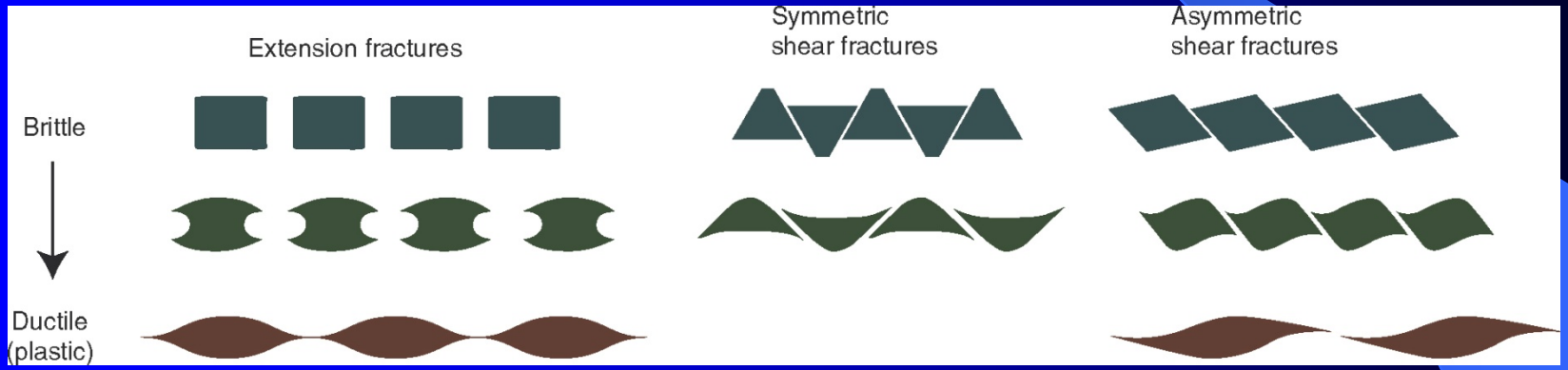
Boudinage

Boudins are more or less regularly shaped and spaced fragments formed by stretching of competent layers or foliations.

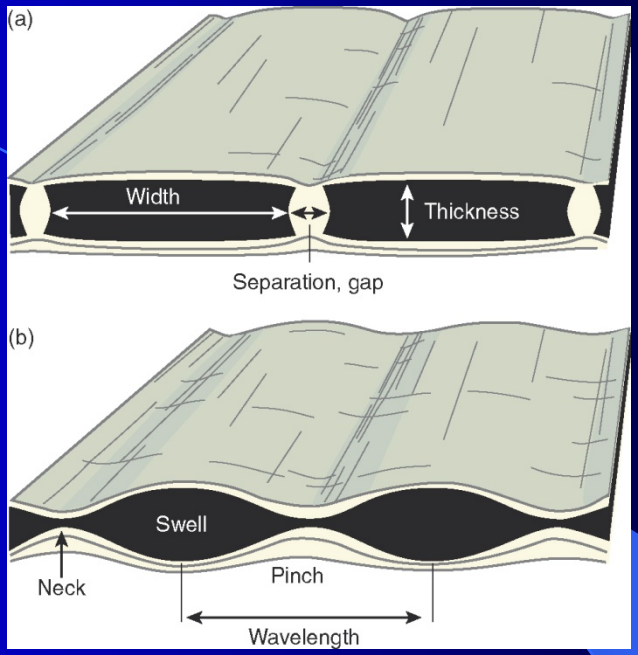
Boudins form where single competent layers are extended into separate pieces through plastic, brittle or a combination of plastic and brittle deformation mechanisms.

