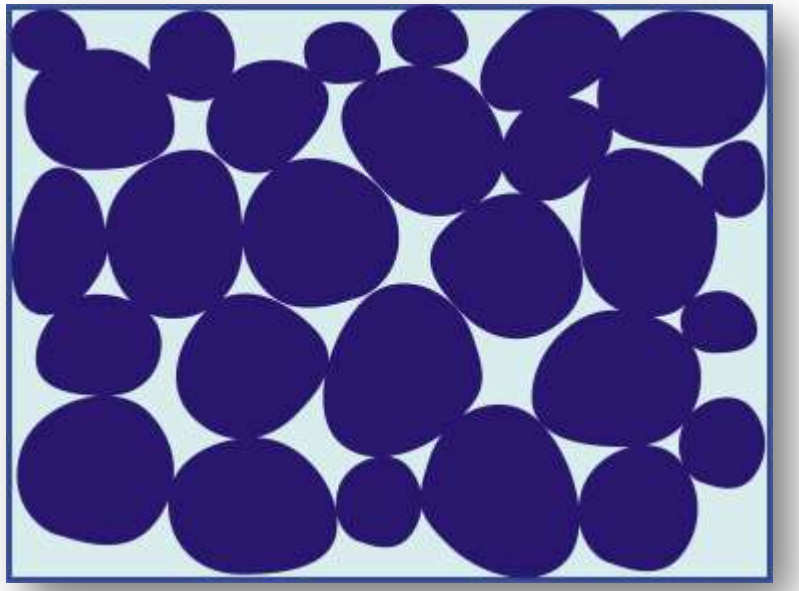

The Rock Structure

Texture

Texture refers to the sizes and shapes of grains, the relationships between neighboring grains, and the orientation of grains within a rock.

- The most common texture exhibited by sedimentary rocks is the clastic texture or fragmental texture.
- The clasts are arranged in different ways and are of assorted sizes and shapes which gives the texture a large variety.
- The main pore space is the intergranular space which forms the porosity. The nature of this varies with the size and shape of the clasts.



Structural geology

Structural geology is a branch of geology that deals with the study of the three-dimensional distribution of rock units with respect to their deformational histories.

In simple terms , the present day rock structure is studied in detail in order to find out the history of deformation (strain) in the rocks and ultimately the then present stress field that caused the deformation in rocks.

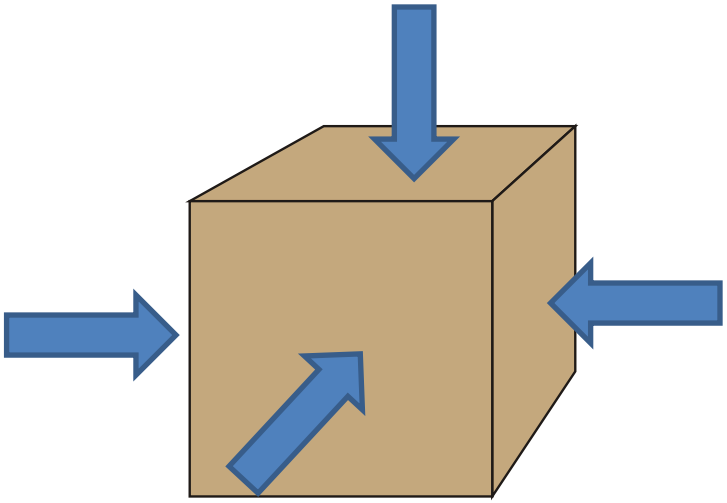
Structural geology

Rocks deform in response to differential stress. The resulting structure depends on the stress orientation.

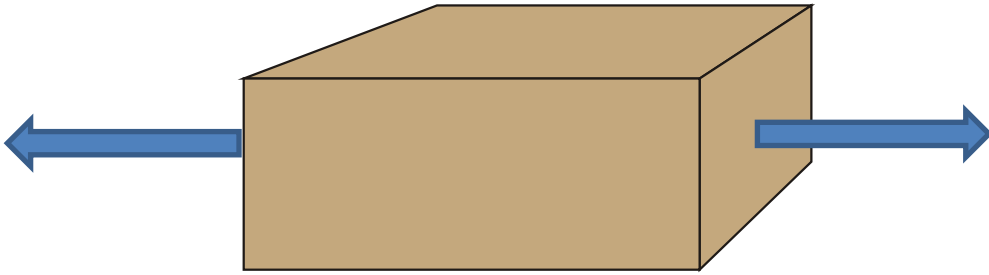
Deformation may be ductile flow or brittle fracture.

- Folds
- Faults
- Joints (or fractures)

