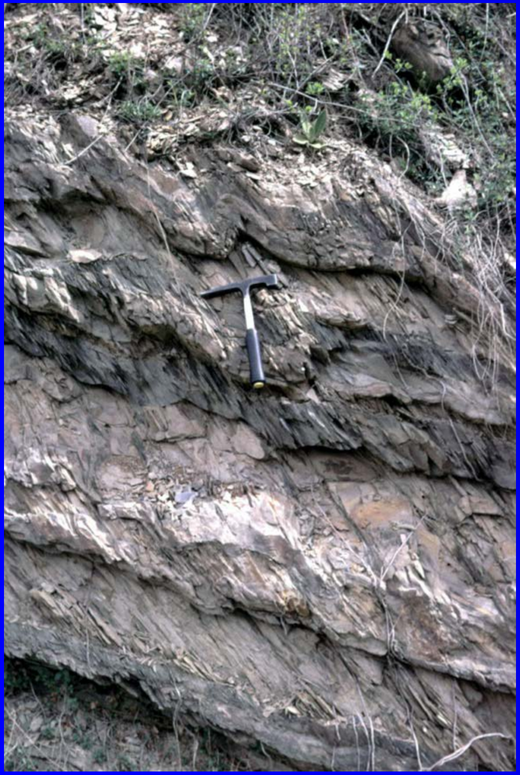
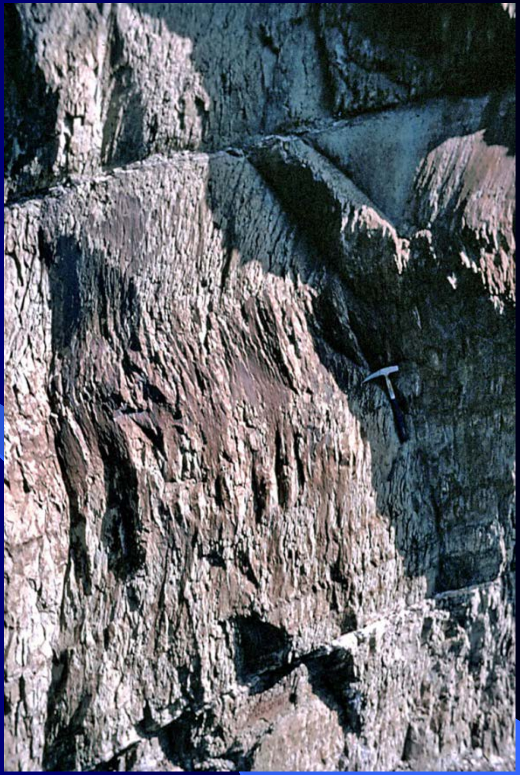
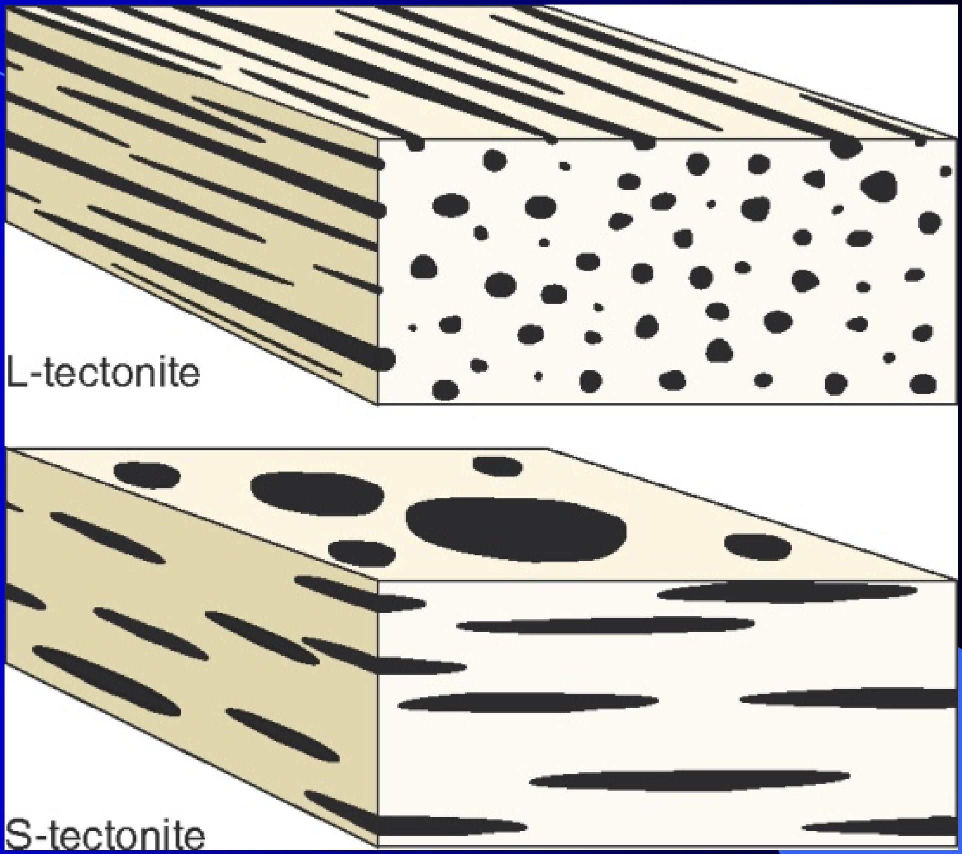


