構造地質学II-2

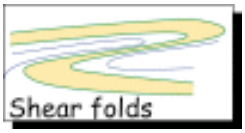
http://earth.leeds.ac.uk/folds

褶曲
Folds

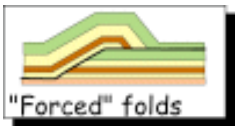
‘07/06/07 Gaku KIMURA

褶曲のメカニクスによる分類

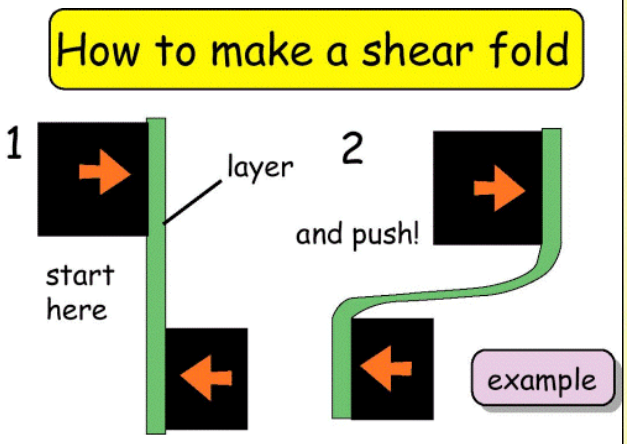
Shear folds （剪断褶曲）

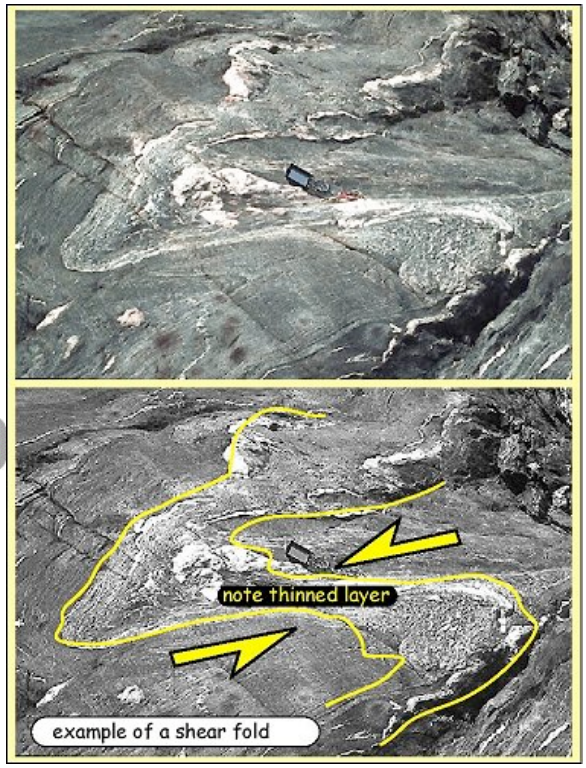


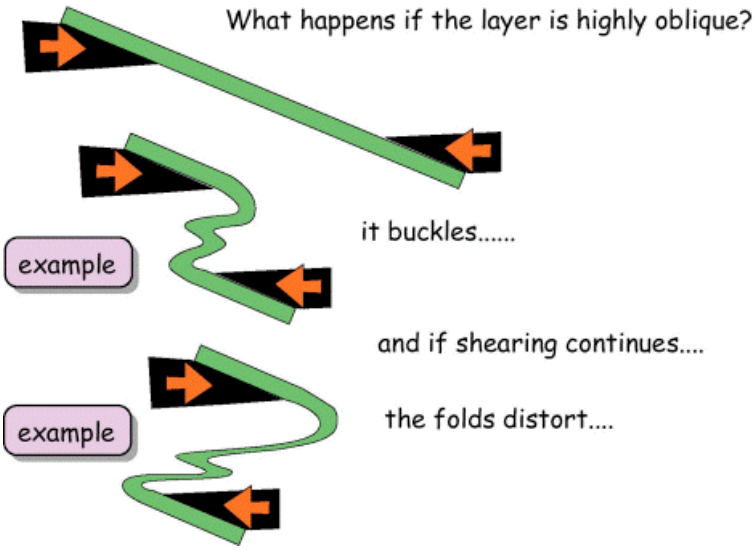
Forced folds（強制褶曲）



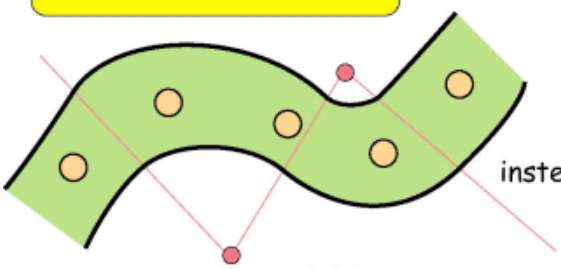
Buckled folds(座屈褶曲）


How to make a shear fold
1
layer
2
and push!
start
here
example
note that layer changes thickness


note thinned layer
example of a shear fold


What happens if the layer is highly oblique?
example
it buckles.....
and if shearing continues....
example
the folds distort....

Tightening folds



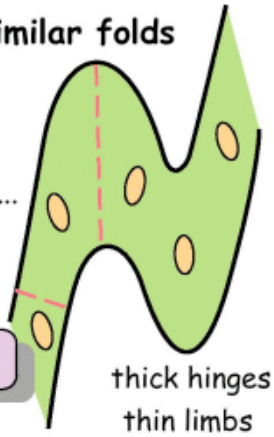
concentric folds

layer retains constant thickness around folds

this can't be maintained as fold tightens

instead....