Stress

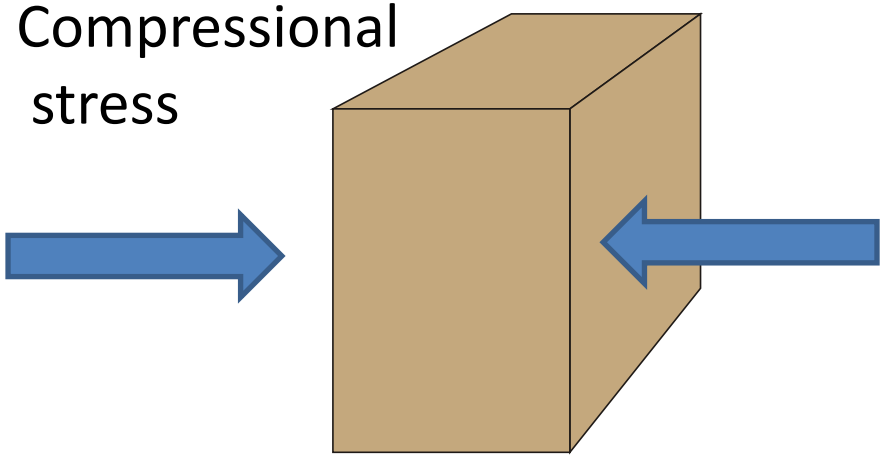


Confining stress

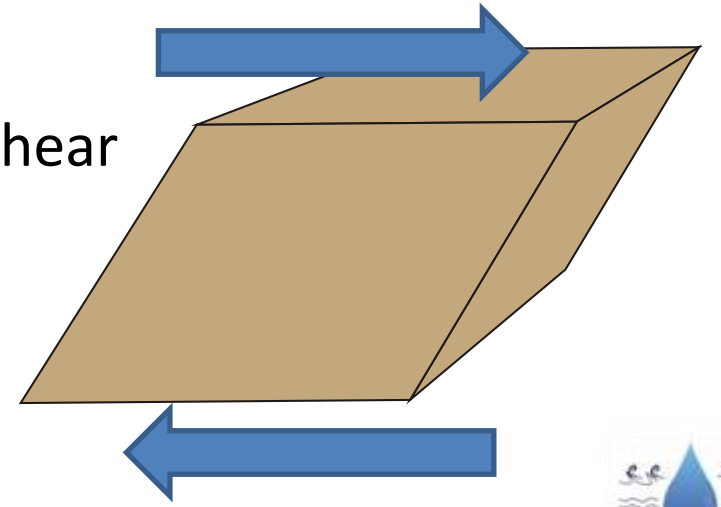


Tensional stress

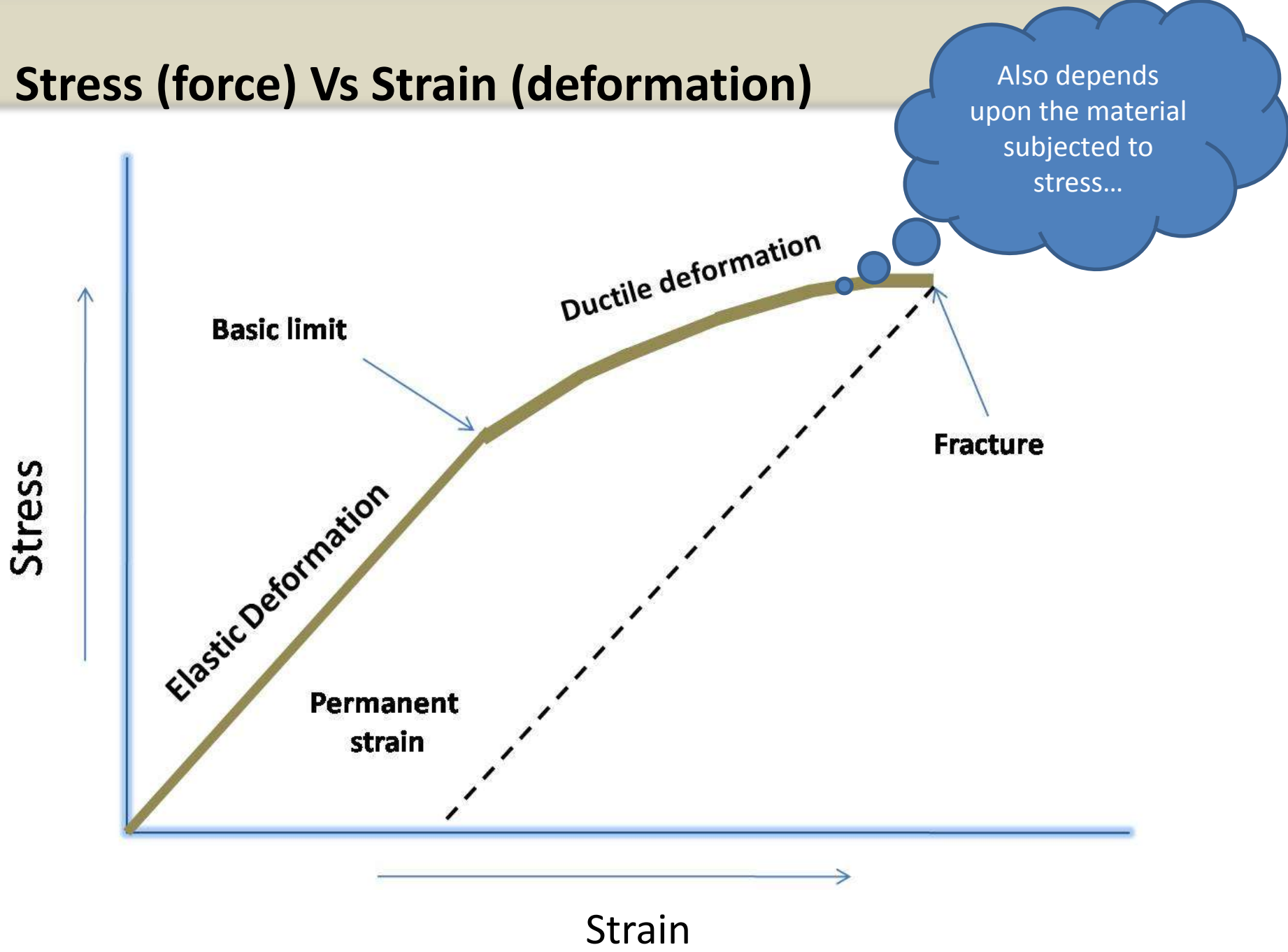