Foliation and Cleavage



A fabric is built of minerals and mineral aggregates with a preferred orientation that penetrates the rock at the microscopic to centimeter scale.

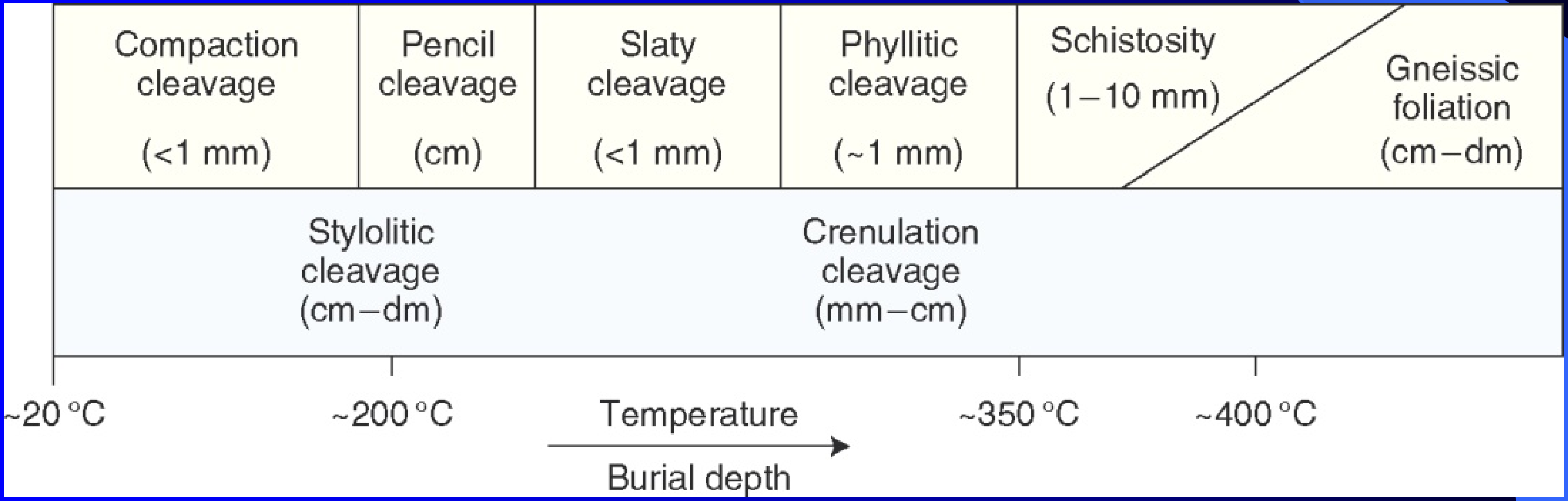
- Linear fabric – elongate elements with a preferred orientation
- Planar fabric – tabular or platy minerals or other "flat" objects with a preferred orientation
- Random fabric – elements show no preferred orientation
- Primary fabric – characteristic of the original rock
- Tectonic fabric – result of deformation