similar folds



example

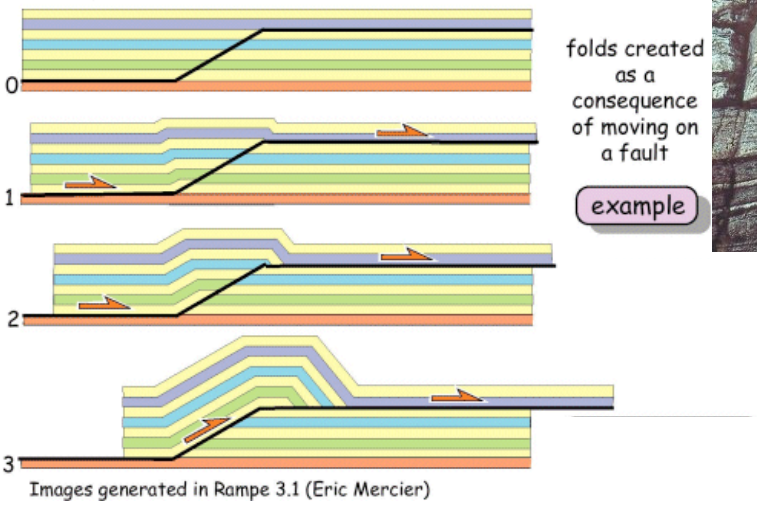
thick hinges

thin limbs

Chevron folds break when they get too tight

Forced folds

simple fault-bend fold model

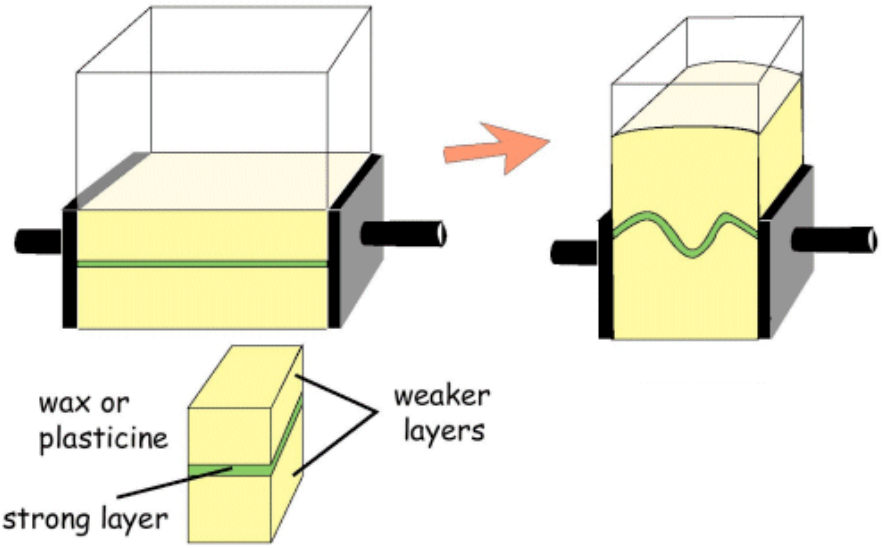


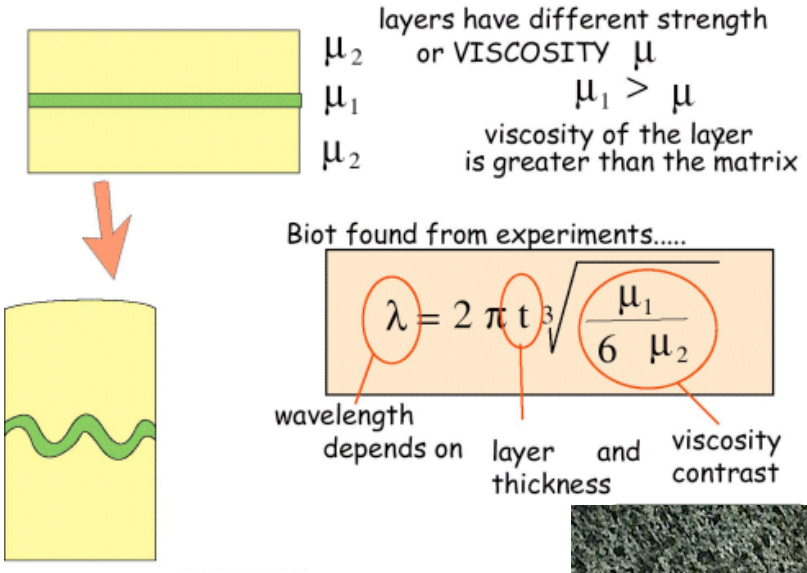
Images generated in Rampe 3.1 (Eric Mercier)

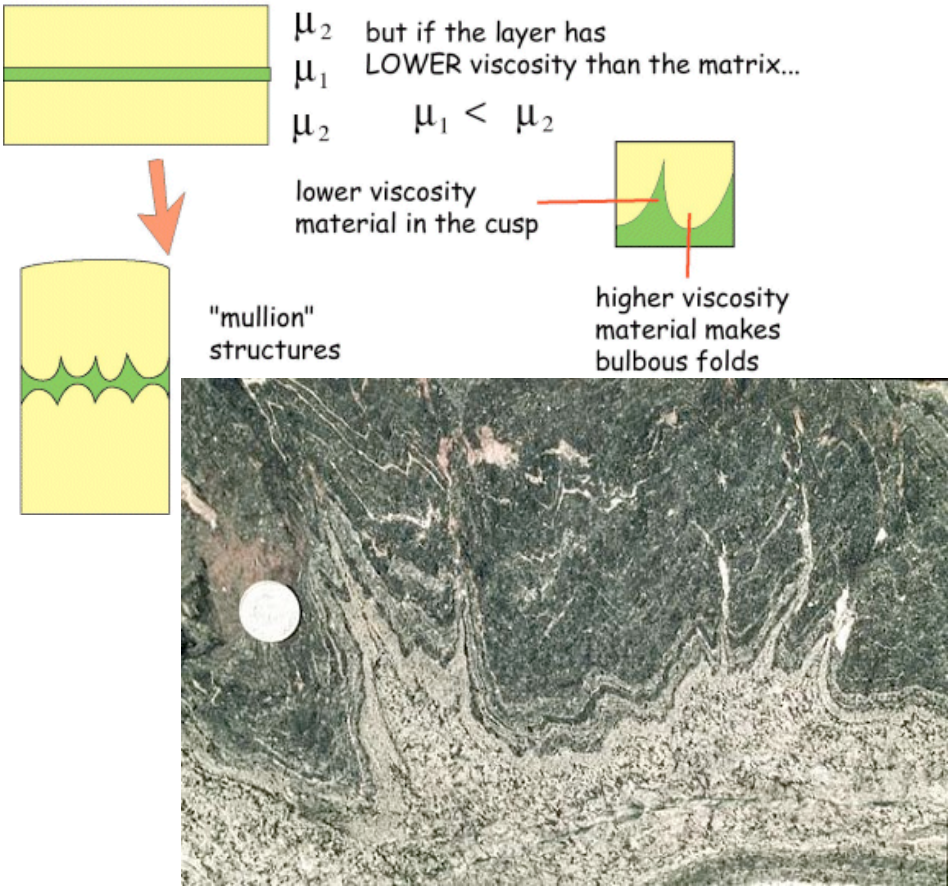
folds created as a consequence of moving on a fault

