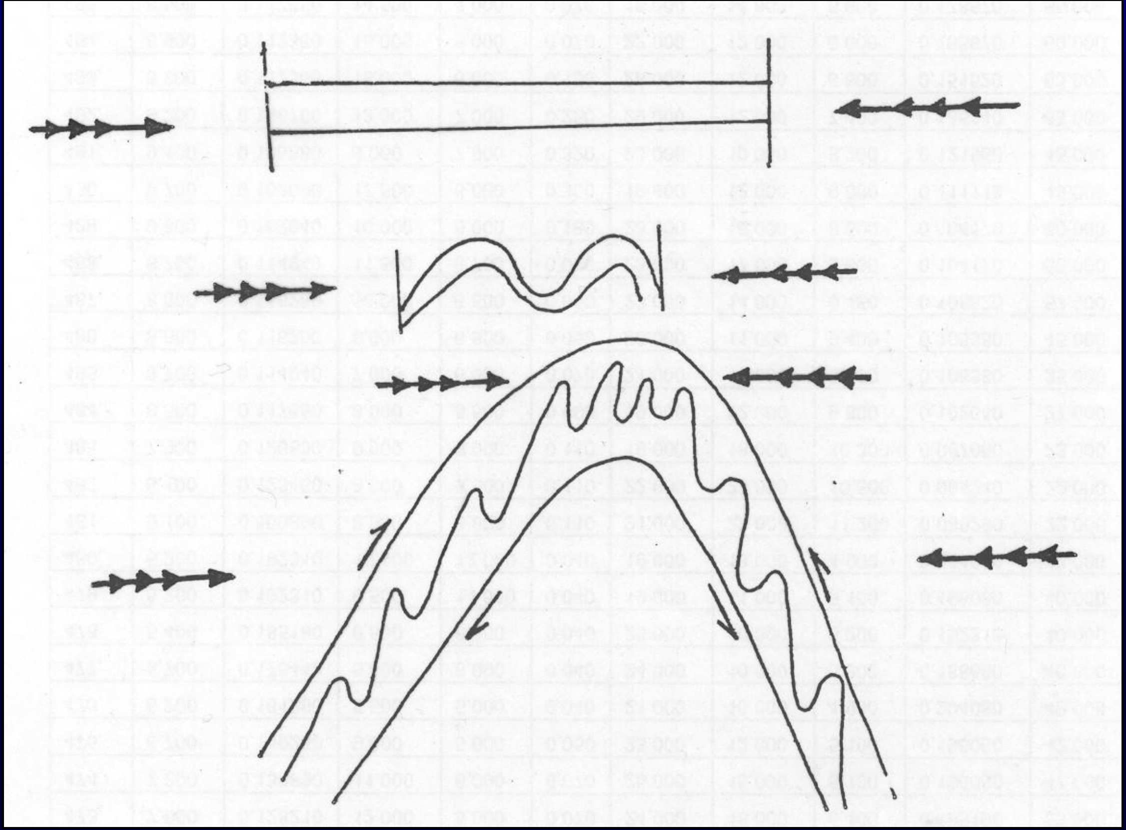
AN OVERVIEW

ON

STRUCTURAL MAPPING

FOLDS

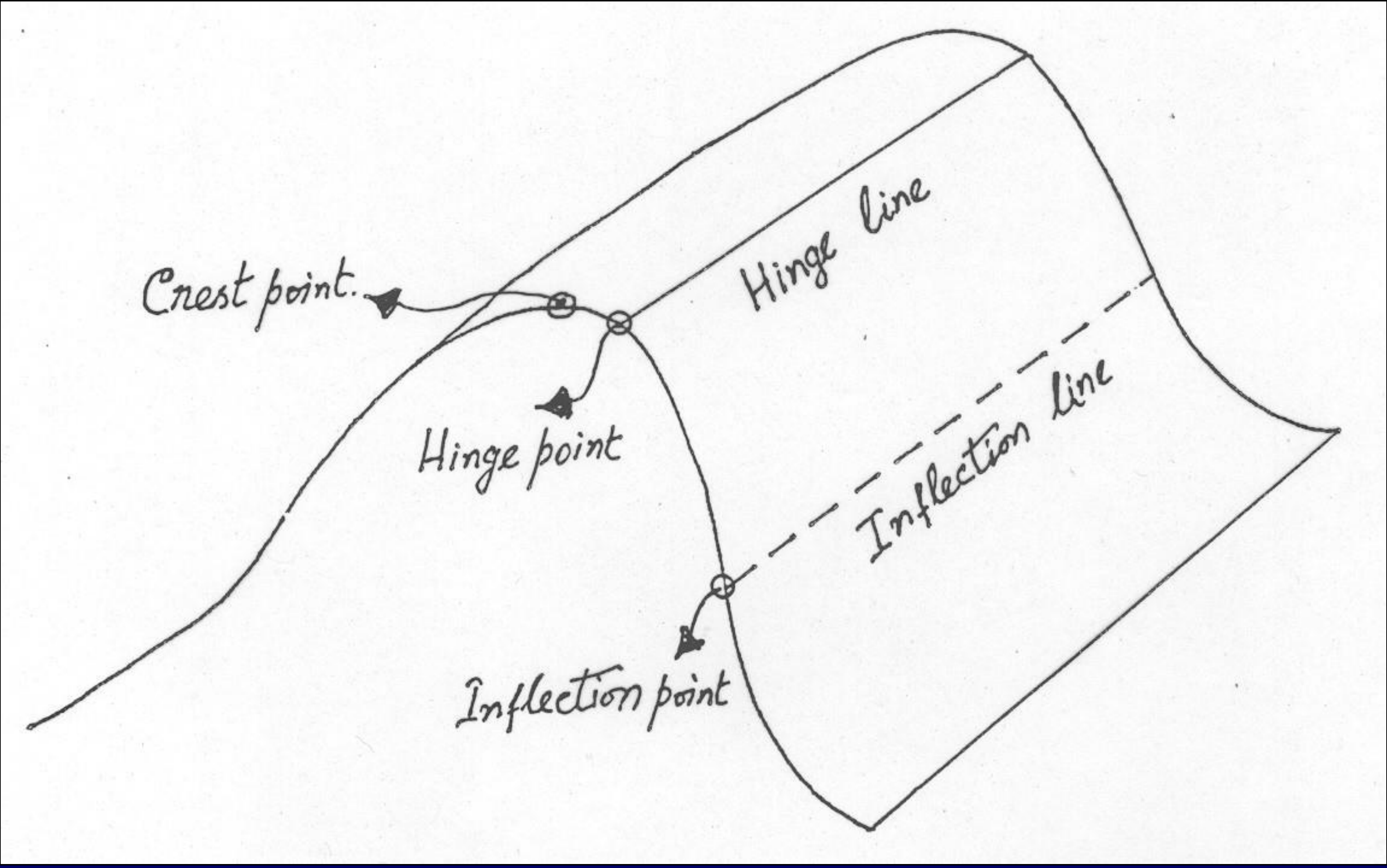


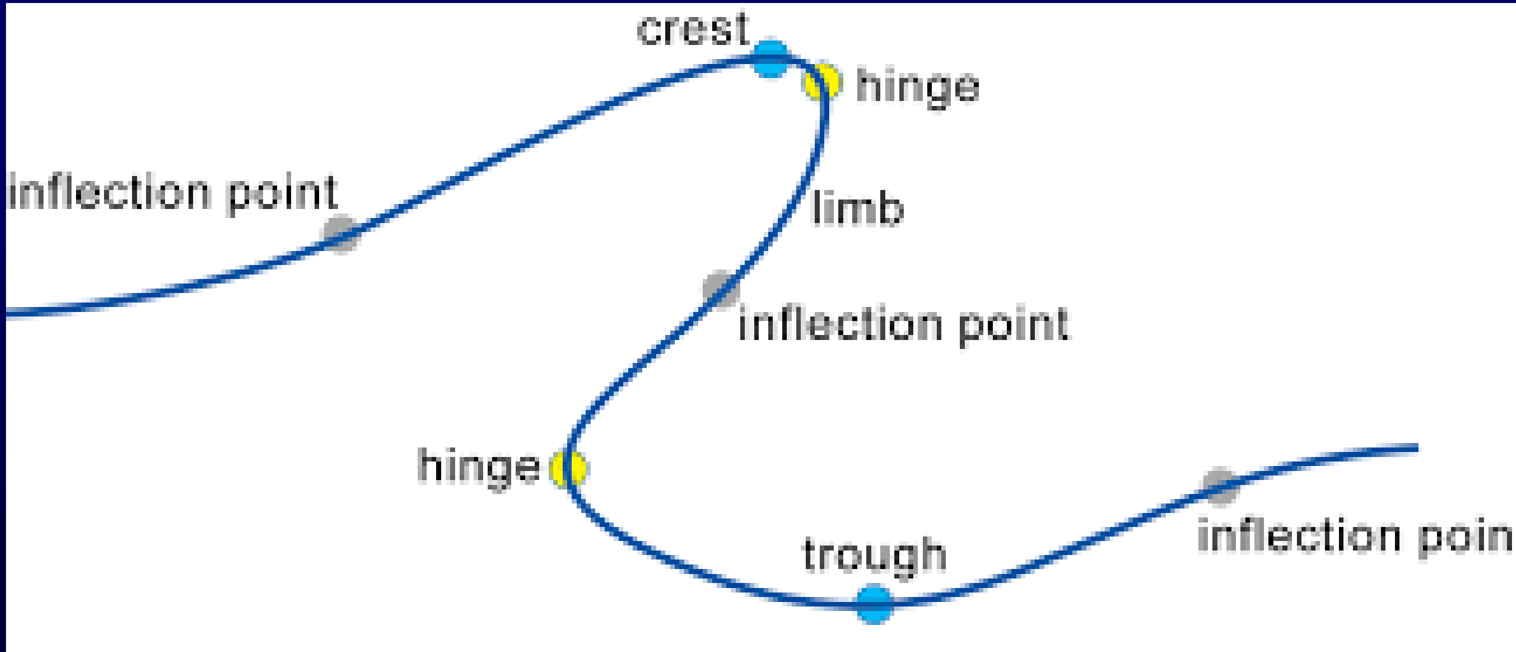
A **geological fold** occurs when one or a stack of originally flat and planar surfaces, such as sedimentary strata, are bent or curved as a result of permanent deformation.

Fold, in geology, undulation or waves in the stratified rocks of Earth’s crust due to tectonic or plutonic activity.

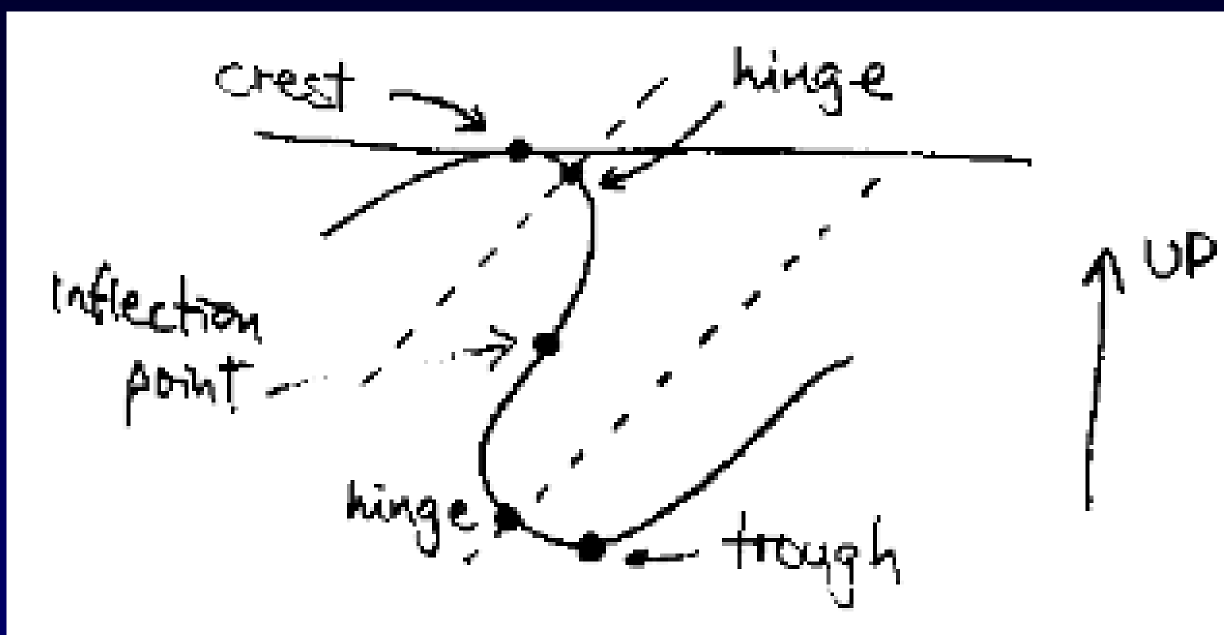
Upward-closing folds are **antiforms**, downward-closing folds are **synforms**.