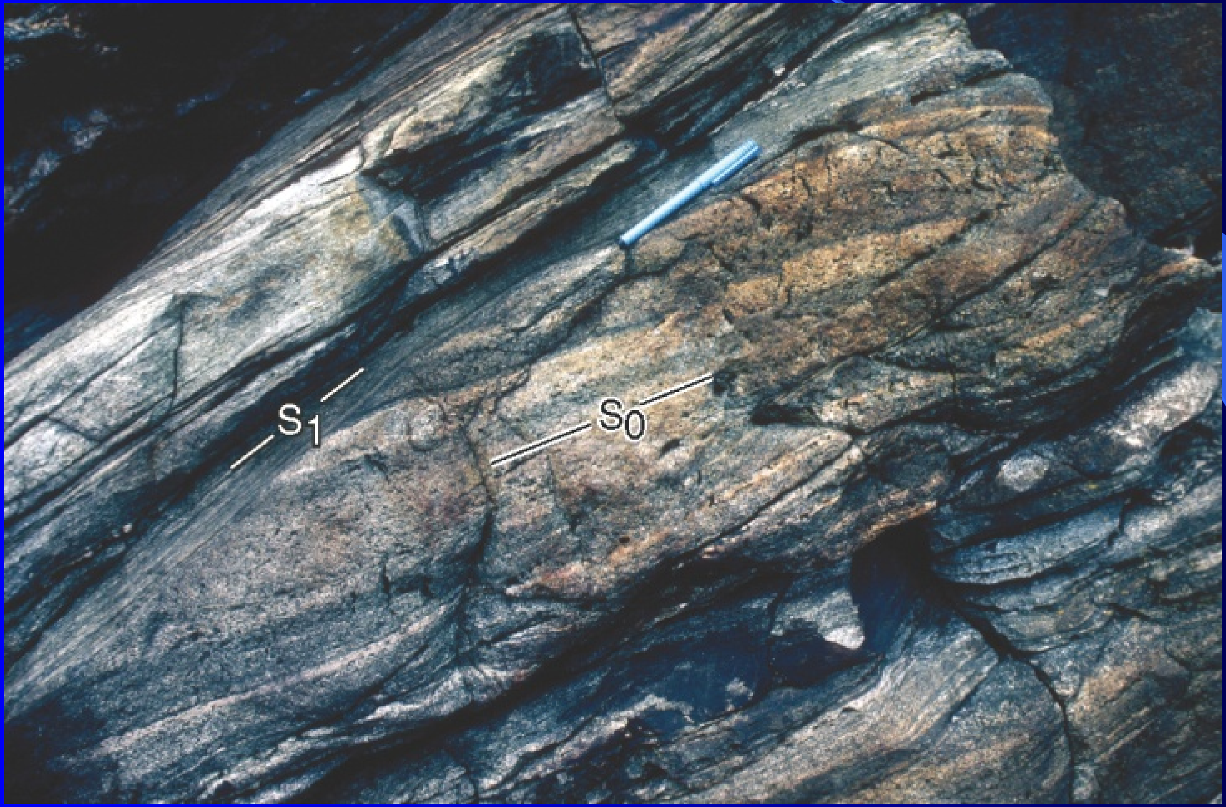
Fabric is a configuration of objects penetrating the rock. Linear objects form L-fabrics (top) while planar objects constitute S-fabrics (bottom). The rocks are known as L- and S-tectonites respectively.

Foliation – fabric-forming planar structure

- Primary – forms during deposition of sediments and formation of magmatic rocks
- Secondary – product of stress and strain (tectonic foliation). Examples are cleavage, schistosity, and mylonitic foliations.
- Cleavage refers to the ability of a rock to split or cleave into more or less parallel surfaces.