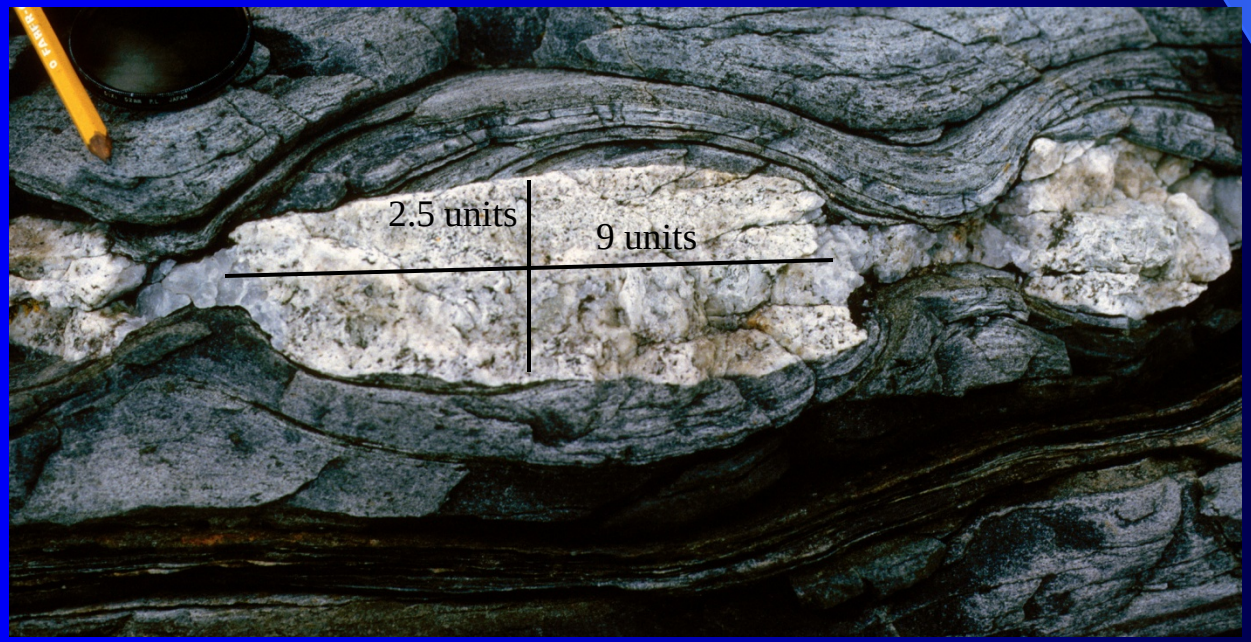


The geometry of boudins in largely controlled by whether boudins are separated by extension or shear fractures and the influence of plastic versus brittle deformation mechanisms. Asymmetric boudins may indicate non-coaxial deformation.

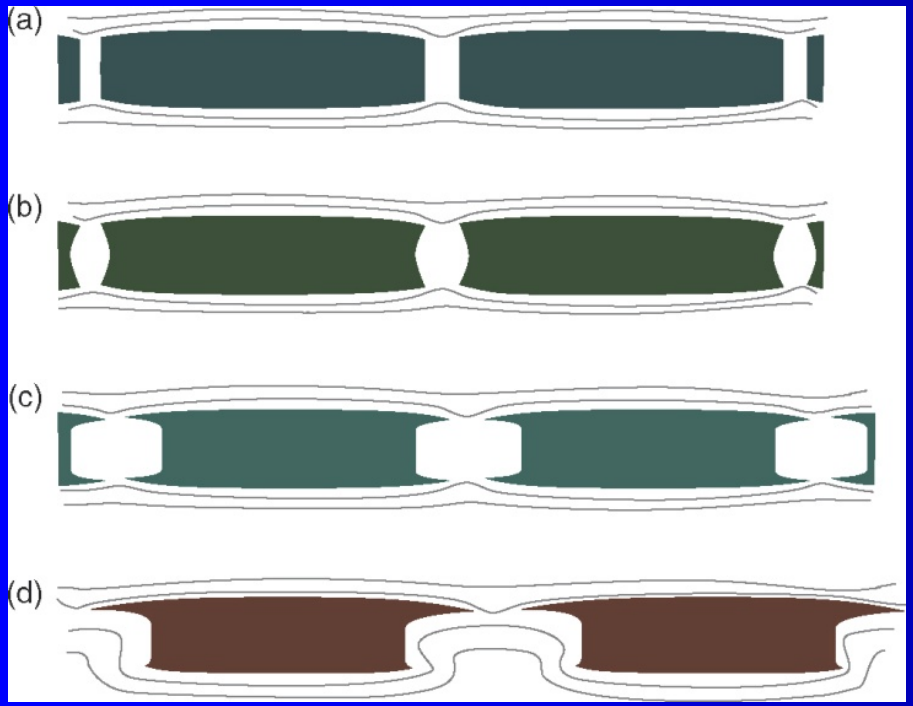
The width of a boudin varies as a function of the thickness of the layer. Typical aspect ratios are 2 – 4.

Example below aspect ratio ~3.5





The shape of the boudins reflects the viscosity contrast during deformation. (a) rectangular boudins high viscosity contrast. (b) rectangular boudins smaller viscosity contrast. (c) marked plastic component along margins. (d) marked plastic component only along upper margin.