Compressional stress



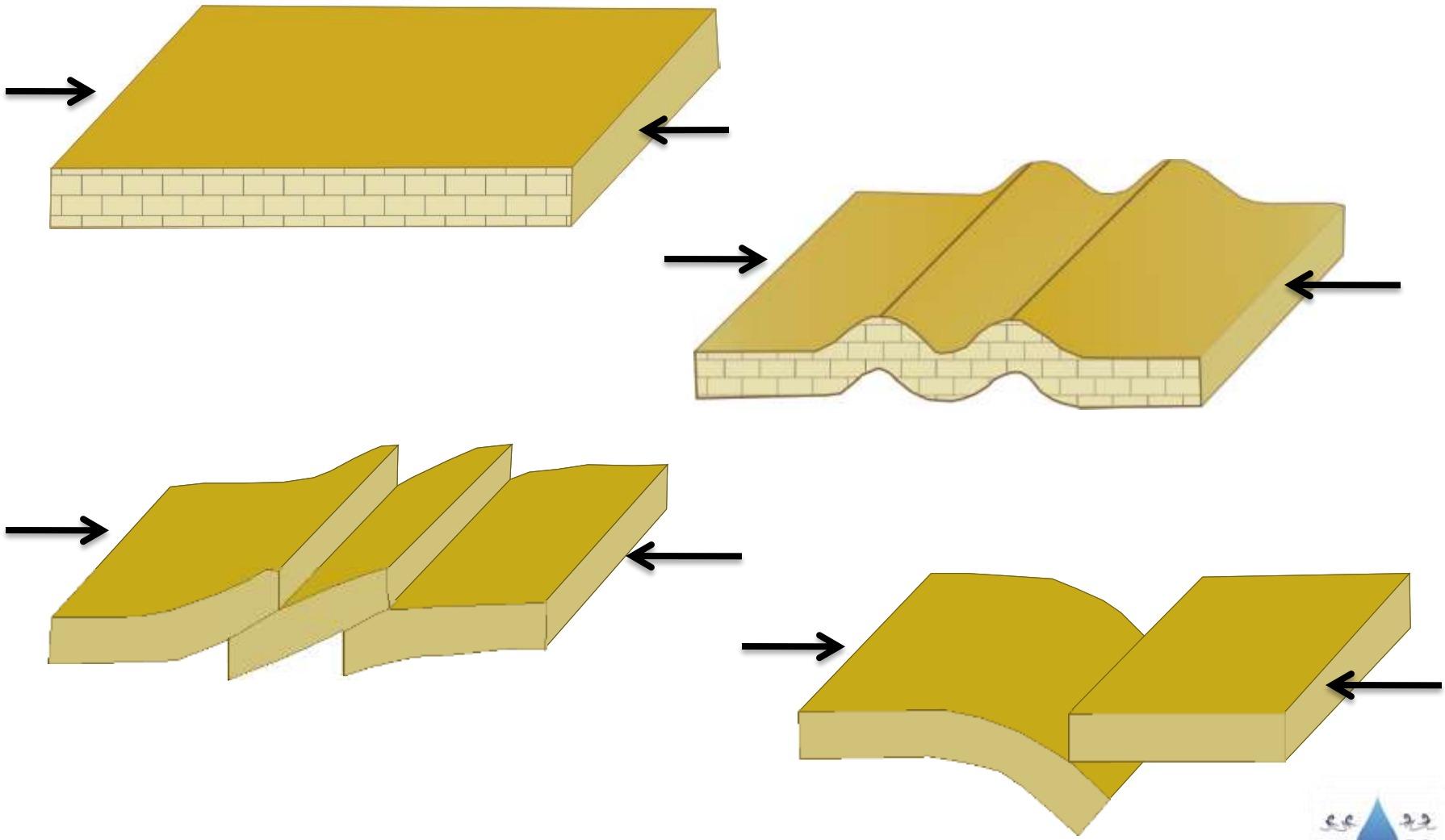
Shear



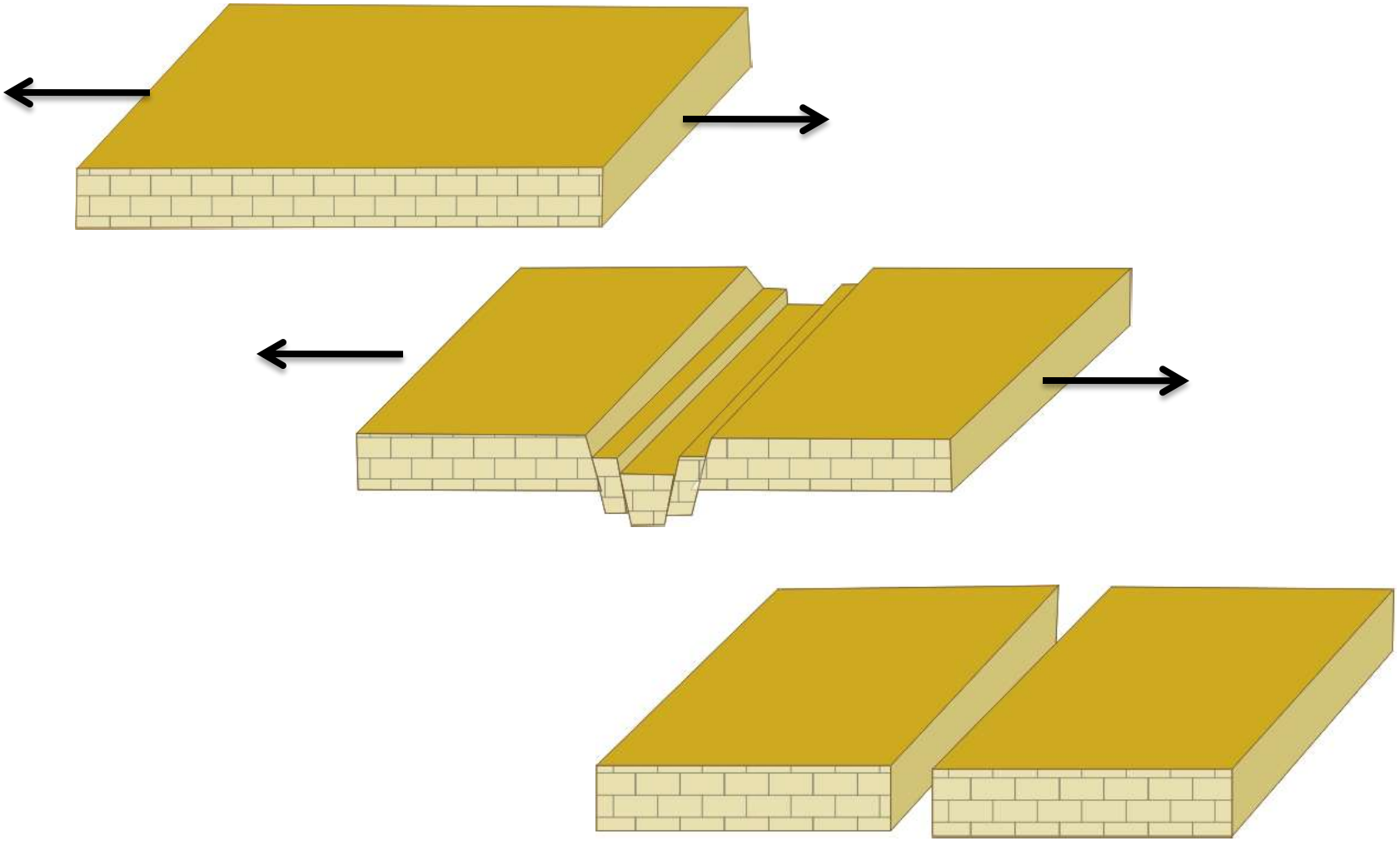
Stress (force) Vs Strain (deformation)