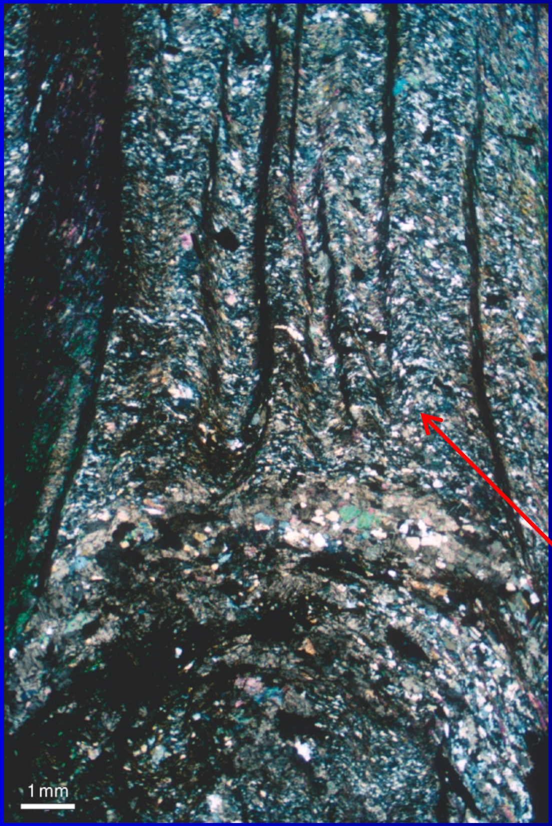


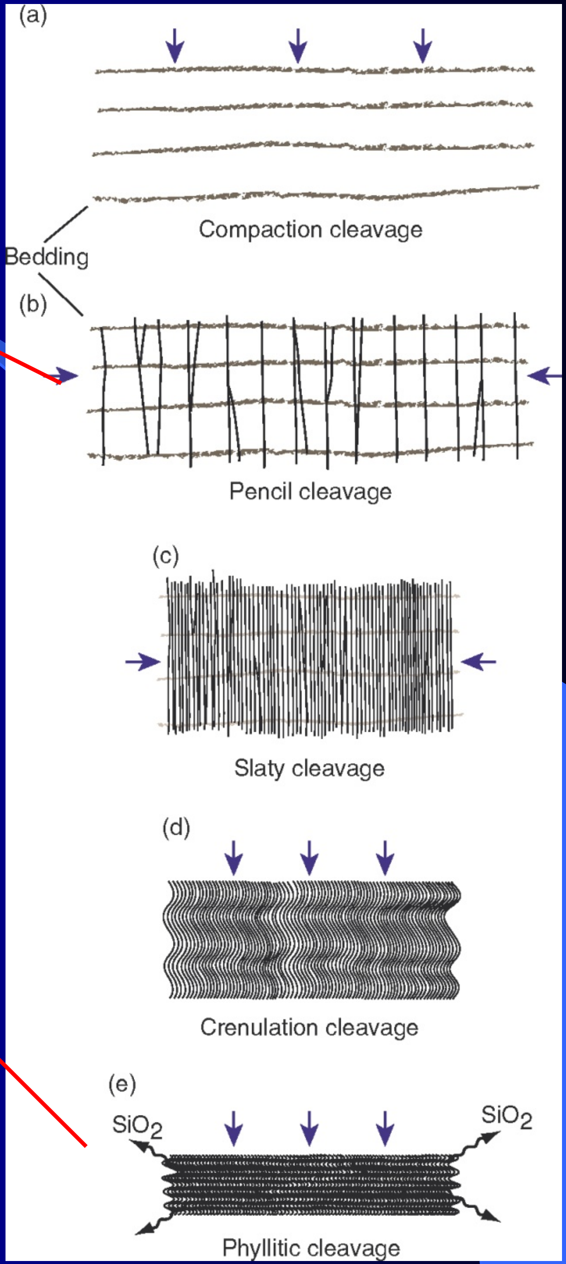
Relative age terminology – S_o, S_1, etc.



