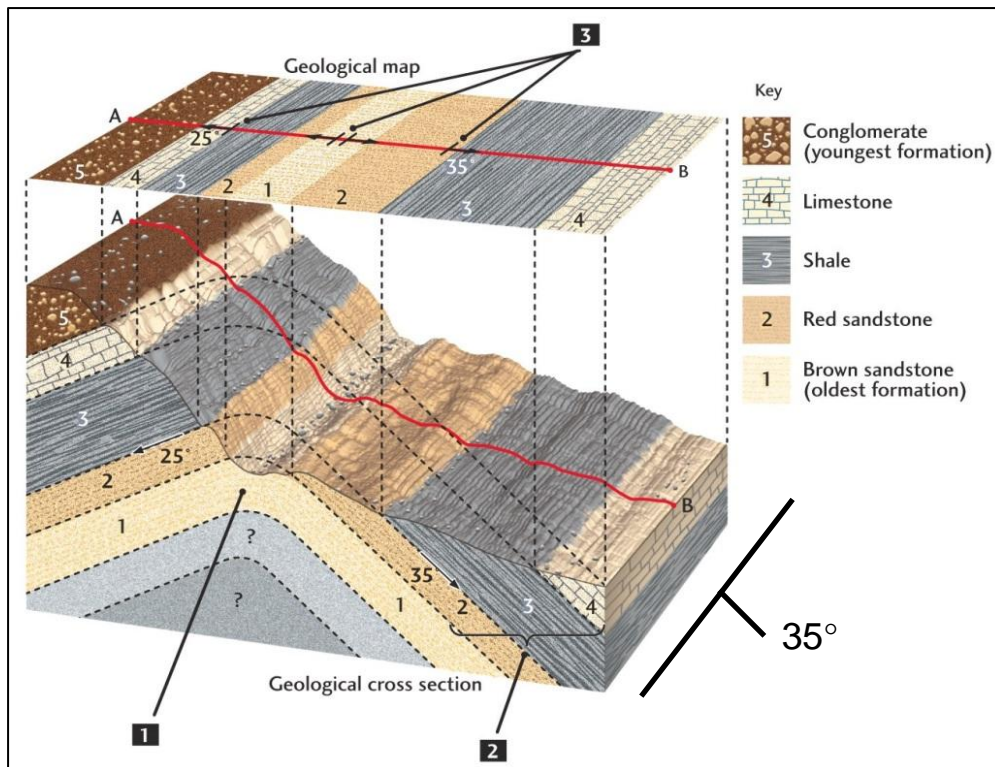


Geologic Maps and Cross Sections:

Geologic maps show the spatial relationships of different formations.

- Strike and dip are recorded on the map using specific symbols
- Different rock types are assigned different patterns.

Geologic cross-sections show vertical slice along a particular plane through the crust.



Geologic map and cross section are two dimension representation of a three-dimensional geologic structures.