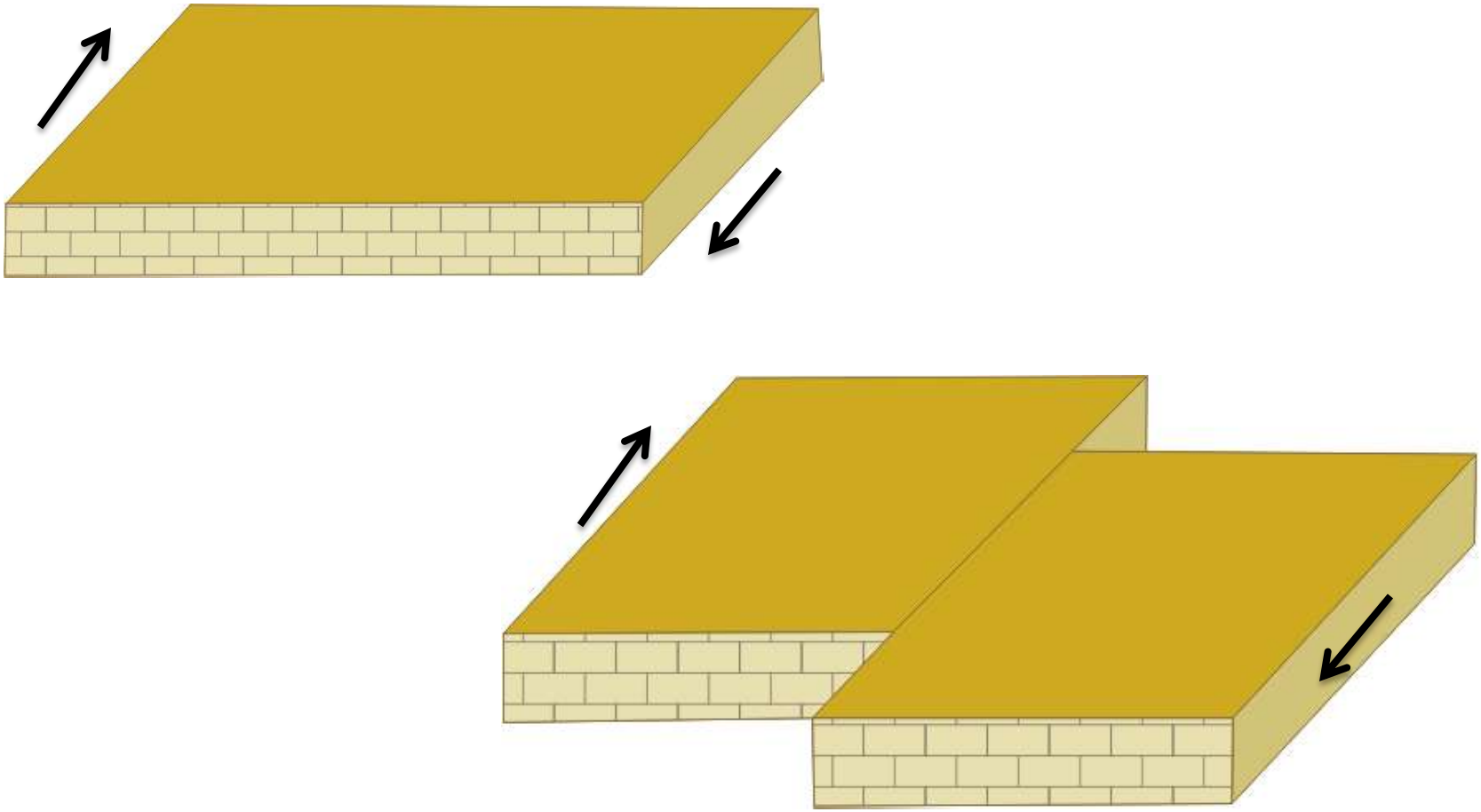
Compression



Tension



Shear

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Folds

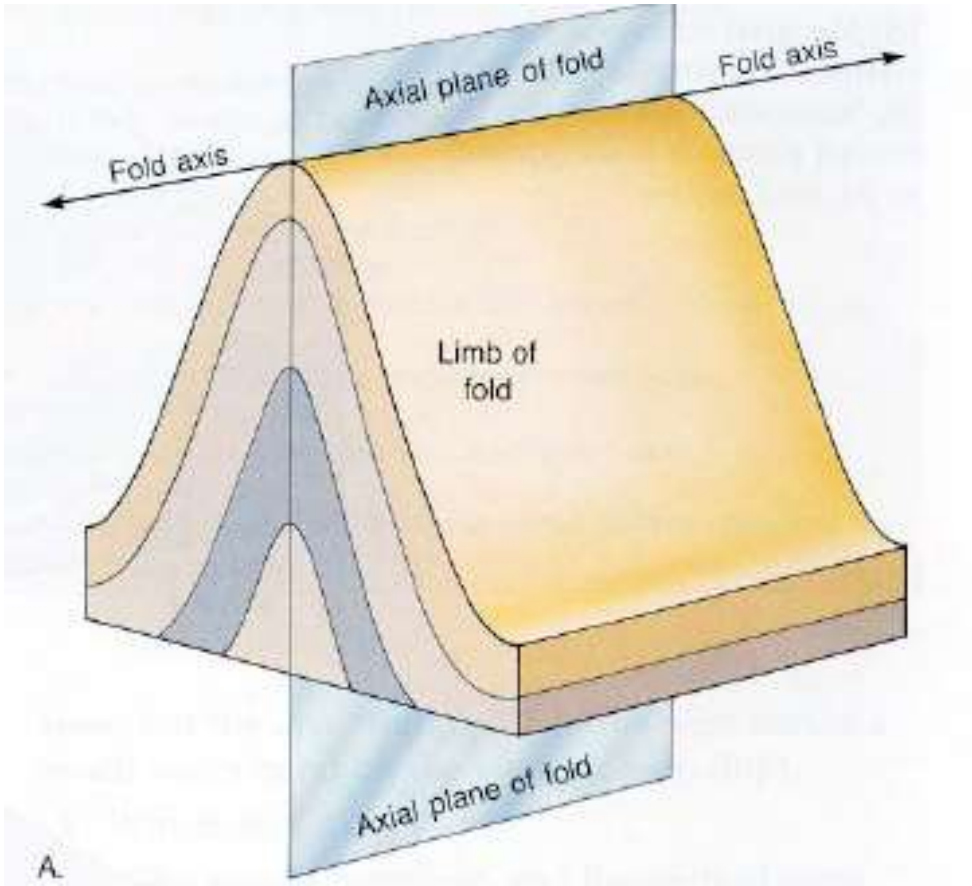
Folds are bends in rock that develop when rocks deform plastically.

Can be any size – including

- small crinkles
- medium size
- or large mountain ranges

Image source: ssf.npolar.no

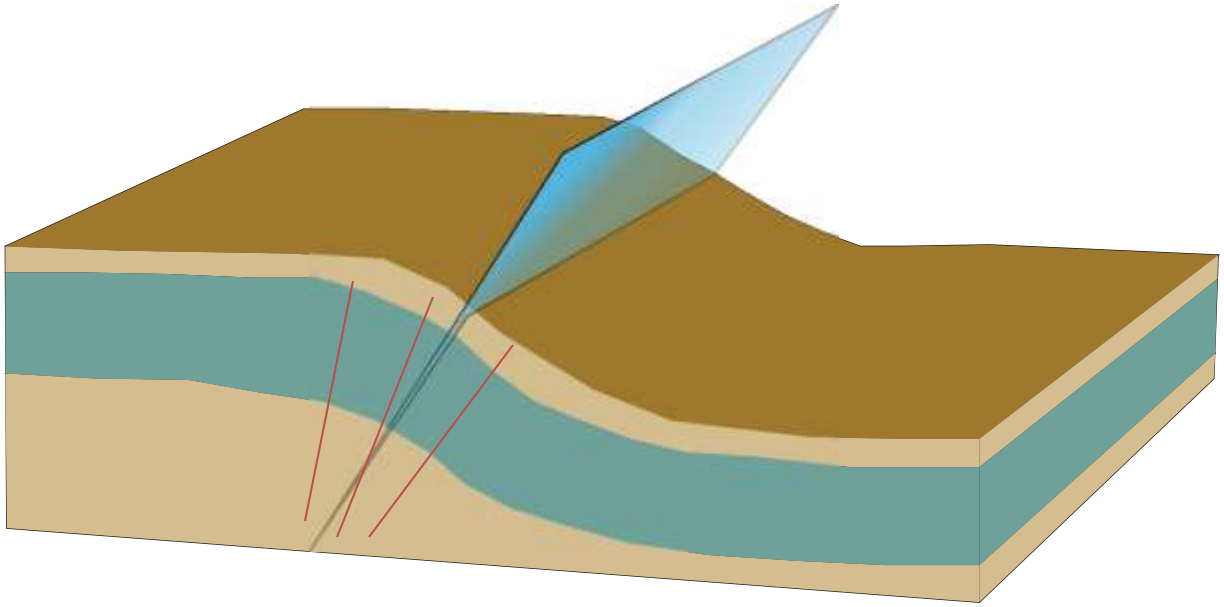
Folds



Folds can be divided into two limbs by imagining a plane that cuts the fold at it's maximum curvature (hinge)