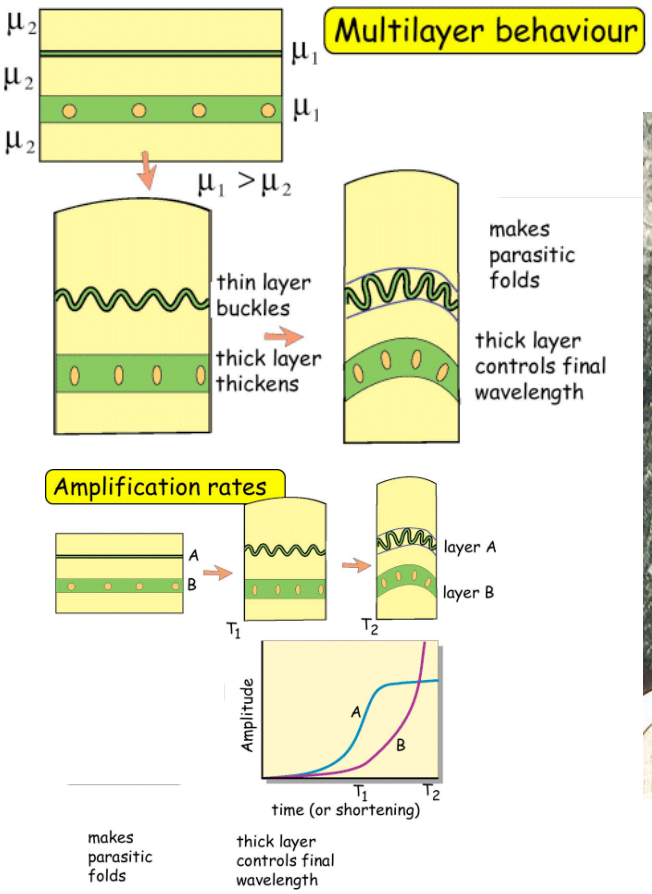
example

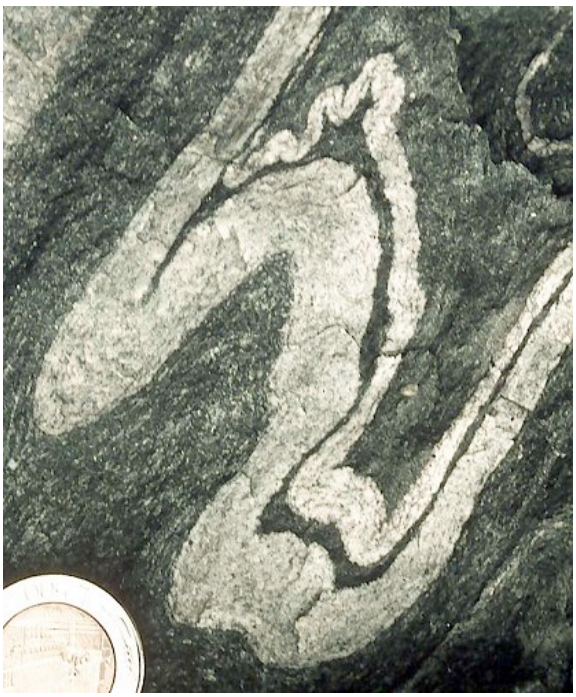
Making buckle folds



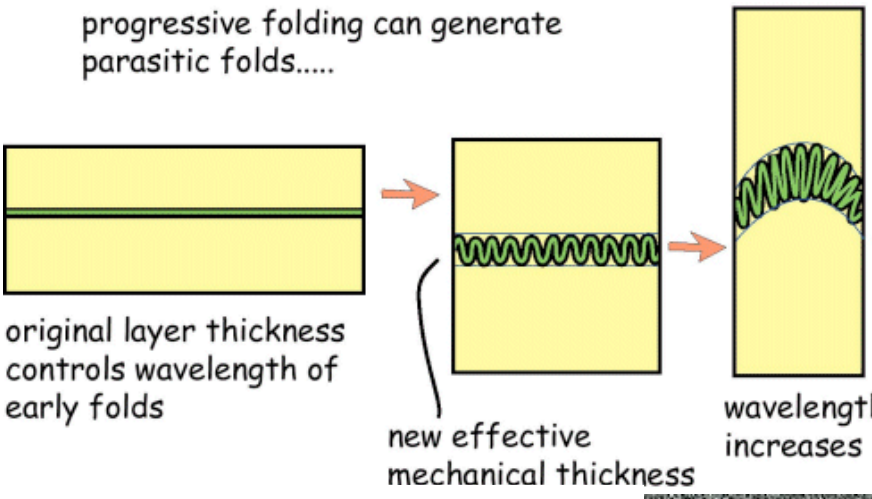



μ2
μ1
μ2
but if the layer has
LOWER viscosity than the matrix...
μ1 < μ2
lower viscosity
material in the cusp
higher viscosity
material makes
bulbous folds
"mullion"
structures


Multilayer behaviour
μ2
μ2
μ2
μ1
μ1
μ1 > μ2
thin layer
buckles
thick layer
thickens
makes
parasitic
folds
thick layer
controls final
wavelength
Amplification rates
A
B
T1
T2
layer A
layer B
Amplitude
A
B
T1
T2
time (or shortening)
makes
parasitic
folds
thick layer
controls final
wavelength

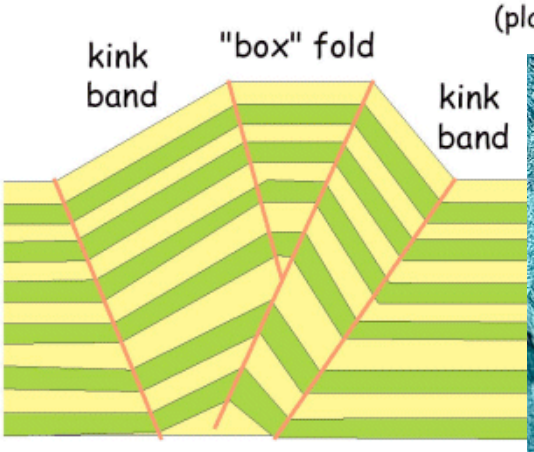


progressive folding can generate parasitic folds.....



Kinky folds

In rocks with very strongly-developed layering (planar anisotropy)

