Lecture FIVE
Metamorphic Textures

Metamorphic fabric and textures

⇨ Again, **Identification of a given metamorphic rock depend on:**

1- Mineral composition 2- Texture

⇨**Metamorphic rocks undergo deformation during their crystallization as a result of pressure influence.**

⇨ **Orogeny is described to long-term mountain-building e.g: Pan African Orogeny. The orogeny may:**

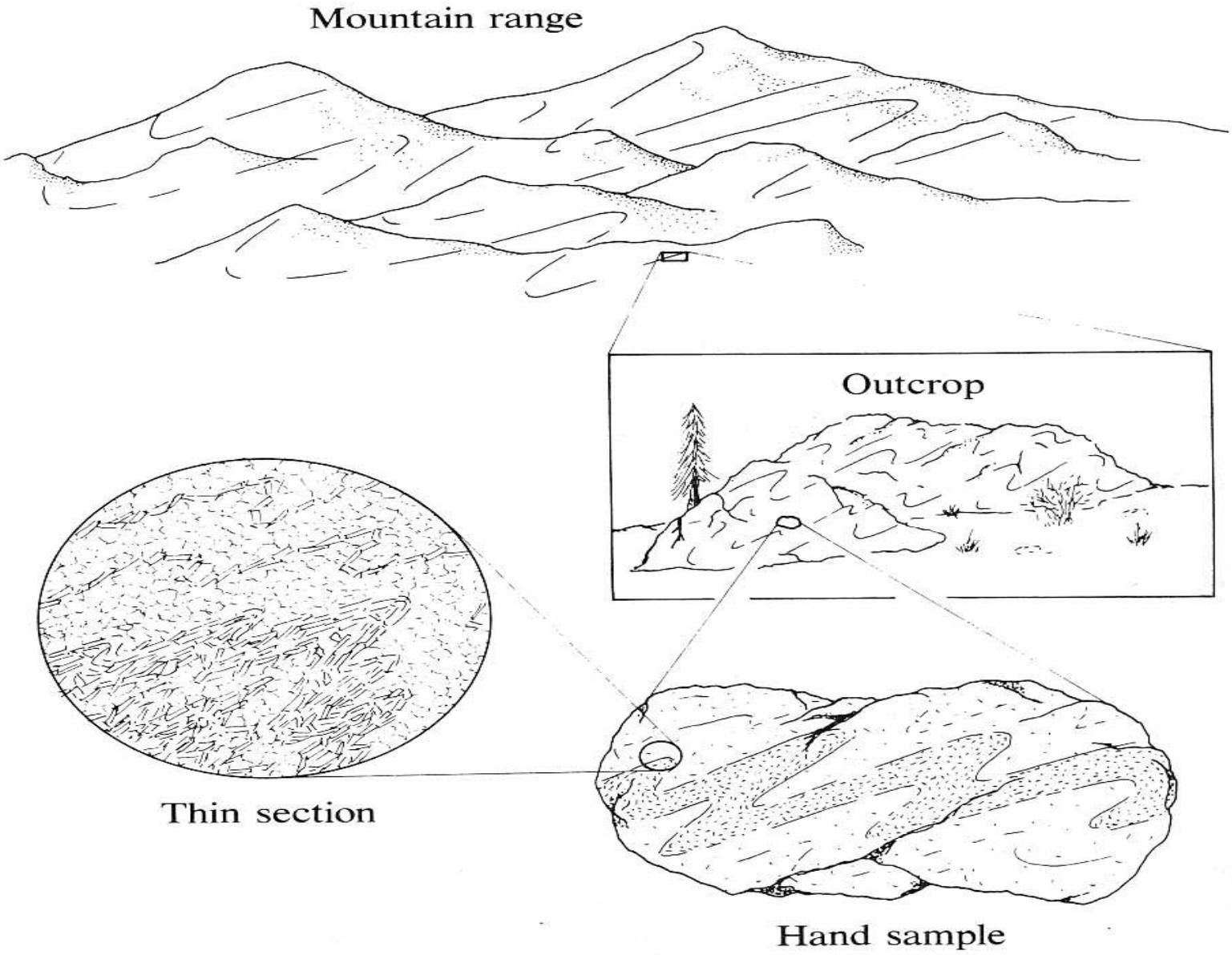
comprise several Tectonic Events

have several Deformational Phases

have an accompanying Metamorphic Cycles with one or more Reaction Events

⇨ **Tectonite is a deformed rock with a texture that records the deformation**

Metamorphic fabric and textures



Metamorphic fabric and textures

⇨ **Texture (grain-grain relationships) refer to:**

1) shape and size of the individual grains

2) orientation of the individual grains

3) arrangements of the mineral grains in metamorphic rock

⇨**structure** used for large features

⇨**Fabric refer to** the complete spatial and geometric configuration of textural and structural elements

⇨**Importance of textures in metamorphic rocks to:**

1) decipher the order of crystallization of minerals,

2) sequence of events involved in forming the metamorphic rocks,

3) Intensity of P-T condition during metamorphism, and

4) used to nominate the metamorphic rocks

A- Grain size

⇨ **Remember that, the grain size of a given metamorphic rocks is function of:**

⇨ **Intensity of P-T conditions**

- **Very low conditions ➔ very low grain size texture**
- **Very high conditions ➔ very coarse-grained texture**

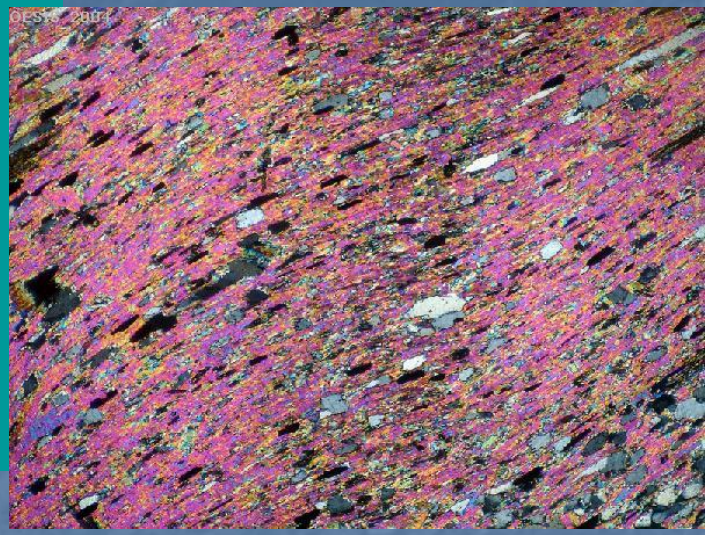
⇨ **rate of nucleation (high rate donate finer grain sizes)**

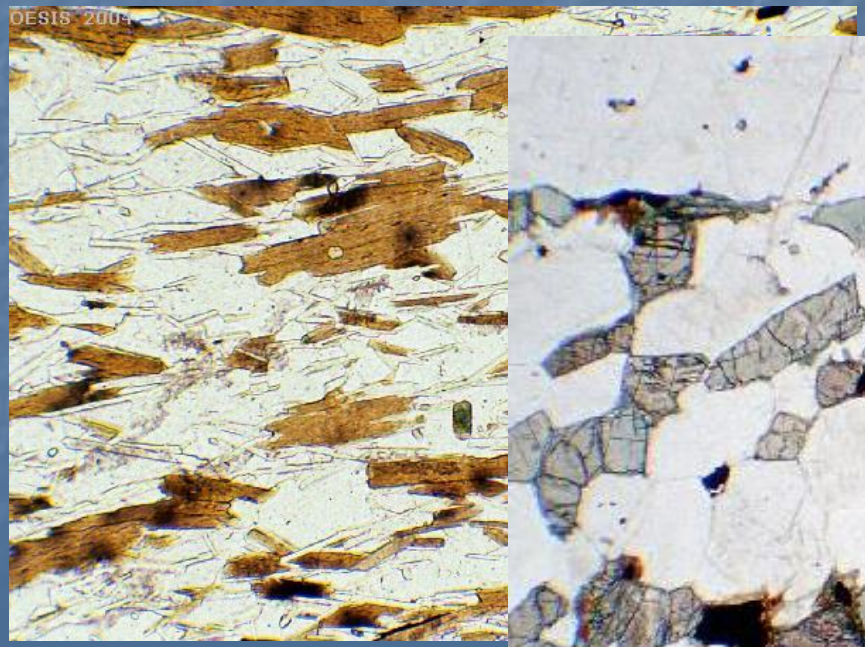
⇨ **Subsequent time internal (shorter time donate more finer grain size)**