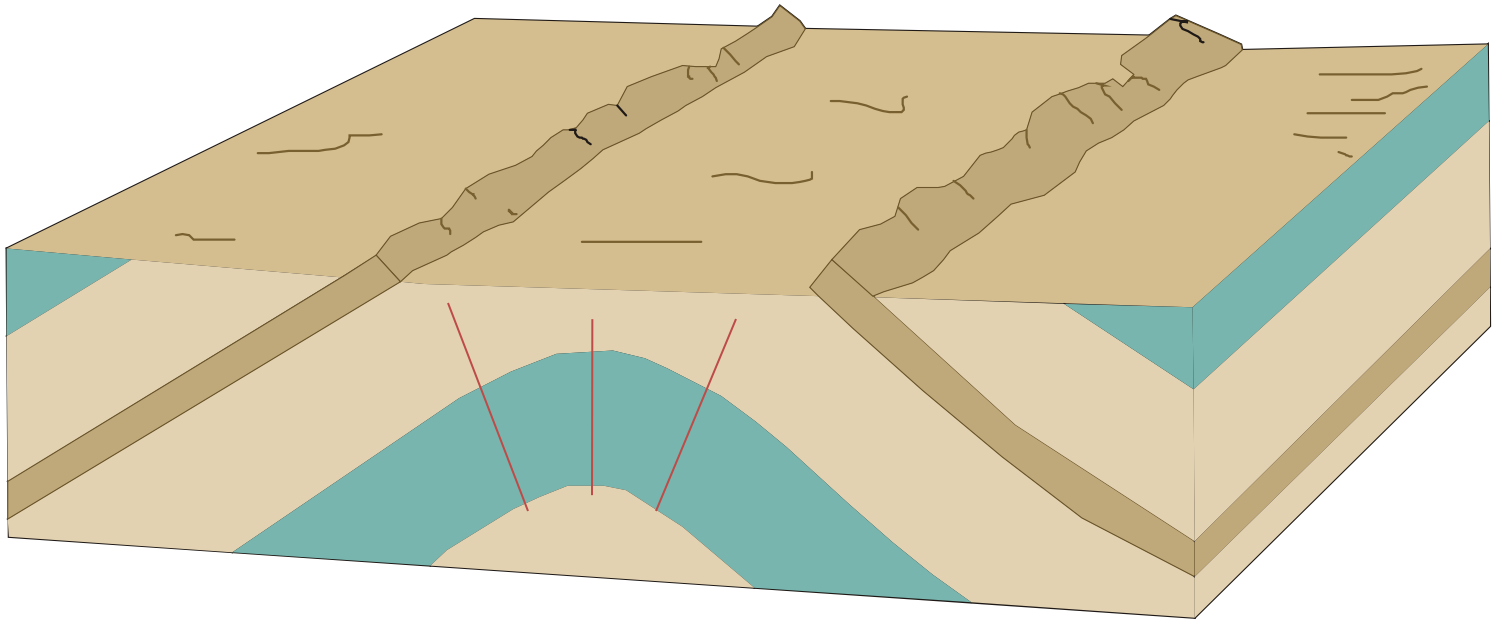
Types of folds

Monocline

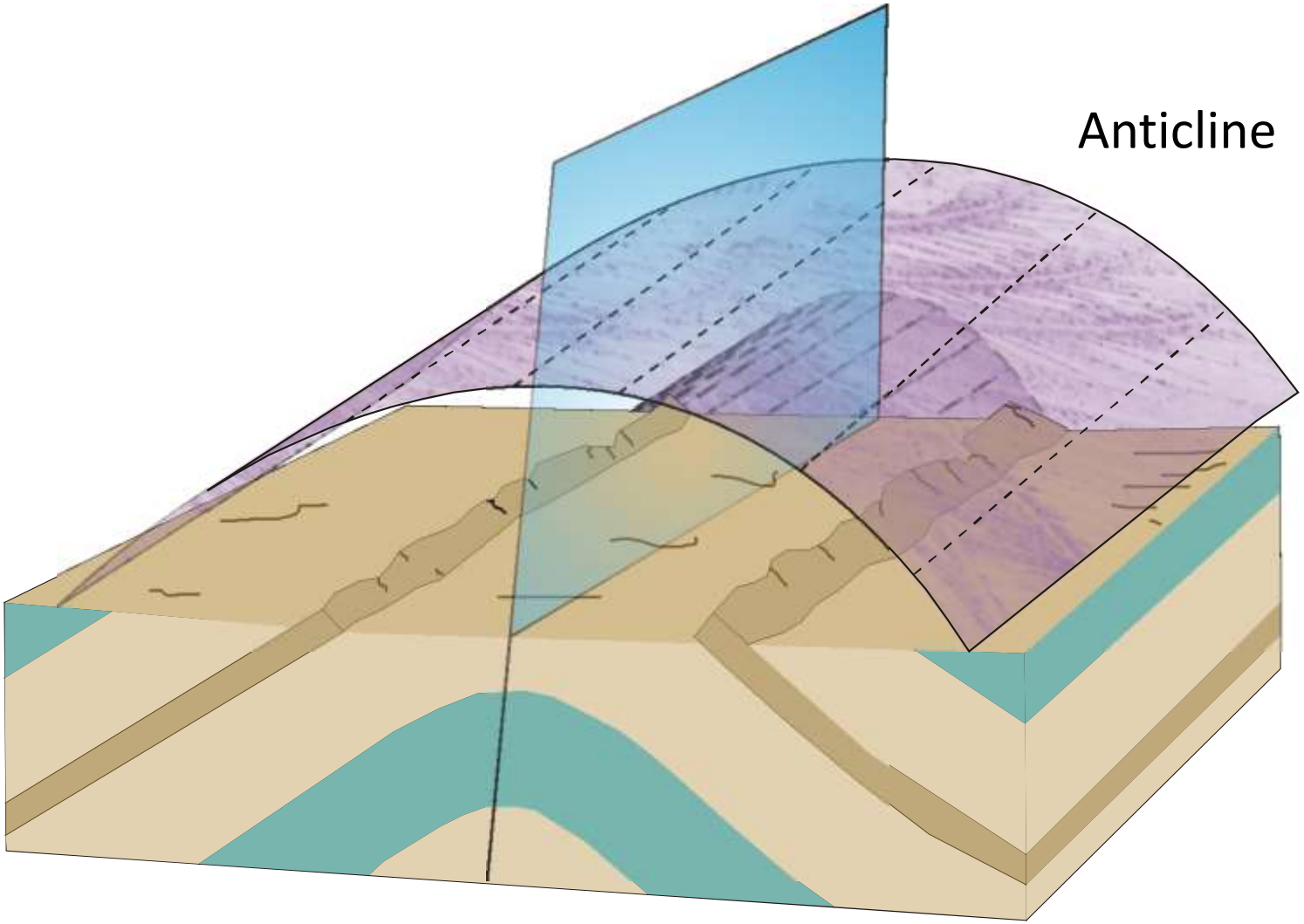


Types of folds

Anticline

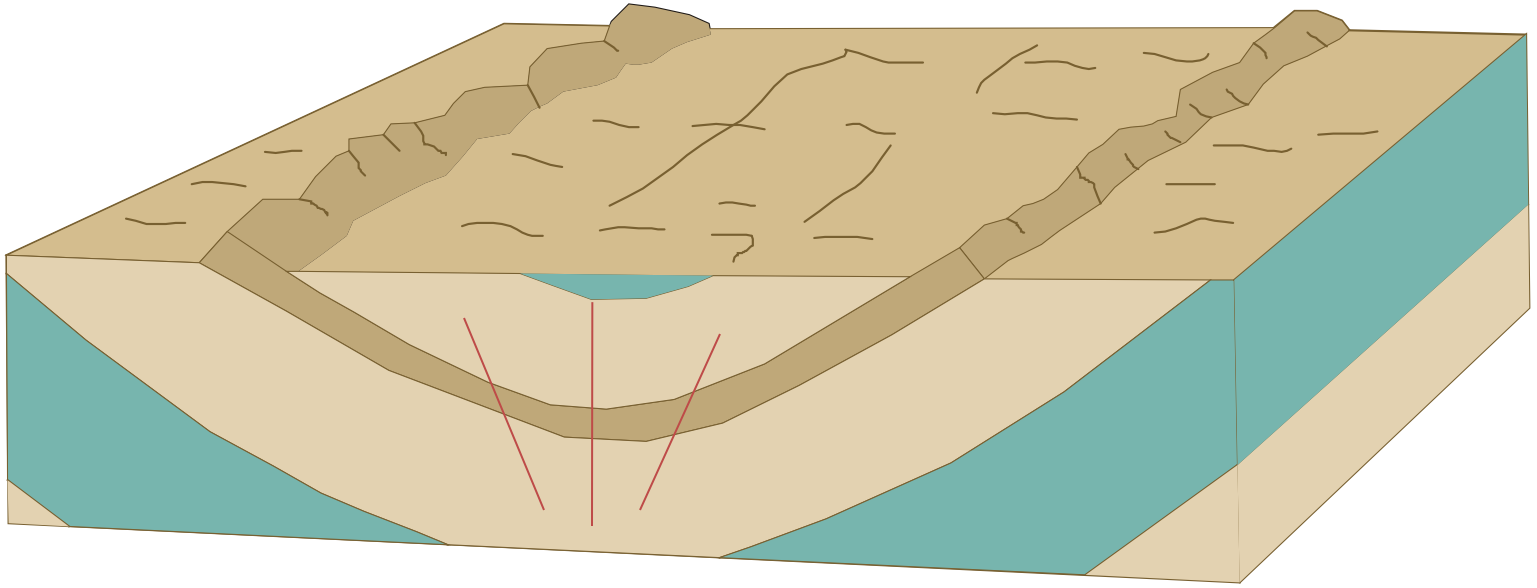


Types of folds

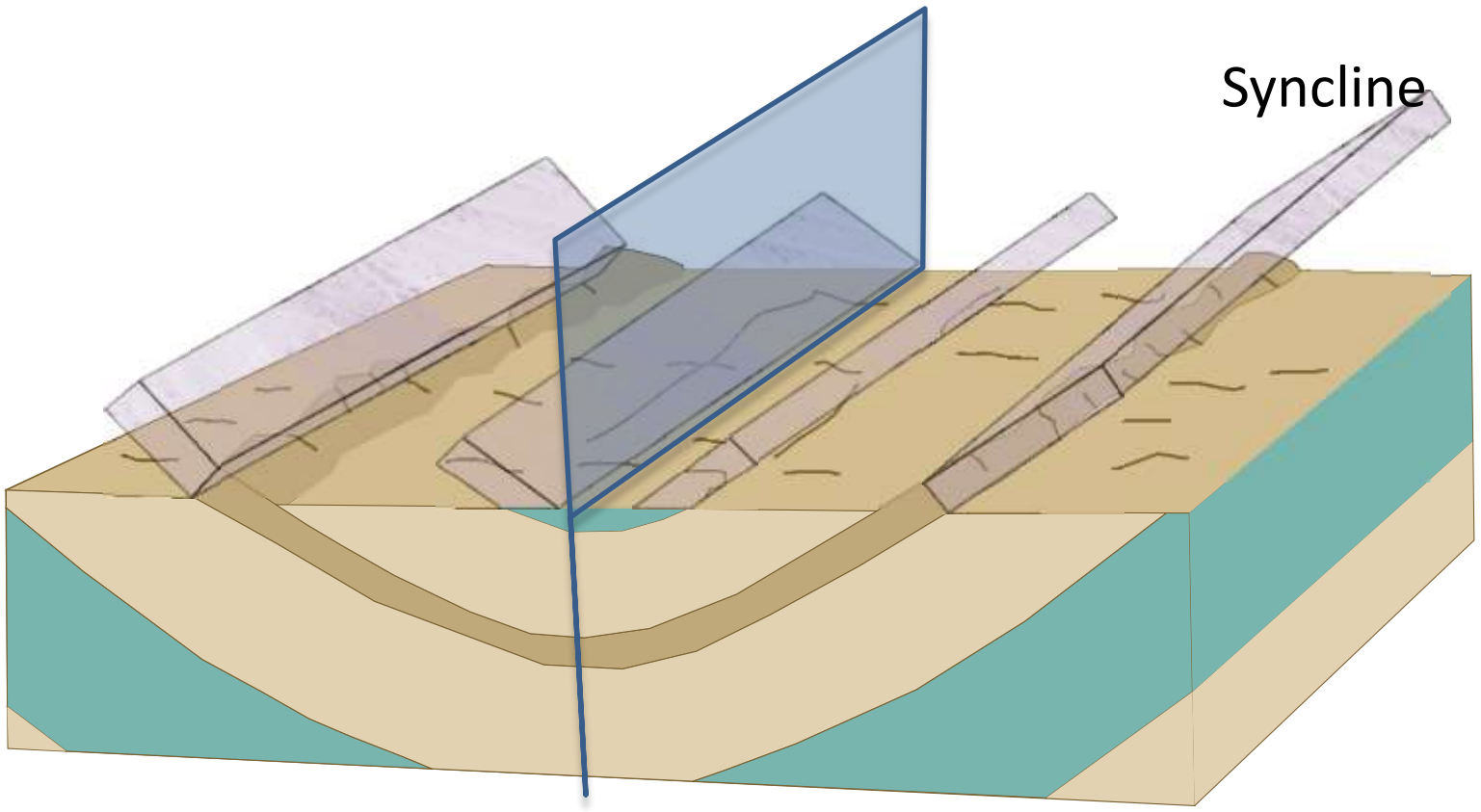


Types of folds

Syncline

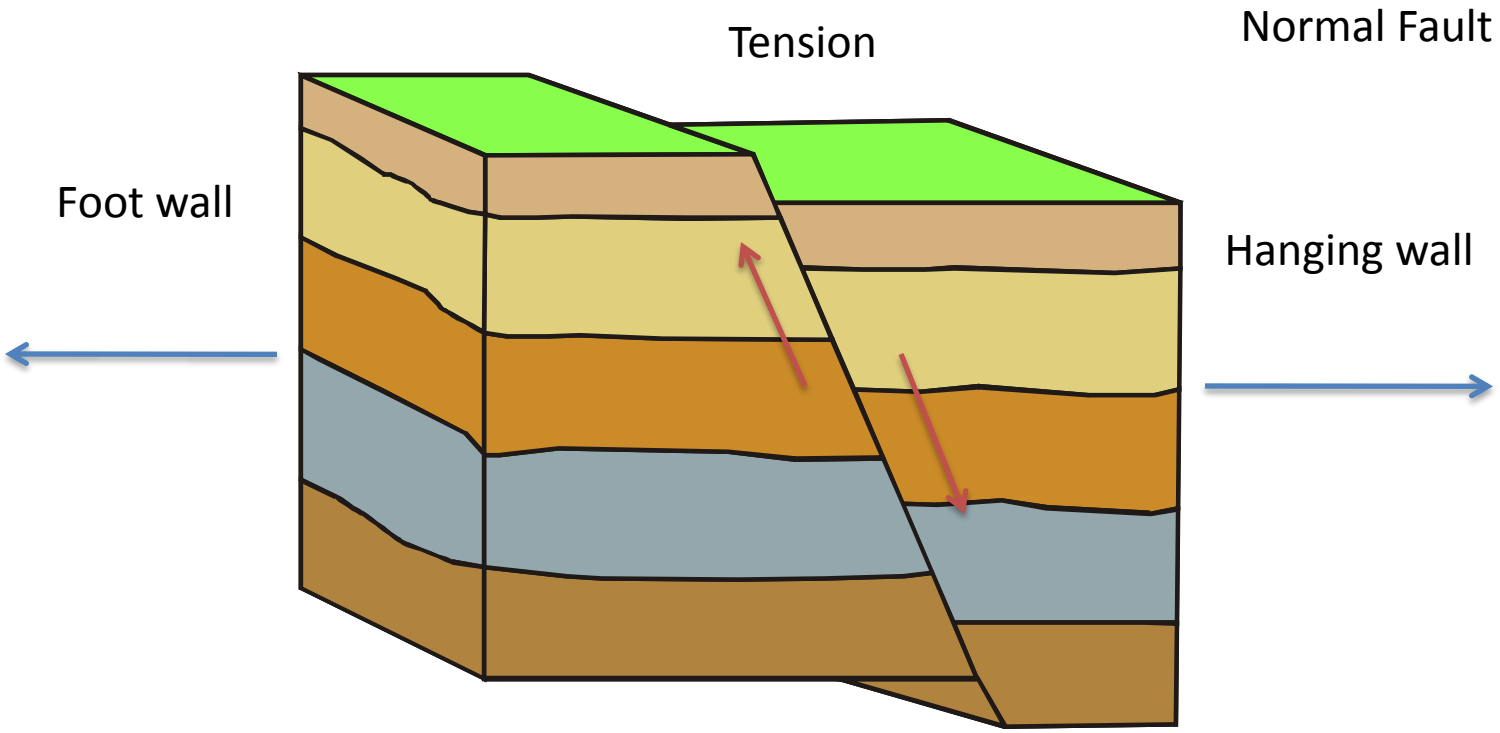


Types of folds

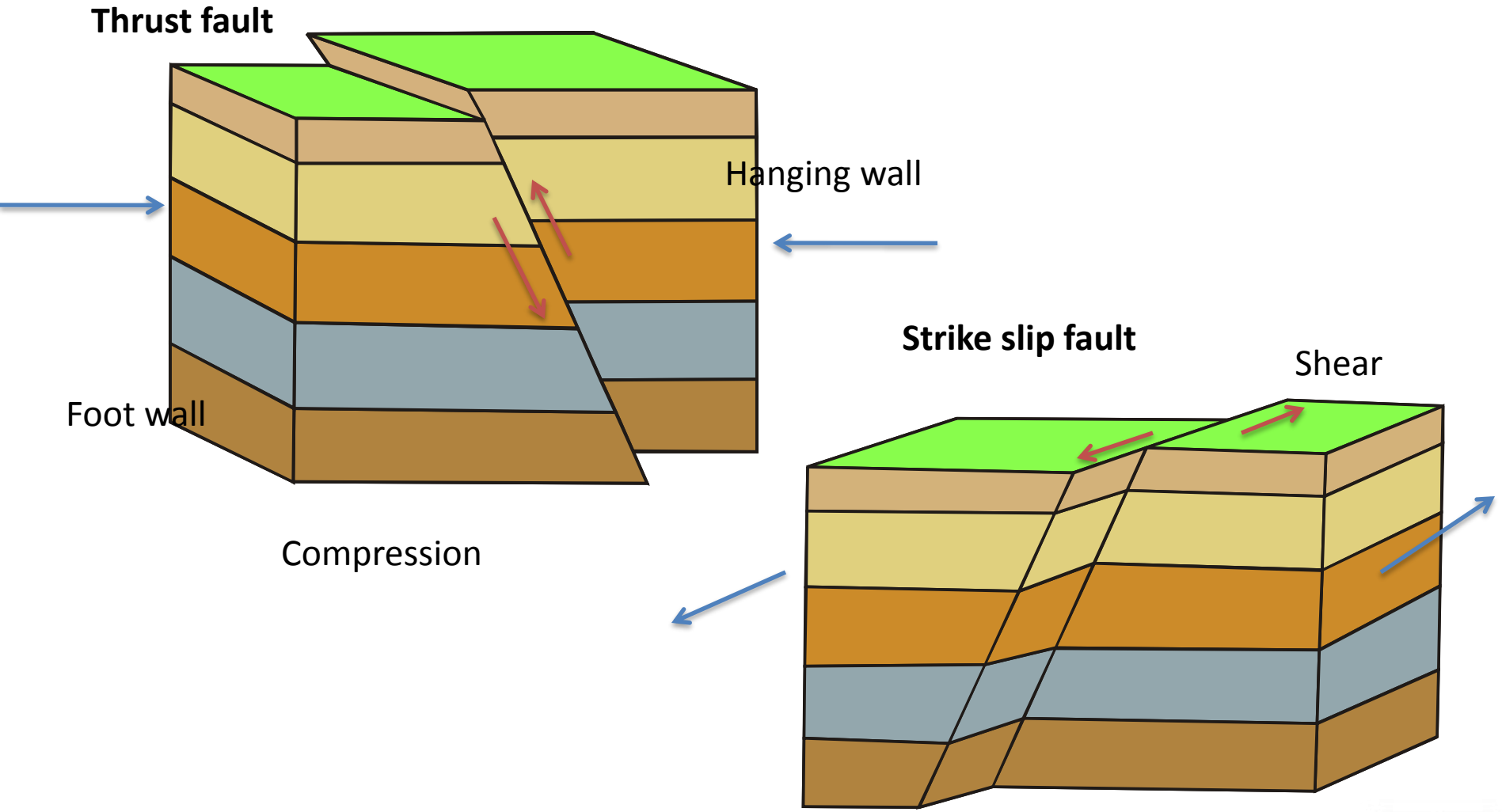


Faults

- Fracture in the Earth's crust, on either side of which rocks have moved past each other.
- Faults may occur where rocks are being pushed together (compression) or pulled apart (tension) by plate tectonics, movements of the plates of the Earth's crust.
-Large movements cause detectable earthquakes



Faults


Thrust fault
Hanging wall
Foot wall
Compression
Strike slip fault
Shear

Joints

Fractures in rocks with no appreciable displacement. They are very common in all rocks.

- Such joints are often zones of weakness where later faults could develop.
- Fluids can travel along joints: water, petroleum, pollution
- Valuable metal ores may form along joints from hydrothermal solutions.