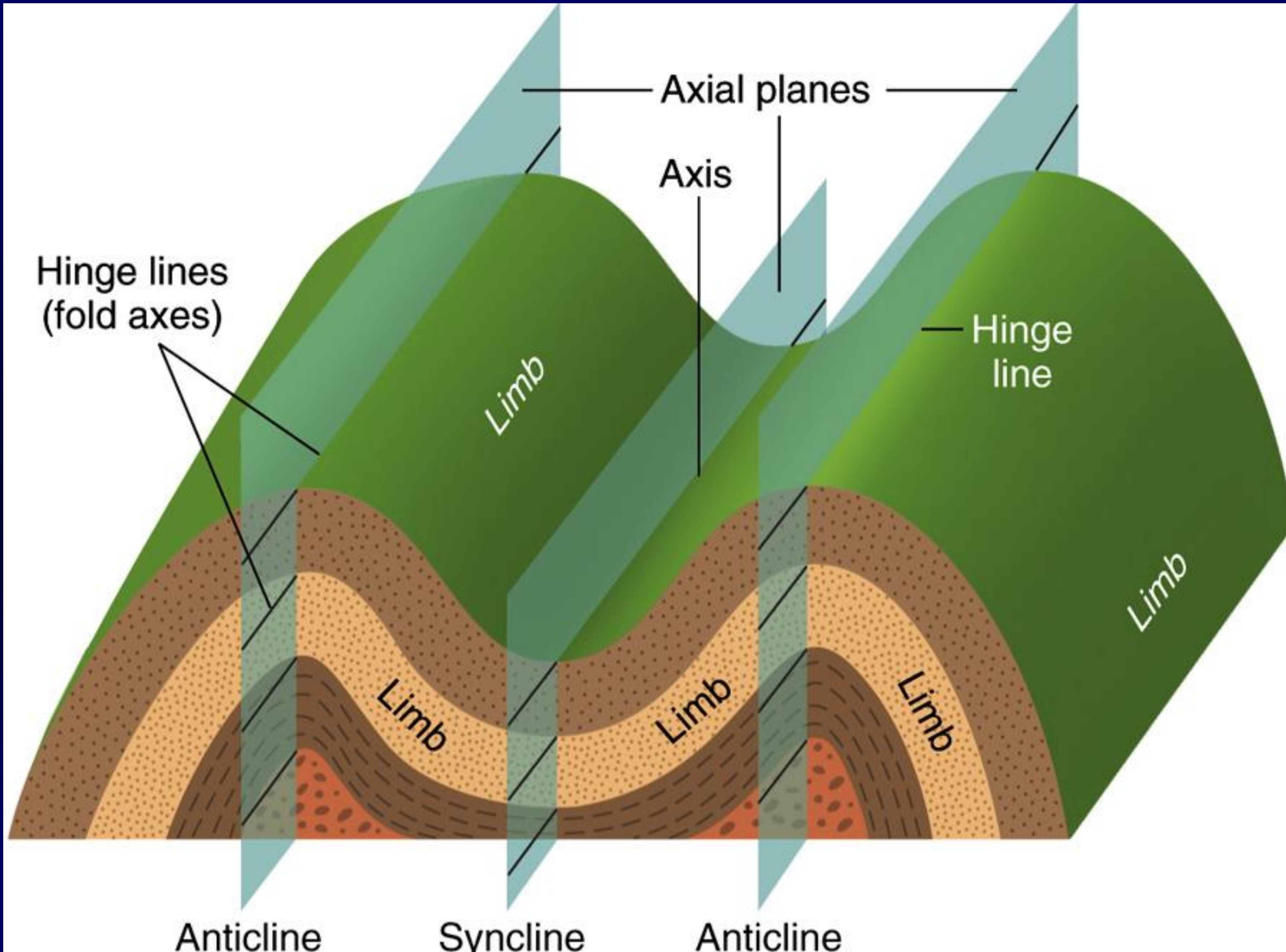
PARTS OF FOLDS

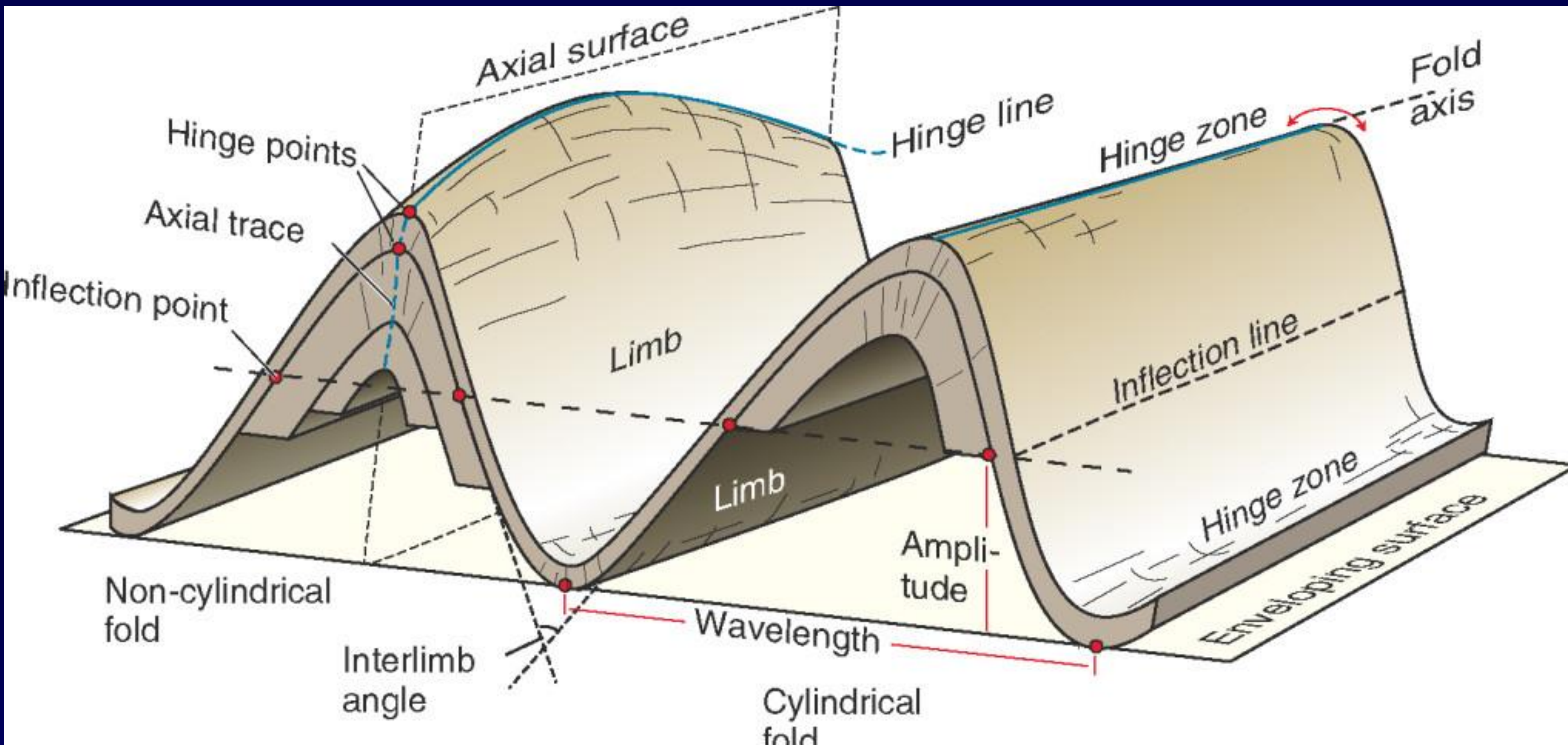




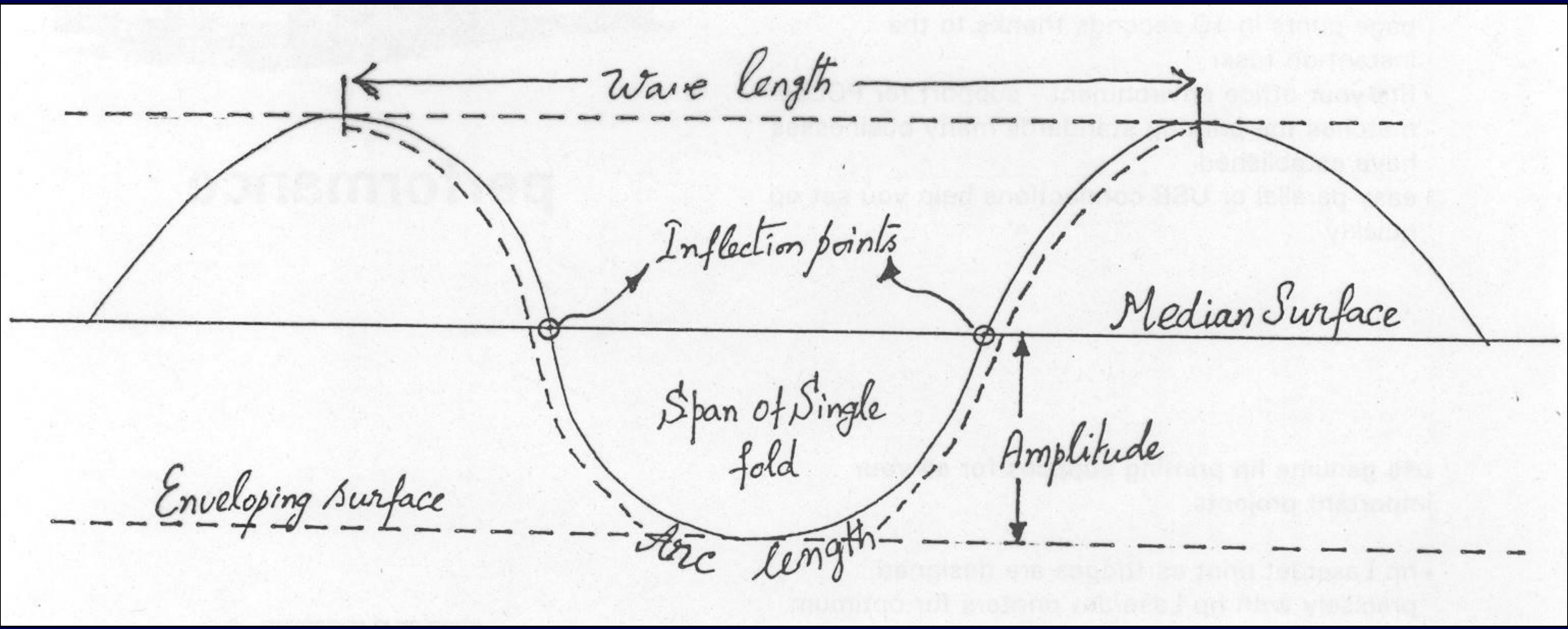
Basic terminology on a folded single surface



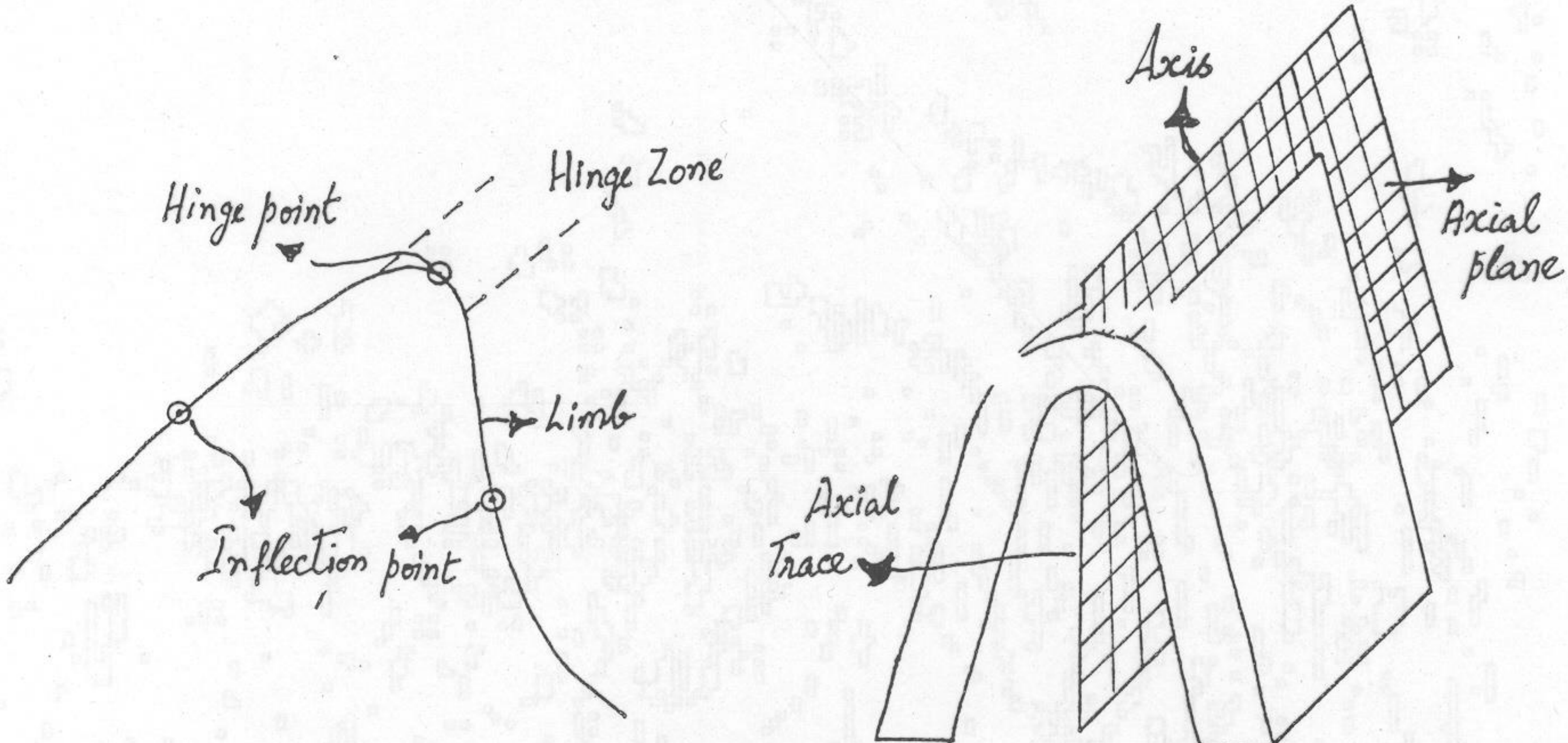

Axial planes
Axis
Hinge lines
(fold axes)
Hinge
line
Limb
Limb
Limb
Limb
Limb
Anticline
Syncline
Anticline

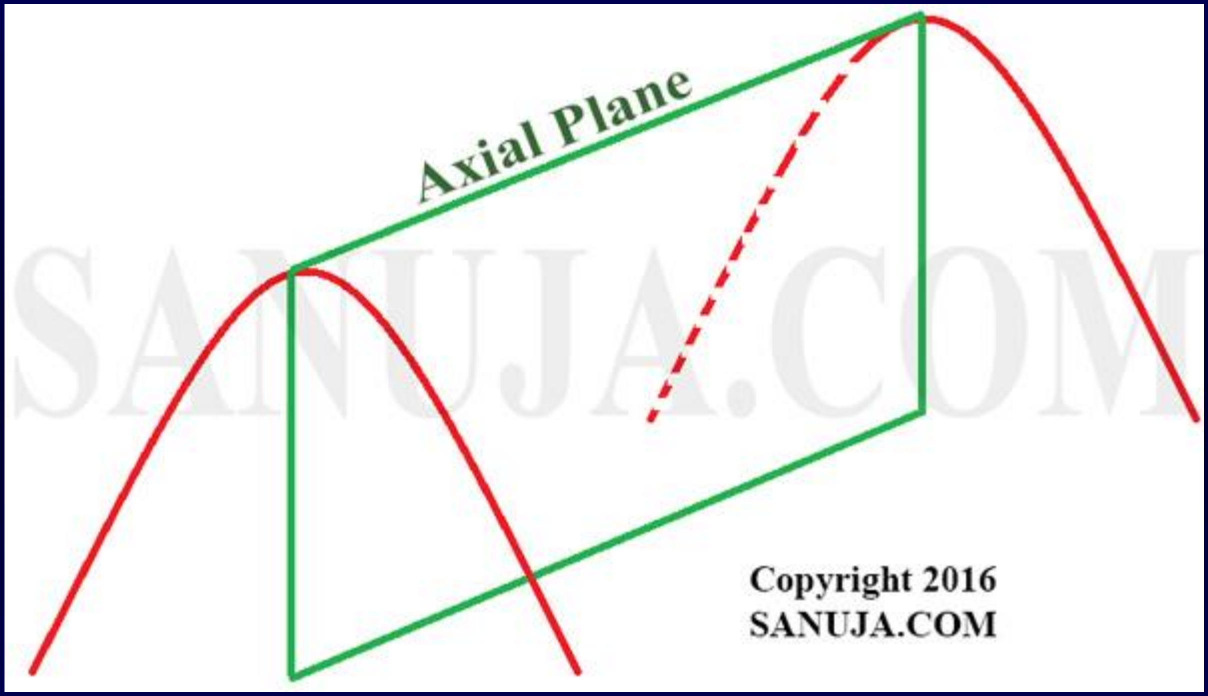

Axial surface
Fold axis
Hinge line
Hinge zone
Hinge points
Axial trace
Inflection point
Limb
Inflection line
Limb
Hinge zone
Enveloping surface
Ampli-tude
Non-cylindrical fold
Wavelength
Interlimb angle
Cylindrical fold

PARTS OF FOLDS



PARTS OF FOLDS




Axial Plane
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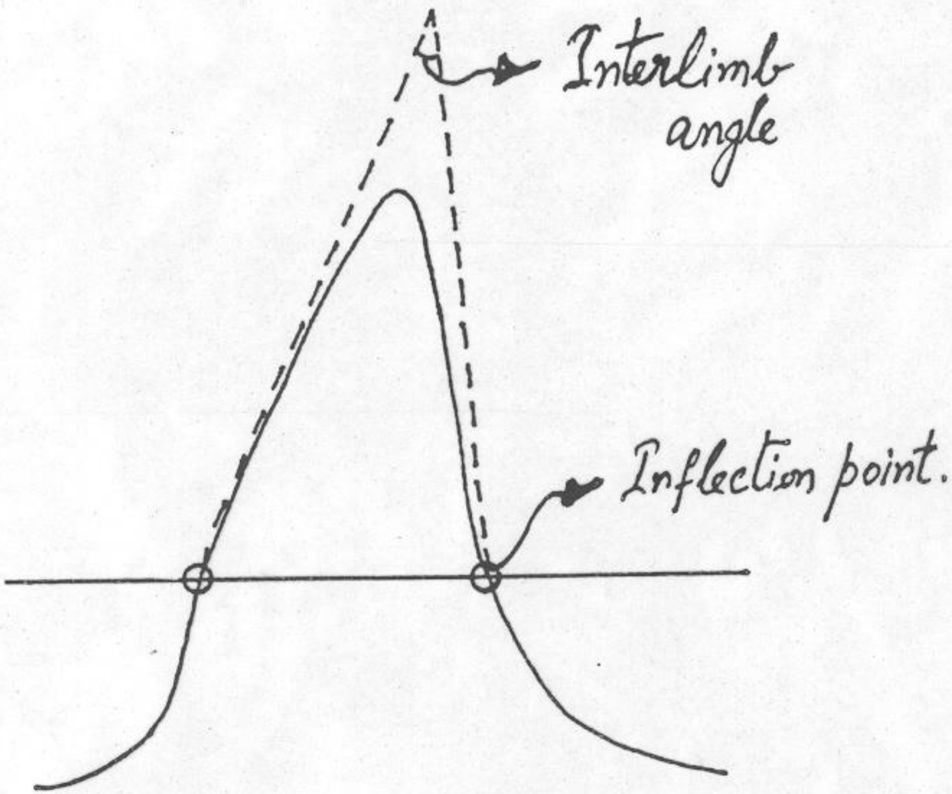
PARTS OF FOLDS



Parts of Fold

Crest Point: **T**he highest point of the fold surface, and the **trough** is the lowest point.

Hinge Point (Zone) : Point / zone of maximum curvature

Axil Plane: The axial plane of a fold is the plane or surface that divides the fold as symmetrically as possible

Fold Axis: The line that divides the section of the fold.

Limb: Limbs or a flank of the fold is sloping side from the crest to the trough.

Hinge line: The hinge line, is defined as the imaginary line that connects points of maximum curvature of a fold. For cylindrical folds, the *hinge line and fold axis are the same*.

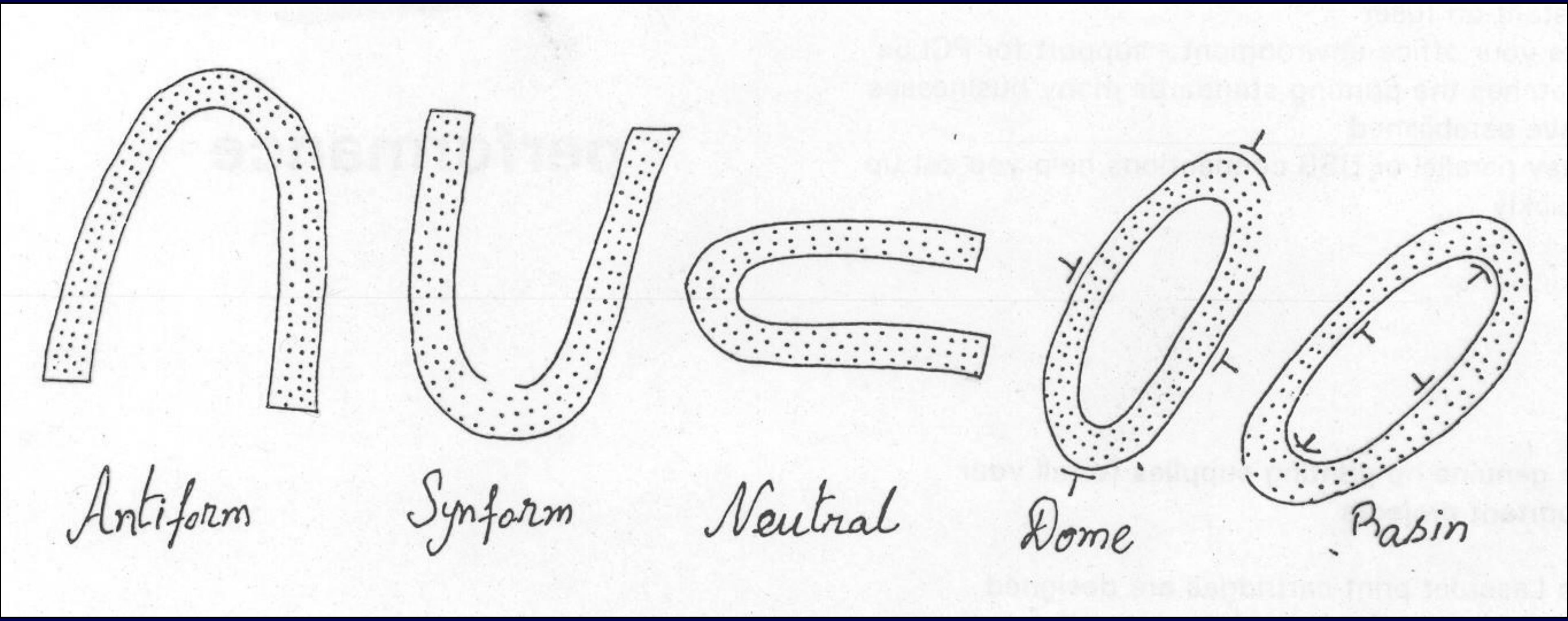
Inflection Point: The inflection **point** of a fold is the **point** on a limb at which the concavity reverses; In this point, the slope of the limb changes its direction

Wave Length: The distance between one peak of a wave to the next corresponding peak

Amplitude: Amplitude is deviation of wave from zero crossing. Maximum positive amplitude is referred to crest and Maximum negative amplitude is referred to trough. The amplitude can be measured if there is a visible complete anticline-syncline pair.