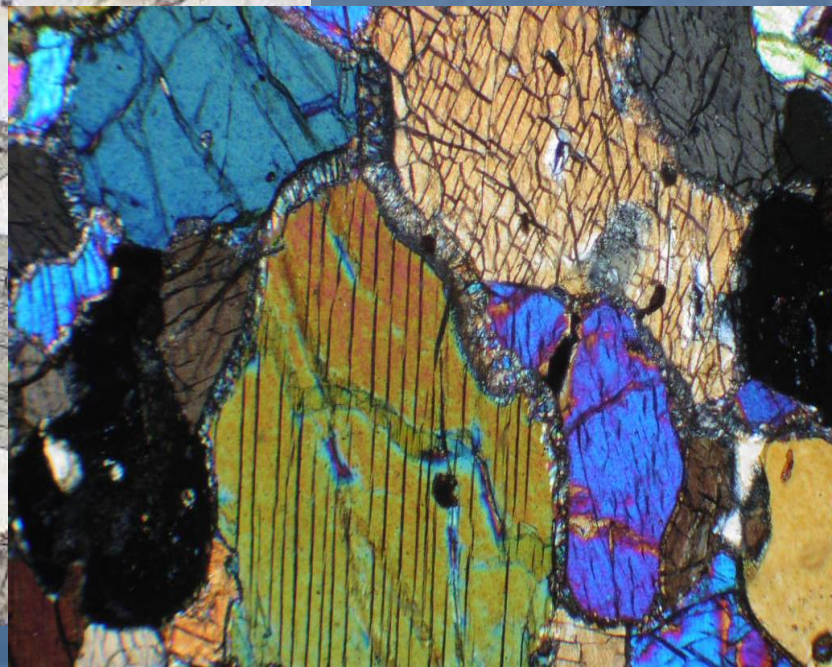
A- Grain size Categories

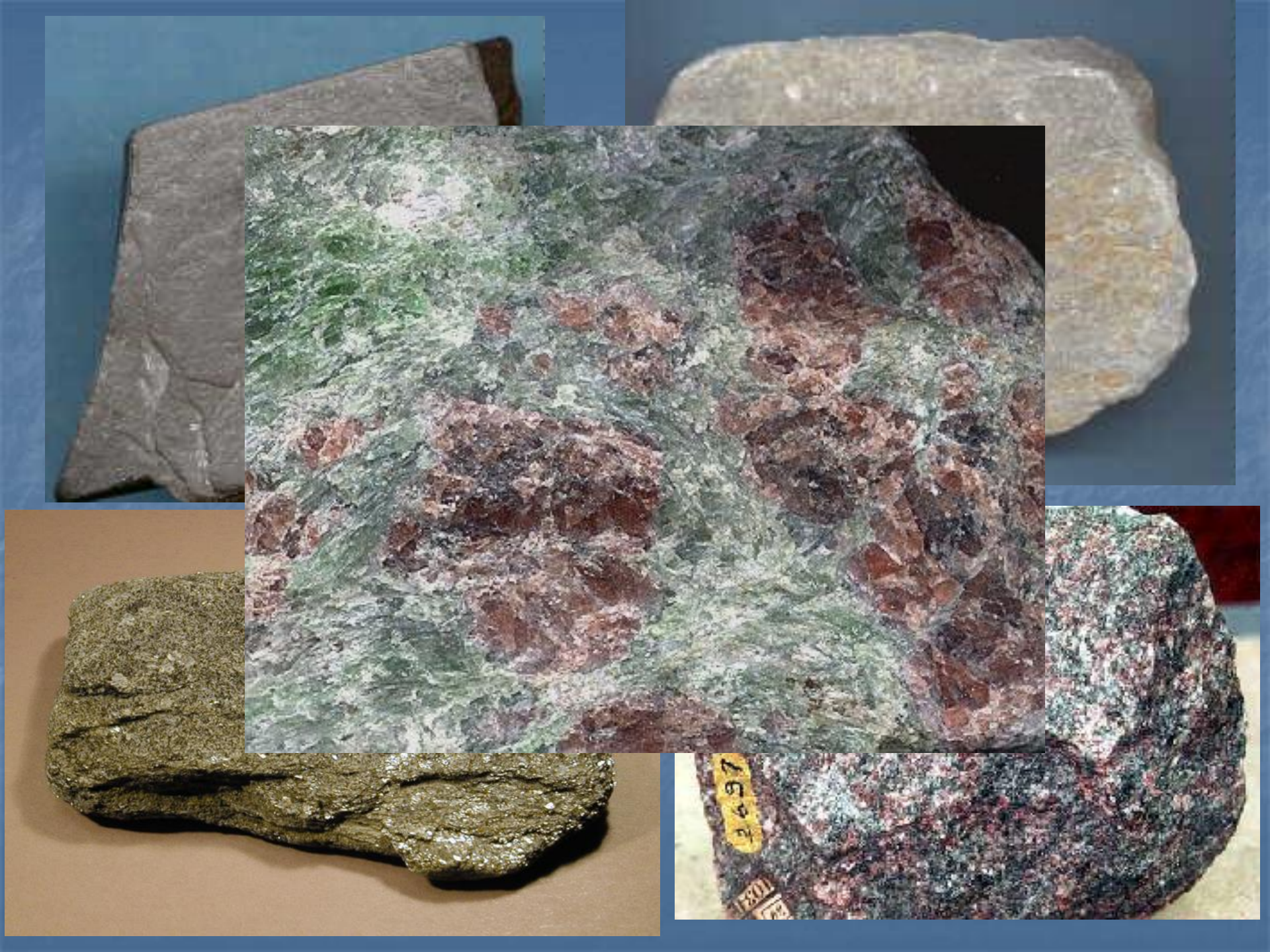
⇨ **Metamorphic rocks have different sizes:**

- Fine-grained (<0.75 mm)
- Medium grained (0.75-1.0 mm)
- Coarse grained (1-2 mm)
- Very coarse grained (>2 mm)









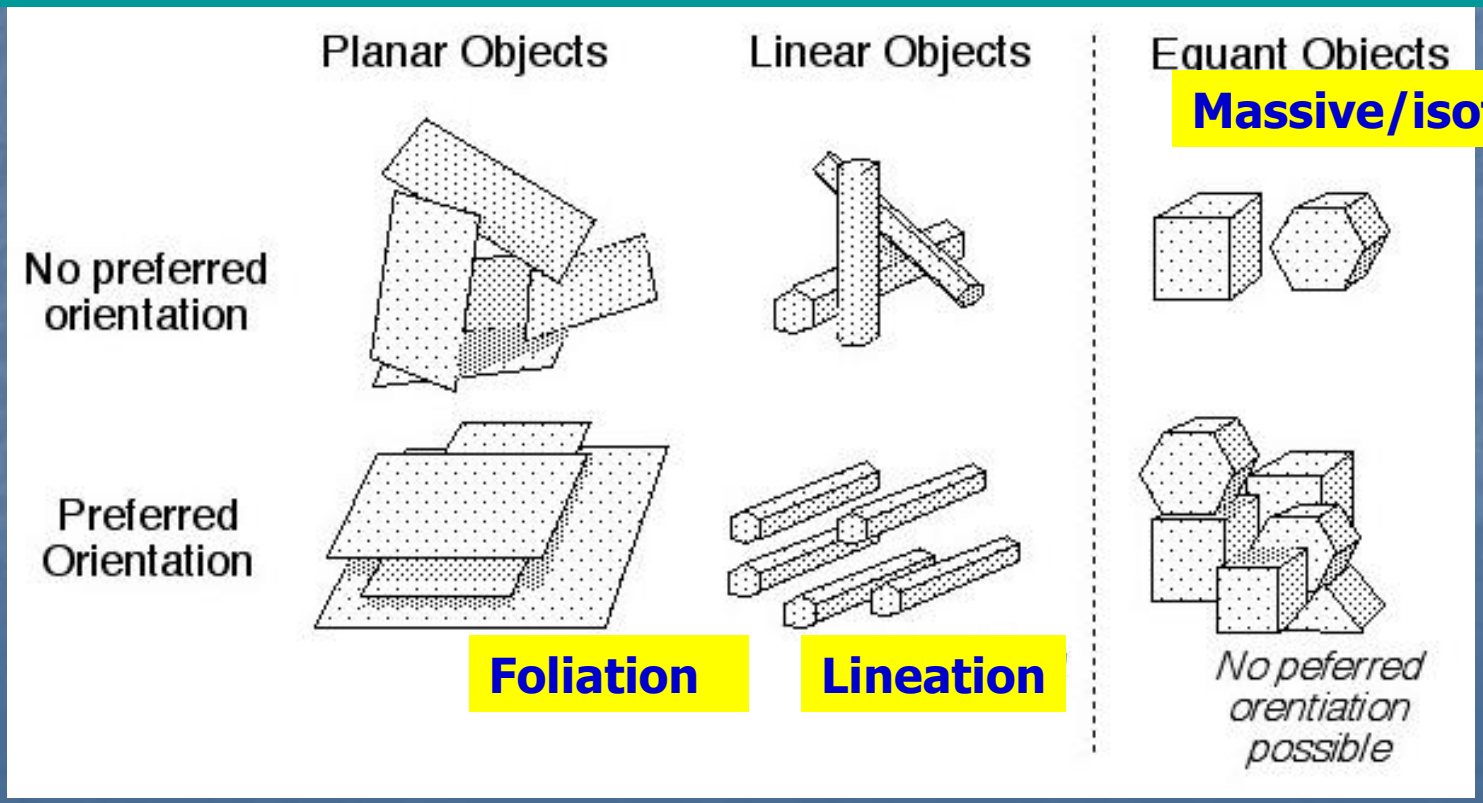
B- Textures donating planar or linear elements:

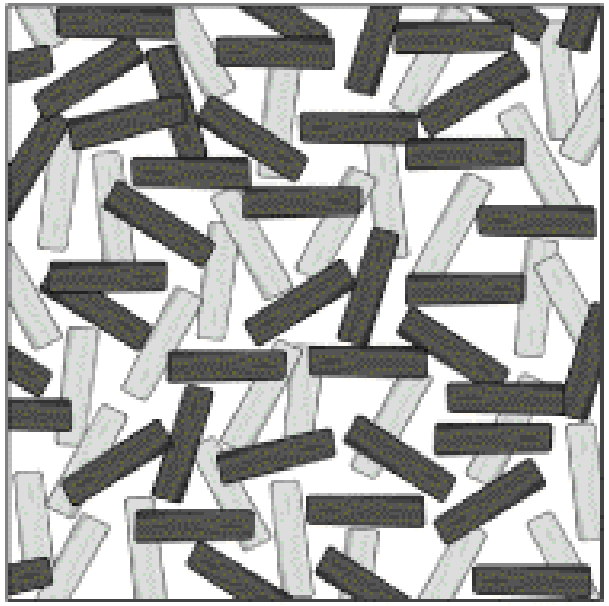
⇨ These textures described in metamorphic rocks that composed of unequal mineral assemblage with preferred orientation. They include:

Foliation- planar textural elements

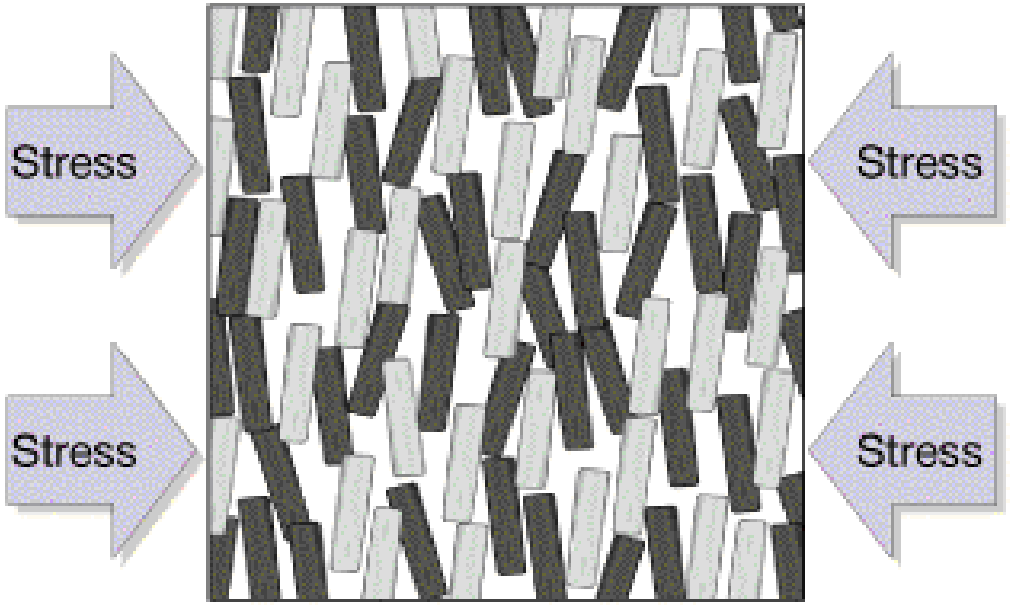
Lineation- linear textural elements

- Rocks without preferred orientation ➔ massive or isotropic





Before metamorphism

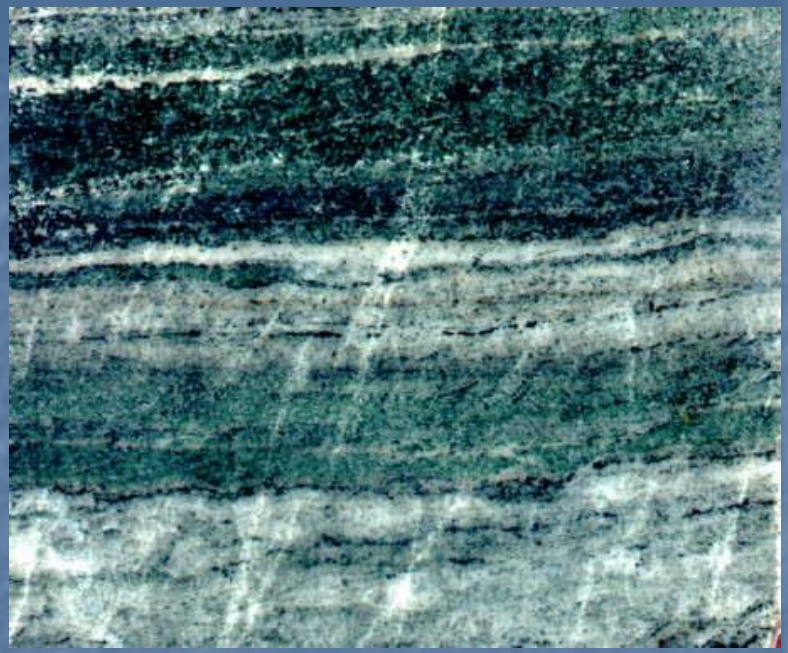


After metamorphism

1- Foliation Types

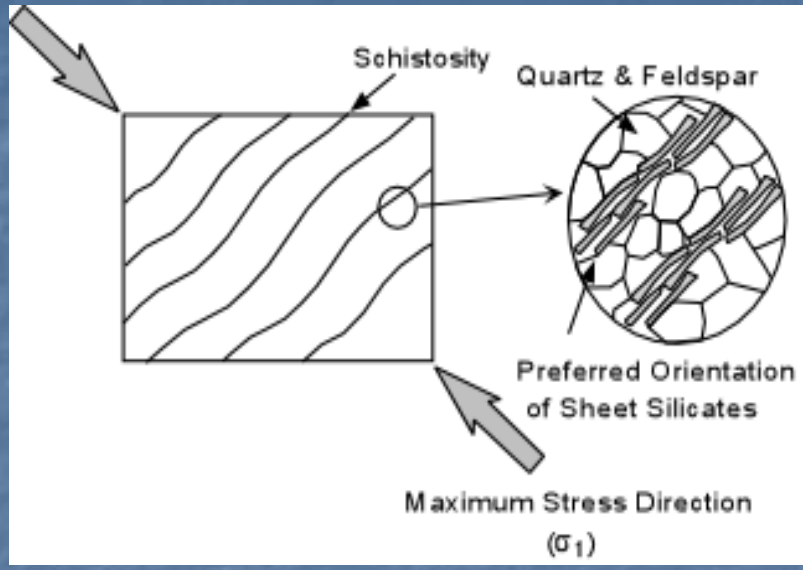
⇨**Foliation:** defined by any layering in a metamorphic rock as a result of parallel arrangement or distribution of planar elements that include:

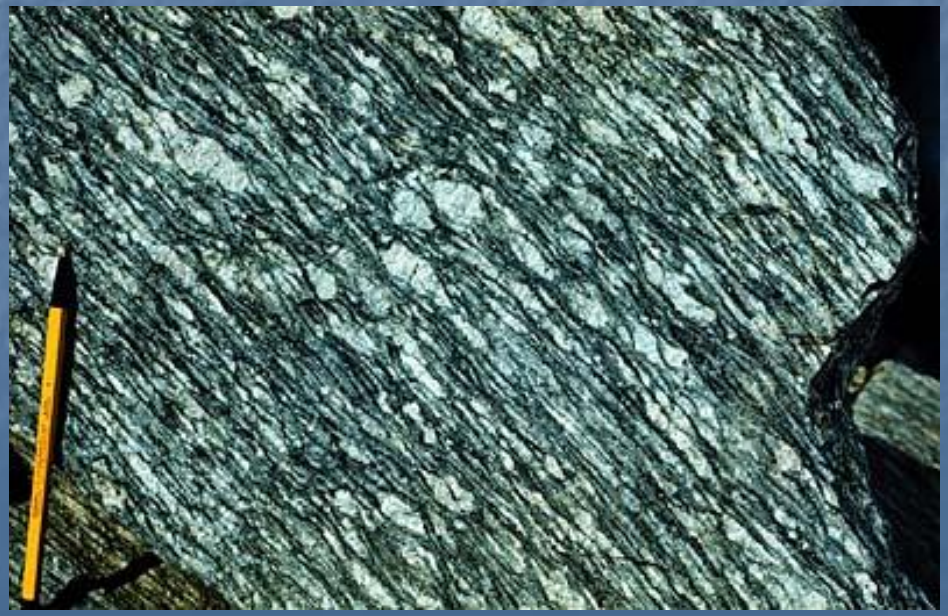
I- **Compositional layering:** defined by alternating layers composed of different mineral composition and/or different grain sizes. Easily recognized by differences in color of layers.

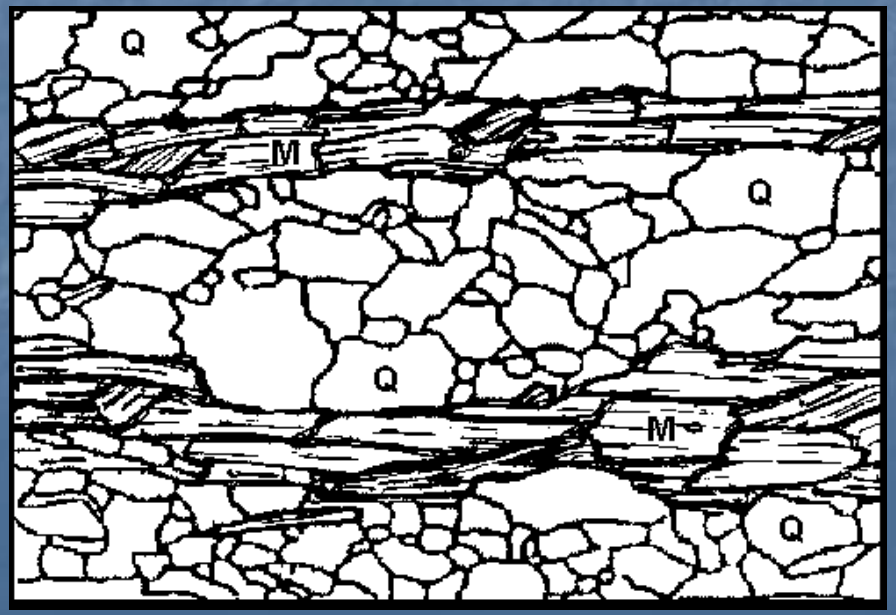


1- Foliation (Cont.)

II- Gneissosity: defined by compositional layering of equent crystals (e.g. quartz, feldspars) alternate with platy or elongate mineral layes (e.g. micas). It is usually coarse-grained size.



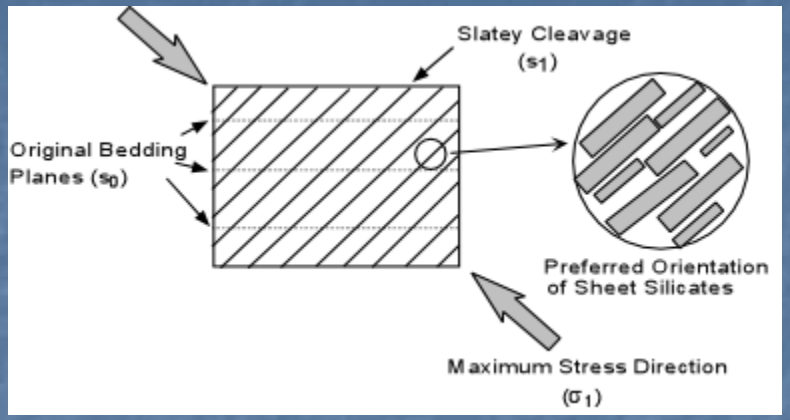




1- Foliation (Cont.)

III- Schistosity: defined by alignment of play (mica, chlorite) or inequent (amphiboles, quarz) minerals

- Minerals defining schistosity are said to posses preferred orientation and usually are medium-grained.