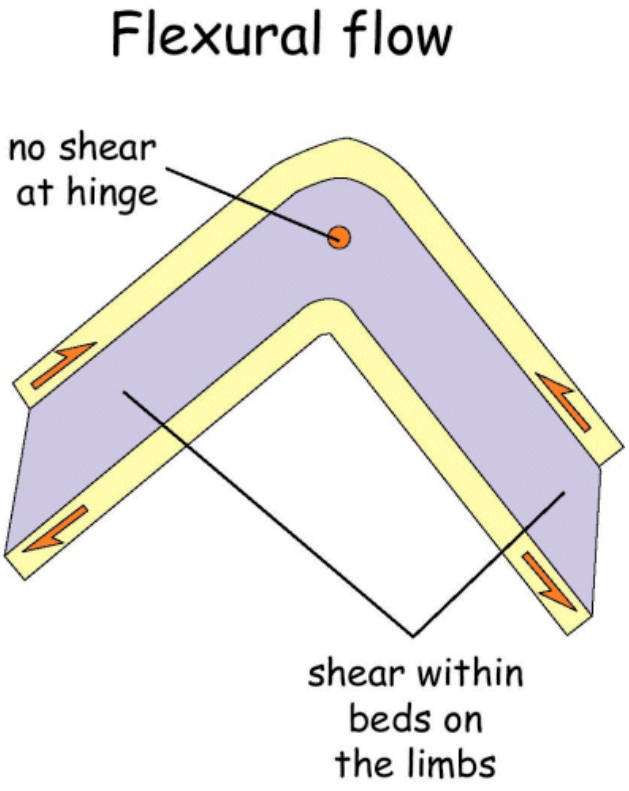


Fold mechanism

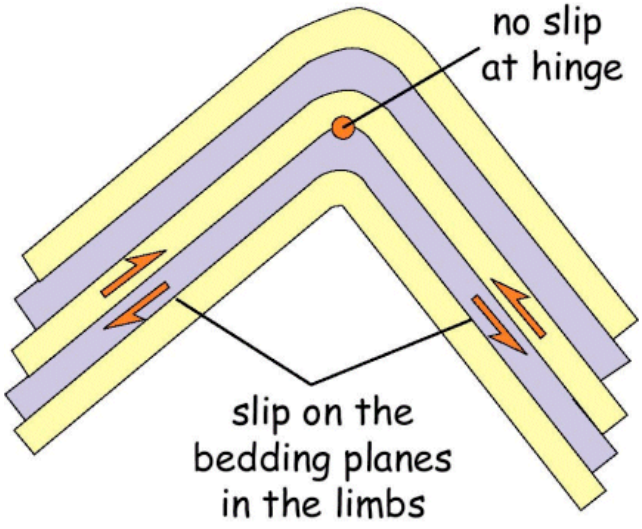
Flexural flow

Flexural slip

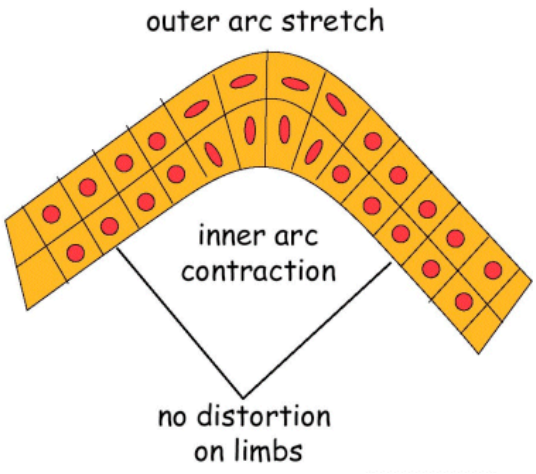
Tangential Longitudinal strain



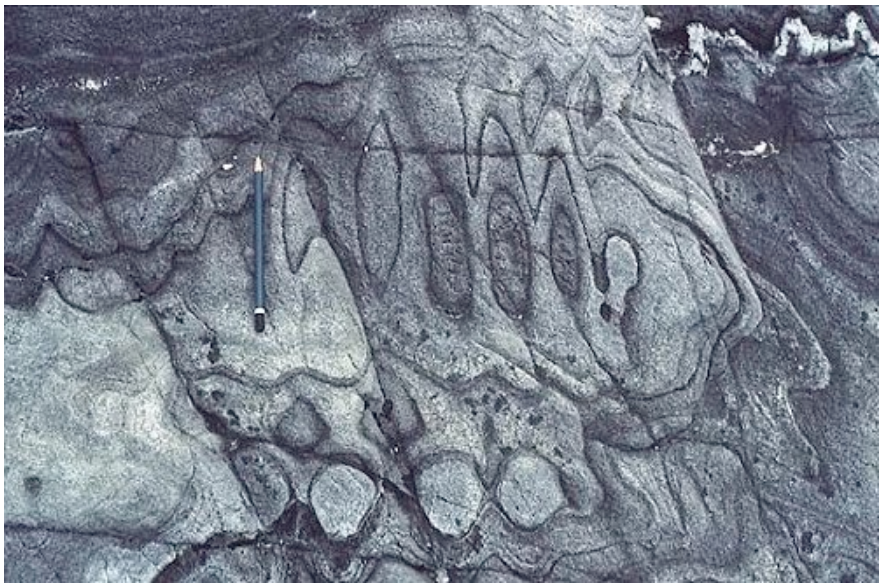
Flexural slip

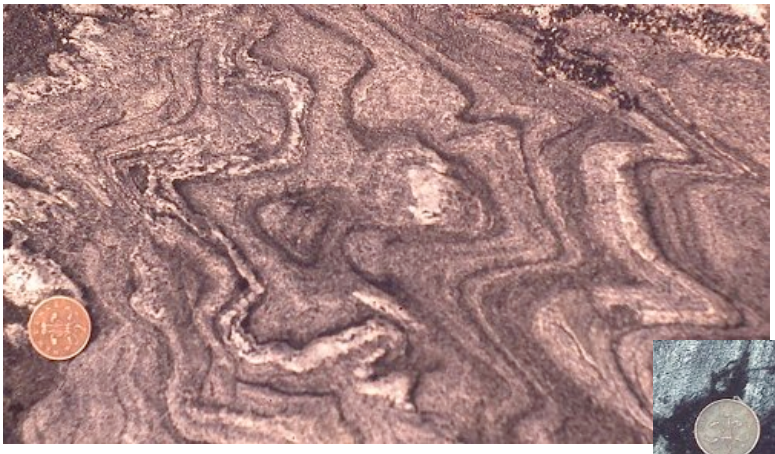


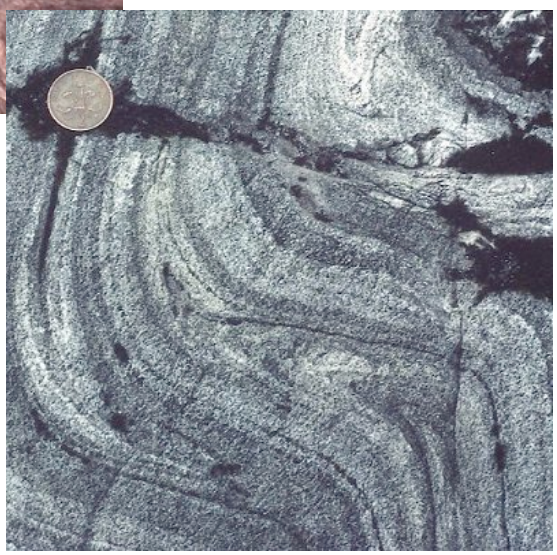
Tangential Longitudinal Strain



褶曲の重複

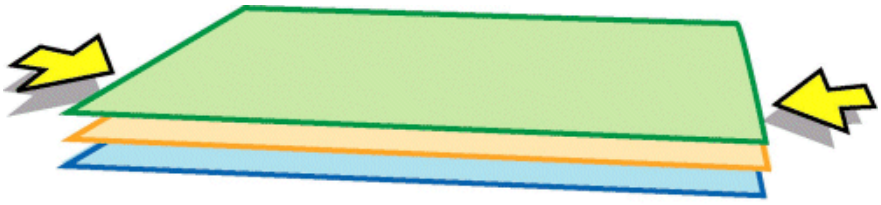


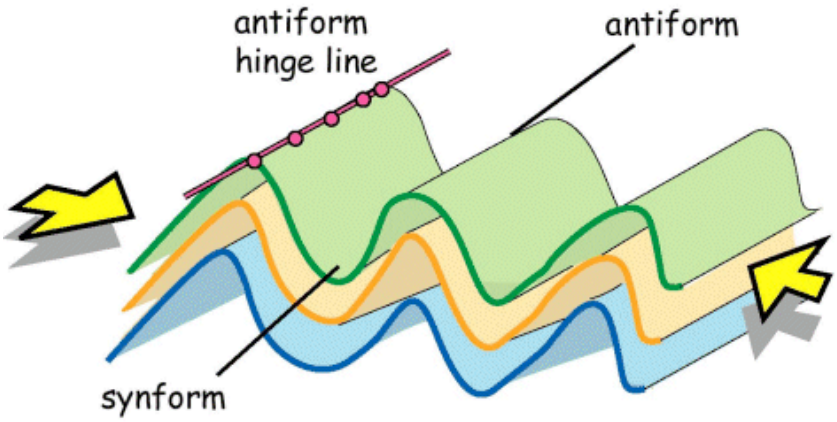




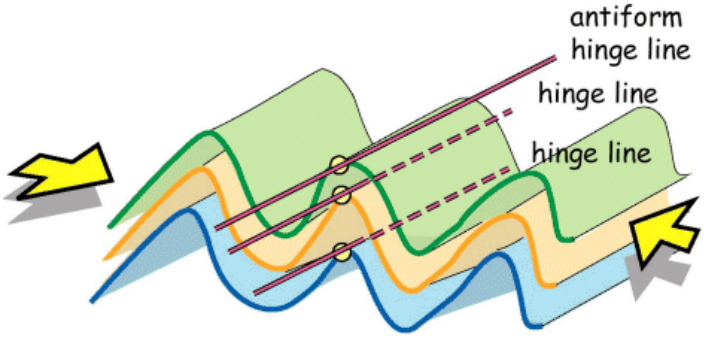
宿題：この褶曲の折り畳まれ方を記せ。
ヒント：２回重複

褶曲の記載



