3.3. Soft tectonics: folds

3.3.1. Definitions:

- Folds are more or less accentuated undulations in the layers. They form in the event of ductile or plastic deformation, and are referred to as soft tectonics.

- Folds are continuous deformations formed by +/- tight undulations. They are the manifestation of brittle rock behavior, and the simplest means of absorbing horizontal compressive stress.

- A fold is a deformation of rock under the effect of stress.

- A fold is a deformation of the rock into a curvature (hump or hollow) resulting from the bending of strata (lateral tectonic compression).

- Under the effect of tectonic forces, the rock has not broken but bent. This "plastic" behavior can be seen in very rigid, usually brittle rocks.

In fact, the application of low-intensity forces over a long period of time enables the rock to be gradually modified (folded) rather than fractured.

3.3.2. Fold characteristics:

3.3.2.1. The hinge:

Is the location of the points of maximum curvature of the layer affected by the fold (right).

It is the zone of maximum curvature of the fold.

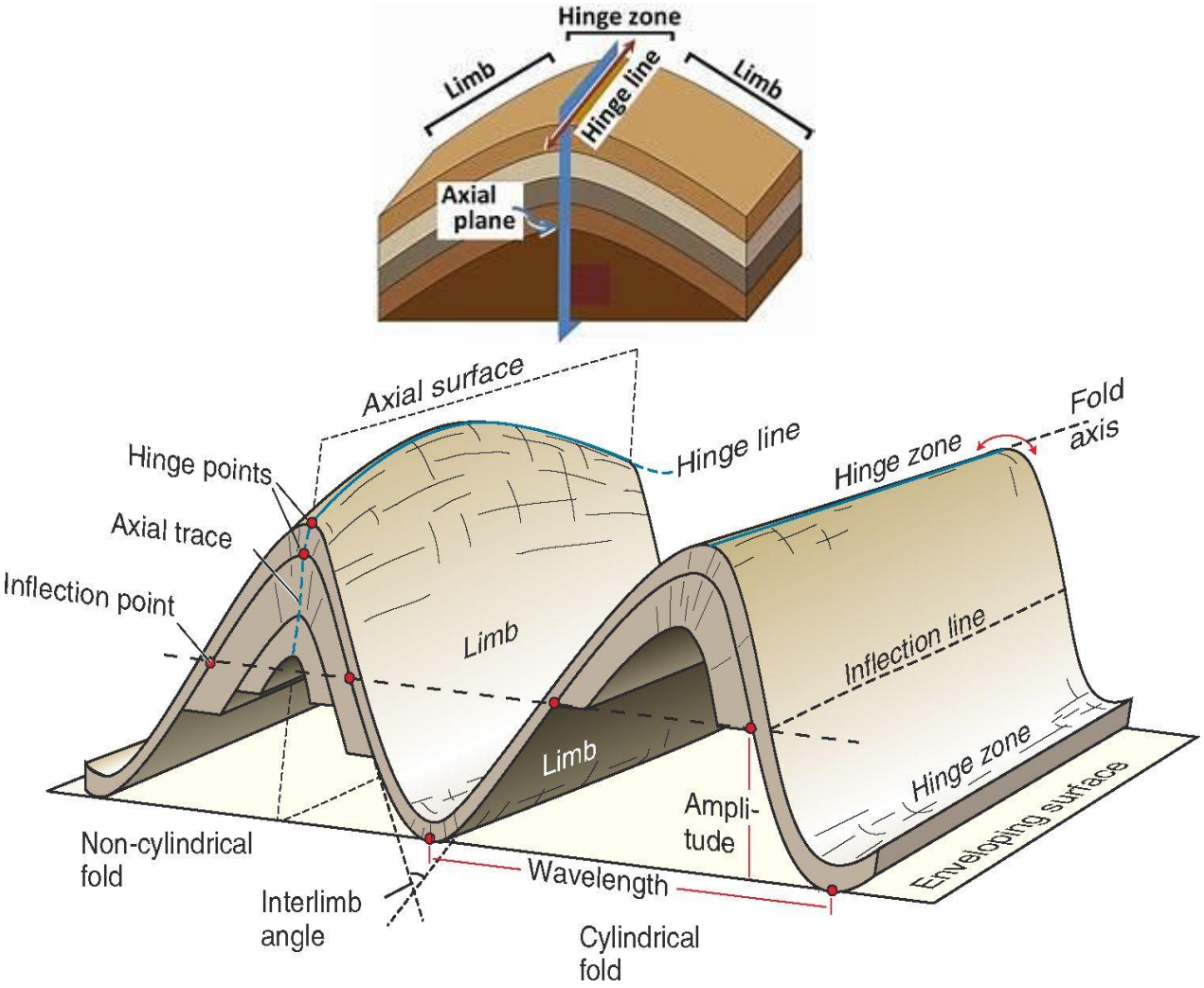


Figure 99: Main components of a fold (geocaching.com).

3.3.2.2. Flanks: are the surfaces connecting two successive hinges. These are the areas of minimum curvature,

3.3.2.3. The fold axis: is the line passing through the middle of the hinge. The direction of a fold is that of the fold axis.

3.3.2.4. The axial surface: is the flat surface passing through the hinges of all the layers affected by the fold.

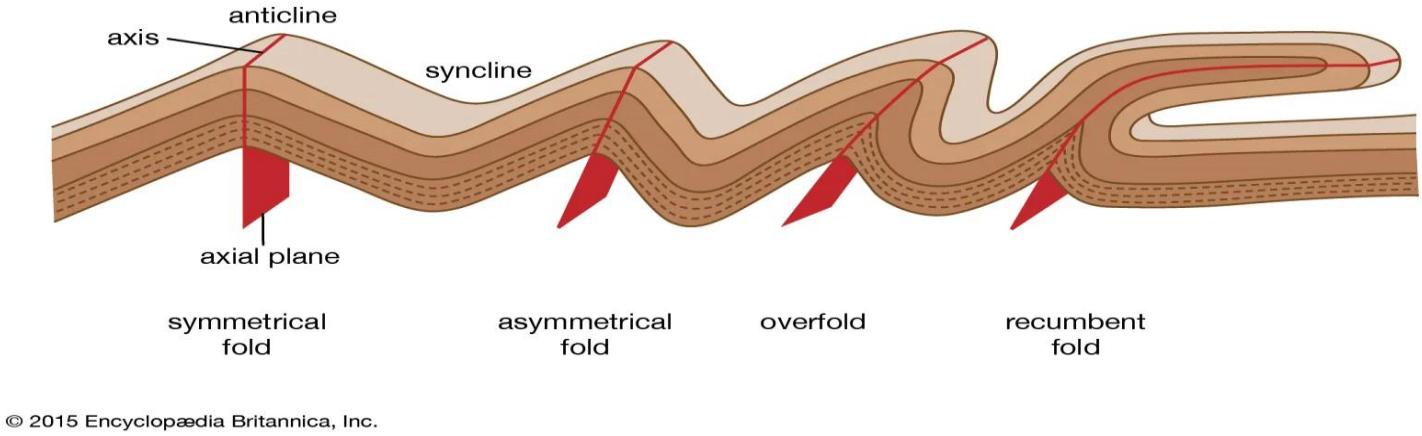
3.3.2.5. The limb of a fold: is the deviation of its axial surface from the vertical or horizontal.

3.3.2.6. The direction of a bend (or elongation) : is that of the axial surface of the bend; in principle, it is perpendicular to compression.

3.3.2.7. The crest: this is the highest topographic point of the fold (passing through the summit),

3.3.3. The main types of fold:

There are different types of fold, depending on the inclination of the flanks and axial surface, shape, type of deformation, mode of formation, etc.