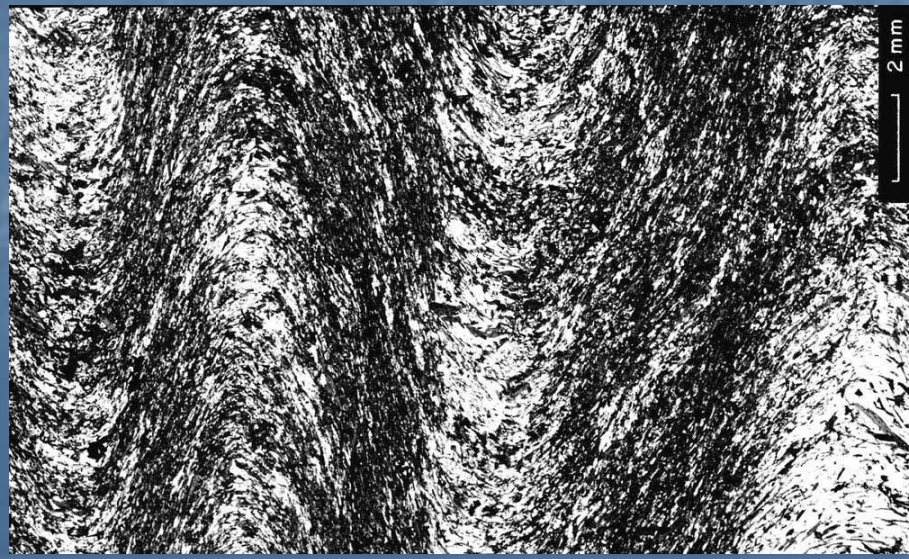


1- Foliation (Cont.)

IV- **Cleavage**: Schistosity surface along which the rock may break (cleave). It include:

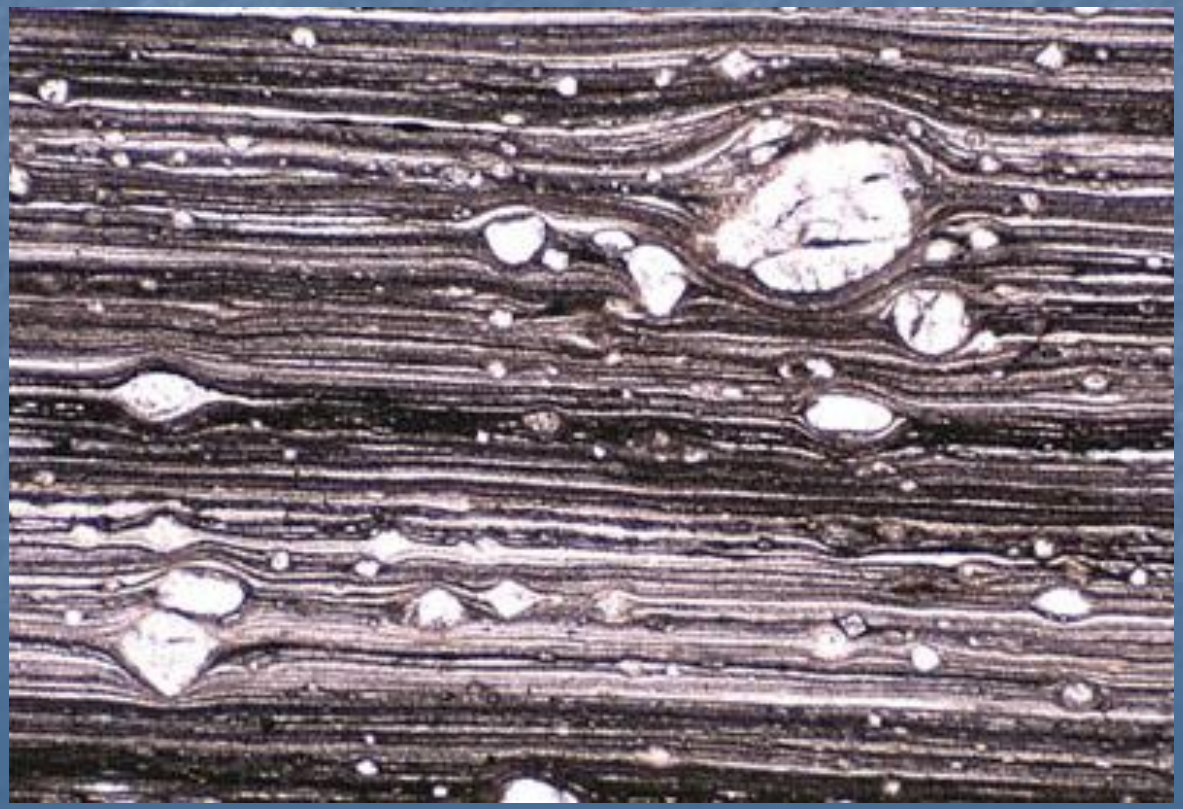
a- **Slaty cleavage** in very fine-grained mica and/or chlorite in slate and phyllite,

b- **Crenulation cleavage**: alignments with cm- to mm-scale periodic folding



1- Foliation (Cont.)

V- Mylonite layering: defined by layers of highly strained rock with elongated grains due to grain size reduction and dynamic recrystalization during shearing



2- Lineation

Lineation: parallelism or alignment of linear elements in the rock

Types of lineations:

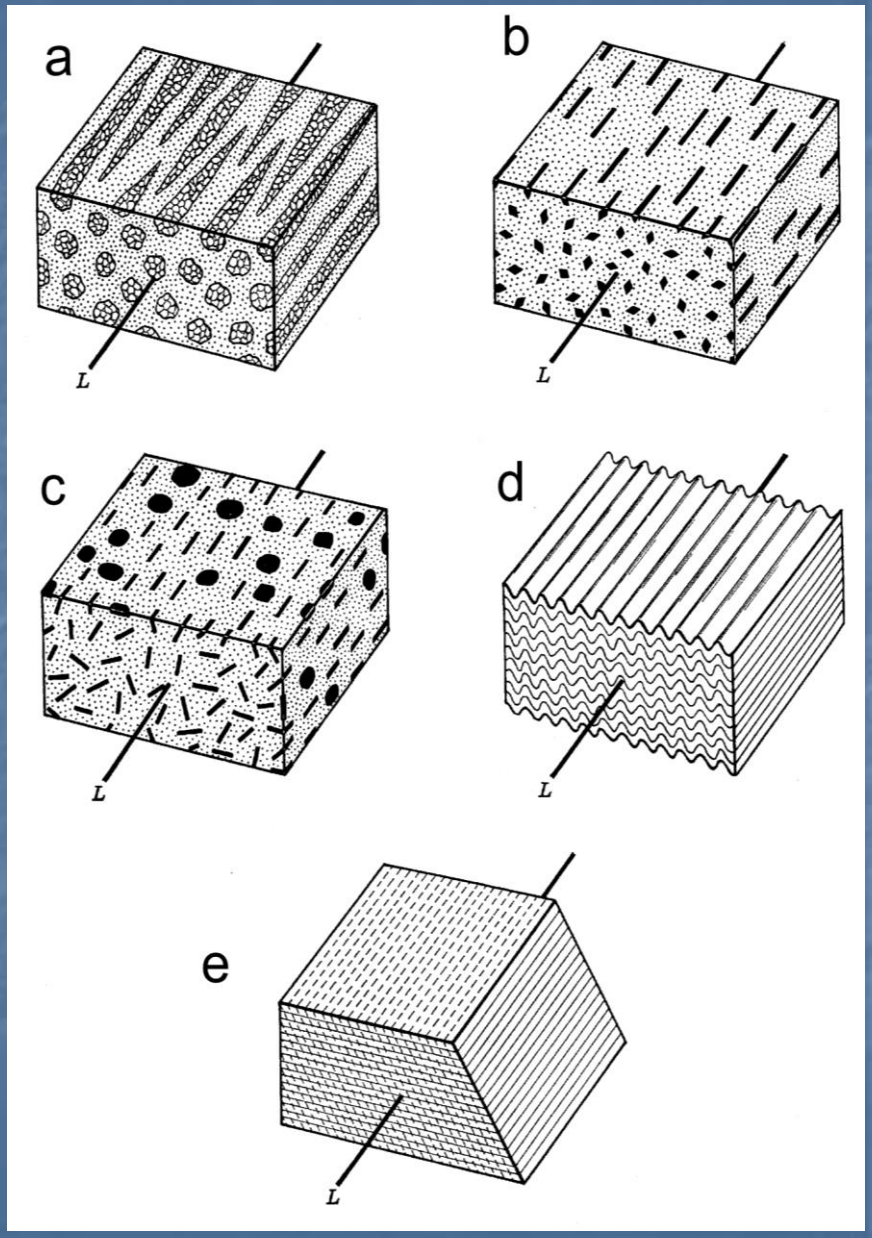
a. Preferred orientation of elongated mineral aggregates (e.g. quartz pebbles in metaconglomerates)

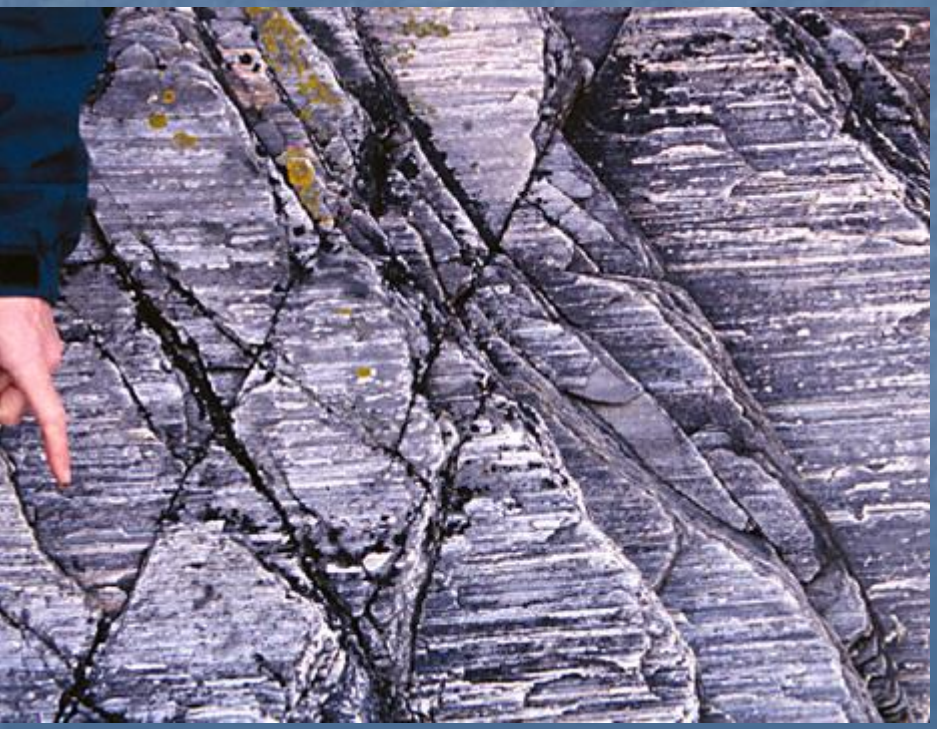
b. Preferred orientation of elongate minerals (feldspars & Hb)

c. Lineation defined by platy minerals

d. Fold axes (especially of crenulations)