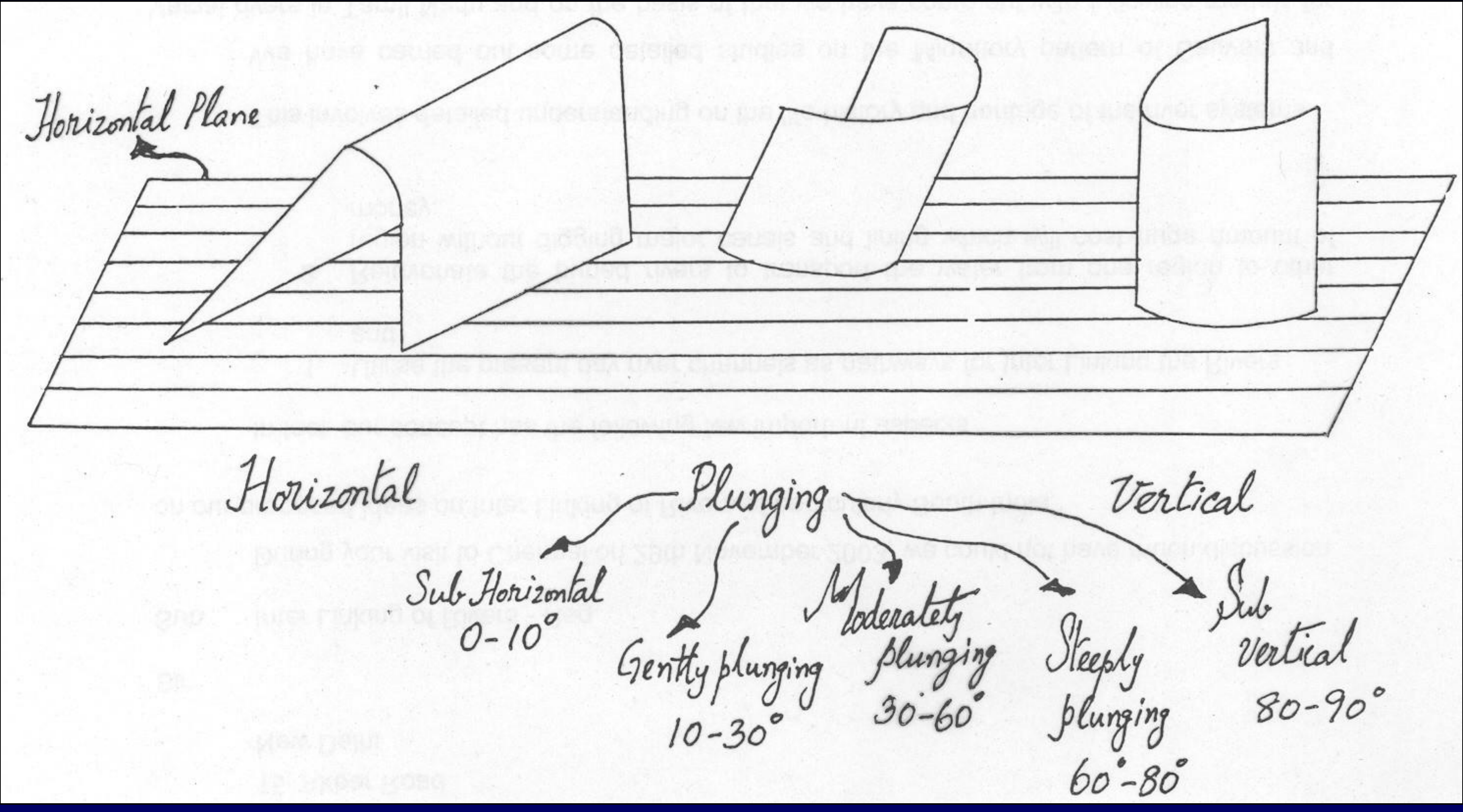
Types of folds

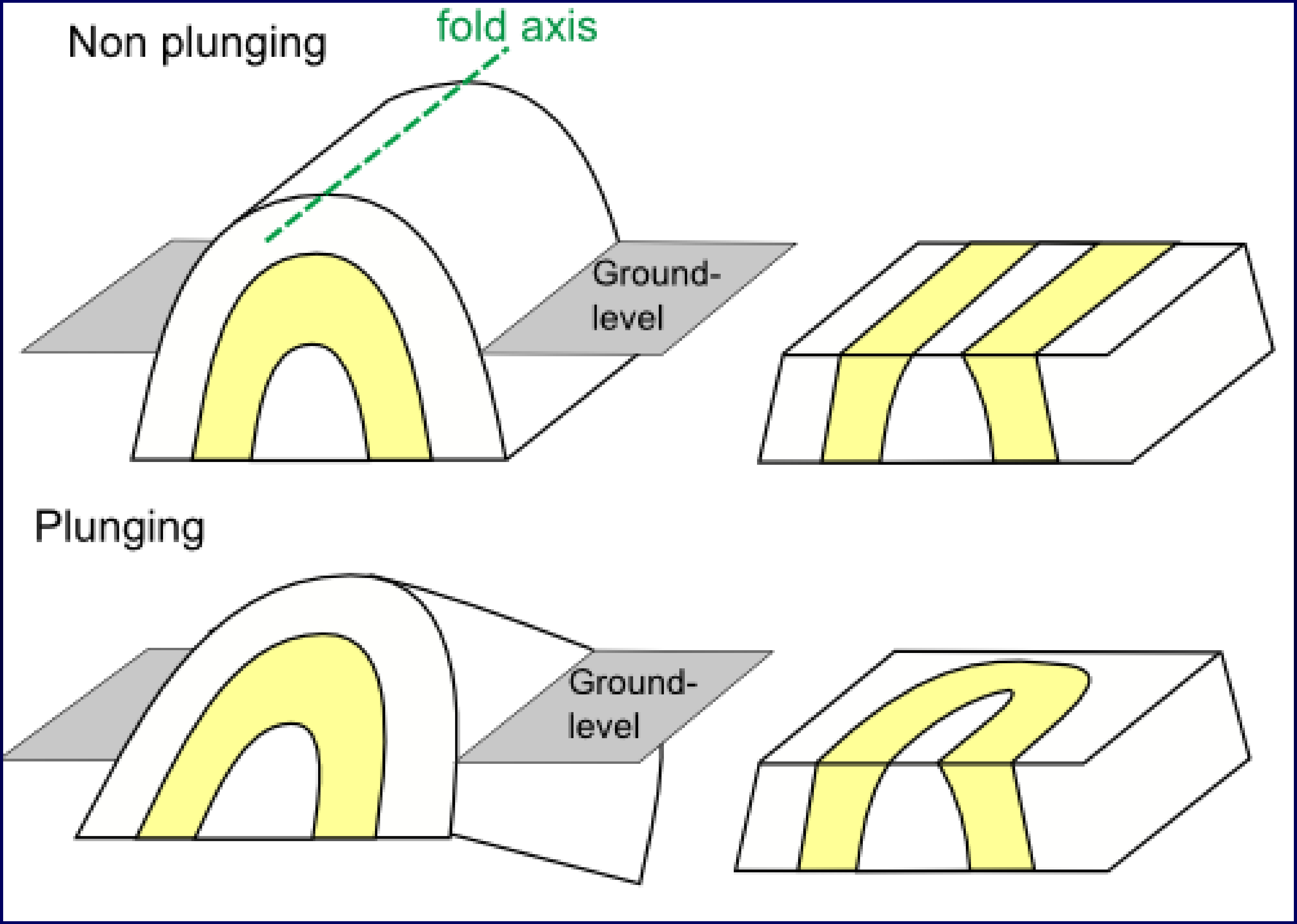
On the basis of sense of curvature



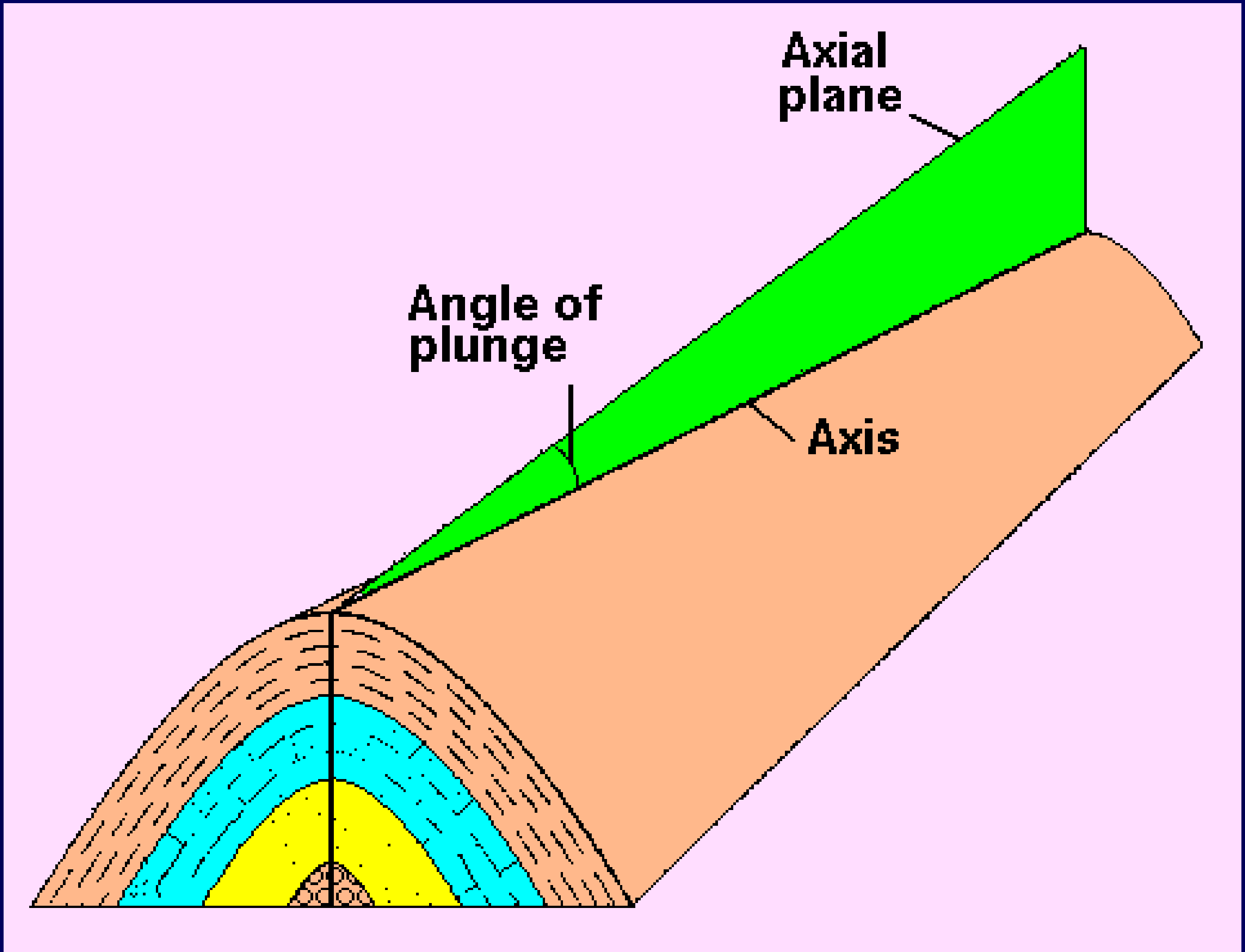
Types of folds

On the basis of Plunge of fold



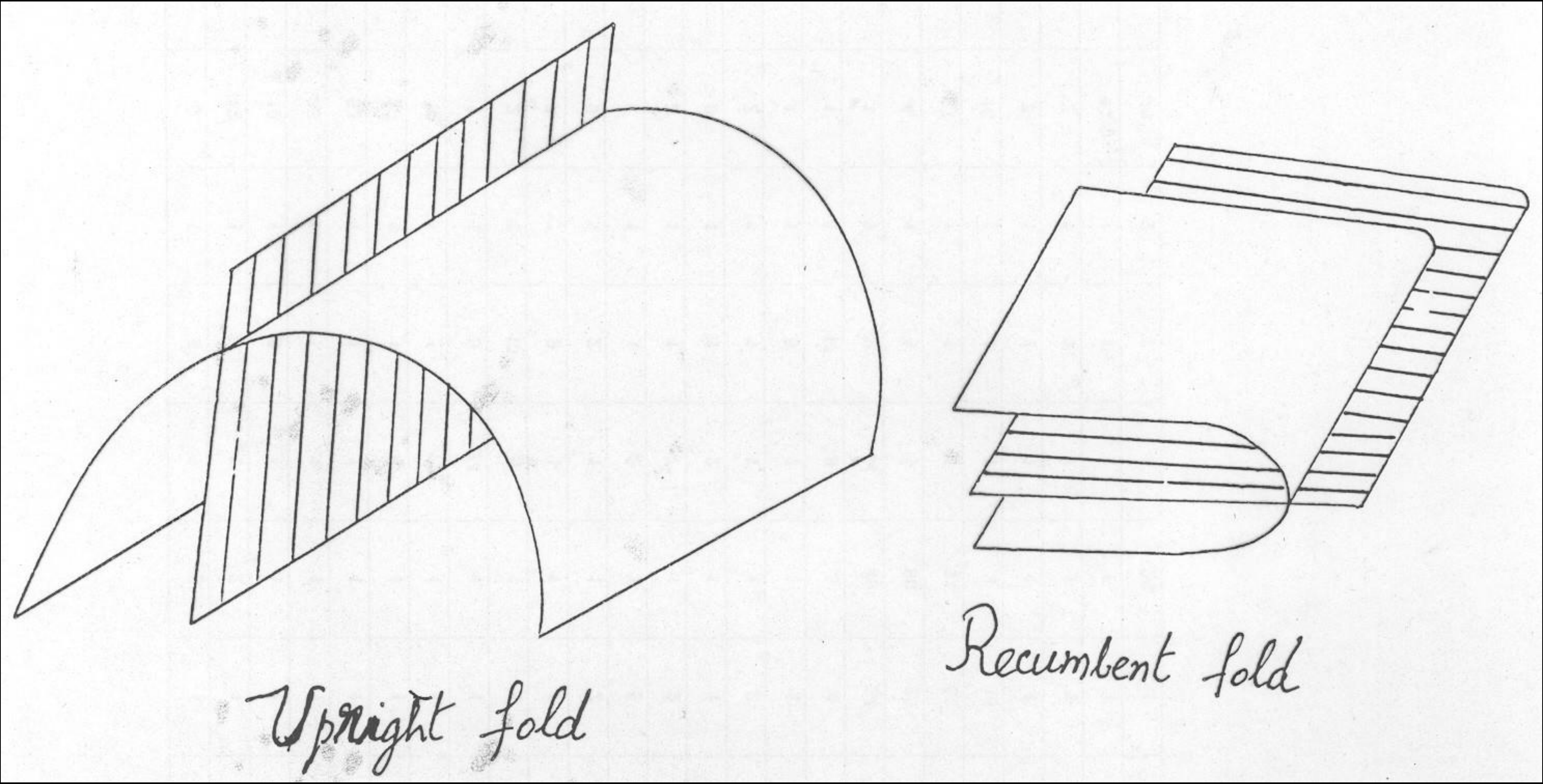


Non plunging
fold axis
Ground-
level
Plunging
Ground-
level


Axial plane
Angle of plunge
Axis

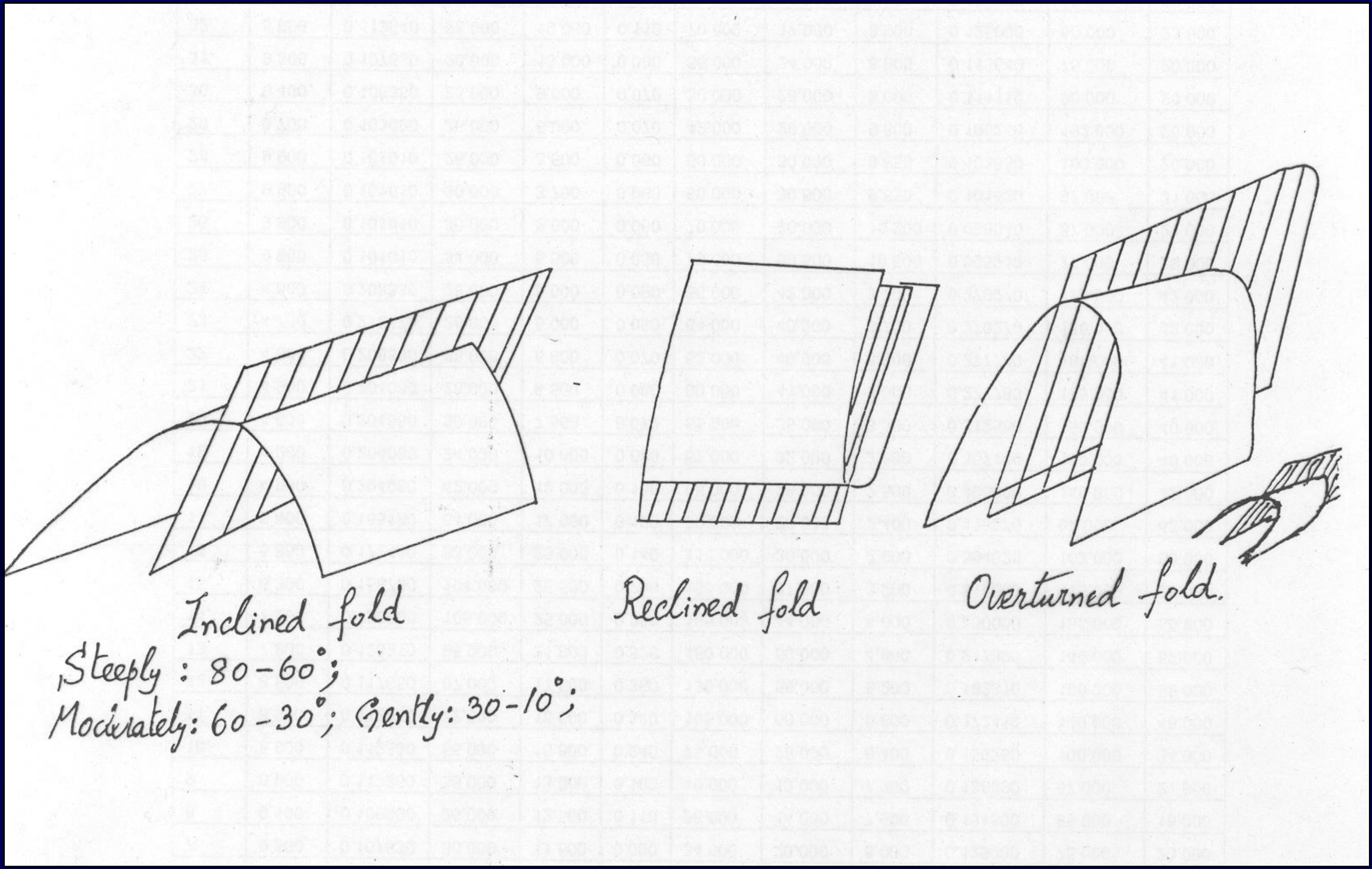
Types of folds

On the basis of Orientation of Axial Plane

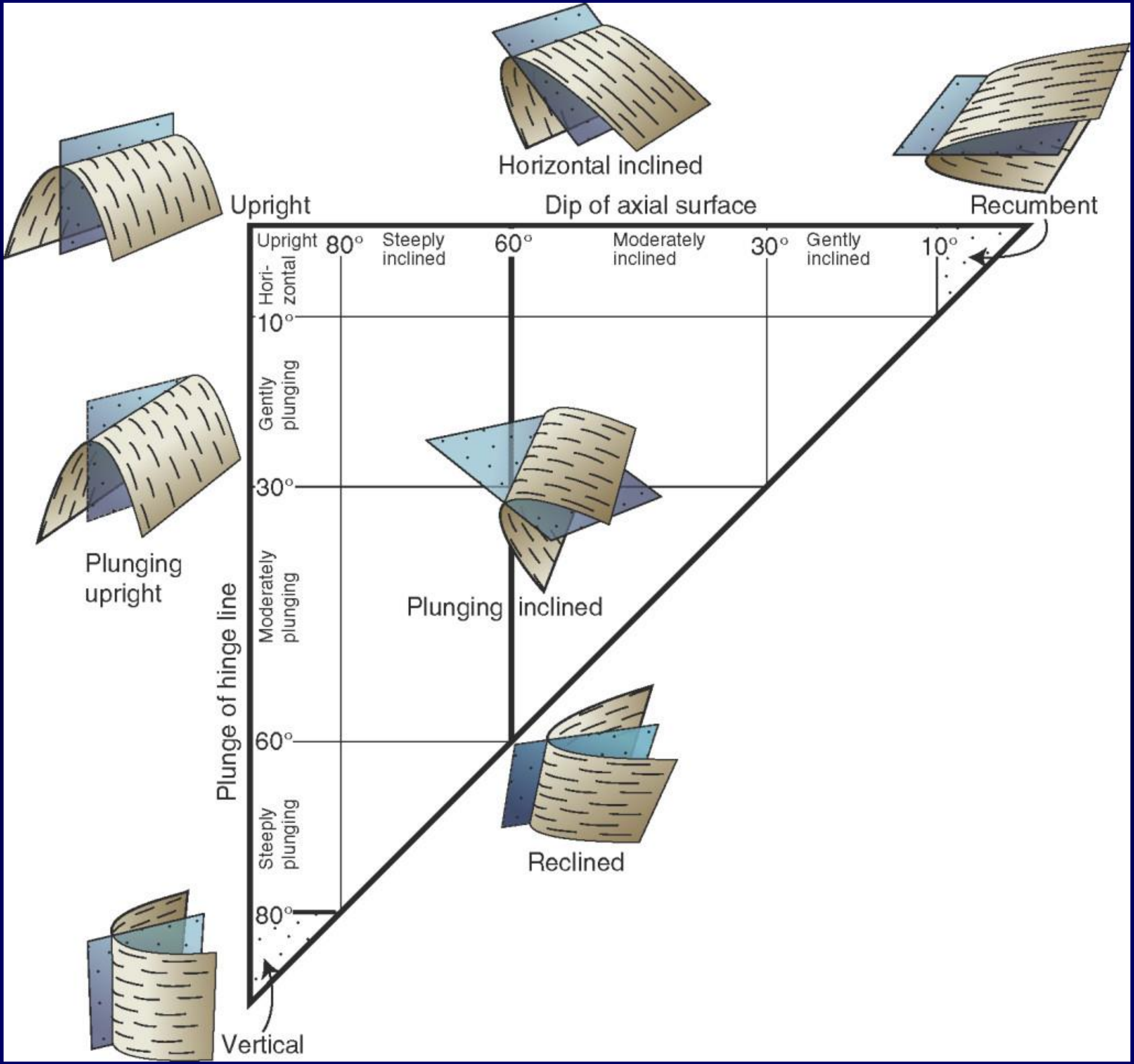


Types of folds

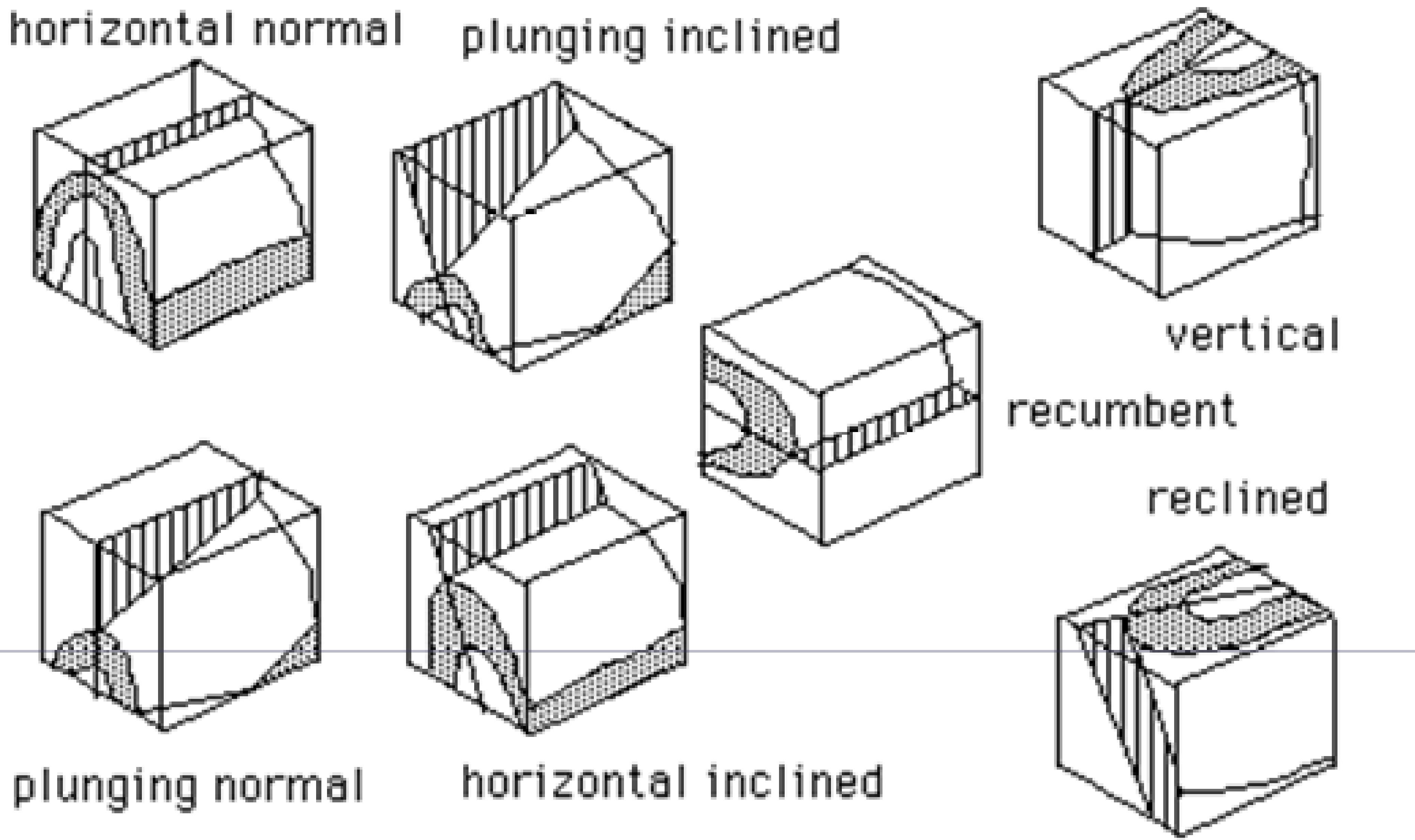
On the basis of Orientation of Axial Plane



A sideways closing fold whose hinge line is parallel to direction of dip of the axial plane is called a neutral or a **reclined fold**