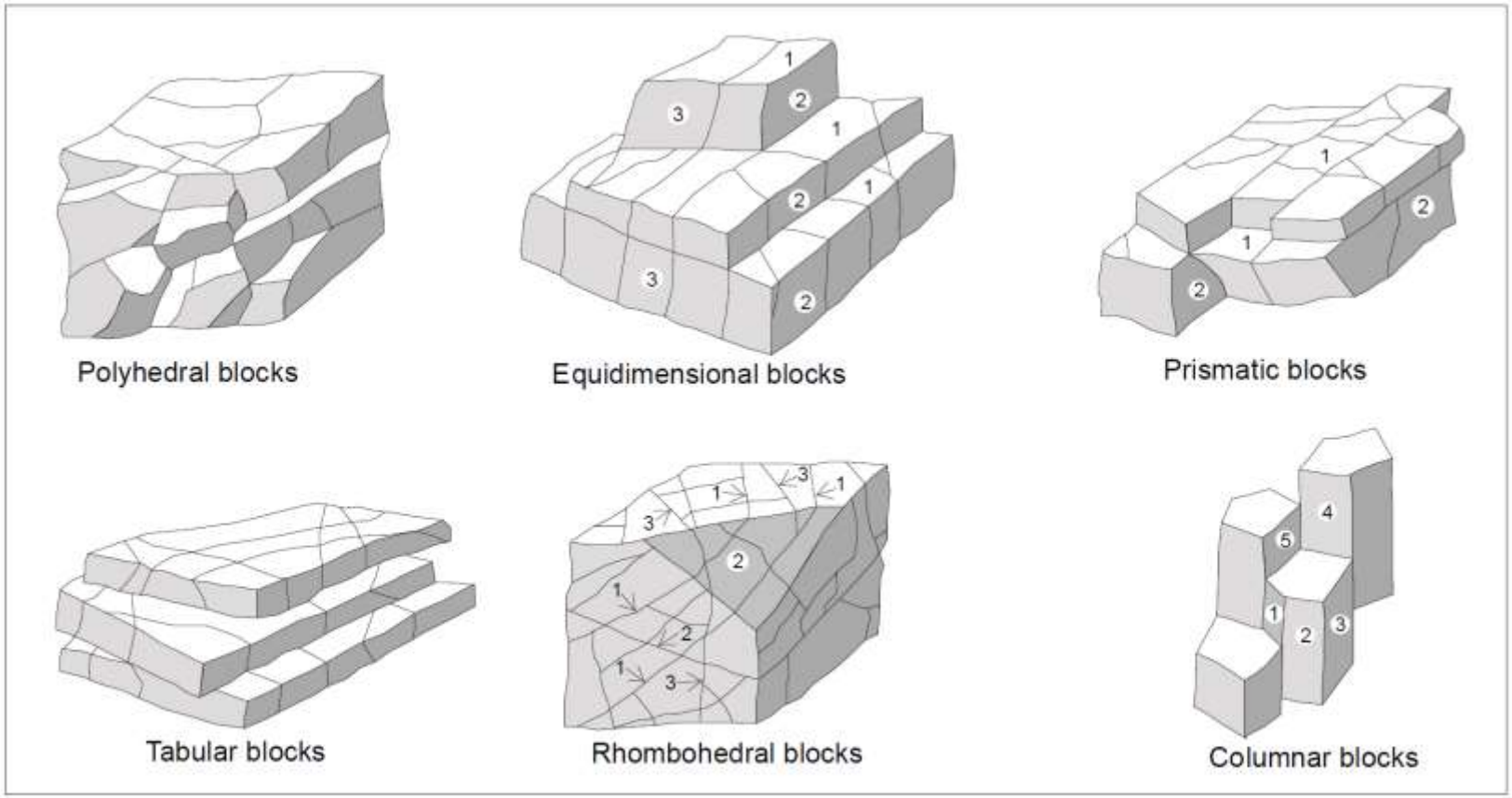


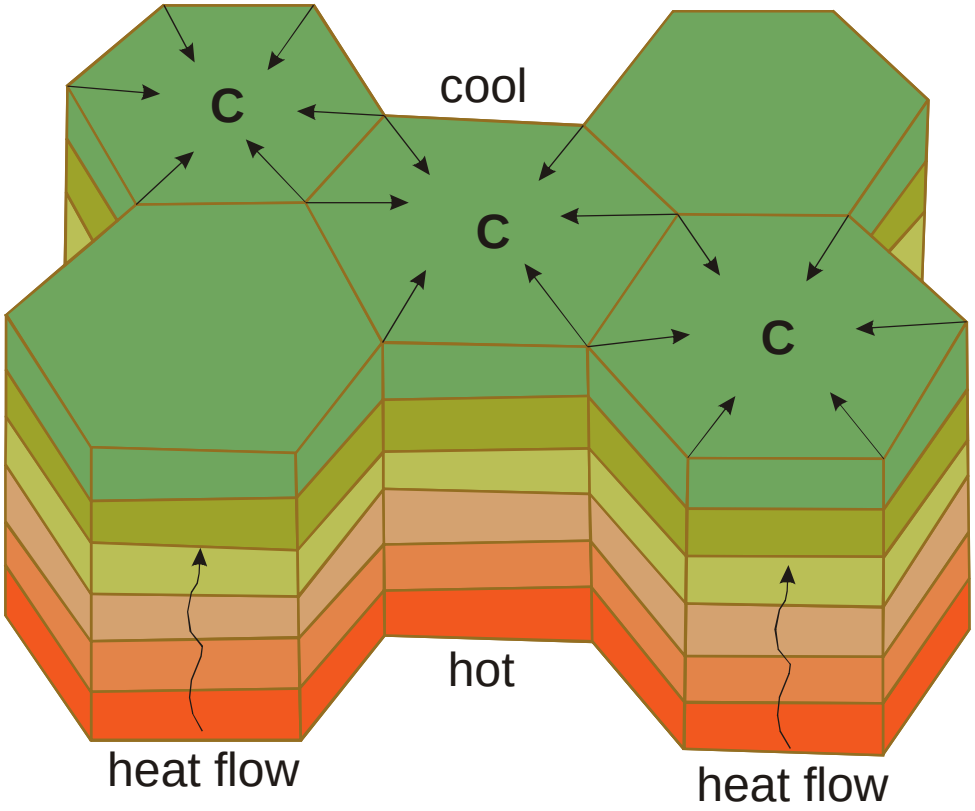
Fig. A1-6 Various types of jointing pattern expressed as block shape. The numbers refer to various joint sets (from Dearman, 1991, based on data from Matula and Holzer, 1978)

Joints

Joints may be the result of failure under natural forces , including small seams (filled joints) and some fractures such as minor and moderate shear ruptures. Thus, the main types of joint are:

- ***Tectonic joints****; i.e. breaks formed from the tensile stresses accompanying uplift or lateral stretching, or from the effects of regional tectonic compression (ISRM, 1975). They commonly occur as planar, rough-surfaced sets of intersecting joints, with one or two of the sets usually dominating in persistence.*
- ***Sheeting joints****; a set of joints developed more or less parallel to the surface of the ground, especially in plutonic igneous intrusions such as granite; probably as a result of the unloading of the rock mass when the cover is eroded away.*
- ***Exfoliation joints****; breaks developed as a product of exfoliation; the breaking or*
- splitting off from bare rock surfaces by the action of chemical or physical forces, such as differential expansion and contracting during heating and cooling over the daily temperature range.
- ***Cooling joints****, breaks formed as a result from cooling of igneous rocks.*
- ***Foliation joints*** *and partings, discontinuities developed along the foliation planes in metamorphic rocks.*
- ***Bedding joints*** *and partings, discontinuities developed along the bedding planes in sedimentary rocks.*

Joints



- Stresses are generated by contraction as the rock cools
- The joints form at 90^0 to the cooling surface
- Localised contraction

Joints

Unconformity

An **unconformity** is an erosion surface separating two rock masses or strata of different ages.

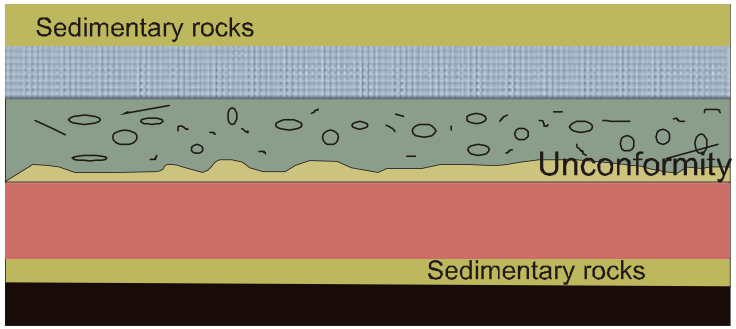
…indicates that sediment deposition was not continuous. i.e. a gap in depositions

Generally described as any break in the sedimentary geologic record.

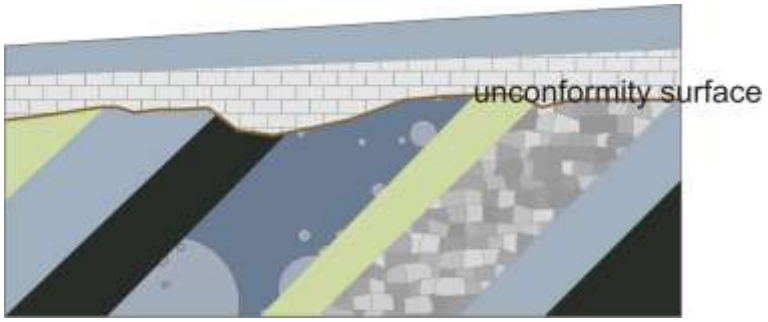
1. Angular unconformity
2. Nonconformity
3. Disconformity.

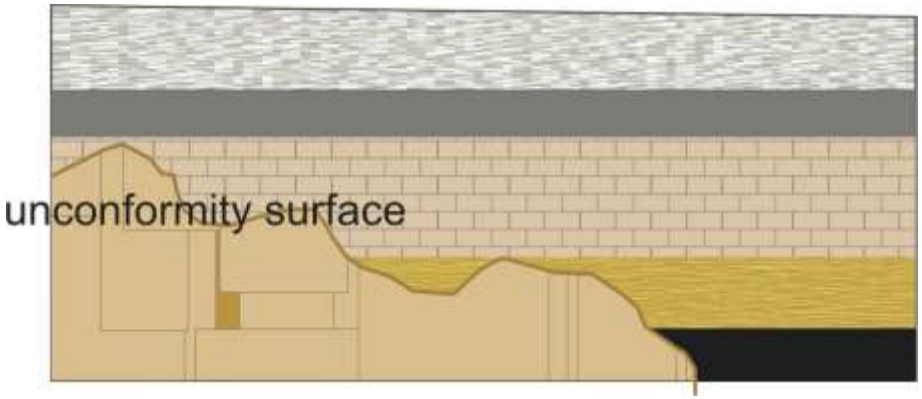
Unconformity

Disconformity



Angular unconformity





Nonconformity

References

Technical Guide to Managing Ground Water Resources, United States Department of Agriculture, May 2007

Earth's Dynamic Systems- Dr. W. Kenneth Hamblin and Dr. Eric H. Christiansen

Palmström A.: RMi – a rock mass characterization system for rock engineering purposes. PhD thesis, Oslo University, Norway, 1995, 400 p.

Illustrated oxford dictionary, 2006.

Ground water occurs in openings in the rocks that form the Earth's crust. The volume of the openings and the other water-bearing characteristics of the rocks depend on the mineral composition, age, and structure of the rocks.

All the rocks that make the crust of earth, display some texture and structure.

Openings in rocks may be associated with movement of groundwater or they may not.

Opening may be further enhanced by decay, thereby making them channels through which water may move and in which water is stored.

- The attitude of openings determine the direction in which the water will move.
- The size of openings would decide the ease with which water would move in the rock.
- Ease of movement of water in the rock is termed permeability.

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