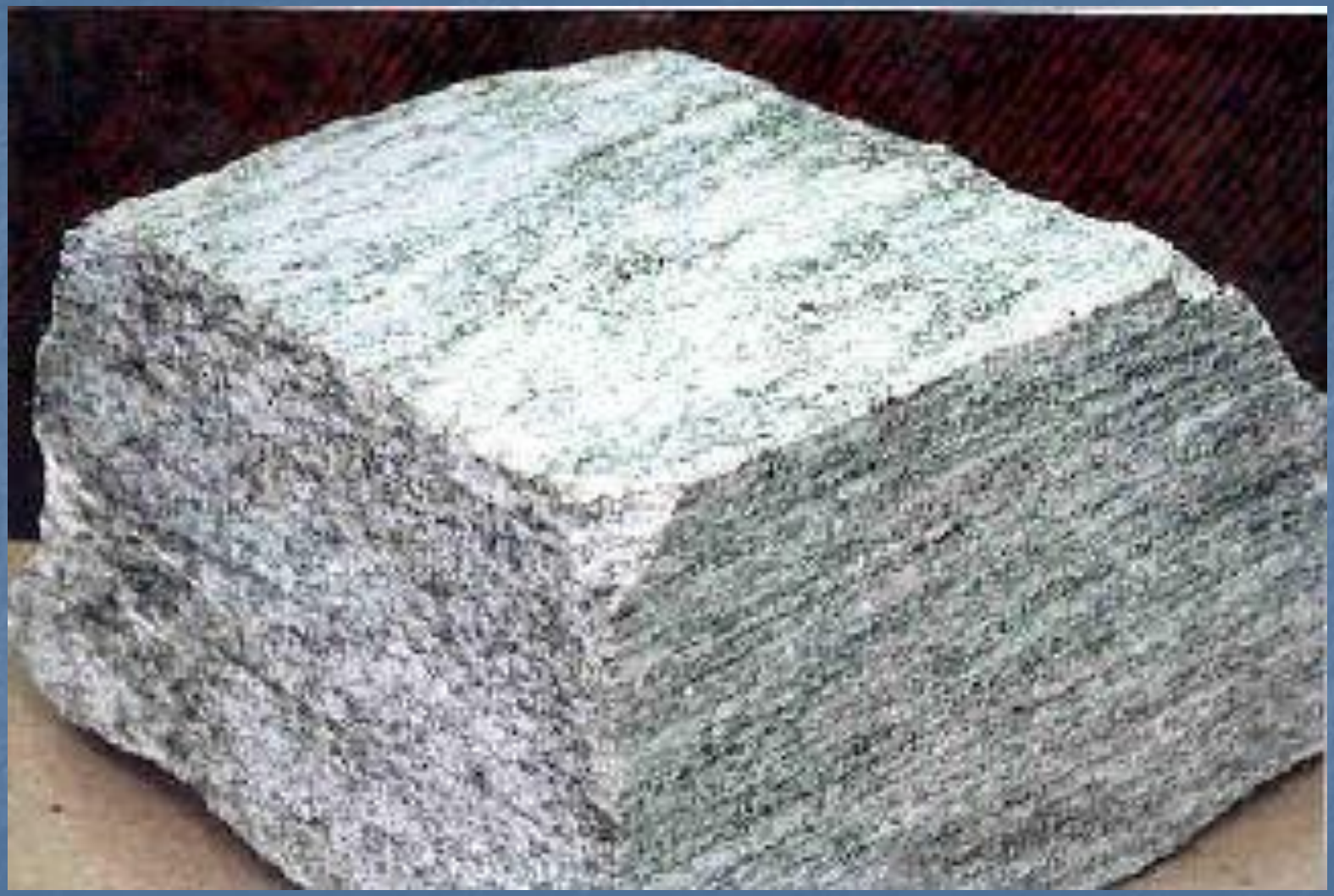
e. Intersecting planar elements.





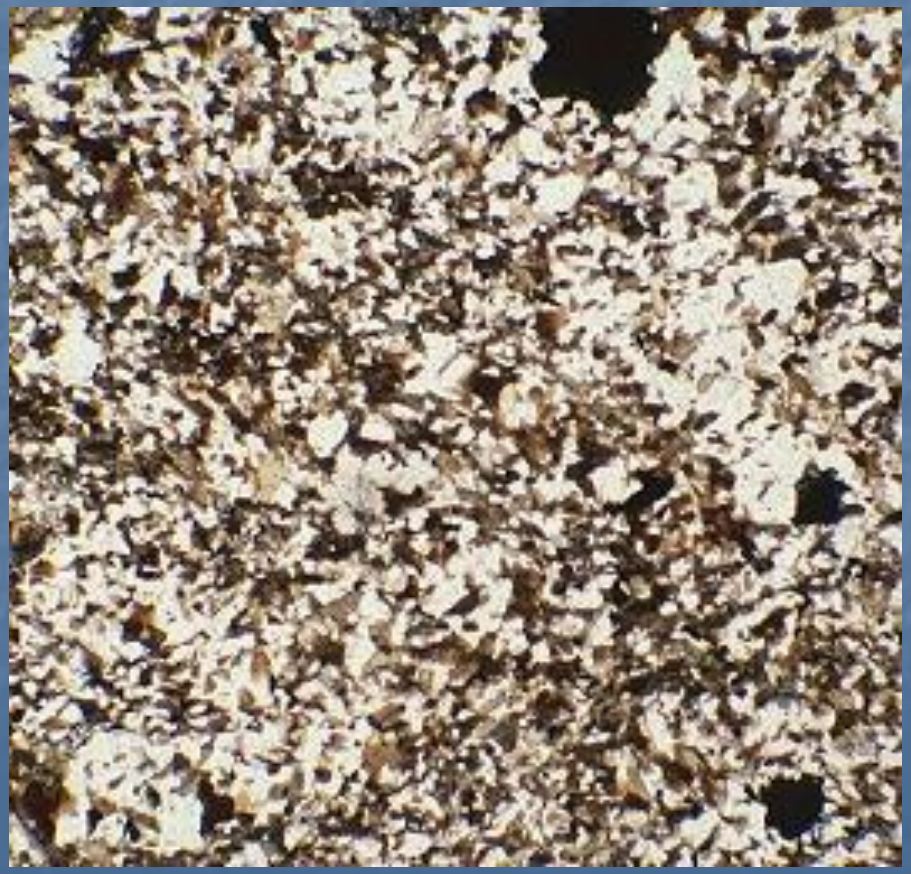

Staurolite
Pamela Gore, 1996

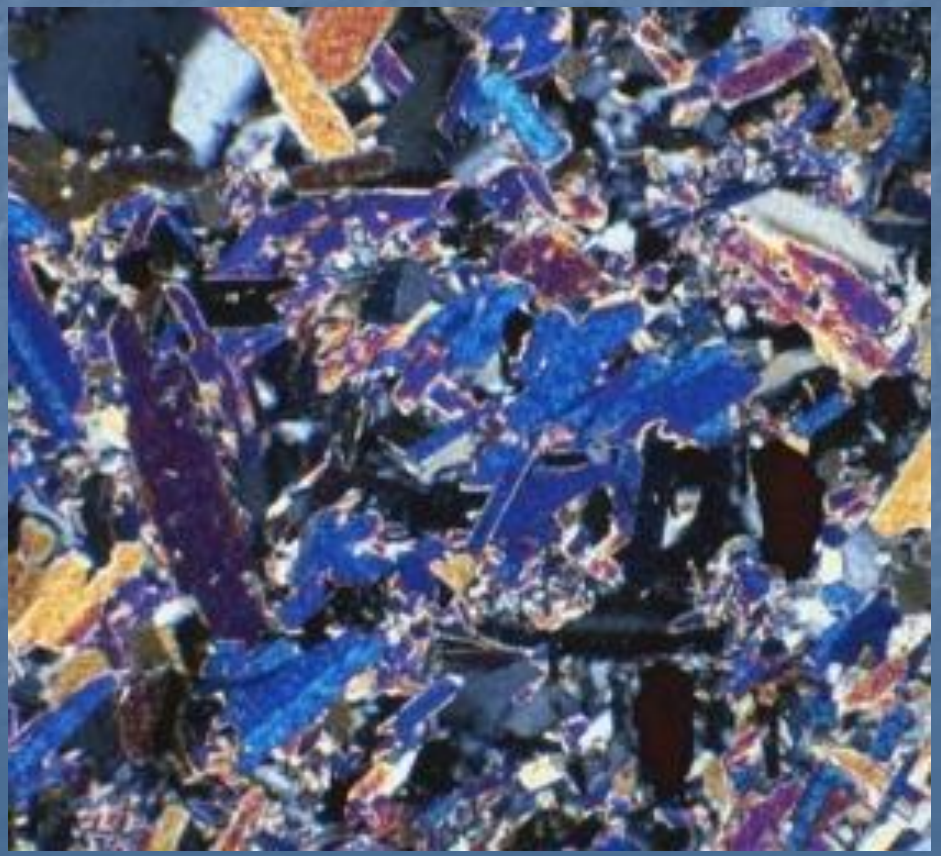
Foliation and Lineation



C- Textures donating lack of preferred orientation or equigranular grains:

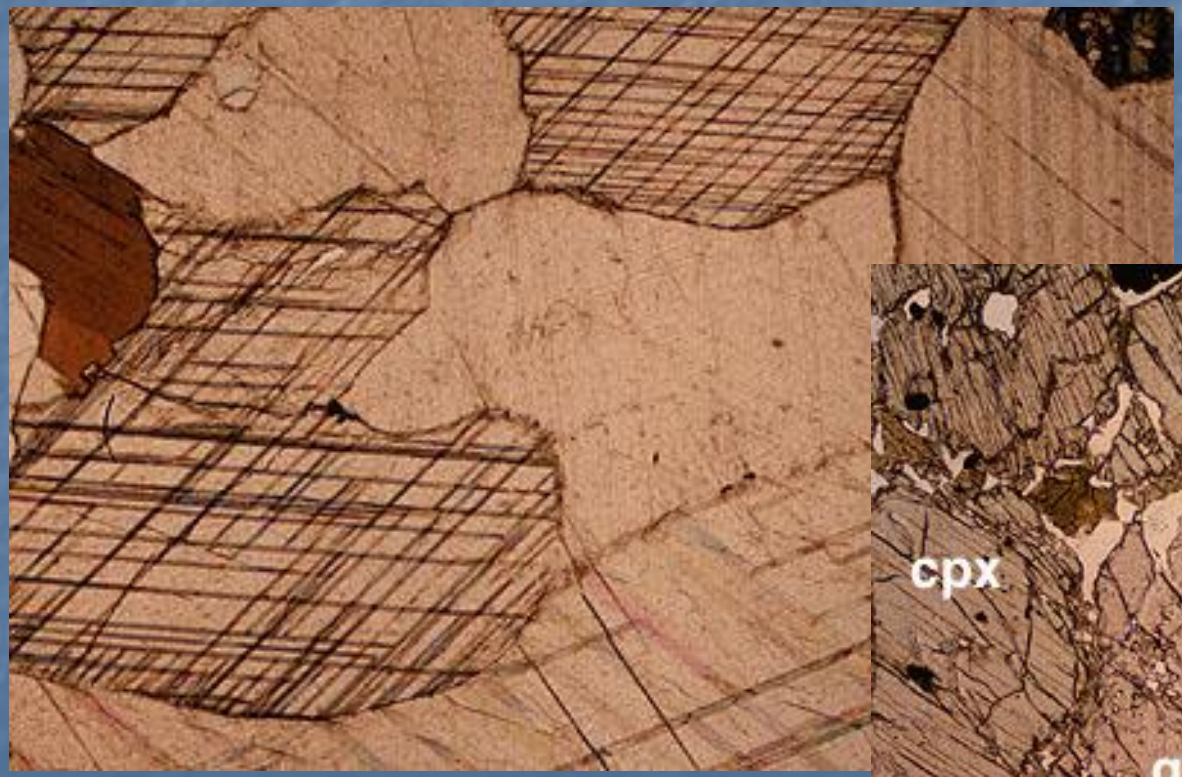
- **Hornfelsic textures**: random orientation of fine-grained rocks, due to lack of stresses, **granofelsic texture** for the medium to coarse grained rock

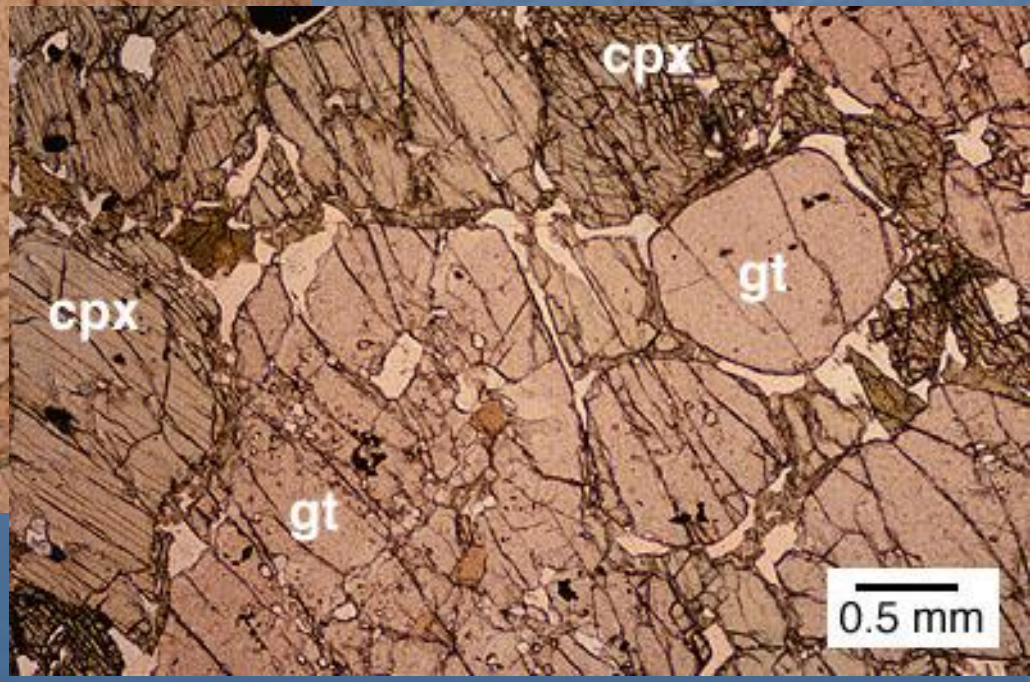




C- Textures donating lake of preferred orientation or equigranular grains (Cont.)

- **Granoblastic texture**: A mosic of fine to coarse grained anhedral grains, such as marble and **granulites**





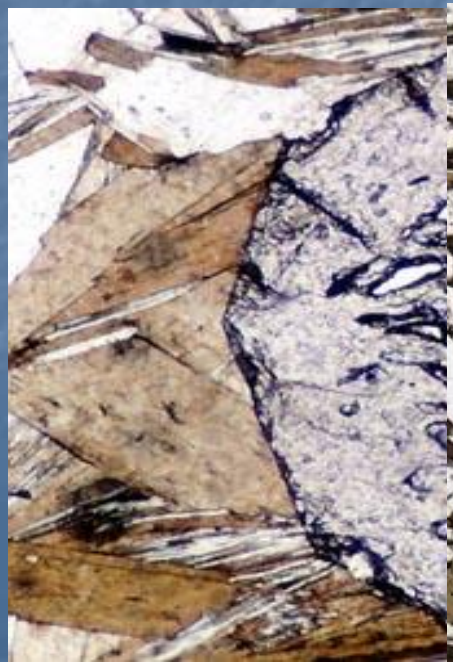
D- Textures donating Large grains within the rock:

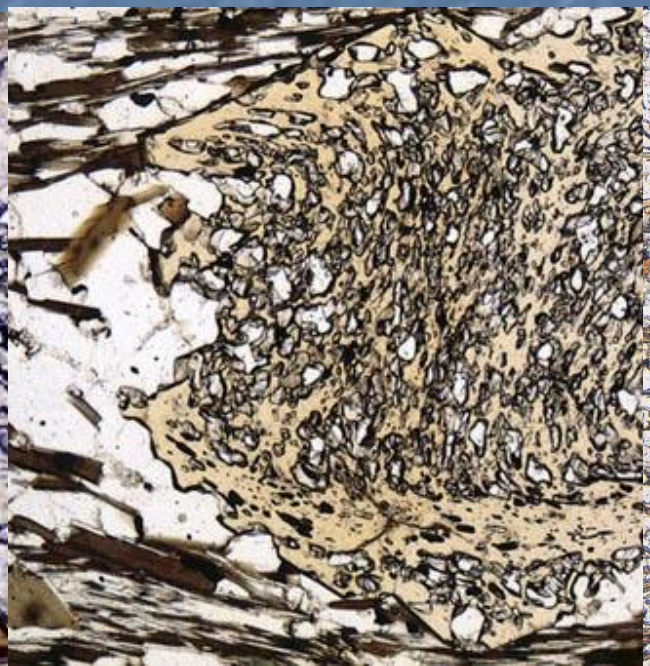
-**Porphyroblastic texture**: A relatively large crystal (e.g. garnet, staurolite) in smaller fine grained matrix. It could be

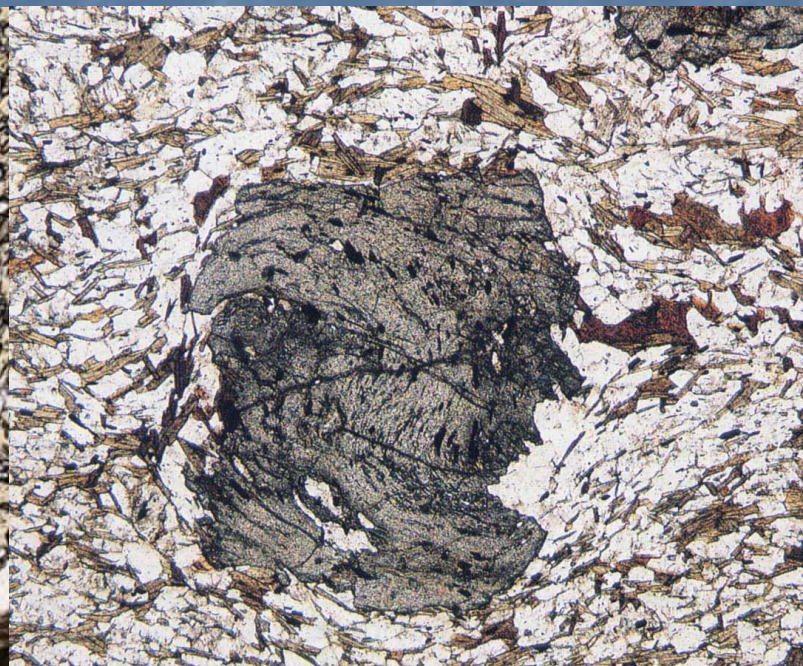
-Idioblast (Euhedral),

-subidioblast (subhedral) or,

- xenoblast (anedral).