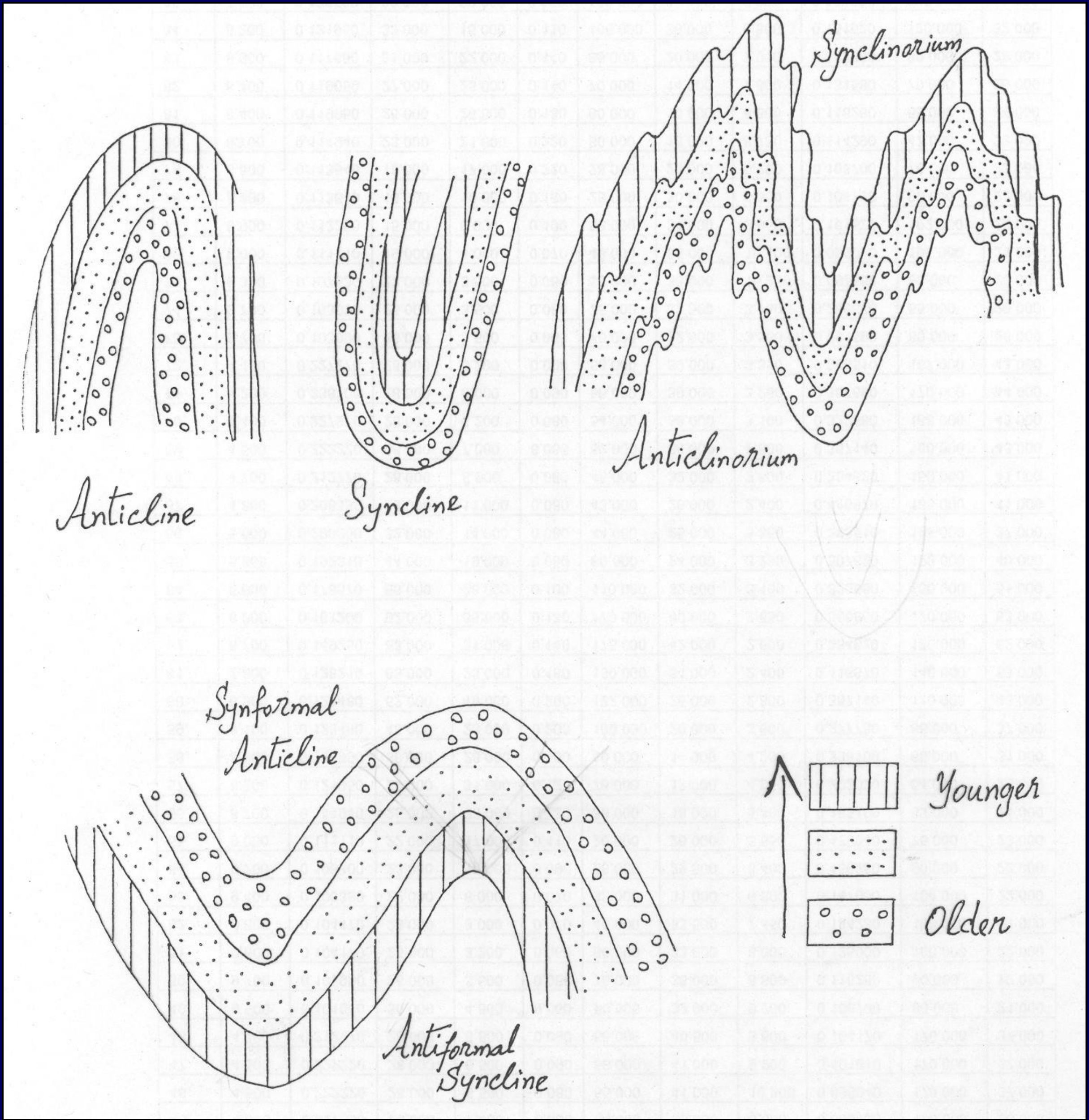


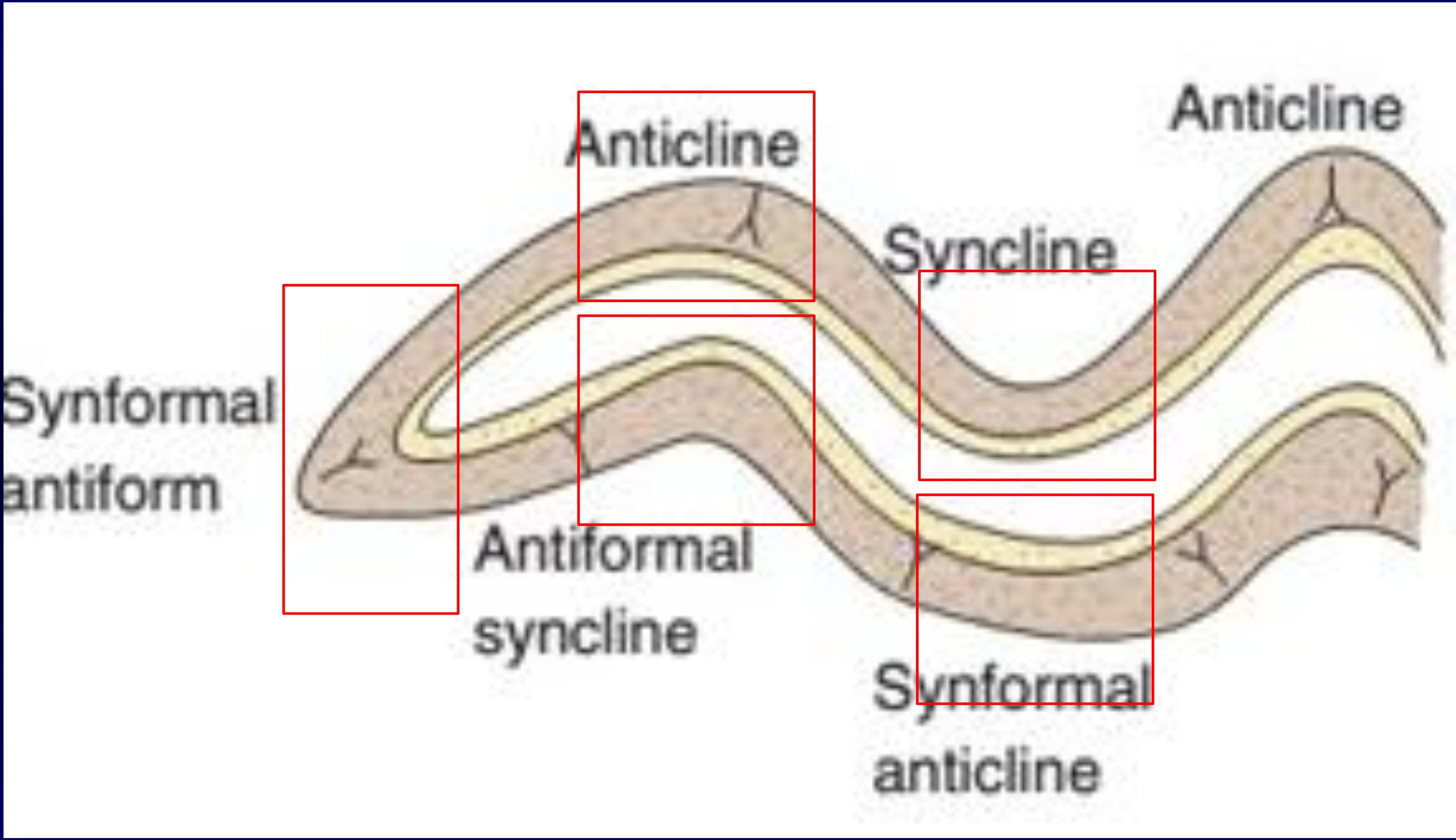
Horizontal inclined
Upright
Dip of axial surface
Recumbent
Upright
80°
Steeply inclined
60°
Moderately inclined
30°
Gently inclined
10°
Hori-zontal
10°
Gently plunging
Plunging upright
30°
Moderately plunging
Plunging inclined
Plunge of hinge line
60°
Steeply plunging
Reclined
80°
Vertical


horizontal normal
plunging inclined
vertical
recumbent
reclined
plunging normal
horizontal inclined

Types of folds

On the basis of Youngling direction

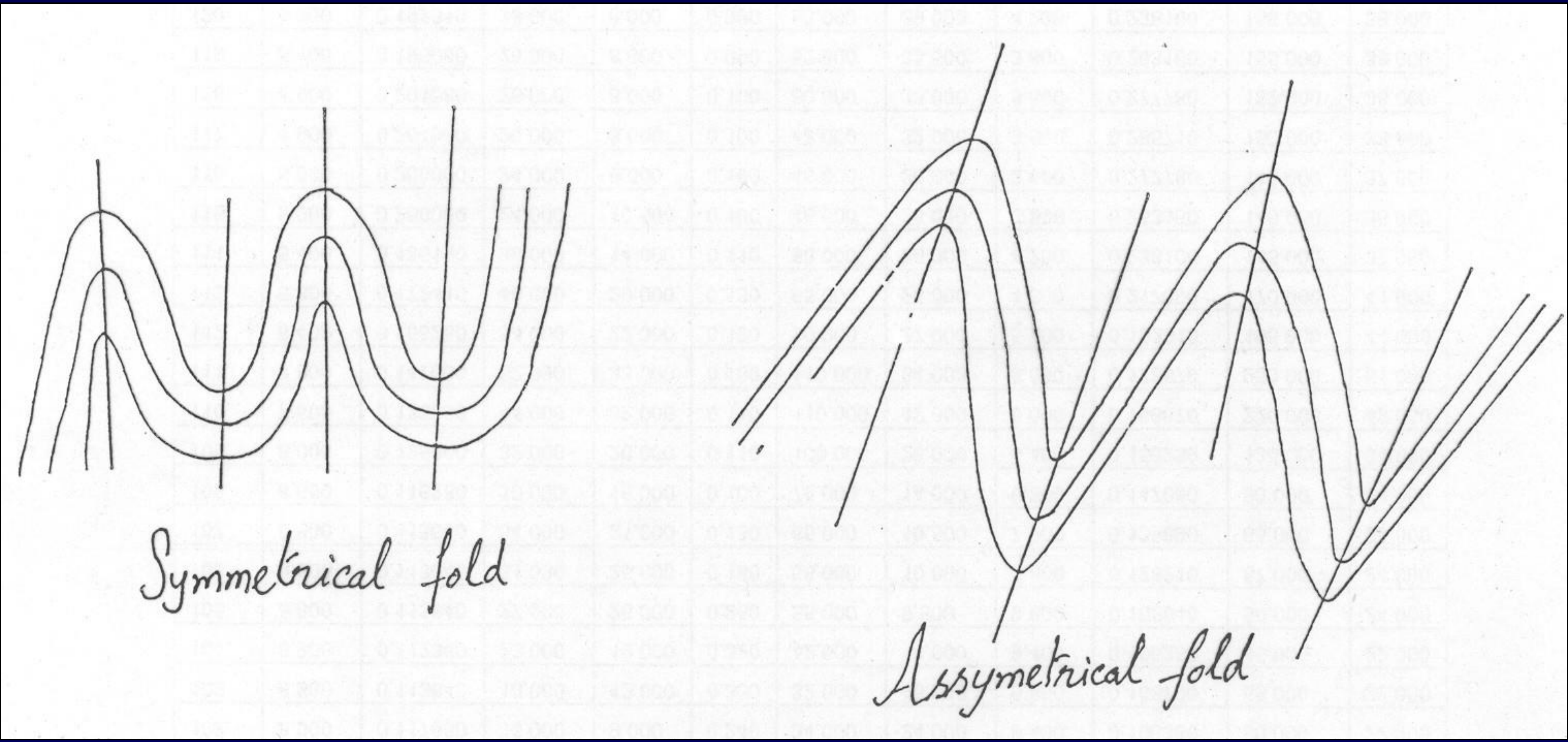




Anticline
Anticline
Syncline
Synformal
antiform
Antiformal
syncline
Synformal
anticline