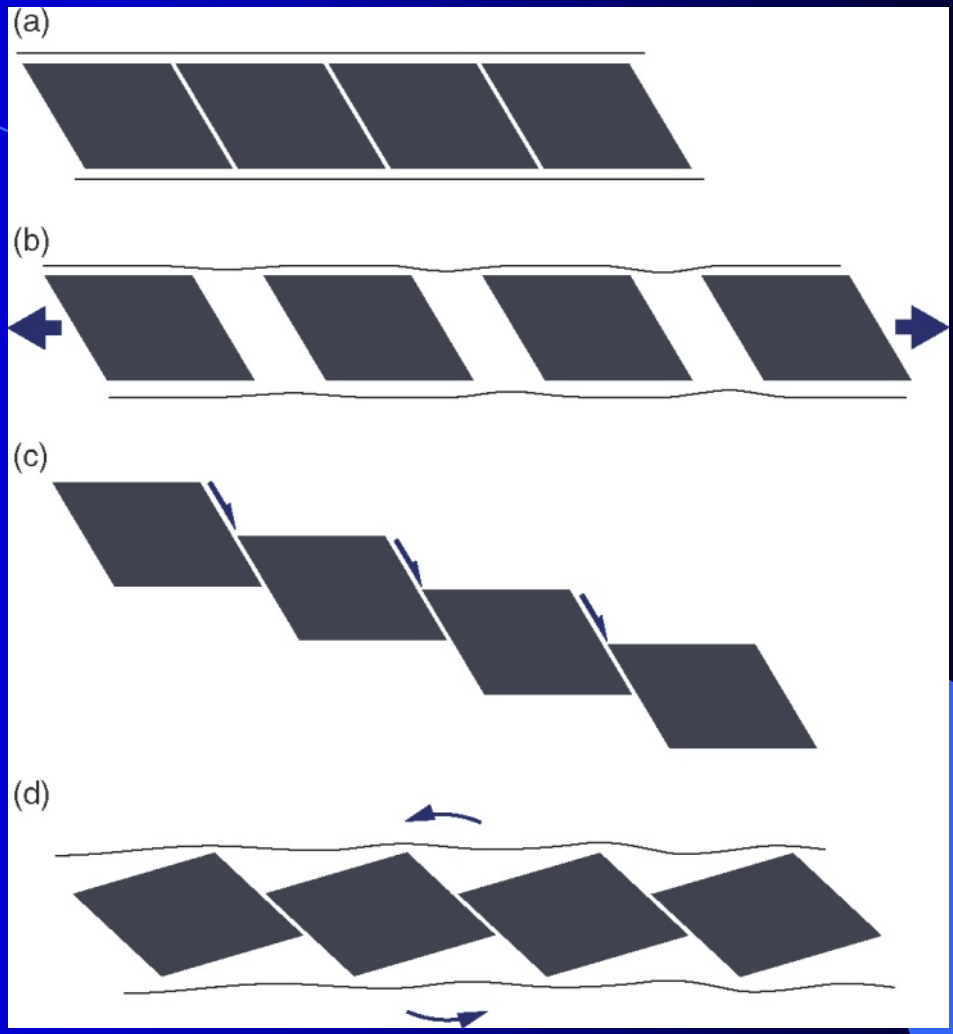


Plastic deformation dominates.

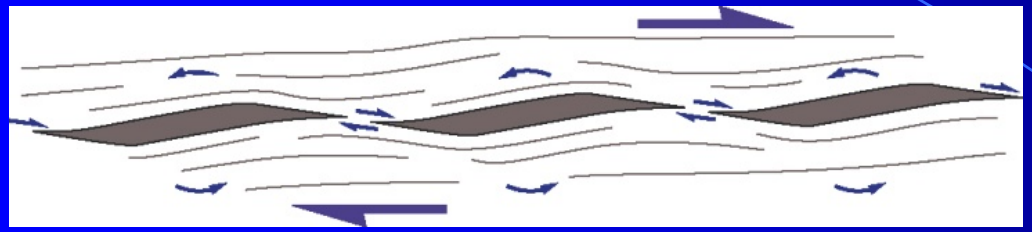
Asymmetric Boudinage

Asymmetric boudins can form by extensions across shear fractures (a, b) or by a combination of shearing along shear fractures (c) and boudin rotation (d).