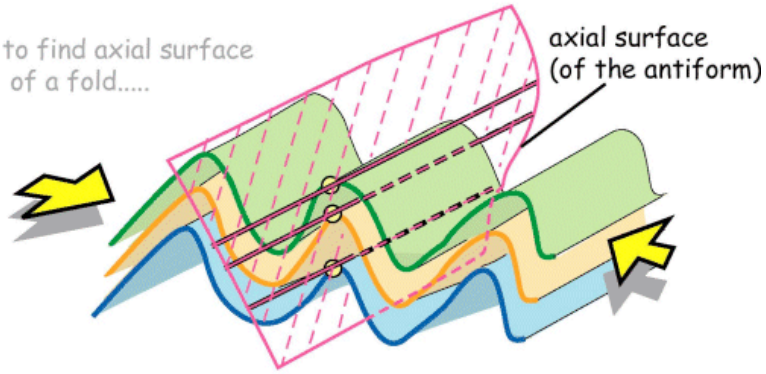


antiform: upward closing fold
synform: downward closing fold
hinge line: joins points of maximum curvature along same layer

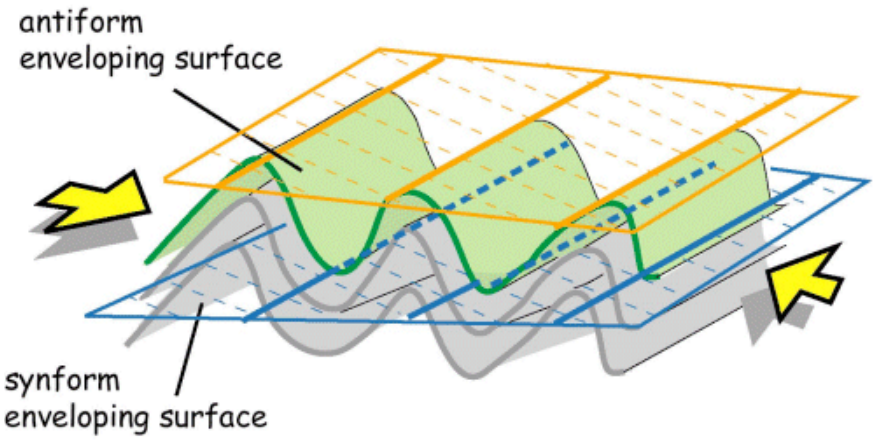


to find axial surface of a fold.....

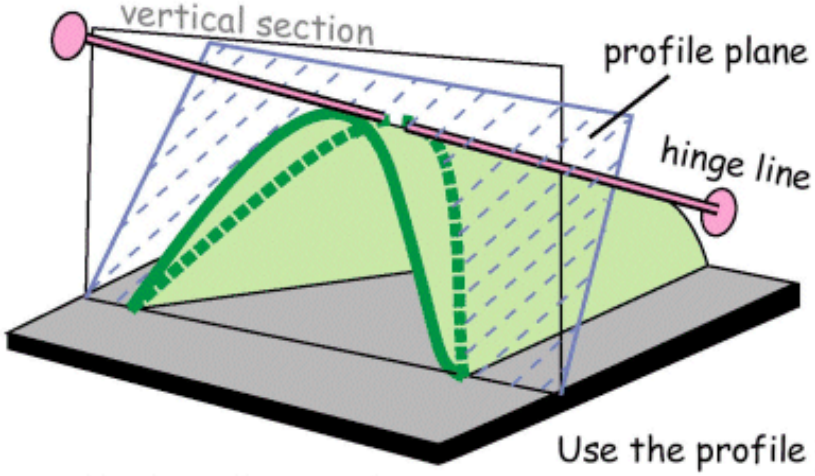
find the hinge lines for different layers



construct the (imaginary) surface that contains
all the hinge line for that fold.



enveloping surface: constructed for an individual layer
antiform enveloping surface - connect the crests
synform enveloping surface - connect the troughs