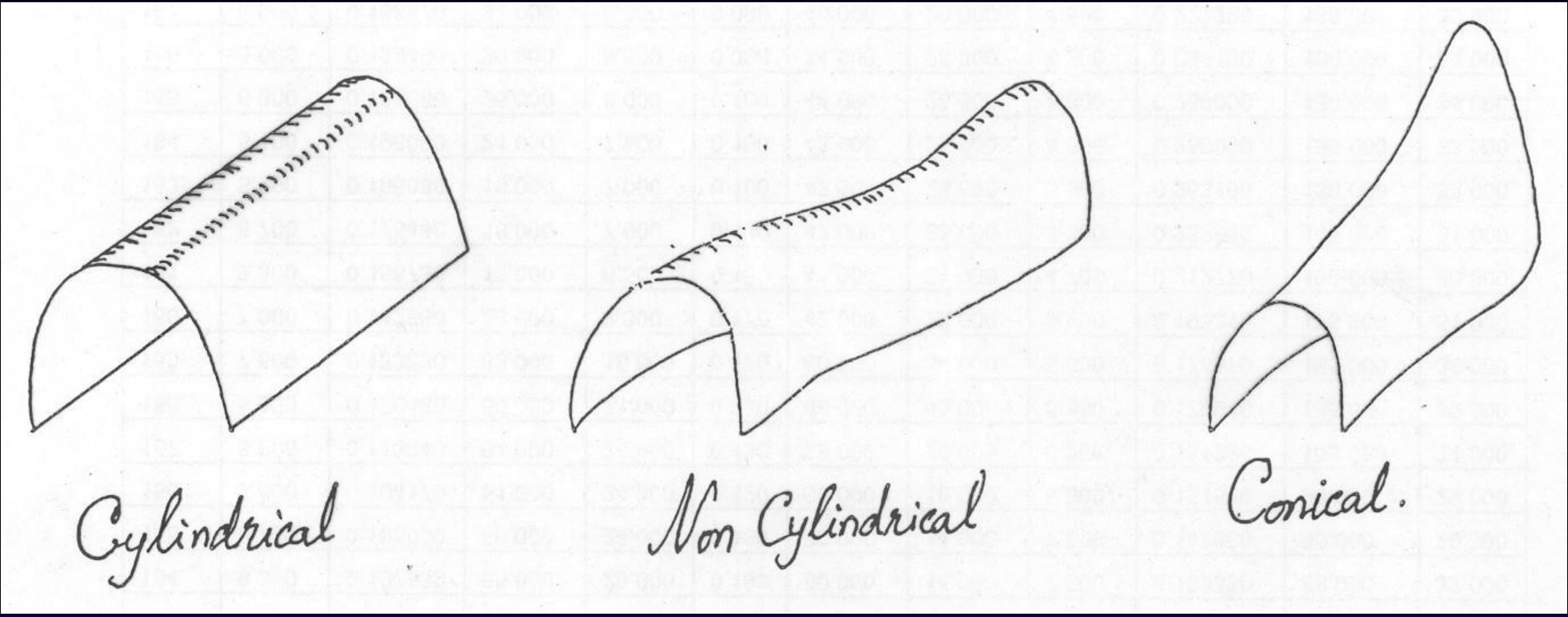
Types of folds

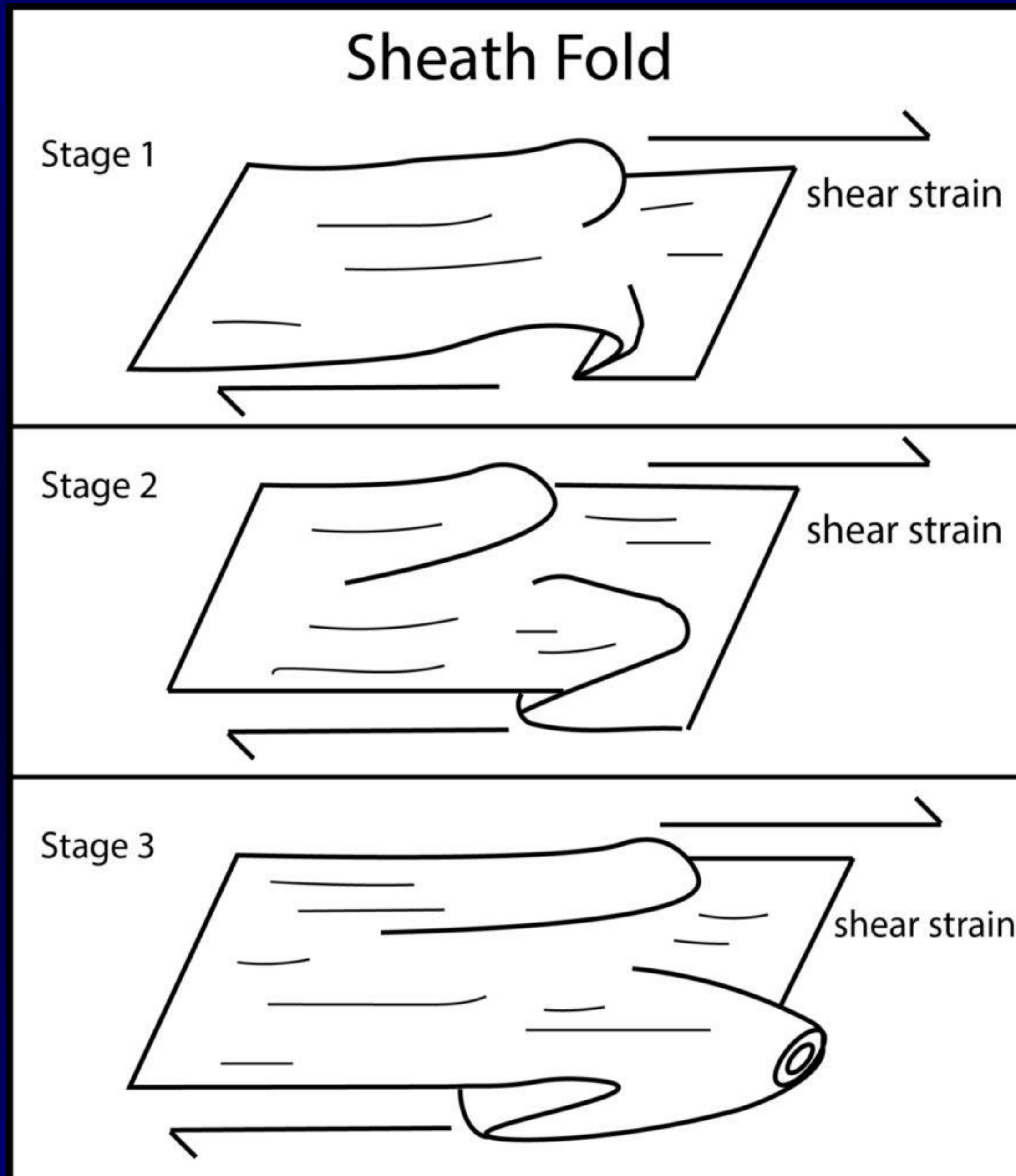
On the basis of symmetry of fold

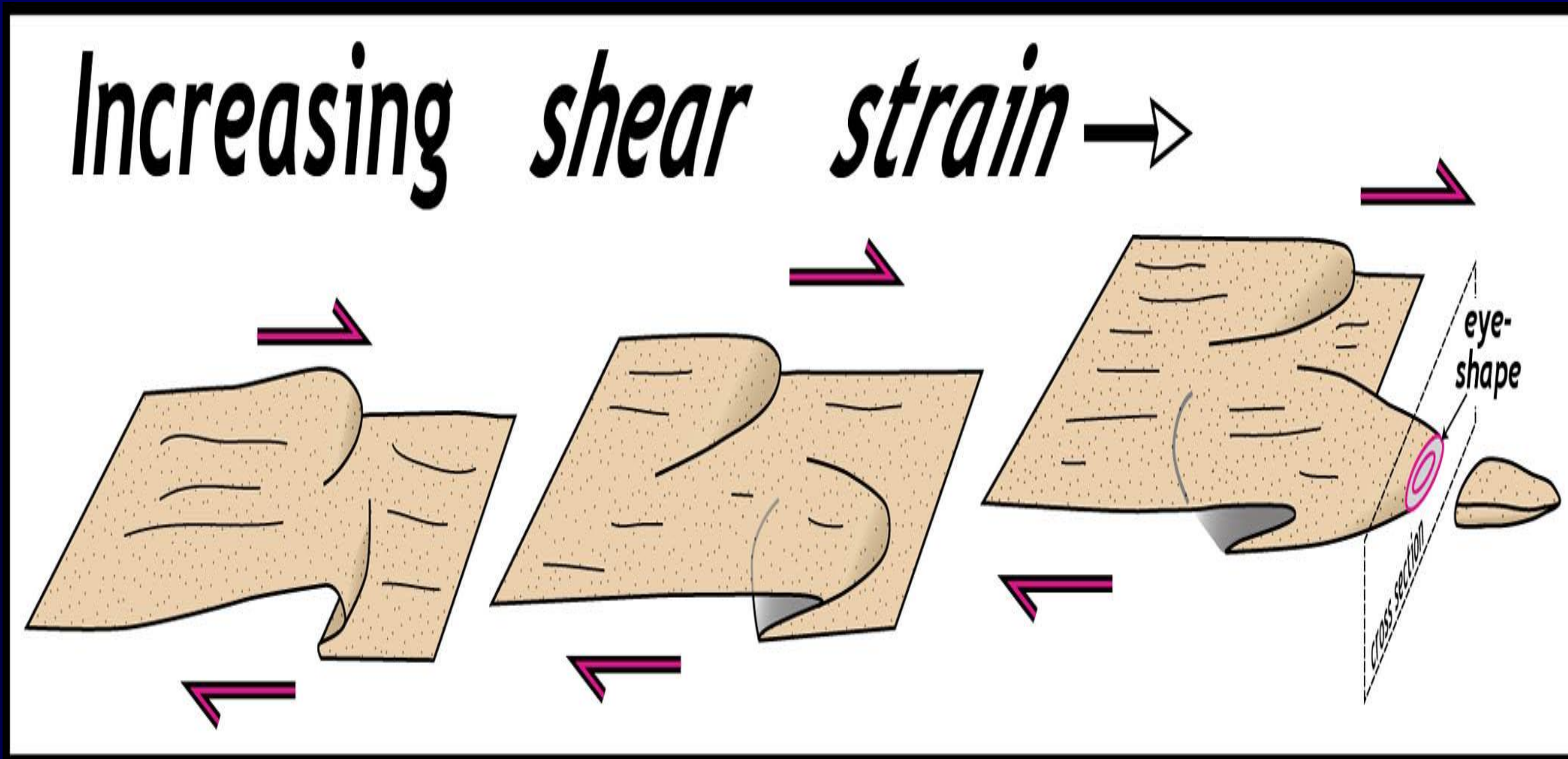


Types of folds

On the basis of nature of hinge line

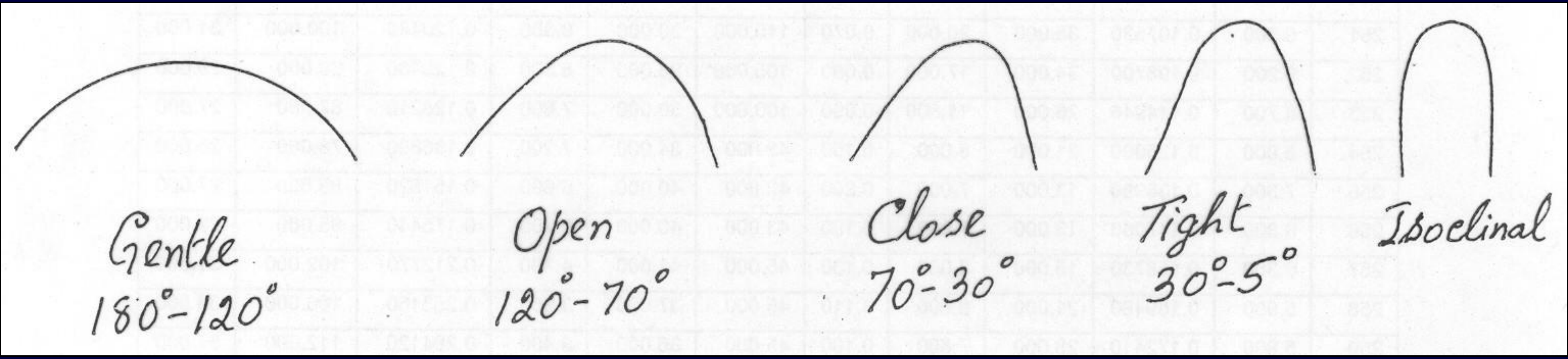



Sheath Fold
Stage 1
shear strain
Stage 2
shear strain
Stage 3
shear strain


Increasing shear strain
eye-
shape
cross section

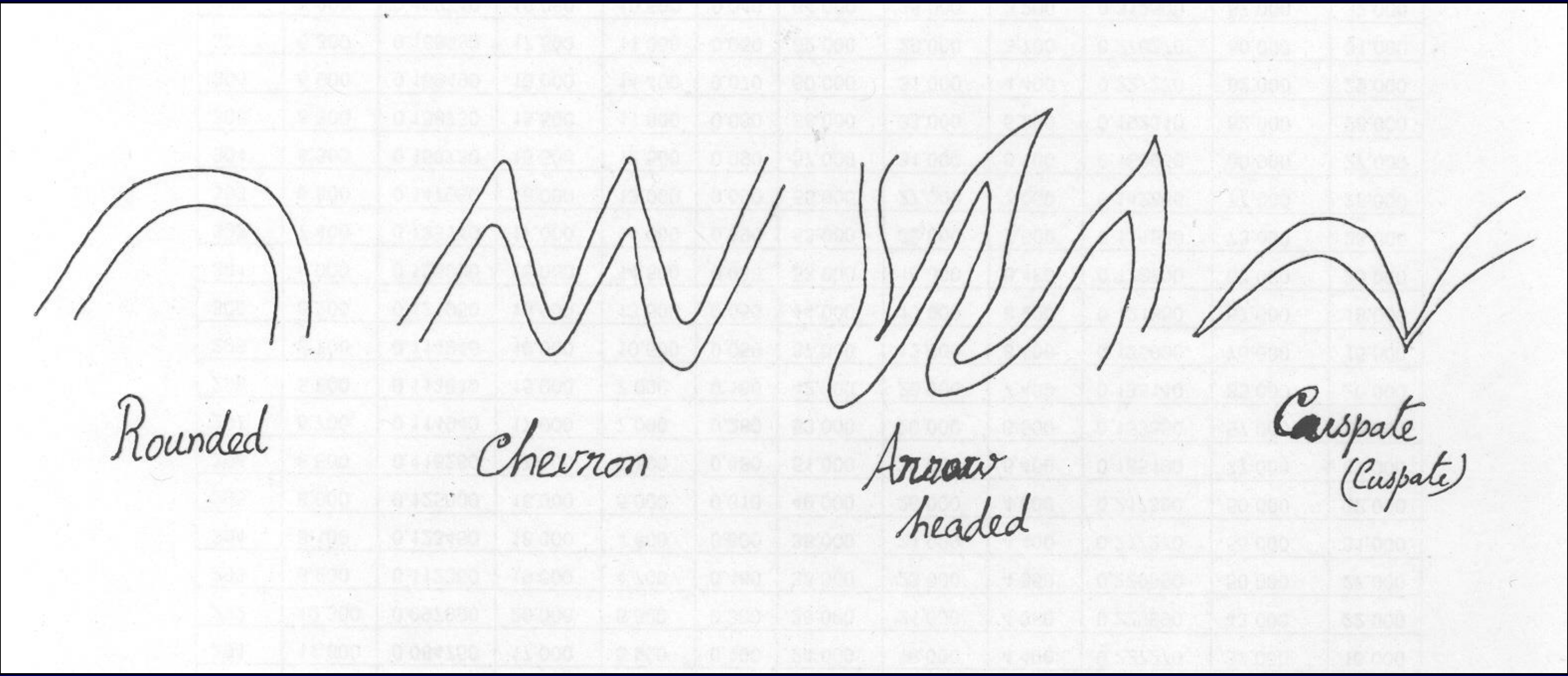
Classification of folds

On the basis of Inter-limb angle



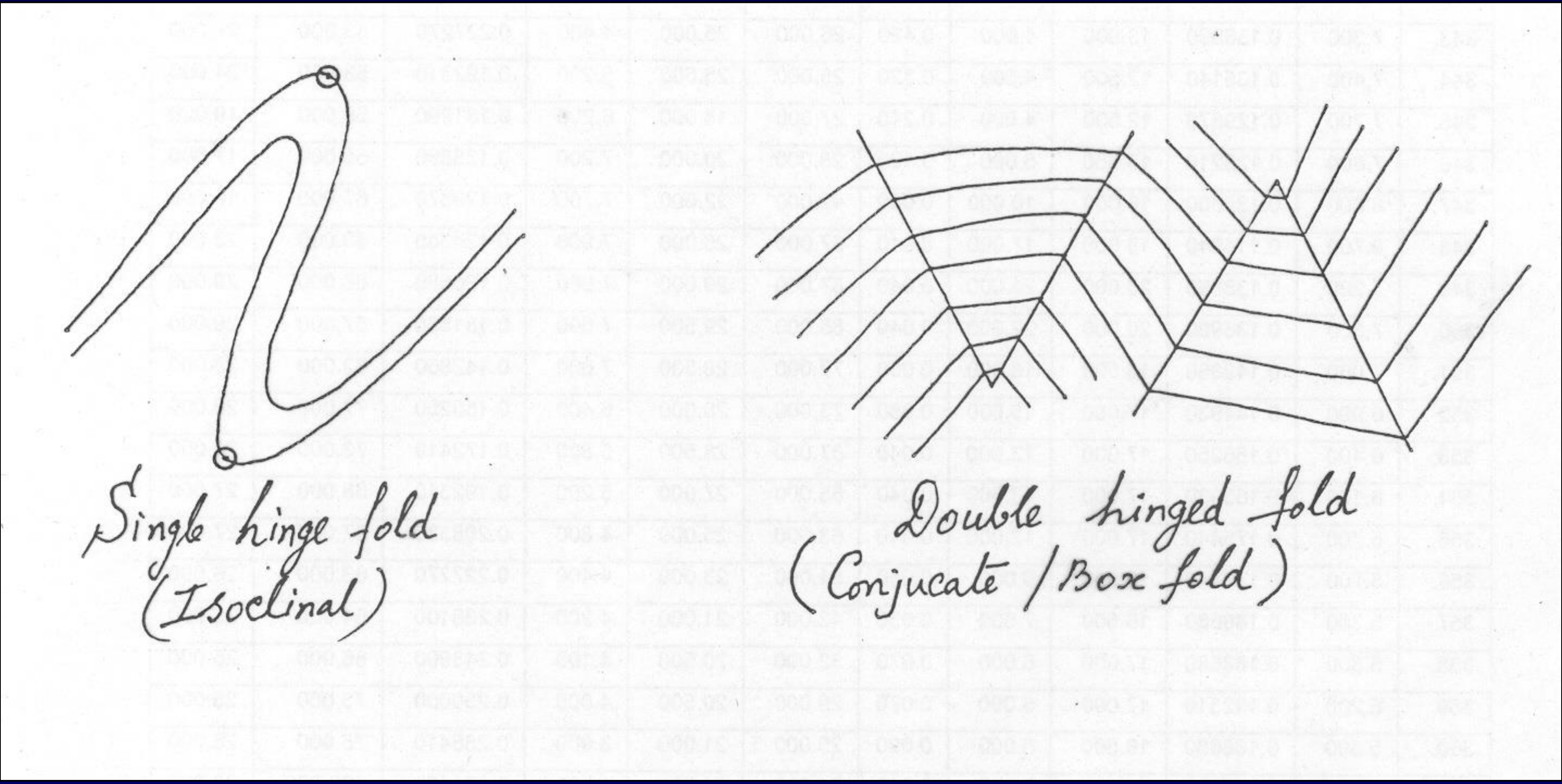
Classification of folds

On the basis of shape of hinge



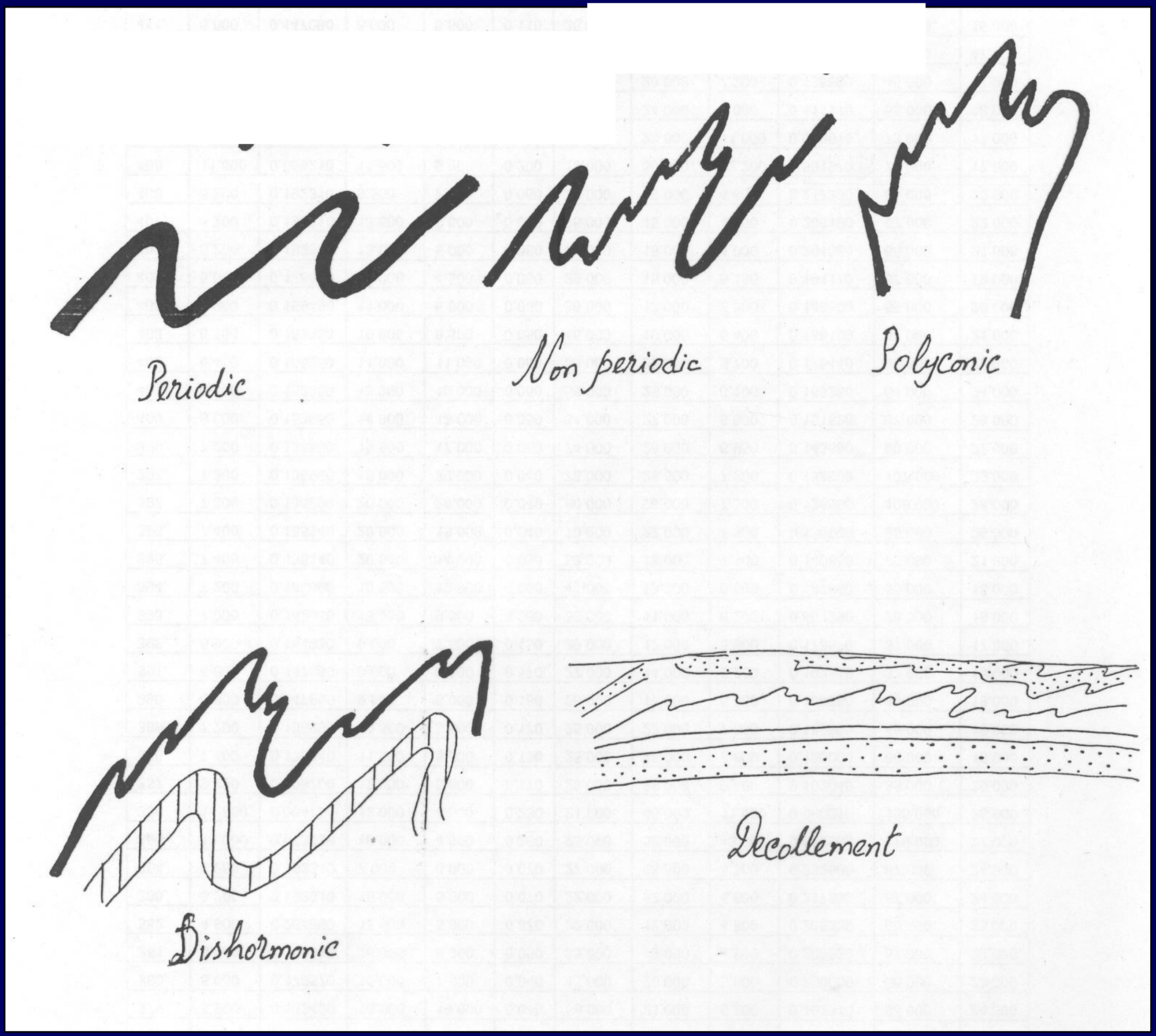
Classification of folds