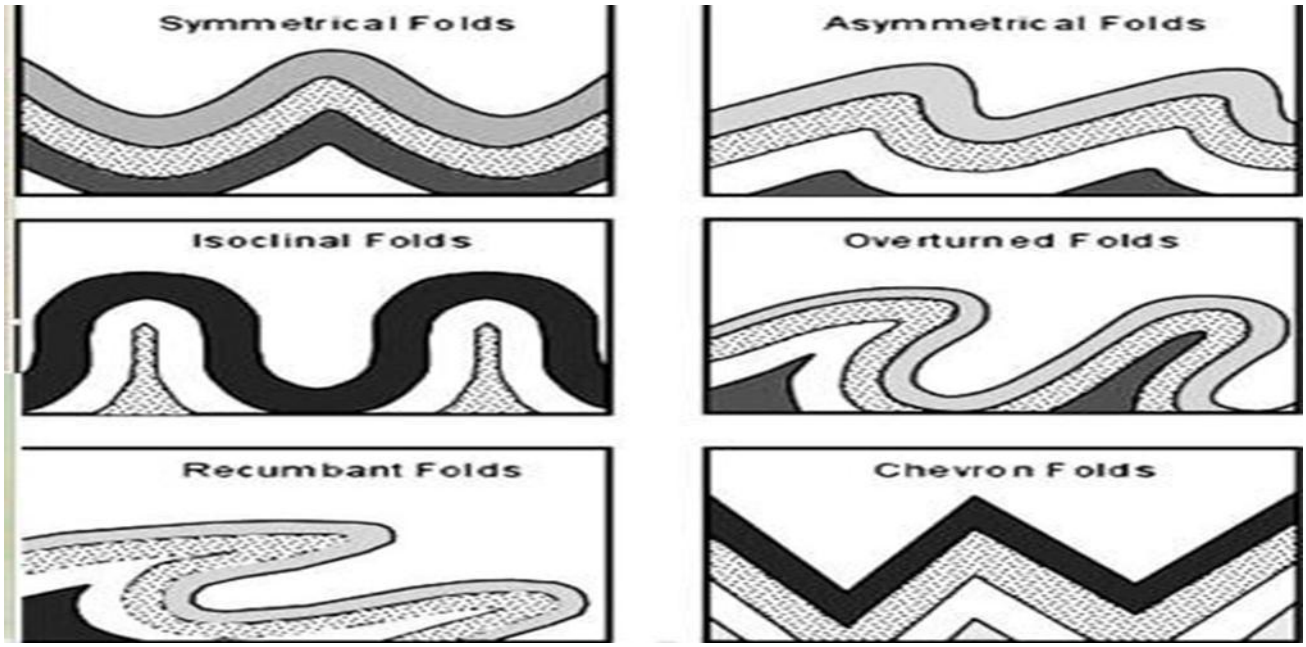


Figure 100: Fold types (larousse.fr).

3.3.3.1. According to the inclination of their flanks and their axial surface: we can distinguish:

3.3.3.1.1. Straight folds: the two flanks are equally and oppositely dipping, and the axial plane is vertical,

3.3.3.1.2. Ejected folds: one of the flanks is straightened without reaching the vertical, so that the two flanks have different dips.

3.3.3.1.3. Tilted folds: one of the flanks has risen above the vertical, the reverse flank.

3.3.3.1.4. Knee folds: one flank is above the vertical and the other flank is vertical

3.3.3.1.5. Inverted folds and recumbent folds: both flanks are approaching the horizontal.

3.3.3.2. Depending on the orientation of the concavity and the succession of layers:

We can distinguish:

3.3.3.2.1. Anticline: An anticline is a hump-shaped fold.

In an anticline, the concavity of the layers is oriented downwards (in the shape of a tunnel) and the oldest layers are found at the heart of the fold.

3.3.3.2.2. The syncline: a trough-shaped fold.

In a syncline, the concavity of the layers is oriented upwards (gutter-shaped) and the core is formed by the most recent layers.