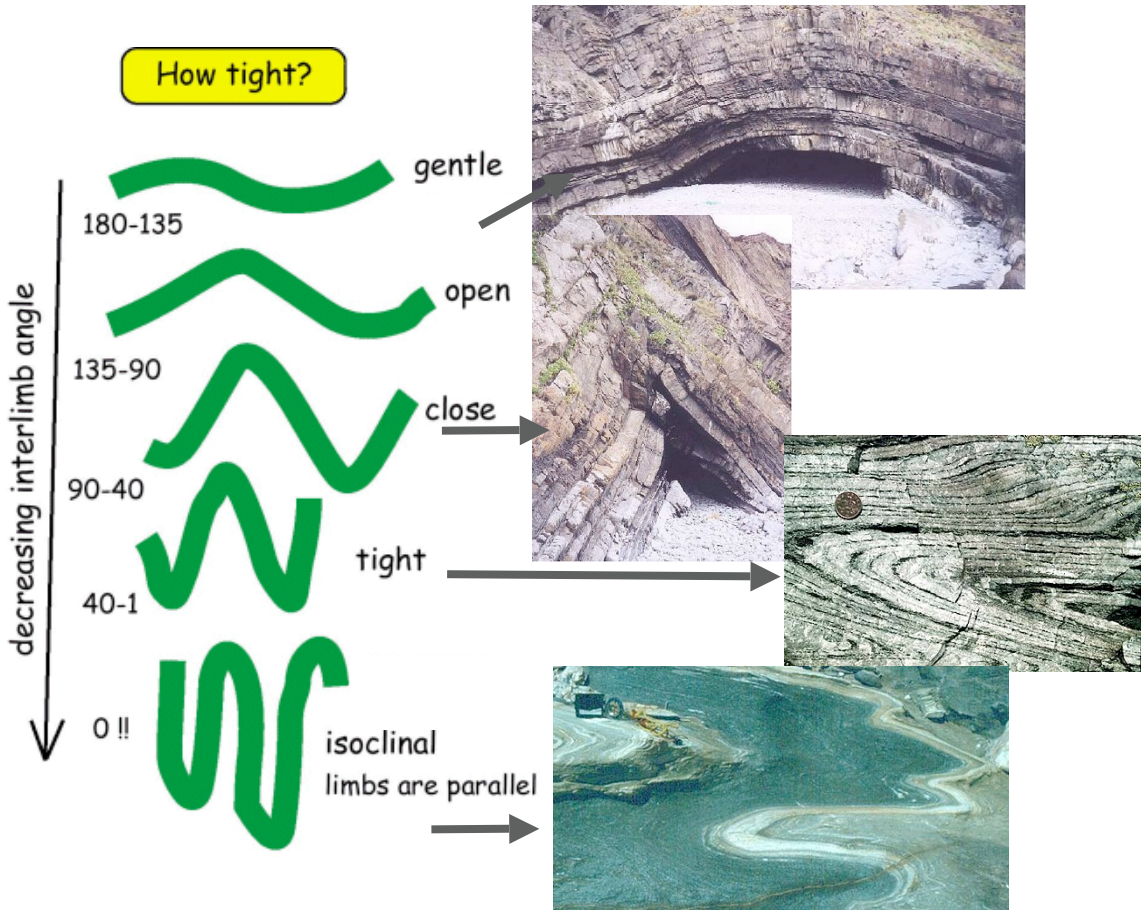


profile plane: the true shape of the fold in 2D orthogonal to the hinge line

Use the profile plane to see

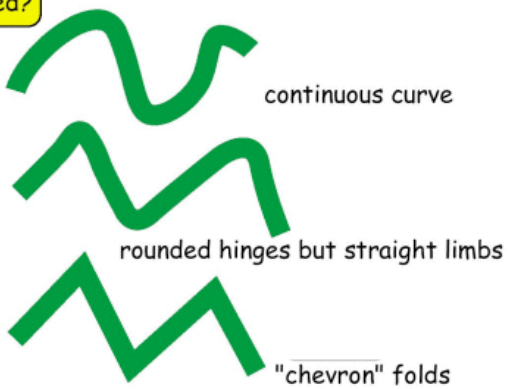
how tight | how rounded

other views are - misleading

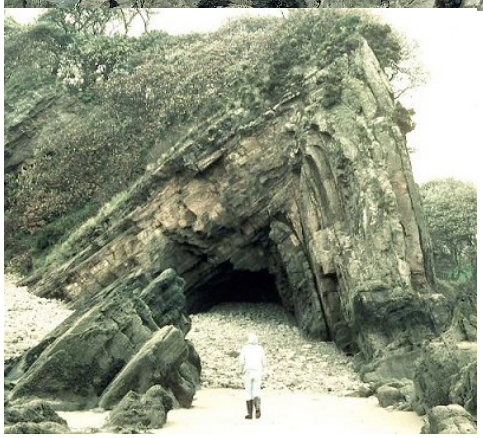


How rounded?

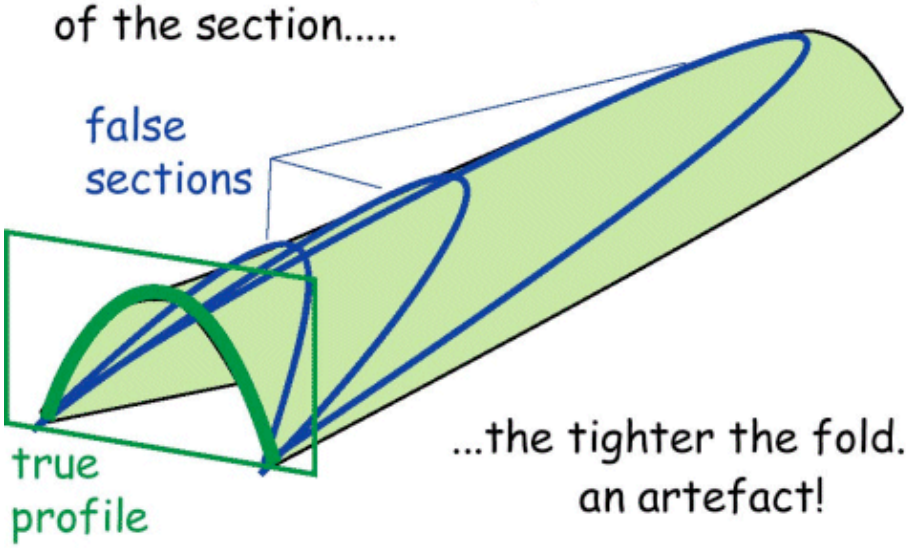
increasingly angular



relates to folding....



the greater the obliquity of the section.....



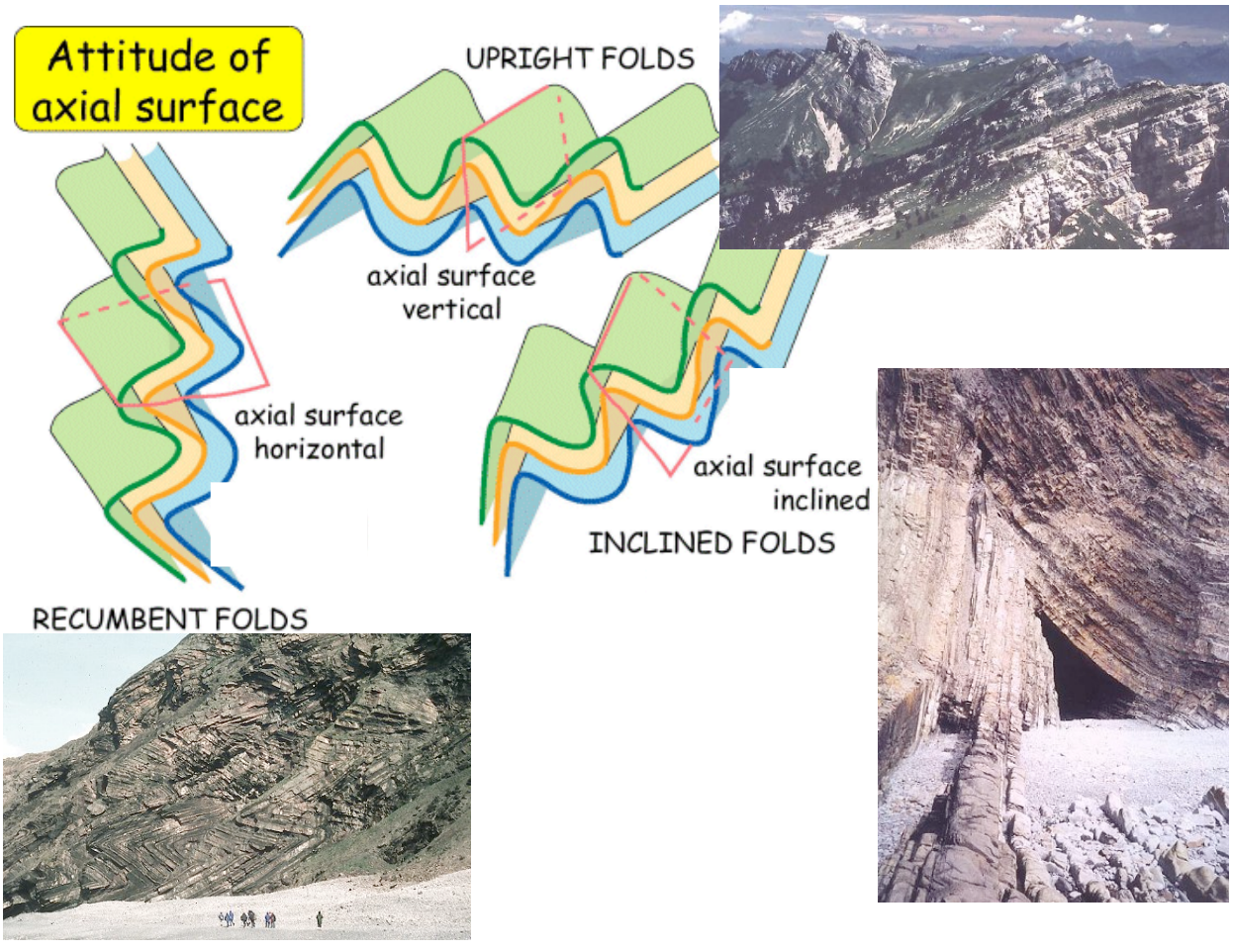
...the tighter the fold. an artefact!