On the basis of number of number of hinges

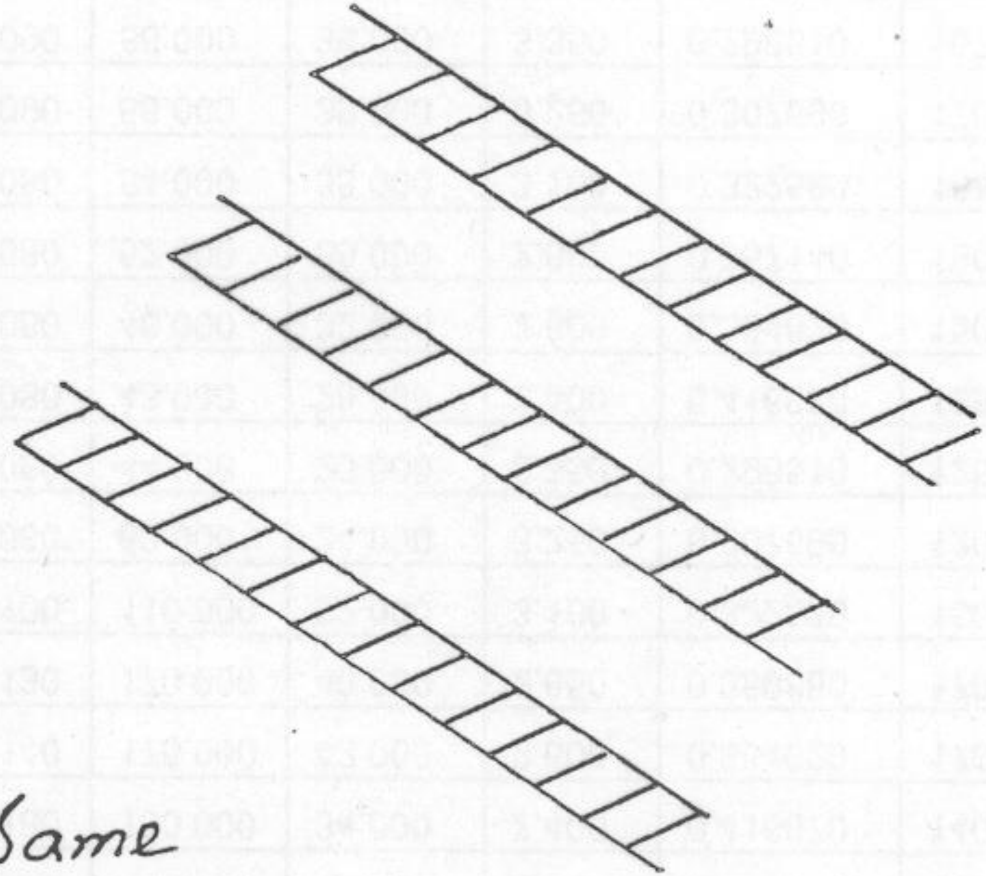


Classification of folds

On the basis of geometrical relation among the neighboring structures

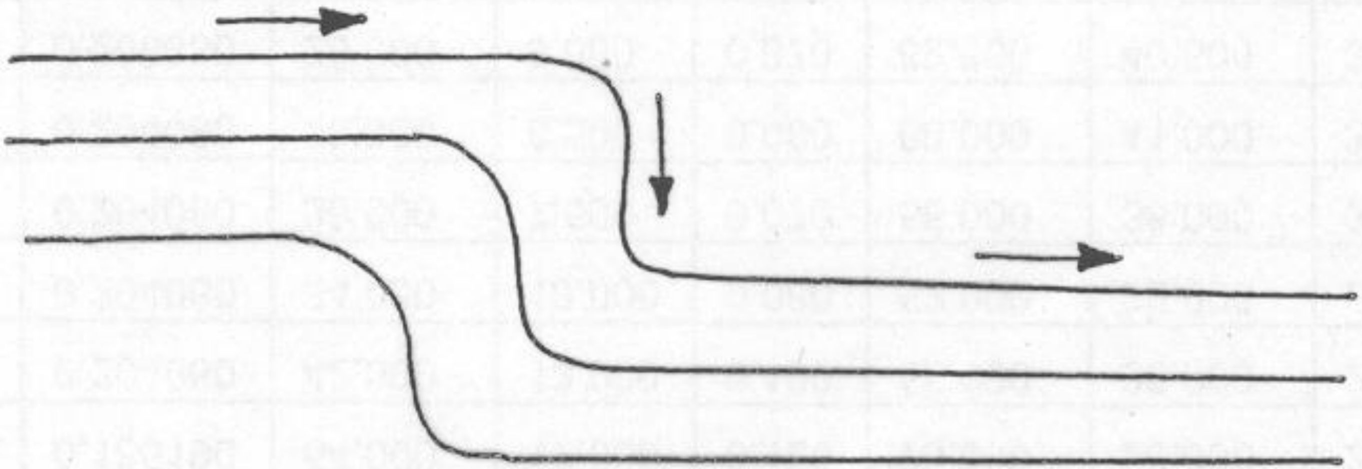


Homoclinal fold

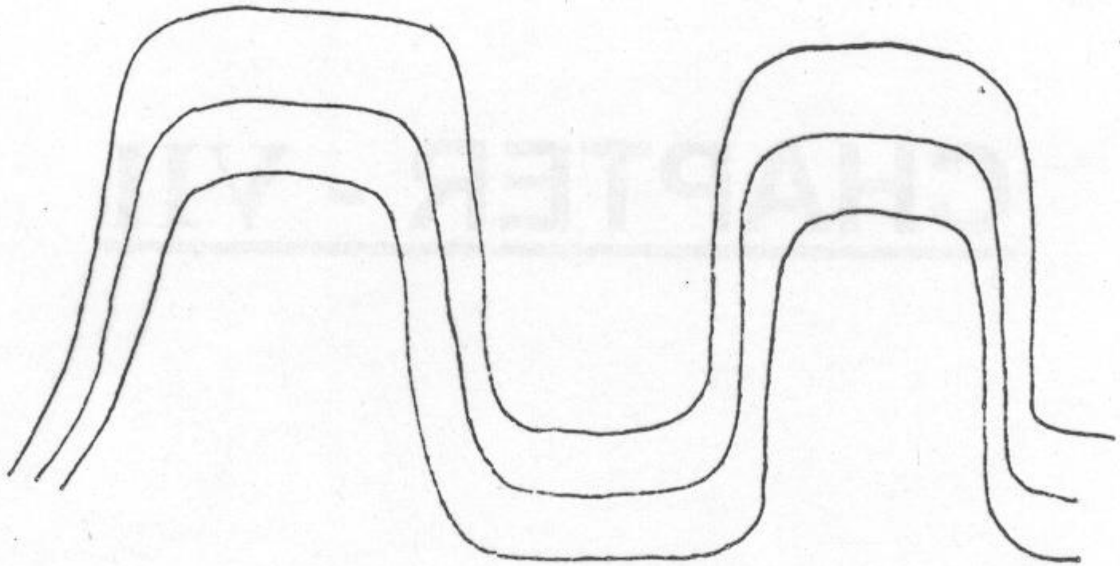


Strata Dipping in Same Direction with Uniform angle.

Monoclinal fold

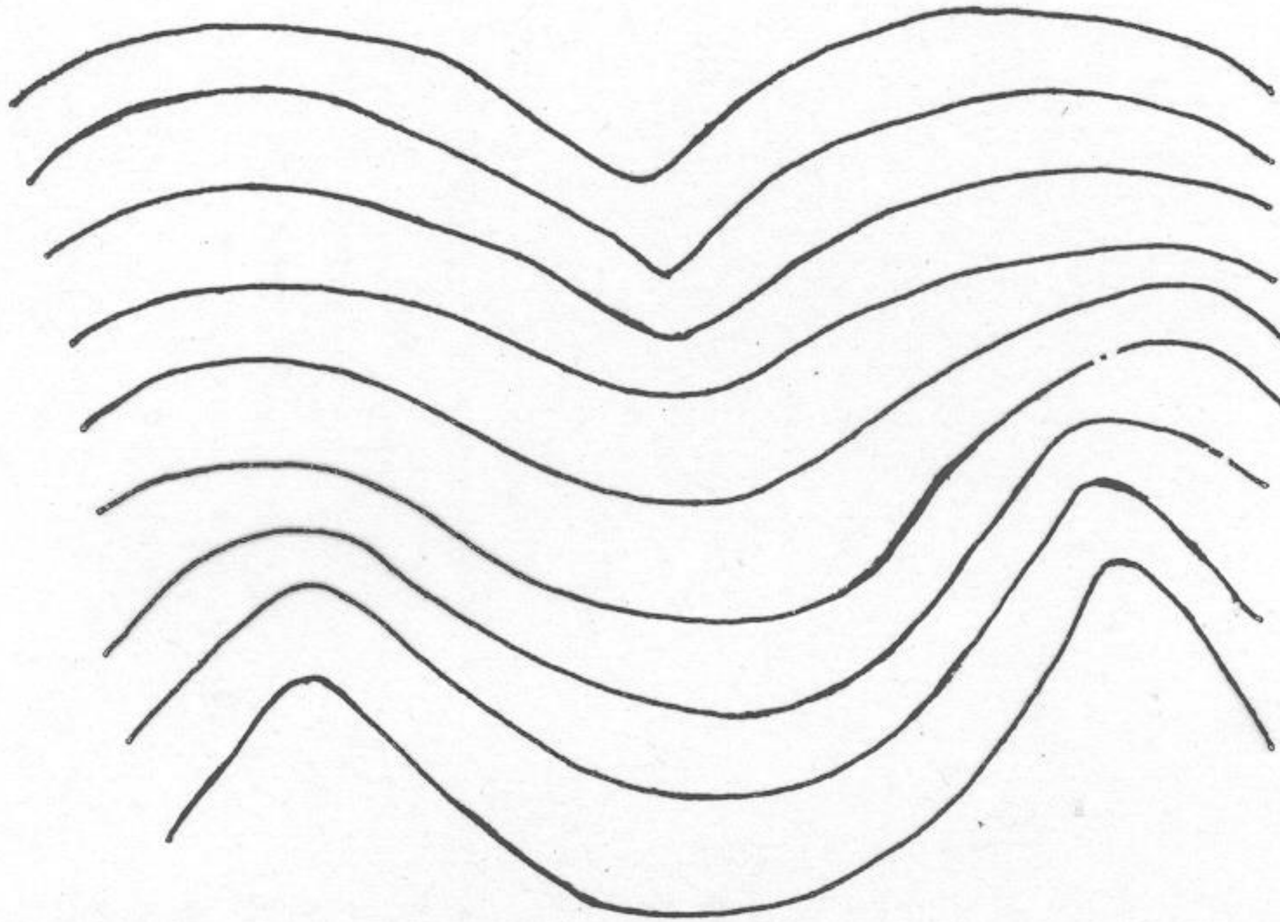


A strata abruptly show steep inclination.



Similar fold:

- Similar at indefenite depth
- Axial regions are thicker and limbs are thinner

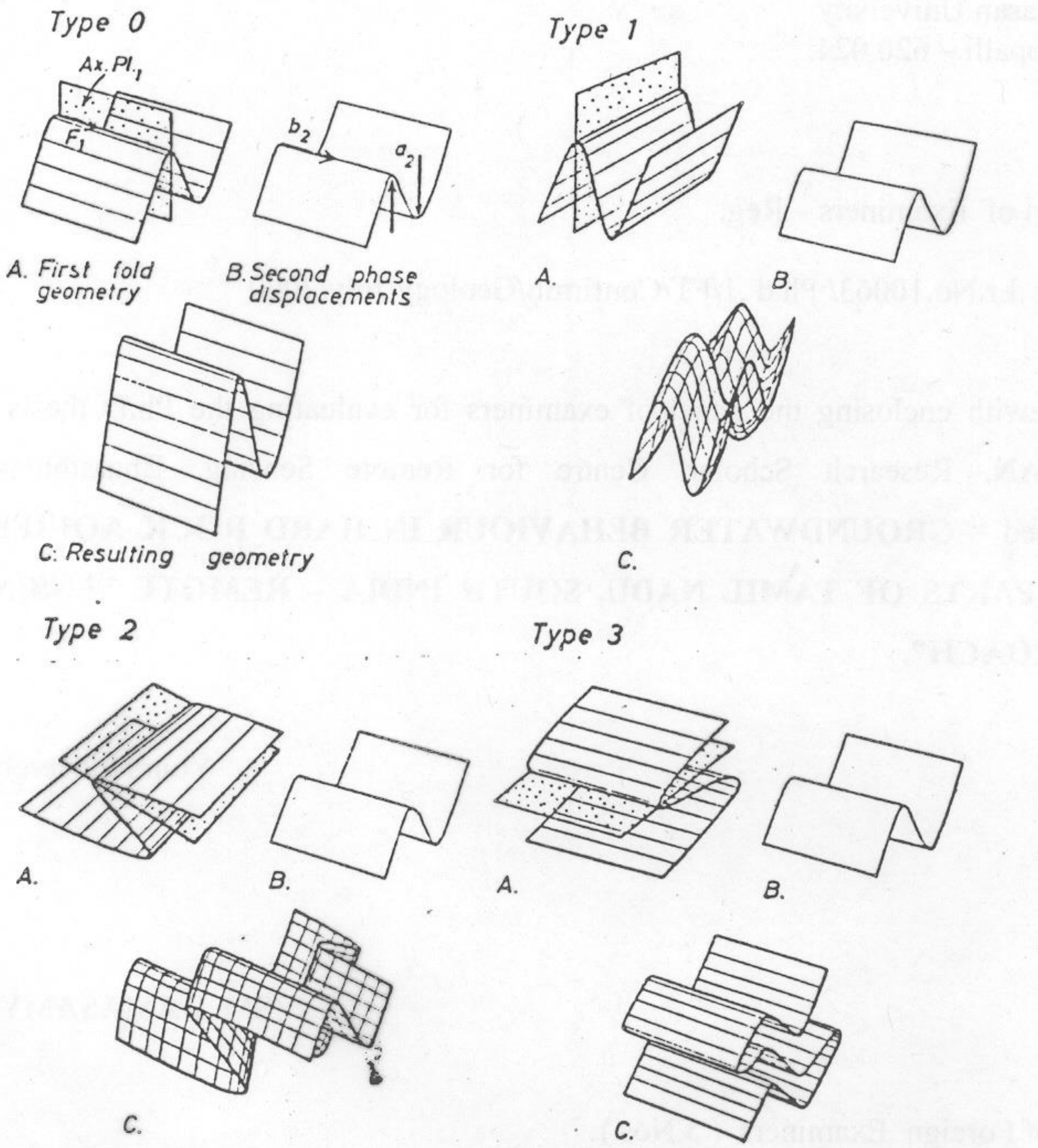


Parallel fold:

- Anticlinal hinges are sharp at depth
- Synclinal hinges are sharp at surface.