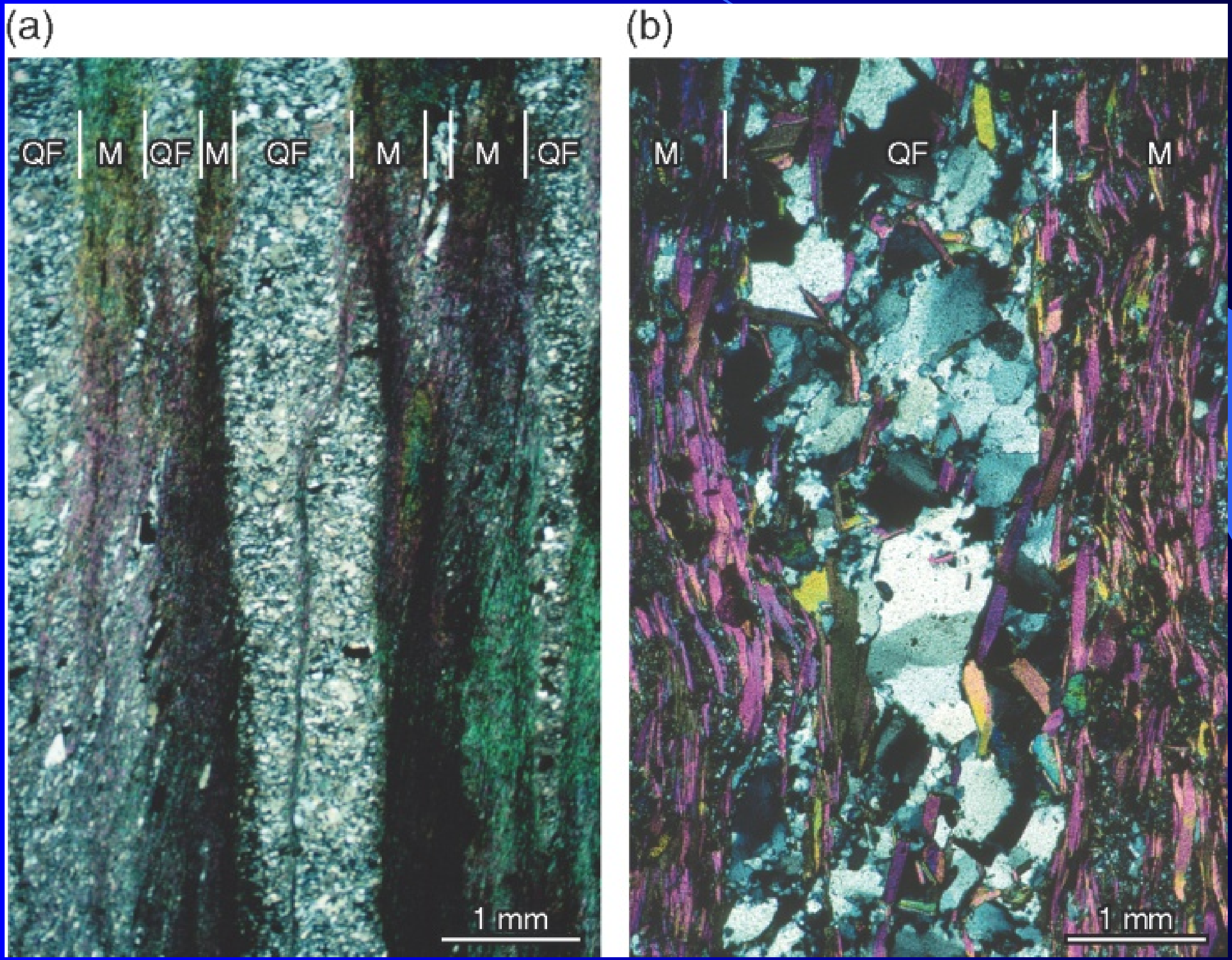
Cleavage development

- Compaction cleavage due to reorientation of mineral grains and collapse of pore space. Some dissolution.
- Pencil cleavage due to tectonic stress and development of a secondary cleavage. Pressure solution important. Clay minerals oriented in two planes.
- Slaty cleavage due to tectonic shortening, reorientation of clay grains, and solution of quartz. QF- and M-domains.
- Phyllitic cleavage - micas form and QF- and M-domains become more pronounced.
- Higher metamorphic grades lead to schistosity.