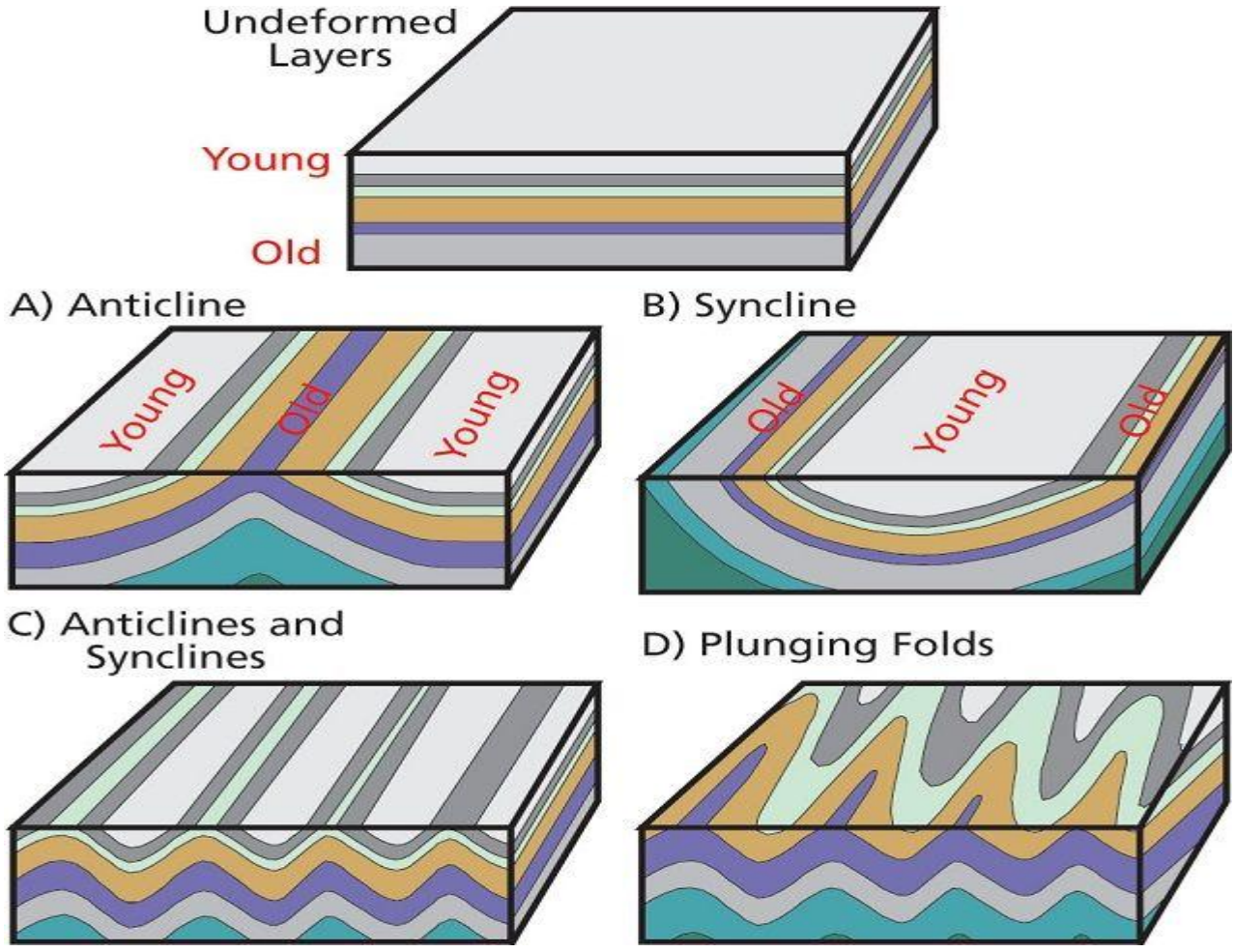


Figure 101: Syncline and anticline

3.3.3.3. Depending on the type of deformation of the thickness of the flank layers, a distinction can be made between:

3.3.3.3.1. Isopaque folds: Folds whose layers maintain a constant thickness are referred to as "isopaque folds".

3.3.3.3.2. Anisopaic folds: in contrast to isopaic folds, the flanks are stretched, laminated or fractured.

3.3.3.3.2.1. Fault folds: are the result of intense deformation of the fold, with rupture and faulting. When the geological layers on either side of the rolling zone are separated (with rejection).