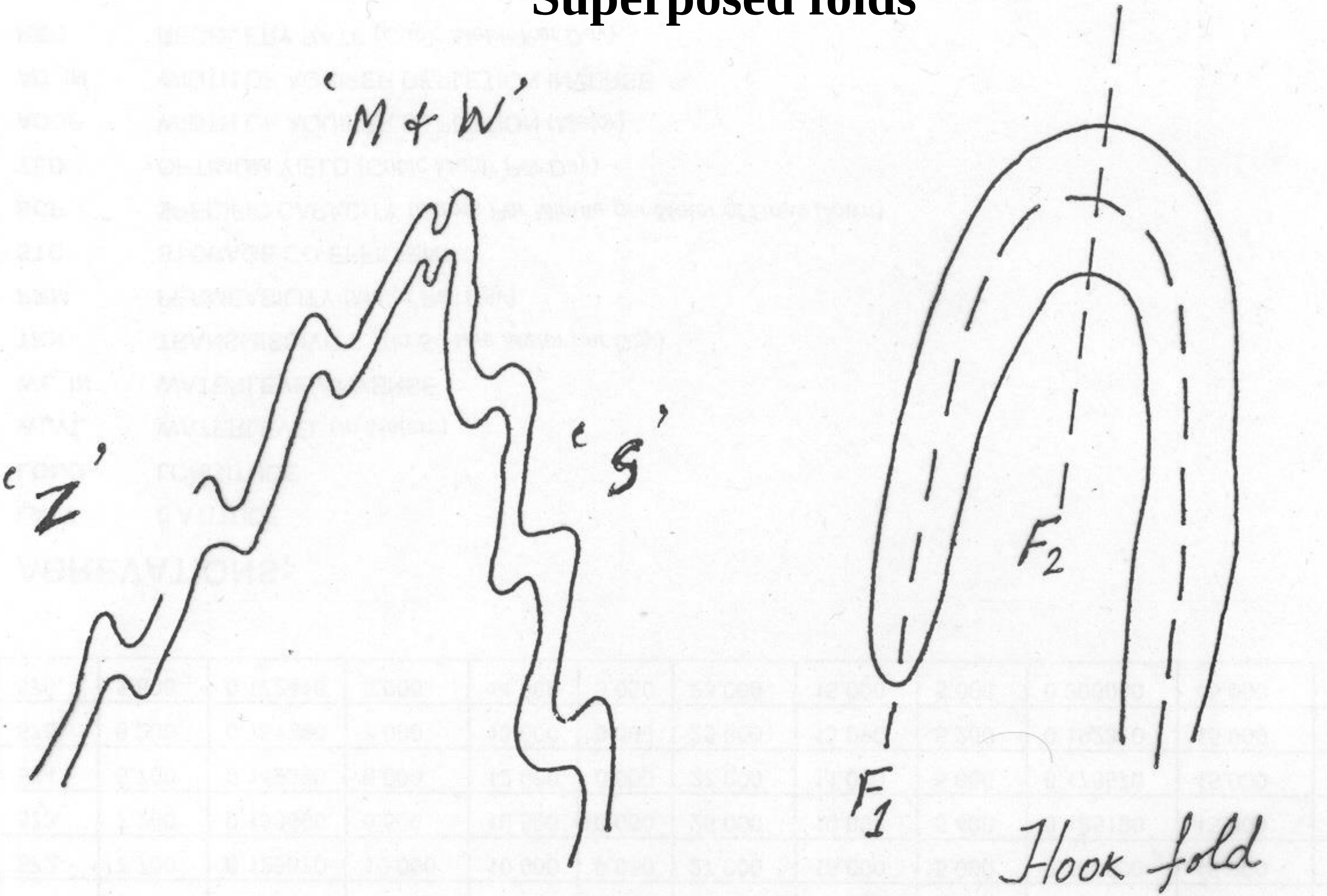
Superposed folds / Refold

1. Type 0
2. Type 1
3. Type 2
4. Type 3

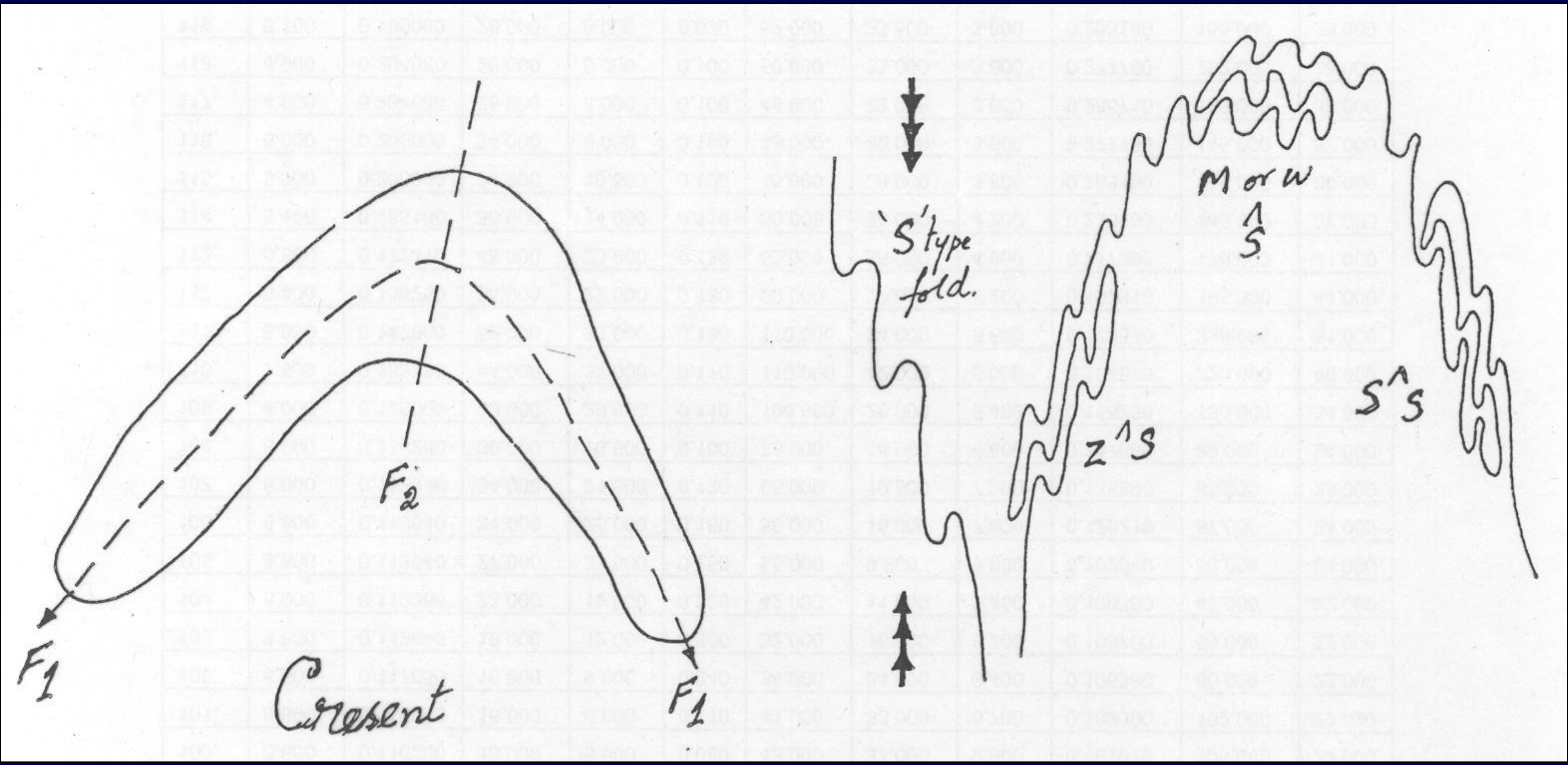


The four principal types of three-dimensional fold forms arising by the superposition of shear folds on pre-existing fold forms.

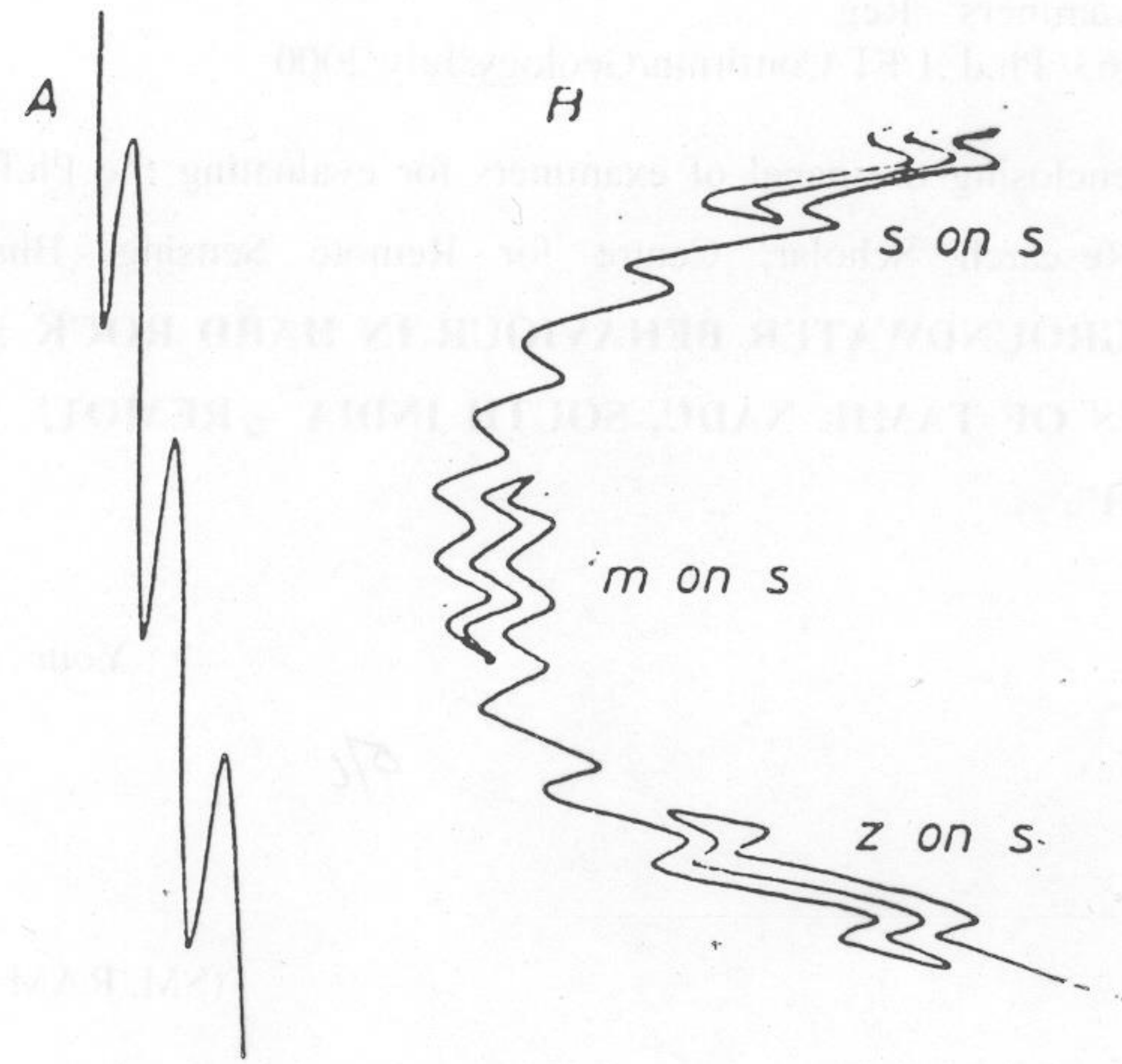
Superposed folds



Superposed folds

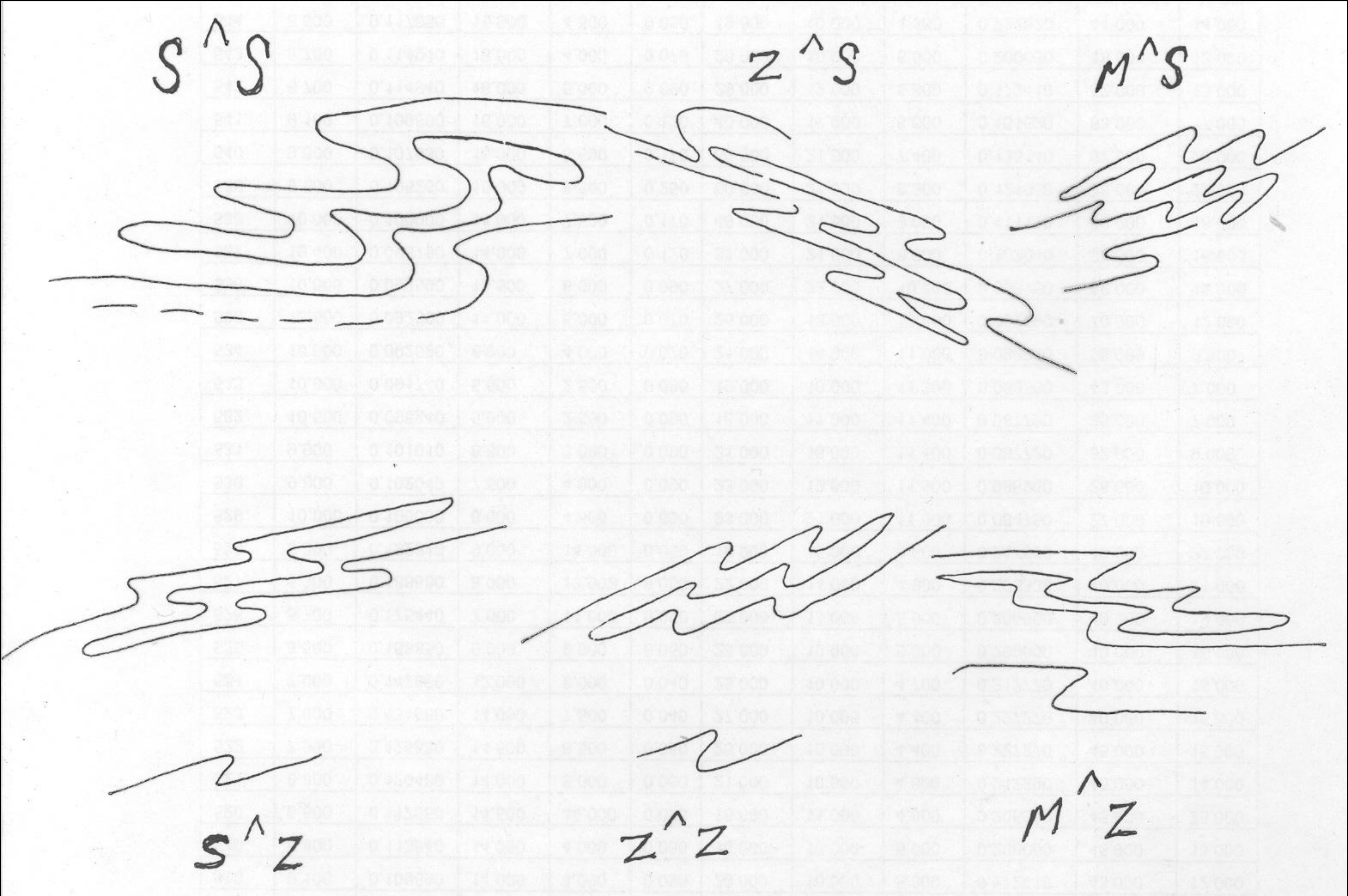


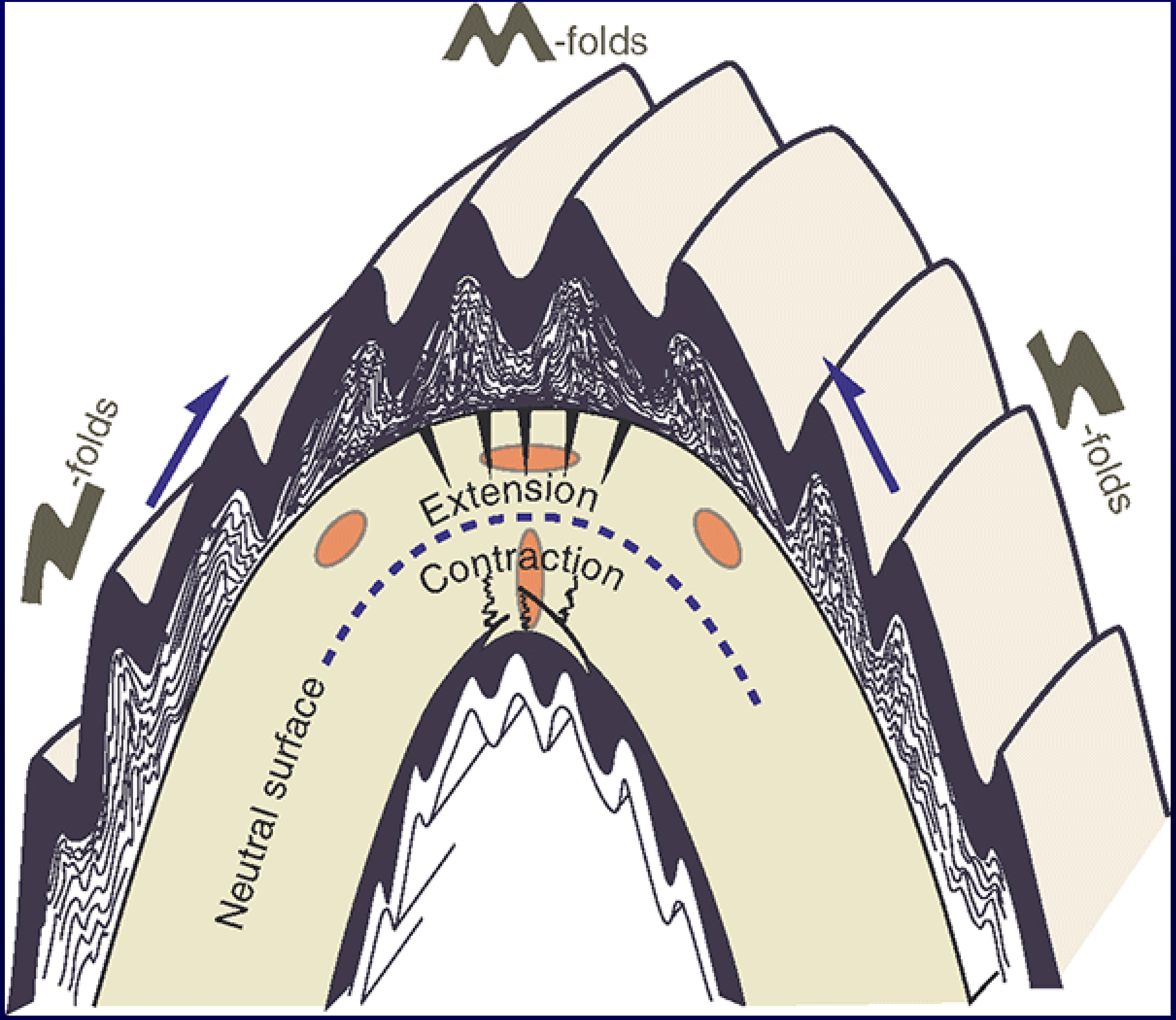
Superposed folds



A: S-shaped first folds. B: Effects of refolding the S-shaped initial folds into various forms of Type 3 interference patterns.

Superposed folds





The Z-folds on an anticline will indicate the left limb, the S-folds will indicate the right limb and the hinge zone will have the M-folds. Z, M and S folds.