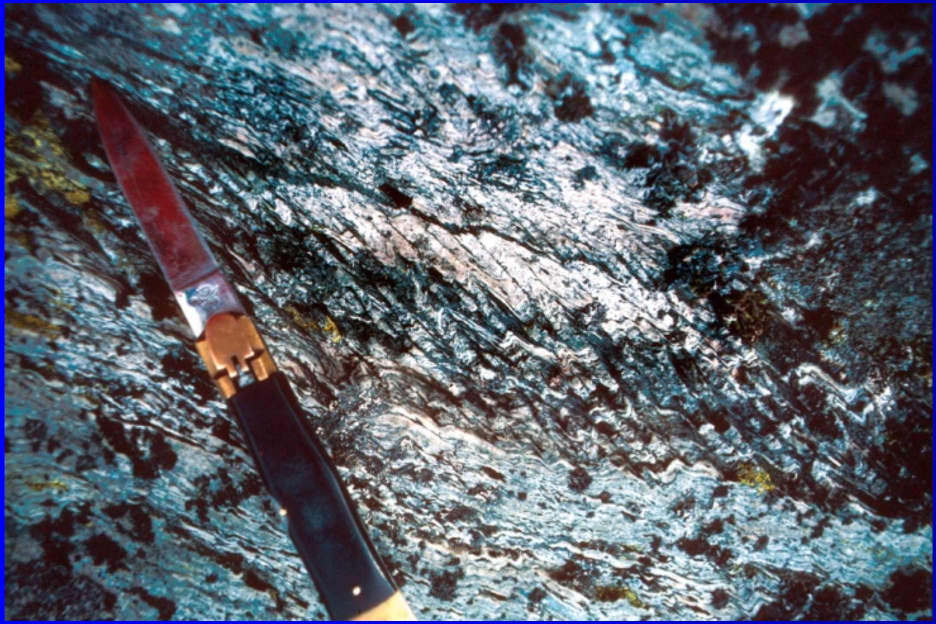




QF- and M-domains in lower greenschist and upper greenschist facies rocks. Note increase in grain size. QF- and M-domains are well-developed.



Crenulation cleavage develops when the principal stress direction changes. Symmetric versus asymmetric depends on the orientation of the original cleavage compared to that of the secondary cleavage. Cleavage develops perpendicular to the direction of shortening.