3.3.3.3.2.2. Stretched fold: when the thickness of the layers on one flank decreases.

3.3.3.3.2.3. Laminated fold: when the thickness of the layers on a sidewall becomes zero.

3.3.3.3.2.4. Overlapping fold: superimposition of old layers on recent layers with horizontal rejection at the curvature.

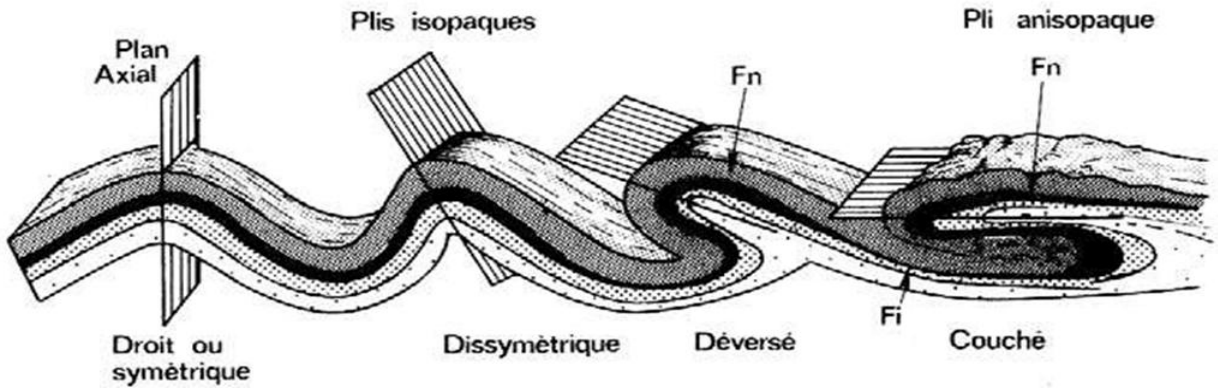


Figure 102: Isopaque and anisopaque folds

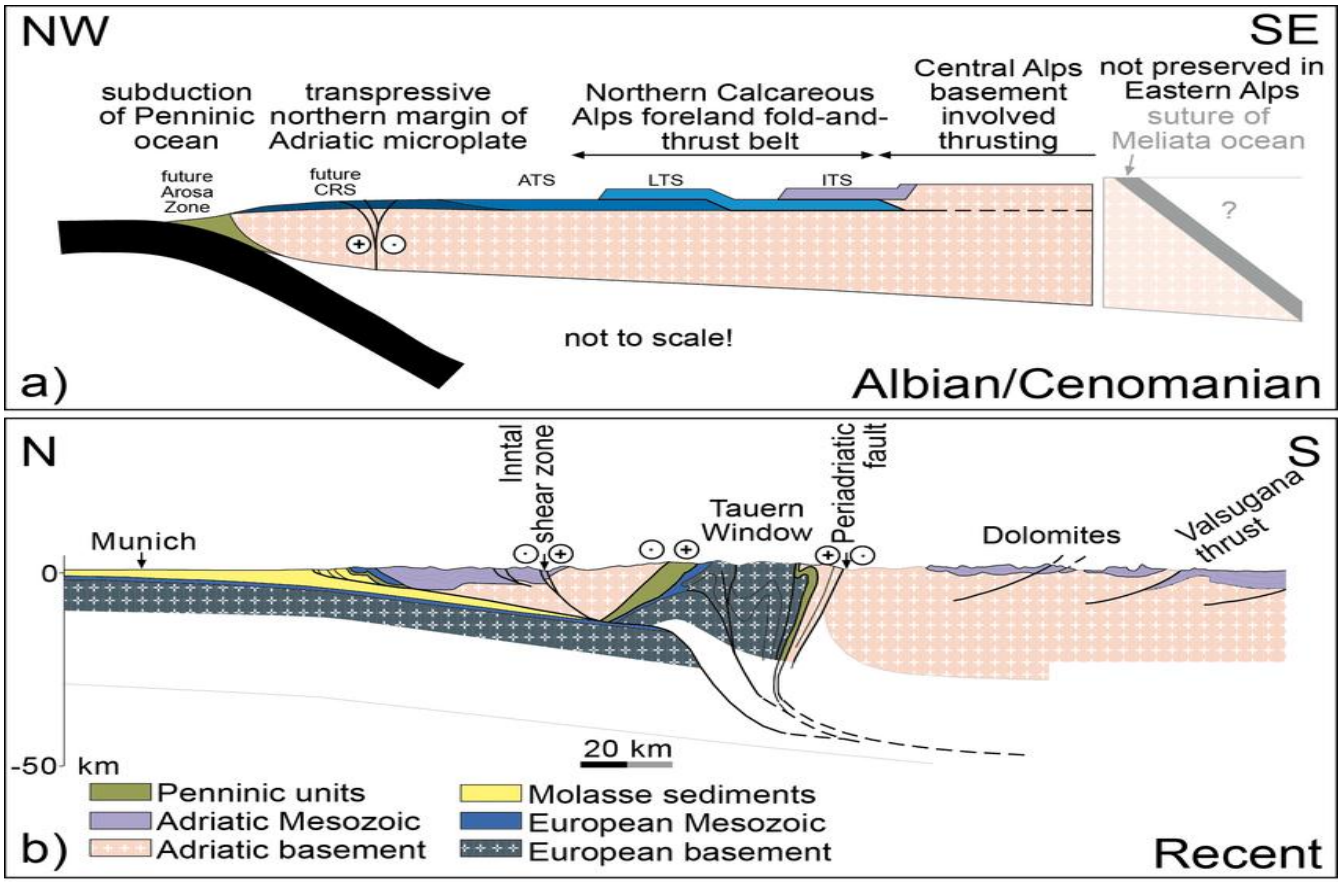


Figure 103: Evolution of soft deformation towards a thrust sheet.

3.3.4. Characteristic relief :