褶曲軸面姿勢による分類

Upright fold

Inclined fold

Recumbent fold

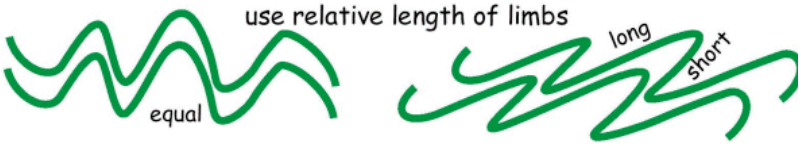


Fold symmetry

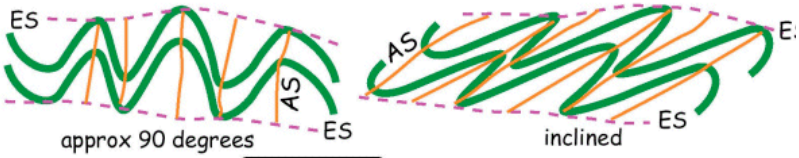
symmetric

asymmetric

use relative length of limbs



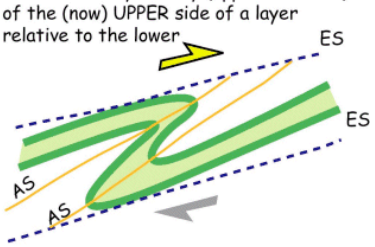
or relationships between AXIAL SURFACES and ENVELOPING SURFACES

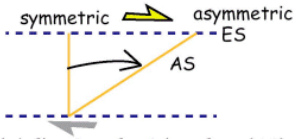


what's the point? ... VERGENCE!

Vergence

the sense of symmetry (apparent shear) of the (now) UPPER side of a layer relative to the lower





notional deflection of axial surface (AS) relative to enveloping surfaces (ES)