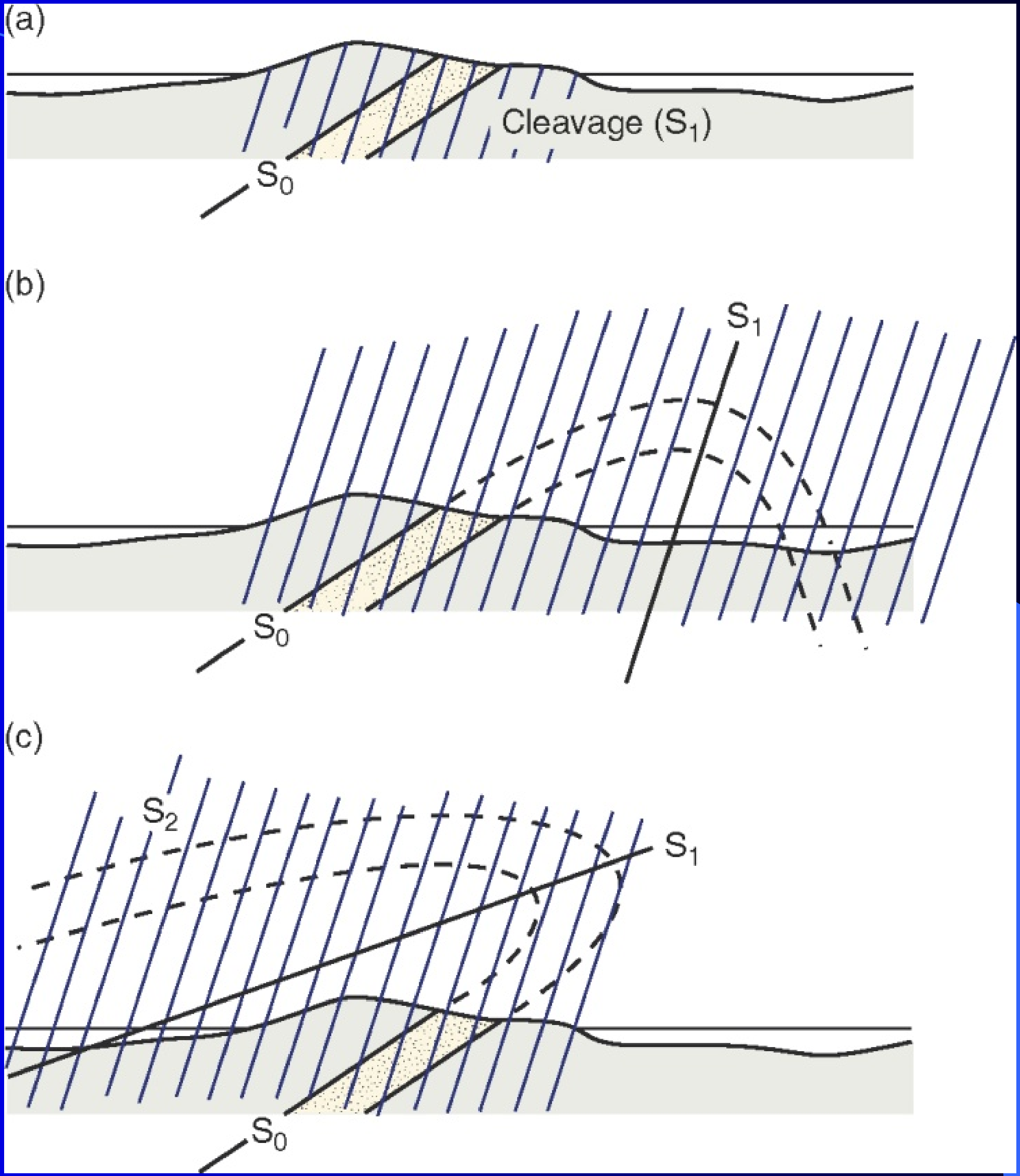
Asymmetric crenulation cleavage (above).
Symmetric crenulation cleavage (right).

Axial plane cleavage parallels the axial surface. Cleavage refraction occurs when cleavage crosses layers of varying viscosity or competency.