From a morphological point of view, folds can give rise in the landscape to a succession of shapes characteristic of the relief of folded zones: mountain, valley, cluse, combe...

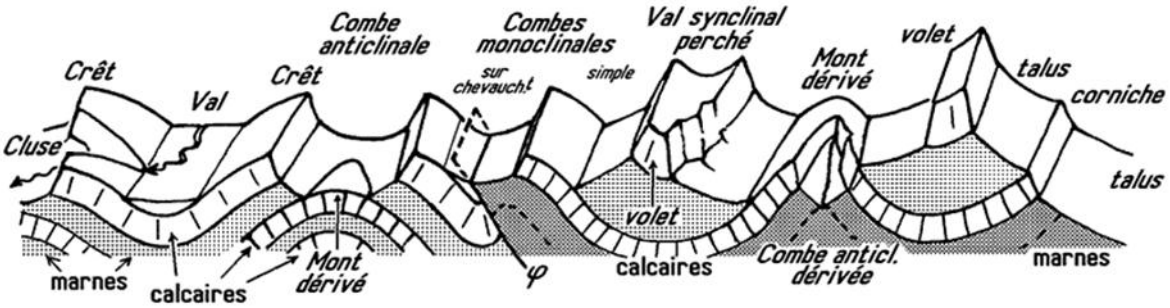


Figure 104: Names used to describe the relief of folded chains (geol-alp.com).

3.3.5. Fold grouping:

Folds are rarely isolated and group together to form anticlinoriums (set of folds that outline an anticline on a larger scale, the synclinorium set of folds that outline a syncline).