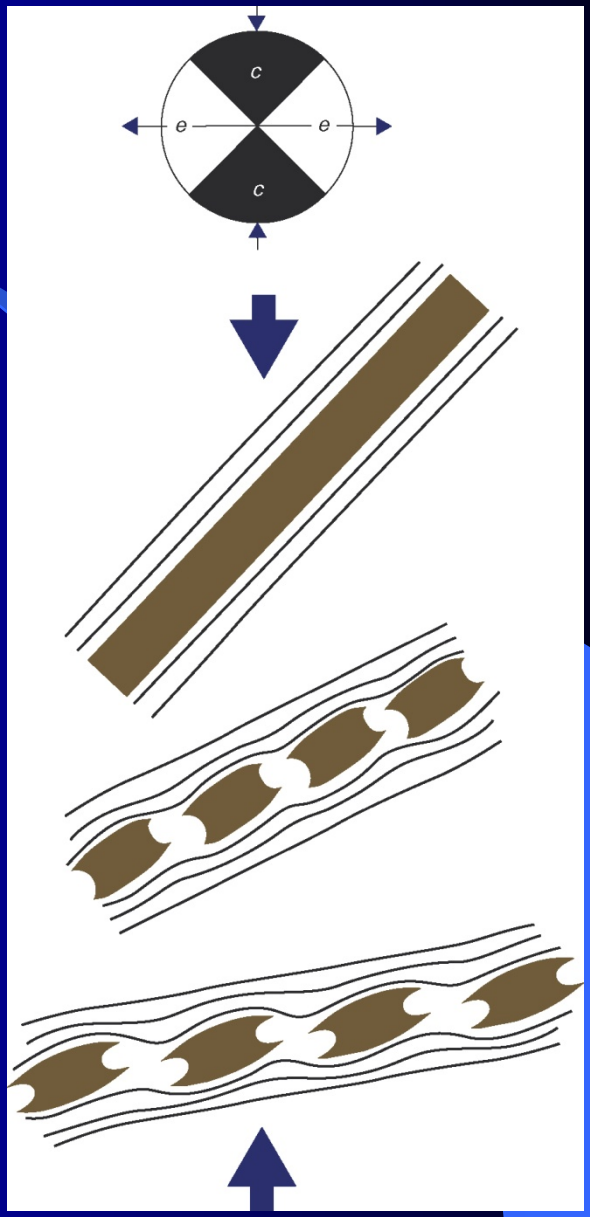
Extension fractures form when $(\sigma_1 - \sigma_3) < 4\ T_o$ where T_o is the tensile strength of the rock layer.



Short, symmetric and rigid boudins tend to rotate with the shear direction, while long boudins back-rotate.

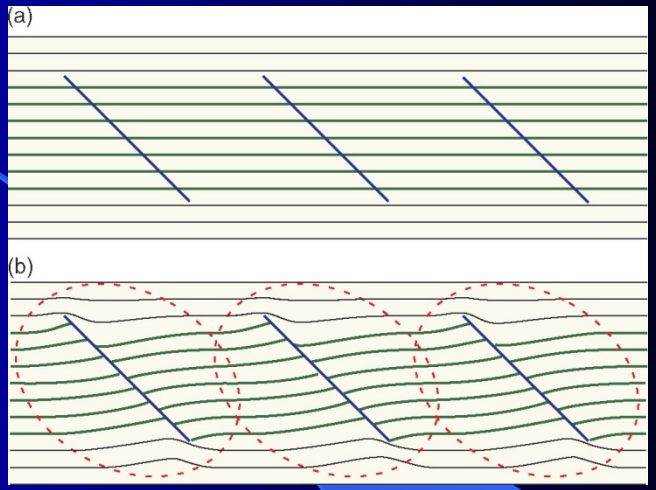


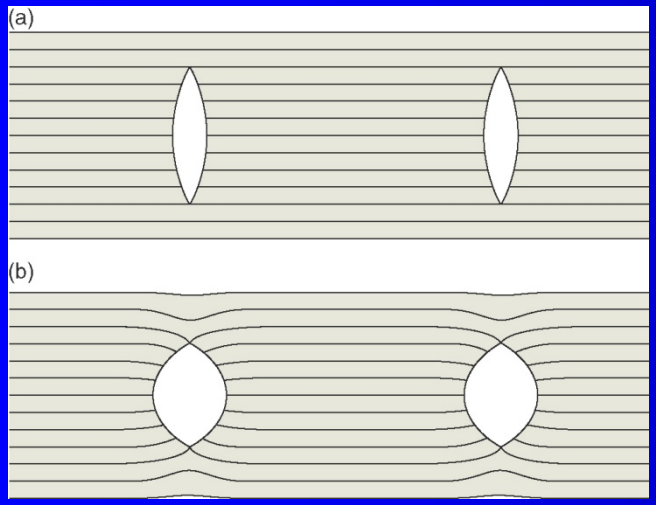
Asymmetic boudins can form during pure shear if the layer is oblique to the plane of flattening. The rigid object rotates slower than the surrounding foliation causing an asymmetry to develop.



Foliation boudinage occurs when there is a strong planar anisotropy (foliation) in deformed rocks.

Symmetric foliation boudinage occurs by formation of tensile fractures and the vertical closing and horizontal opening of these fractures. The fractures are filled with quartz or other hydrothermal minerals





Asymmetric foliation boudinage occurs by the formation of shear fractures and movement along these shear fractures causing rotation of the foliation between the fractures.

Relation between boudinage geometry and strain geometry. Typically folds and boudins occur in differently oriented layers, but a single layer may show boudin structures in one section and folds in another if the strain is constrictional. The 3-D layer at the base of each drawing corresponds to the black layer.