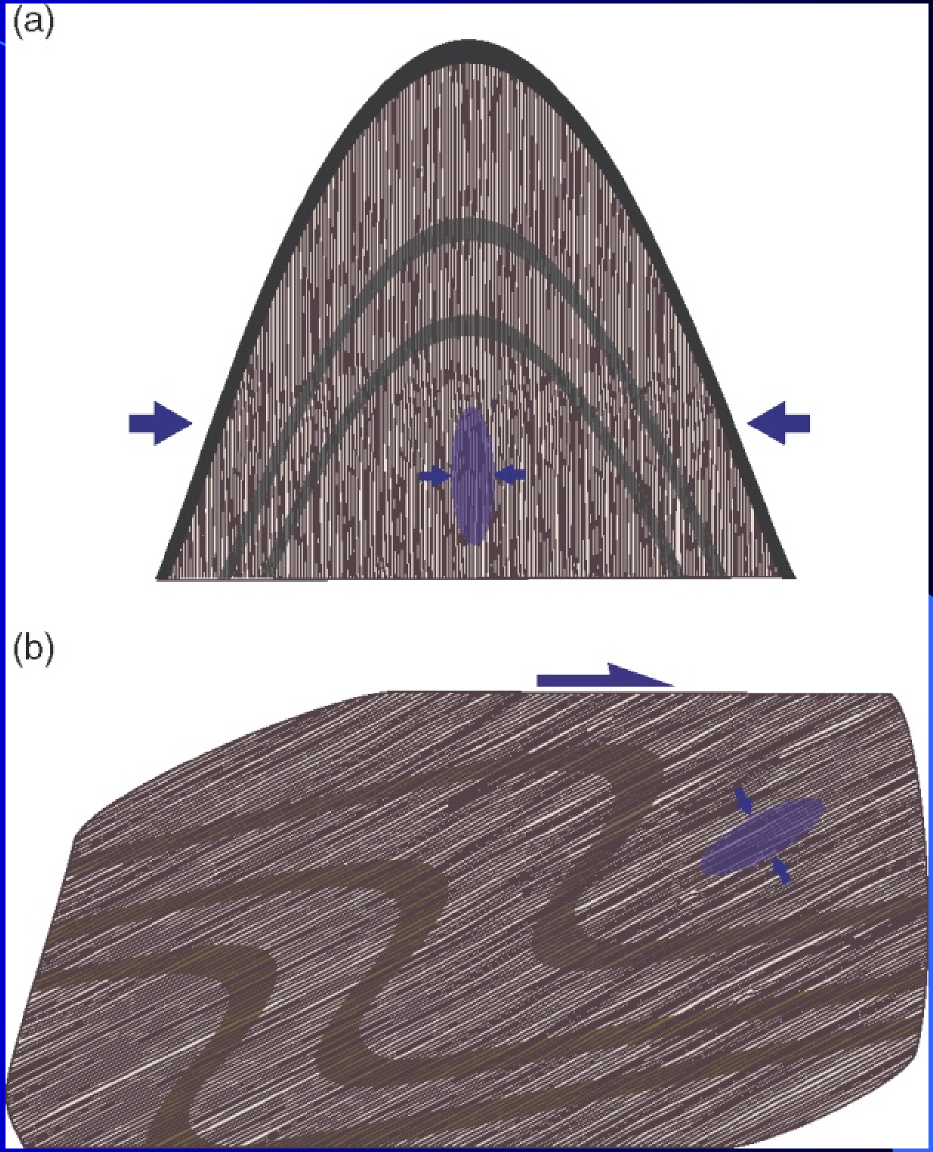
a) Mapped cleavage-layering relation in a deformed area.

b) Interpretation of large-scale fold based on the assumption that the cleavage is an axial plane cleavage that is related to the fold.

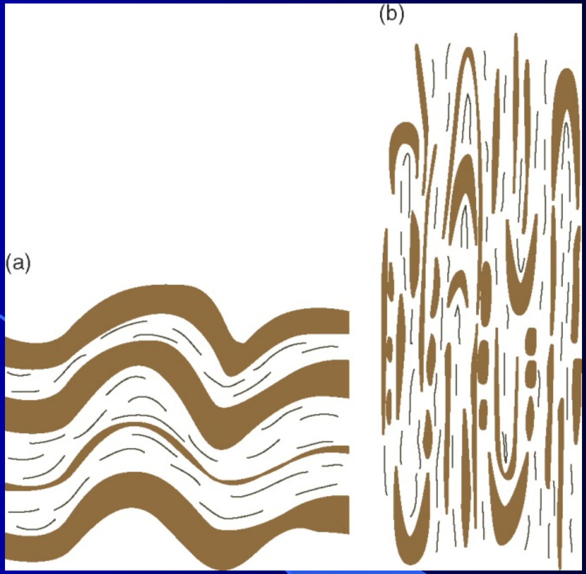
c) If the fold has a different geometry then the fold and the cleavage must have formed at different times.



Relationship between the strain ellipse and cleavage. (a) If the deformation is coaxial the cleavage is in the plane of flattening. (b) During simple shear the cleavage lies in the shear plane.



Transposition by horizontal shortening and vertical extension which leads to gneissic layering. Both coaxial and non-coaxial strain can produce this result.



Mylonite foliation formed by shear-related plastic grain size reduction of a coarse-grained granitic rock. This fabric forms because of high non-coaxial strain and it is found in shear zones or thrust zones that involve large (kilometer scale or more) displacements.