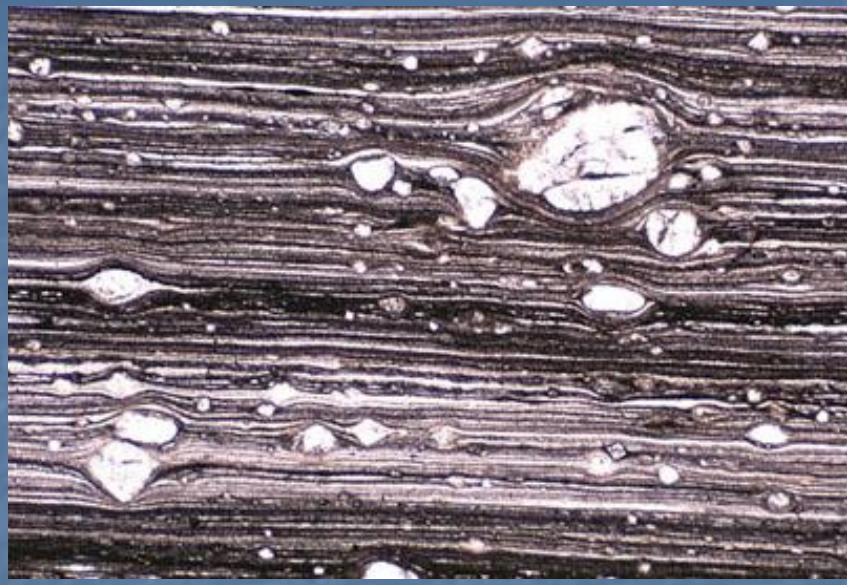


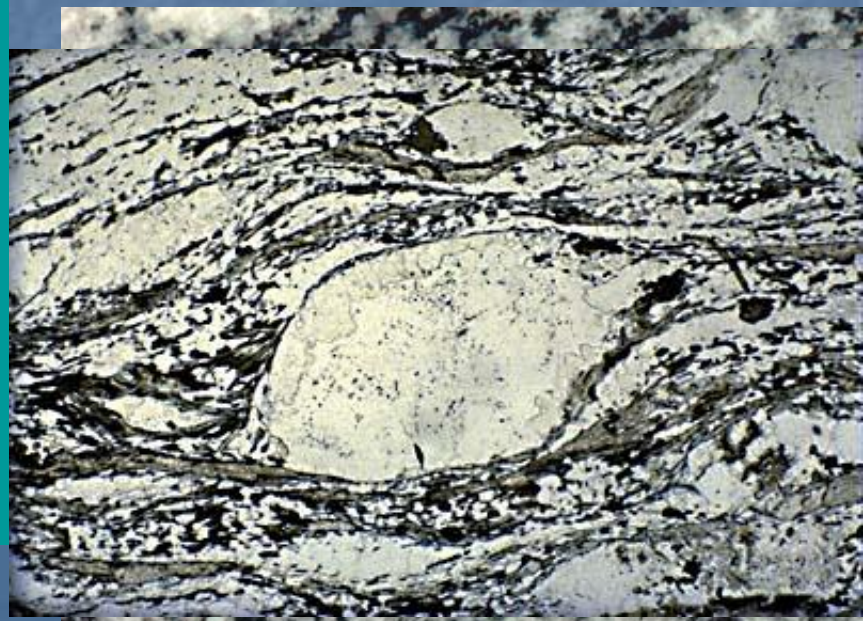
D- Textures donating Large grains within the rock:

-**Porphroclastic texture:** A large strained or bracken grain in fine grained matrix

-**Blastoporphyritic texture:** A relict of porphyritic volcanic texture in metamorphic rocks

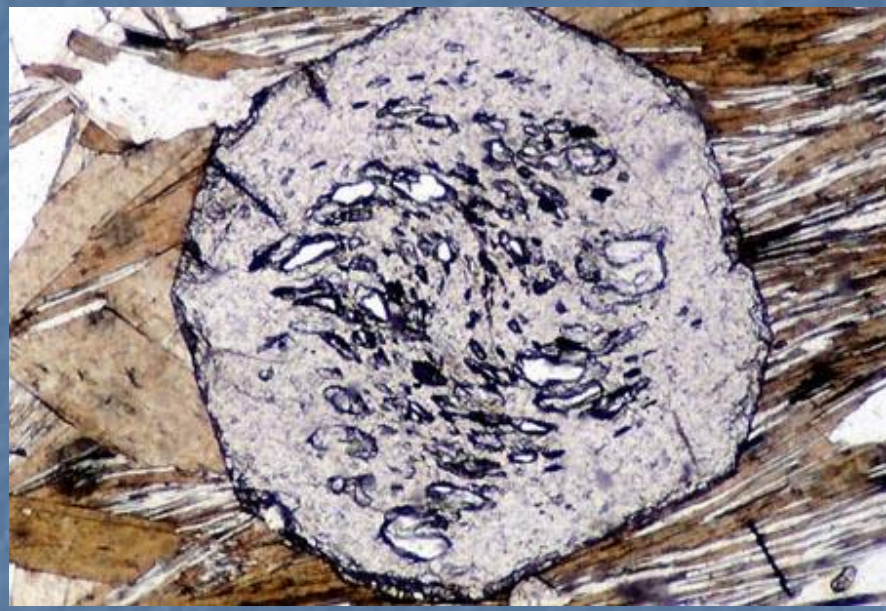
- Augen texture: Porphyroblast of feldspars with eye-shape cross section in fine grained gneissic matrix





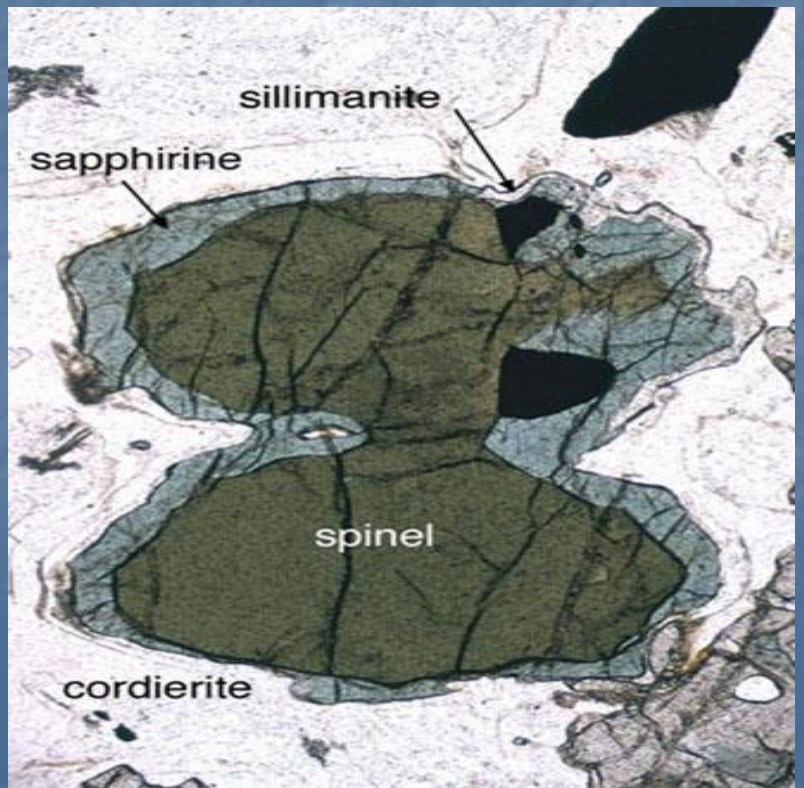
E- Textures donating inclusion within or rim on a porphyroblasts:

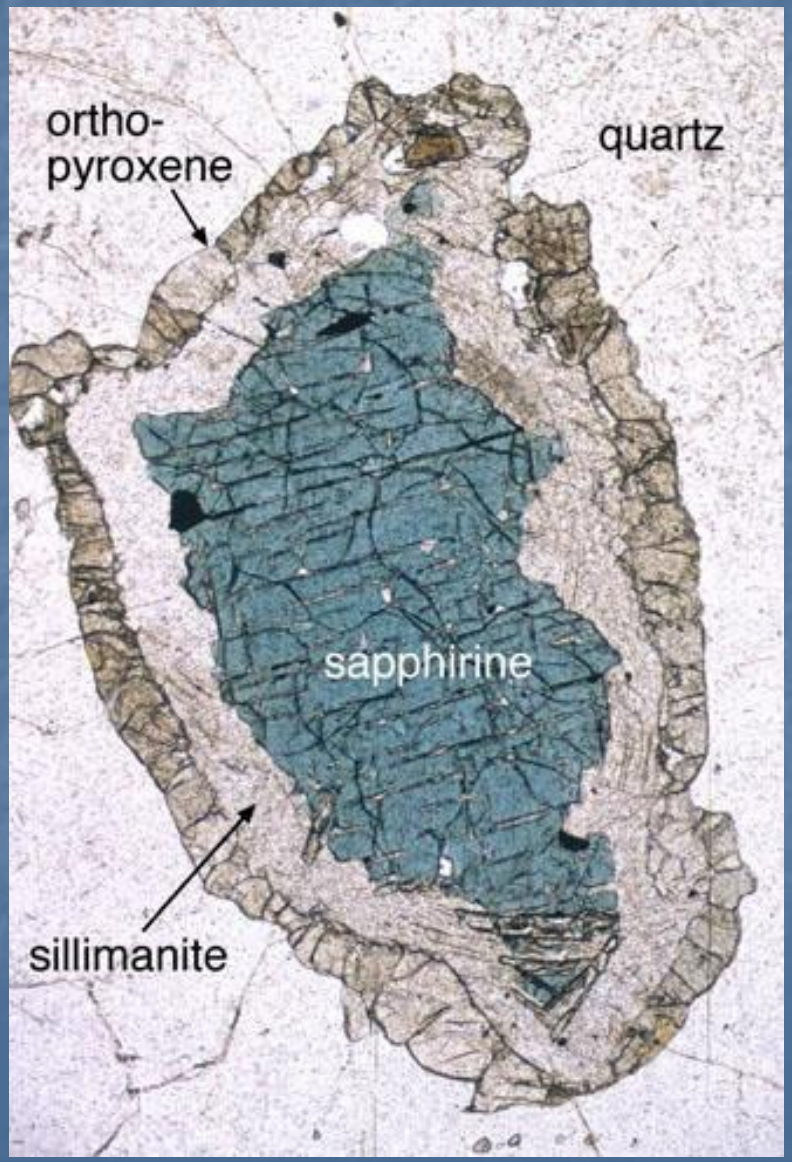
- **Poikiloblastic or sieve texture**: porphyroblast containing numerous inclusions of one or more fine grains.