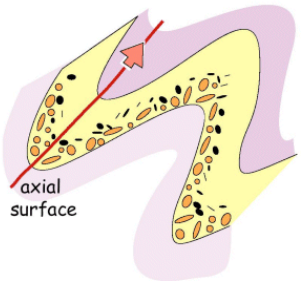
Recorded towards a geographic direction

Facing

direction of younging along the fold axial surface

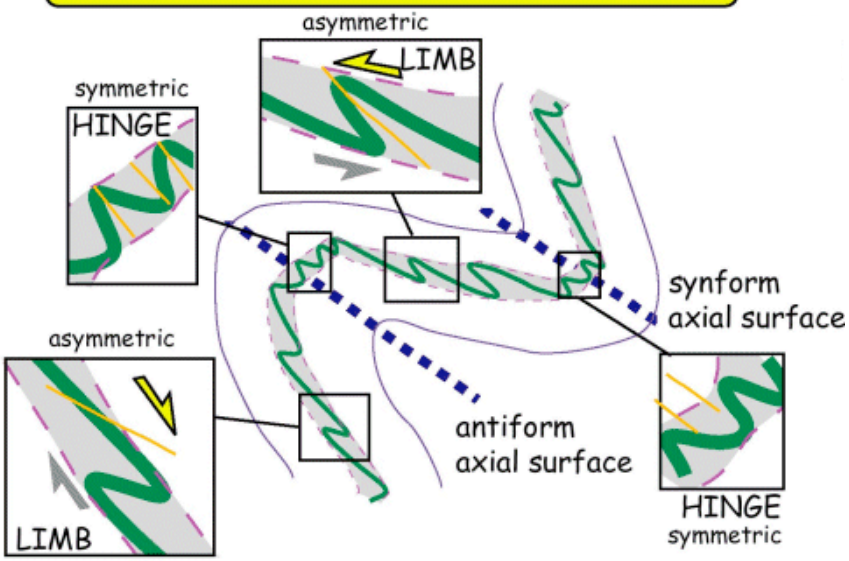
upward or downward

or towards geographic direction

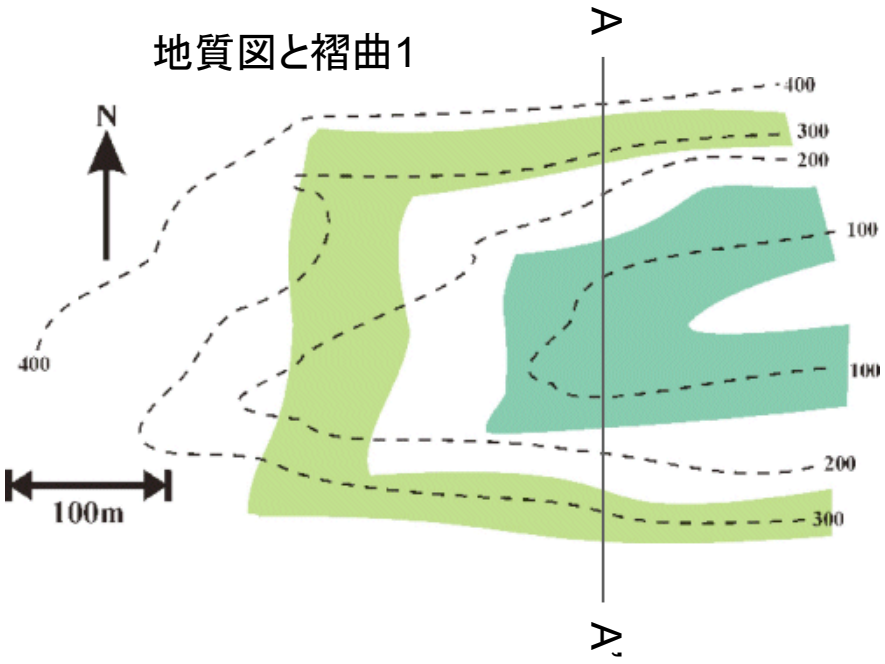


need to know stratigraphic order

minor folds and position on a major fold

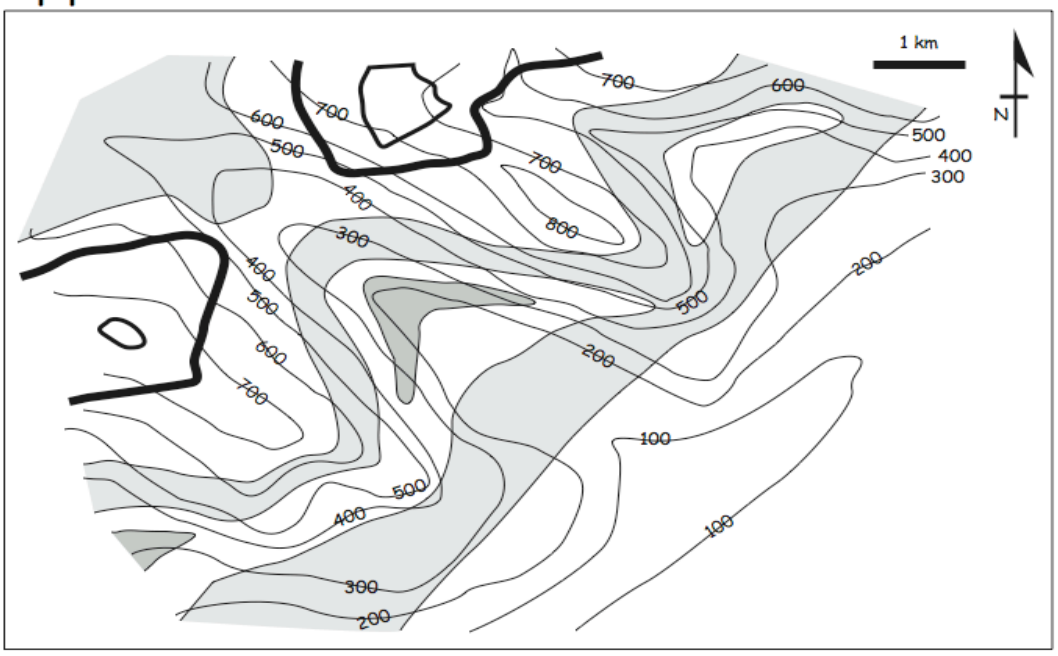


地質図と褶曲1



宿題：断面図を書きなさい

map problem

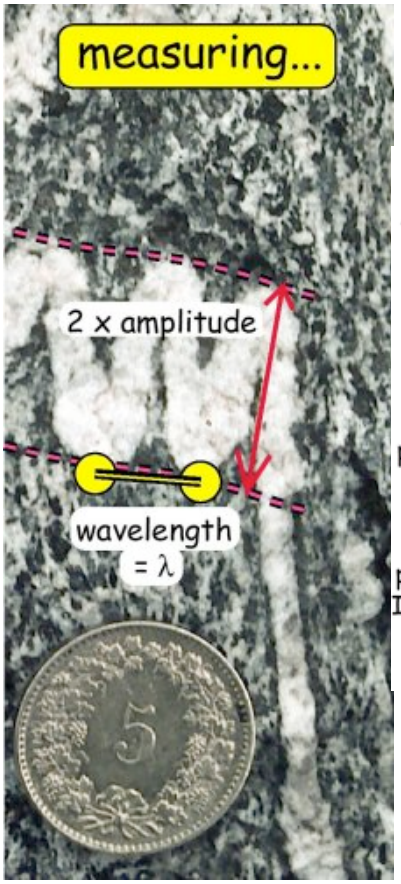


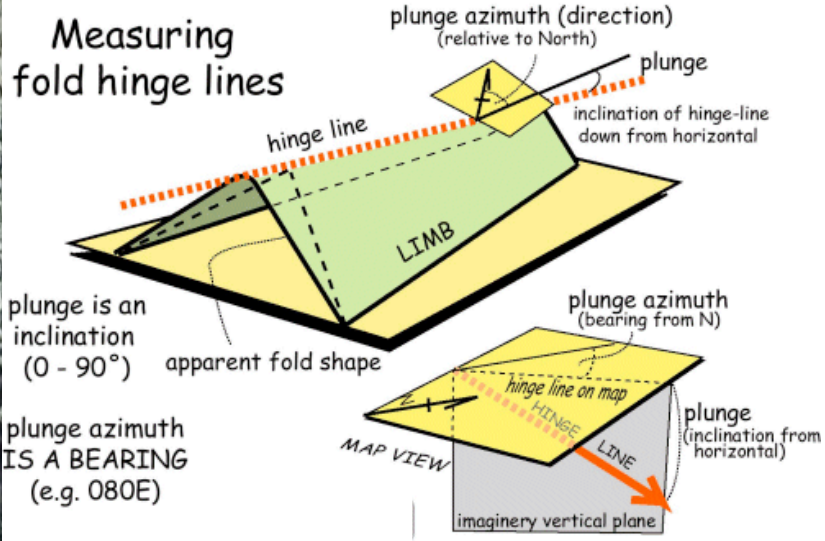
宿題：任意に断面図を書きなさい（最低3本）

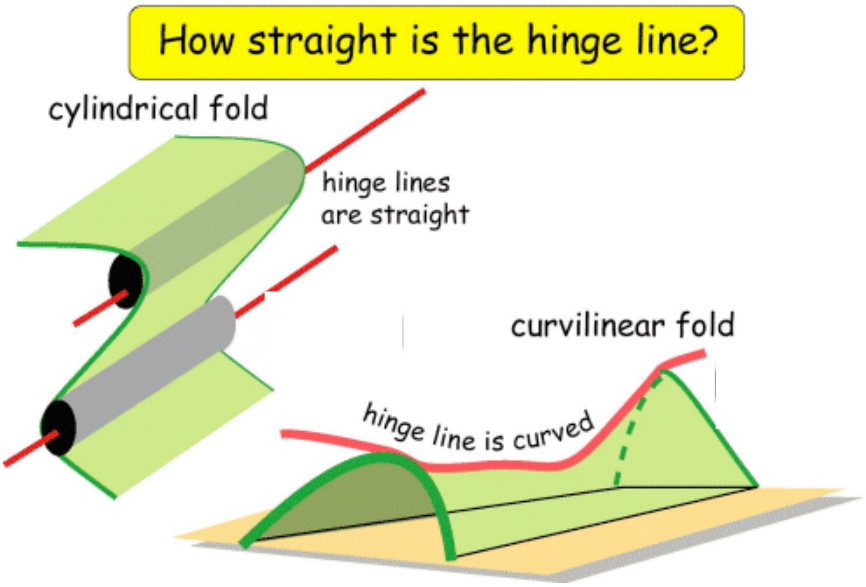
褶曲を計る

波長と振幅

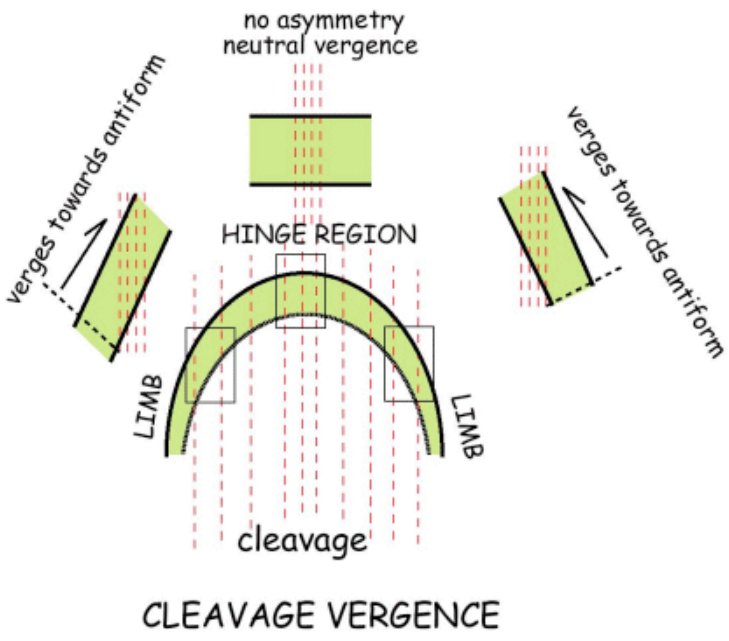
ヒンジ







壁開と褶曲



CLEAVAGE VERGENCE