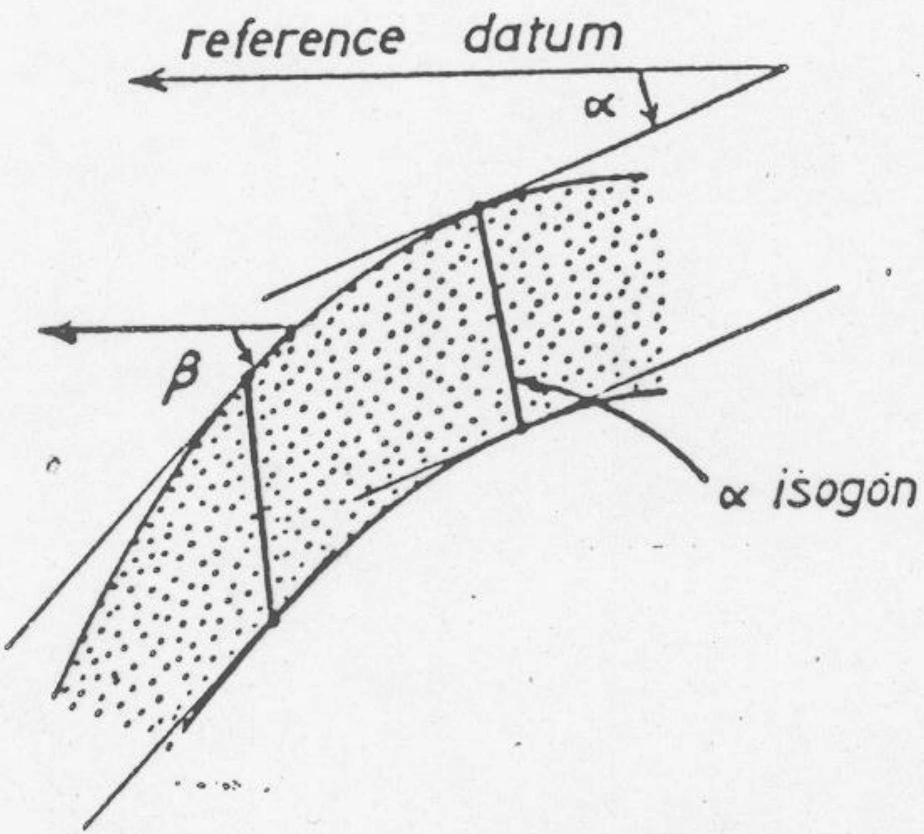
RAMSAY'S FOLD CLASSIFICATION

Ramsay classified the folds on the basis of "Dip Isogon"

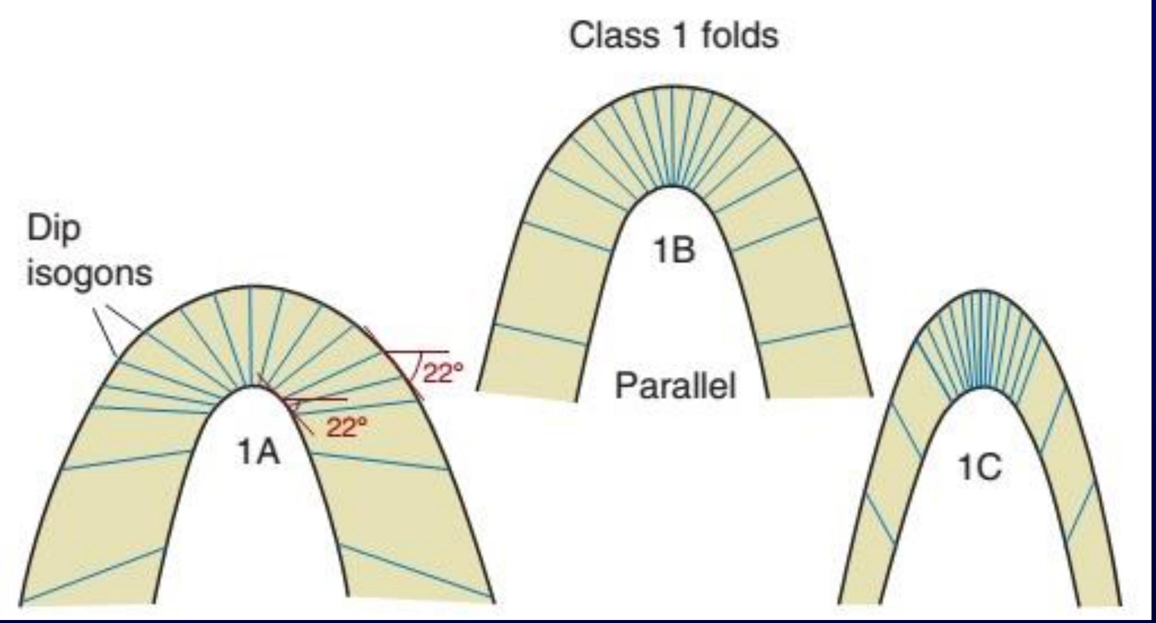
Dip Isogons:-

Lines joining locations of equal dip on either side of a folded layer

Dip isogons construction



Method of constructing dip isogons of value α and β.

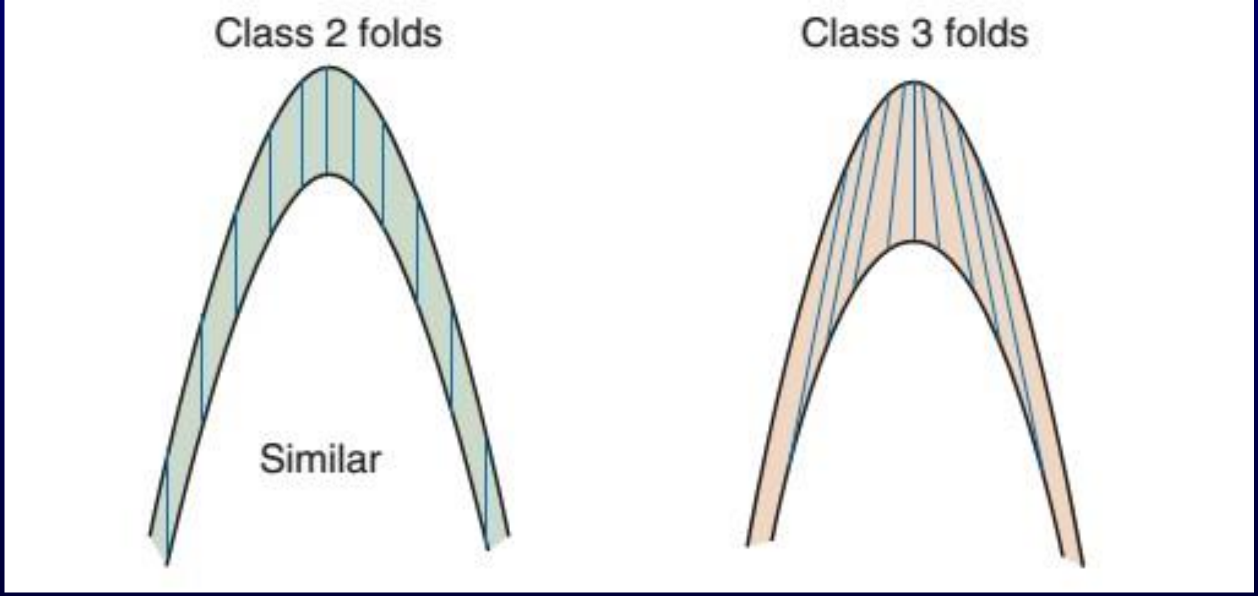


Class 1 – The dip isogons converge toward the inner arc, which is tighter than the outer arc.

Class 1A – The dip isogons have the same characteristics as the Class 1, but the limbs have a larger thickness (thicker) than the hinge.

Class 1B – The dip isogons have the same characteristics as the Class 1, but the thickness remain consistent (same) hence it is a parallel fold.

Class 1C – The dip isogons have the same characteristics as the Class 1, but the limbs have smaller thicknesses (thinner) than the hinge.

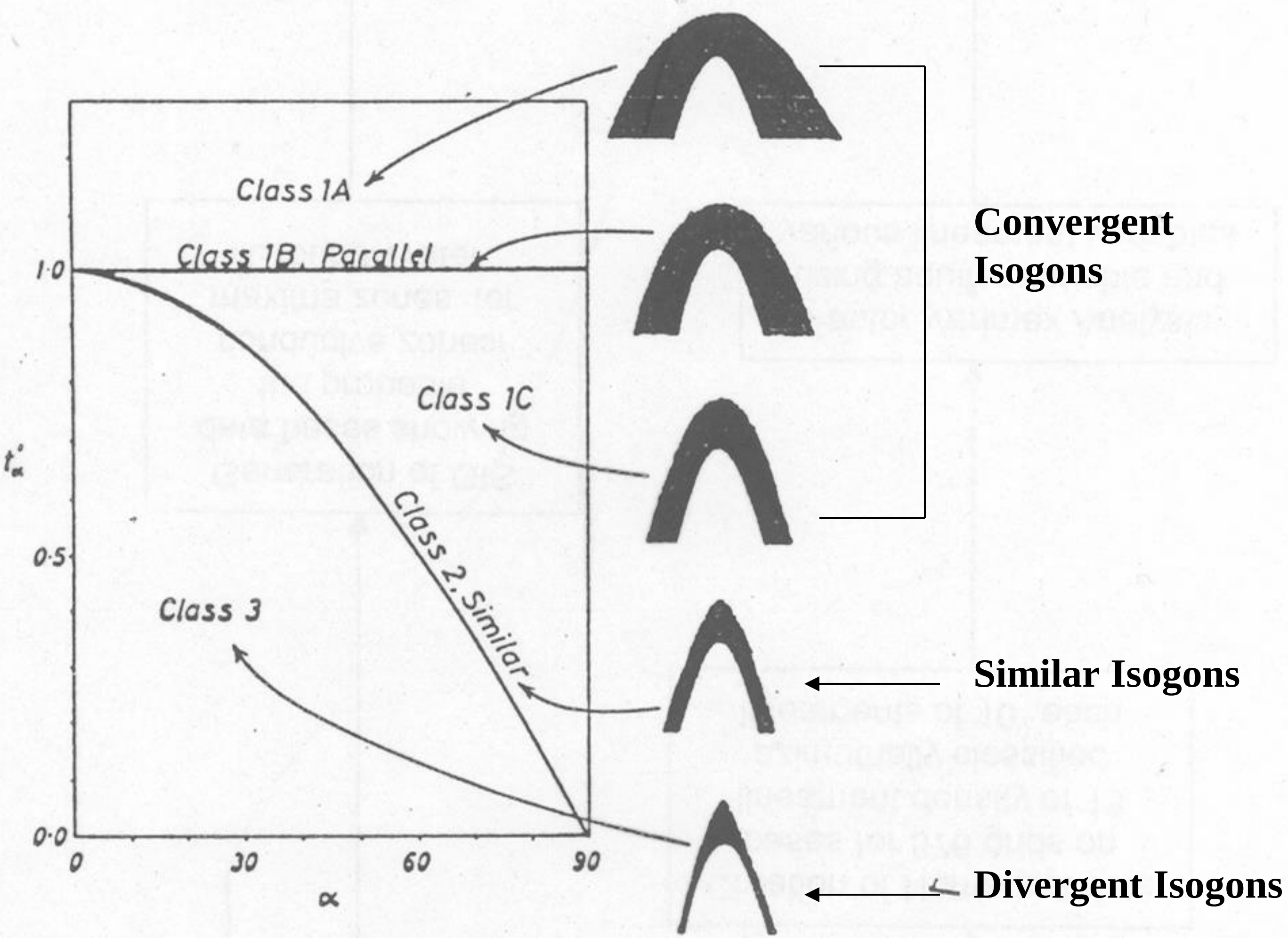


Class 2 – The dip isogons are parallel hence the inner and outer arc curvatures are the same. It is known as a “similar fold”.

Class 3 – The isogons converging toward the outer arc.

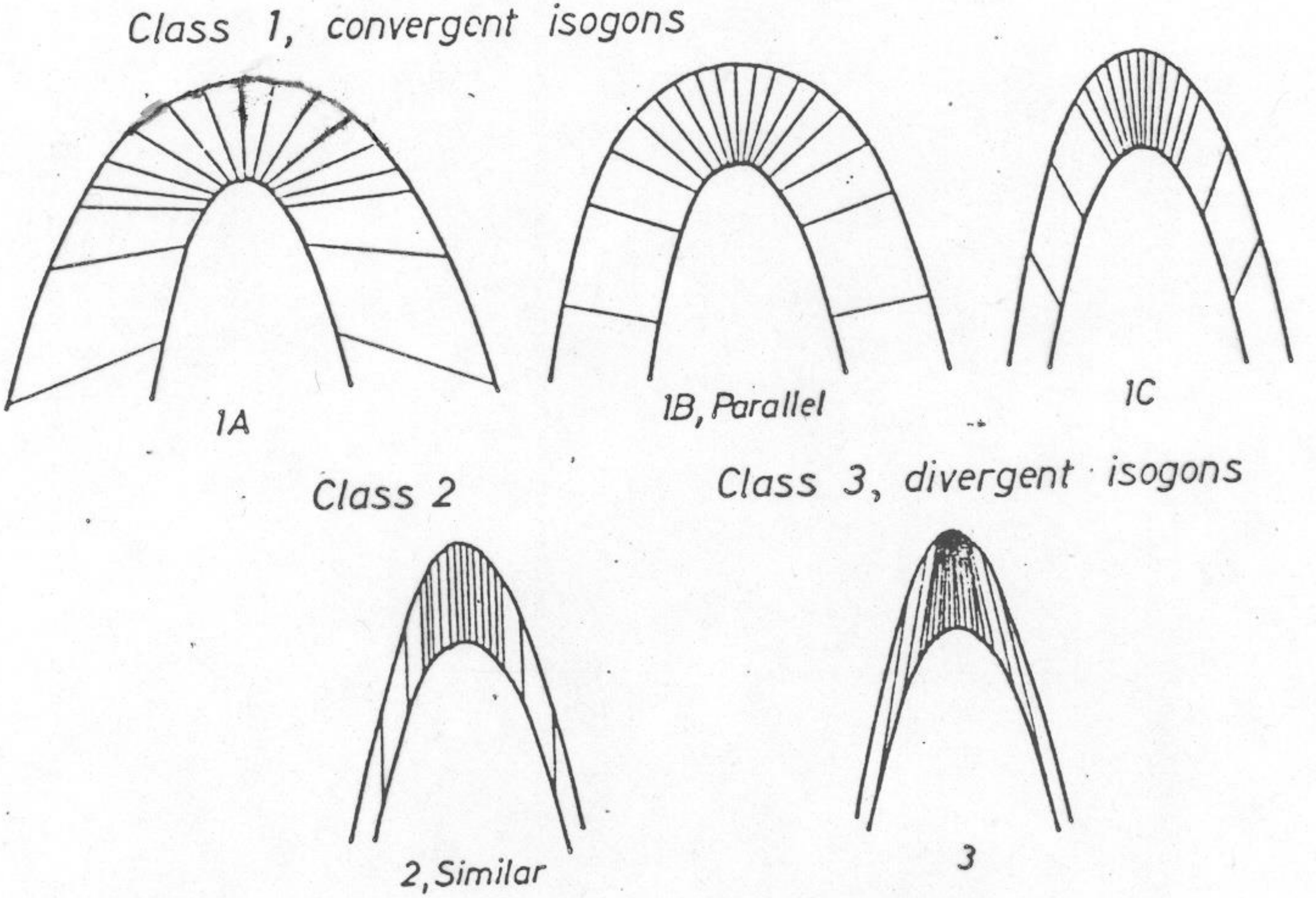
The most common classes of folds are Class 1B and Class 2 folds. However, depending on the area of interest and variations in respective layer properties, one class of folds may be more common than another.

RAMSAY’S FOLD CLASSIFICATION



Graphical plot of standardized orthogonal thickness t'_α plotted against angle of dip α and the in types of fold classes.

RAMSAY'S FOLD CLASSIFICATION



The dip isogon characteristics of the main fold lasses.

Convergent Isogons:-

Folds in which adjacent dip isogons converge when traced from the outer to the inner fold arc.

→ **Strongly Convergent (Class 1A)**
Isogons are rotated in the same rotation sense as the bed perpendiculars.

→ **Parallel Folds:- (Class 1B)**
Where isogons are perpendicular to the layering.

→ **Weakly Convergent:- (Class 1C)**
Where isogons are rotated in the opposite rotation sense to the bed perpendiculars.

Similar Folds (Class 2)

Folds with parallel dip isogons implying that the bounding surfaces of the folds are geometrically identical.

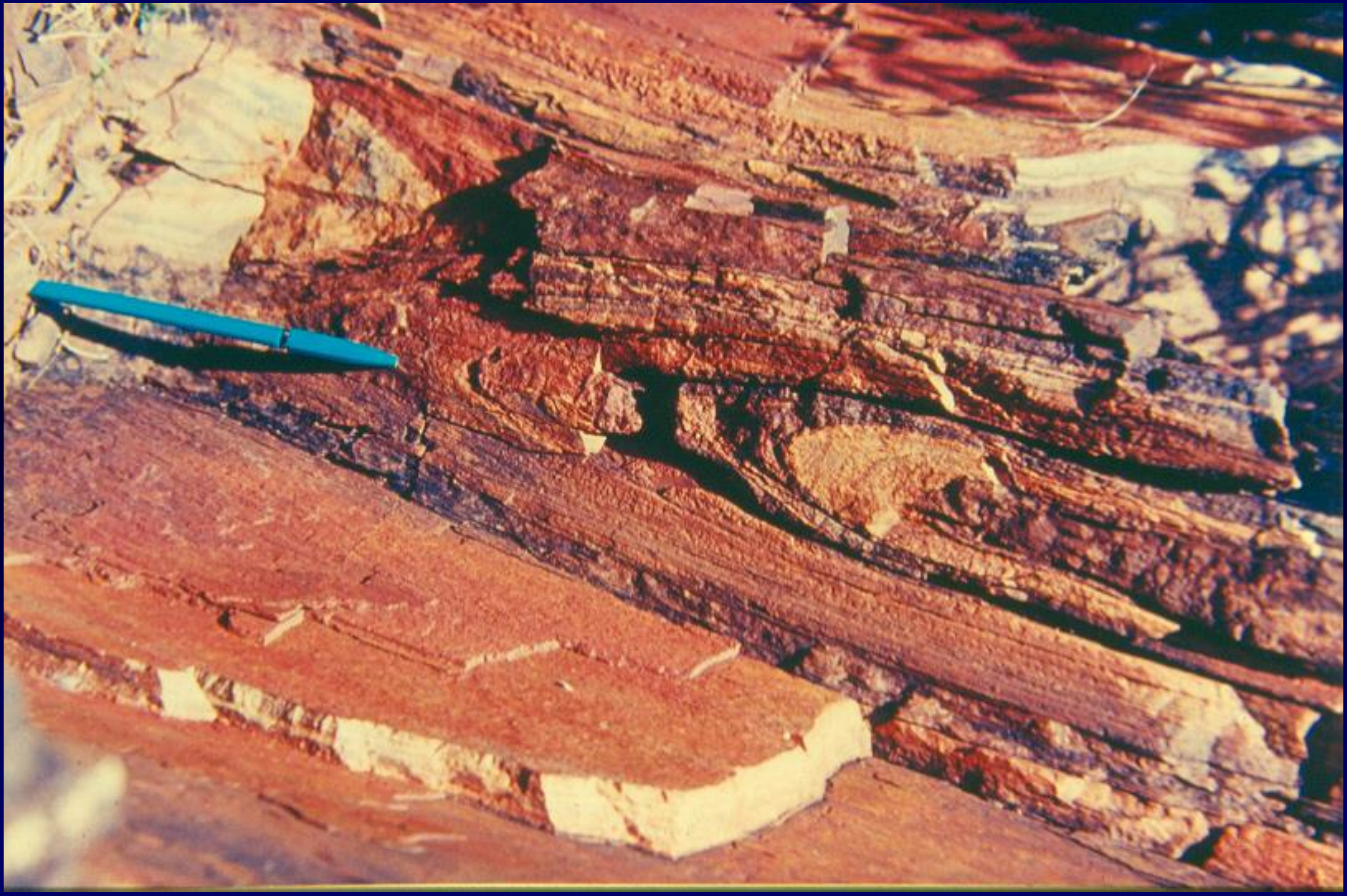
Divergent Isogons Folds (Class 3)

Folds in which adjacent dip isogons diverge when traced from outer to inner fold arc.

Flattened Folds:-

Folds of any class which have undergone a homogeneous strain over the whole field of the fold.

Field photographs




0 1 2 3 4 5cm