# GCSE Geology – 1.5 Deformational structures

The rock record provides evidence of tectonic activity. Sedimentary rocks are laid down horizontally when formed, but many rock layers have been deformed by tectonic activity since their deposition. The amount of tectonic deformation can be assessed by measuring the dip and strike of the rock layers.

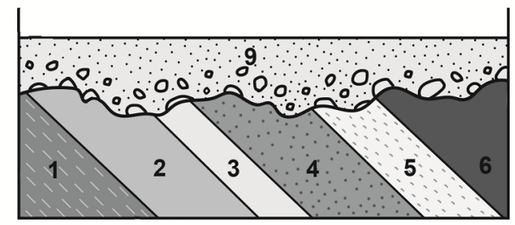
**Dip** is the maximum angle of inclination of a bedding plane surface away from the horizontal. Dip angle values range from 1-89˚. 0˚is horizontal and 90˚is vertical. Dip angles are measured using a clinometer. Dip direction is the compass direction at which the beds are disappearing into the Earth, away from the point of measurement.
**Strike** is the direction in which beds outcrop and trend across the Earth's surface, always at right angles to the dip direction. This is measured using a compass and can be expressed as a direction or bearing. A bed dipping north will have a strike orientation east-west or 090-270 degrees.

**Folding** is caused by compressional tectonic stress and is associated with convergent plate boundaries.
Antiforms are folds in which the sides (limbs) close upwards in a convex or arch shape and dip away from each other.
Synforms are folds in which the sides (limbs) close downwards in a concave or U shape and dip towards each other.
The axial plane of a fold is a plane bisecting the angle between the limbs of the fold; the axial plane trace is where the axial plane outcrops on the Earth's surface.

**Faulting** is caused by tectonic stress or by tensional, compressional or shear forces.
Tensional stress produces normal faults which are often at a steep angle. They show vertical displacement and that the hanging wall of the fault has moved downwards. Compressional stress produces reverse faults which are often low angle. They show vertical displacement and that the hanging wall of the fault has moved upwards. Thrust faults are a type of reverse fault when the angle of the fault plane is less than 20˚from the horizontal.
Shear stress produces vertical strike-slip or tear faults where only horizontal movement takes place.
Fault displacement is a measure of how much movement has taken place along the fault plane. This can be calculated by measuring the distance between displaced rock units along the fault plane.

**Unconformities** are gaps in the rock record with a significant time gap between the age of the rocks, below and above the plane of unconformity. Unconformities are best described as erosion surfaces. In many cases, the rocks above and below the erosion surface will dip at different angles (the feature is termed an angular unconformity).

The sequence of events to produce an angular unconformity may include:
- deposition of the older, lower series in horizontal layers
- burial and cementation of the older, lower series
- deformation including folding, faulting and uplift of the older, lower series
- erosion of the older, lower series to produce an erosion surface or plane of unconformity
- deposition of the younger, upper series on top of the erosion surface/plane of unconformity.




**Angular Unconformity**

1. Beds 1-6 deposited
2. Beds 1-6 tilted
3. Erosion
4. Bed 9 deposited