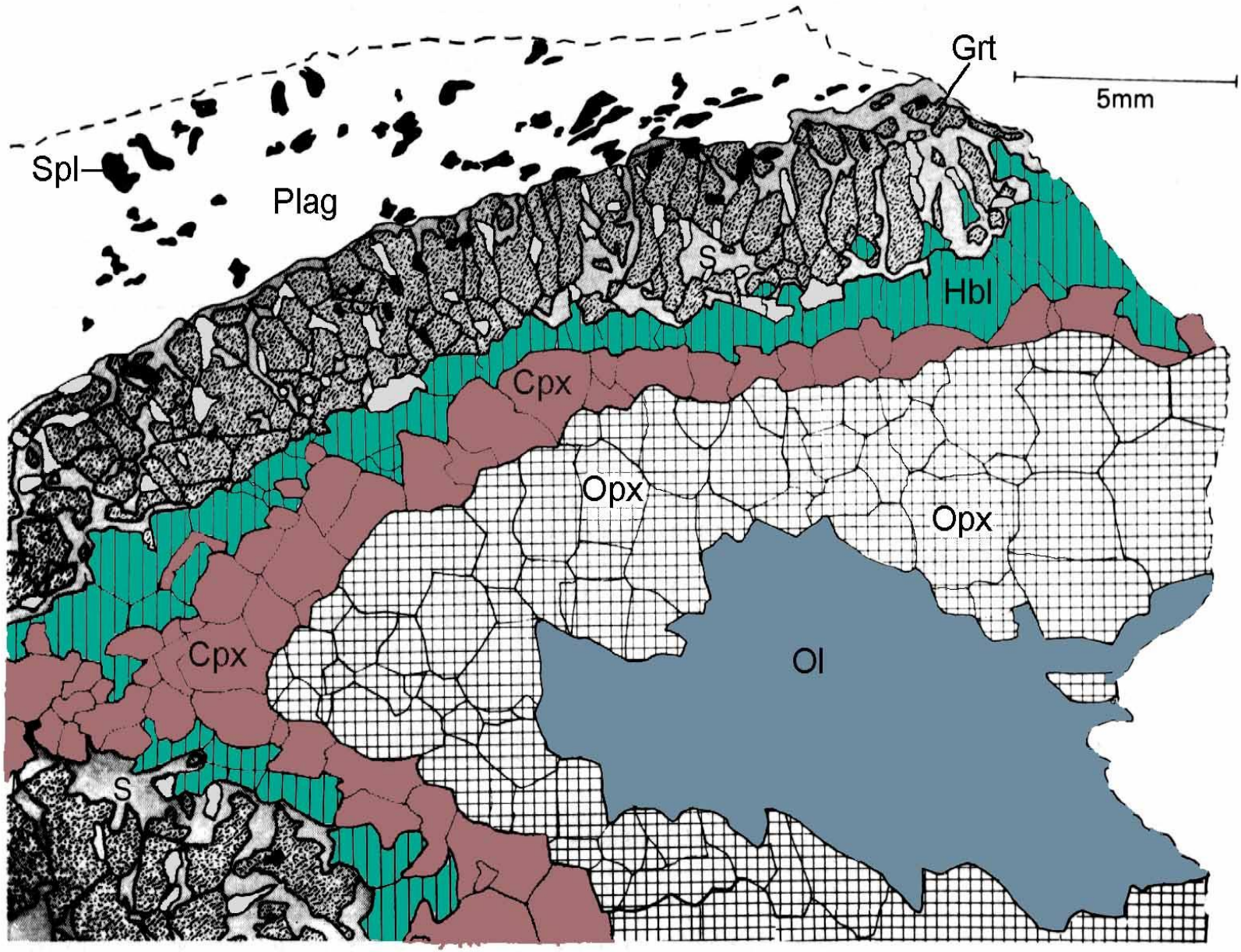
E- Textures donating inclusion within or rim on a porphyroblast:

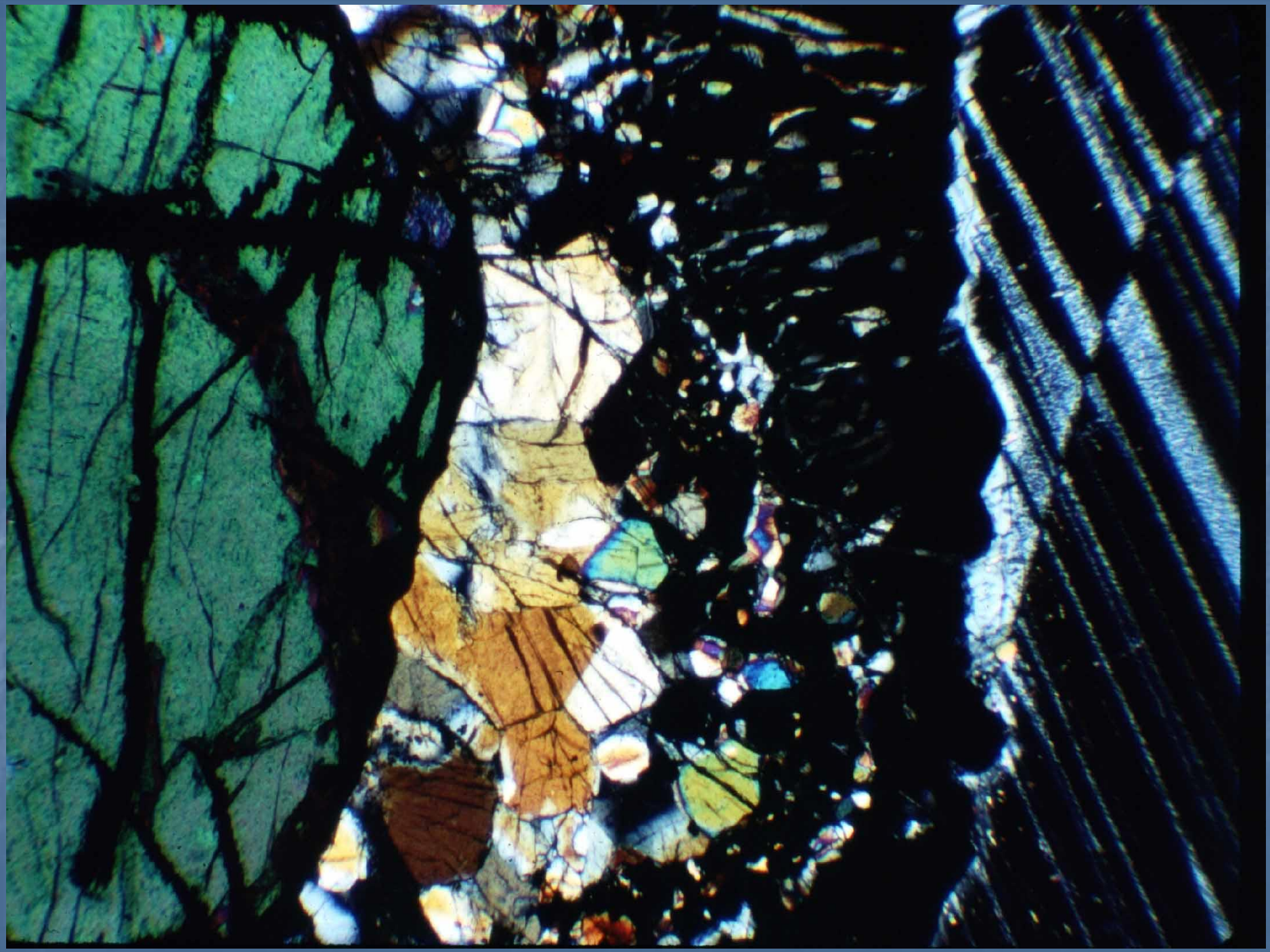
Corona or reaction rim: A zone consisting of grains of a new minerals that have formed at rim around mineral.





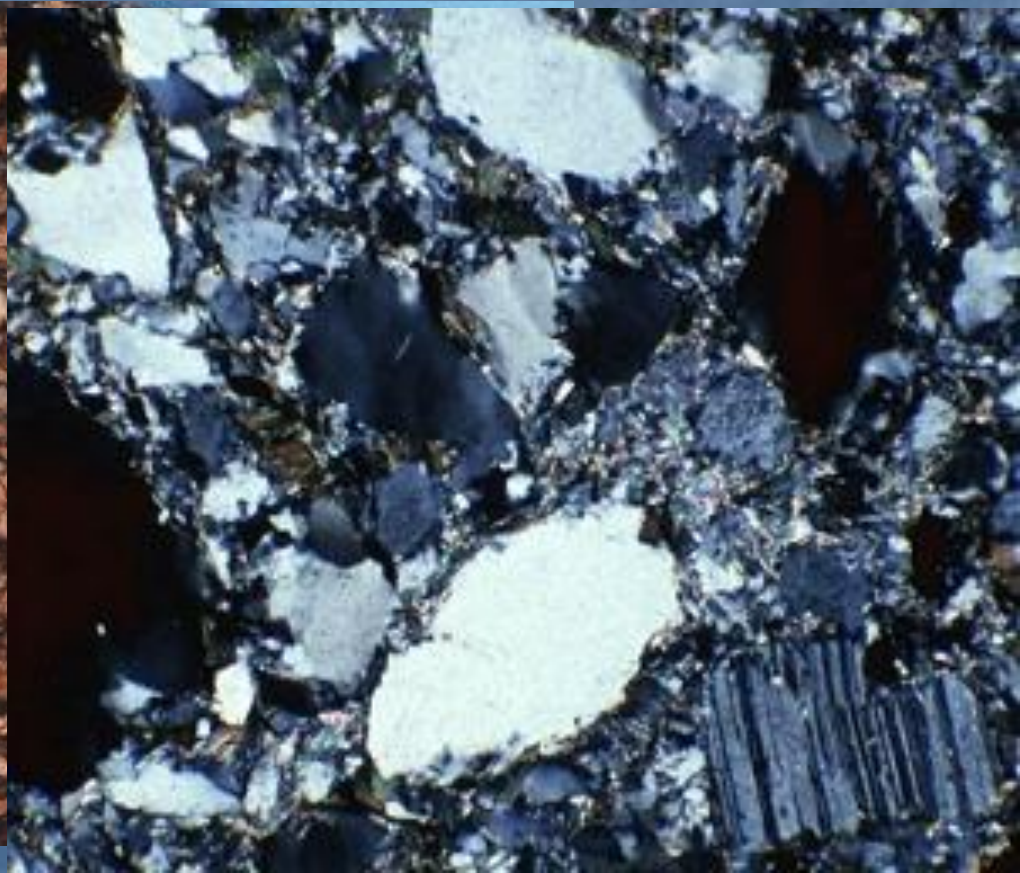
Corona texture





F- Textures donating fragmental nature of whole rock:

- **Cataclastic texture:** sheared or crushed rock fabric. The nature of original rock still recognized



F- Textures donating fragmental nature of whole rock:

Mylonite texture: Extremely sheared, stretched and recrystallized grains, typically foliated and containg ovoid relict crystal.

- Slightly sheared: Protomylonitic texture
- exteremely sheared: ultra-mylonitic texture