

BSc (IV) semester:

Lecture Notes (Prof. S. Sensarma)

Metamorphic Rocks: Texture, Structure and Classification

The texture and structure, put together the fabric, is very important for understanding and naming the metamorphic rocks. The texture of a metamorphic rock includes the size, shape, and arrangement of crystals present in the rocks. Structure refers to broader relationship of crystals that impart overall aspect to the rock.

Fabric is basically two types: foliated and non-foliated. Foliated type basically refers to a directed growth pattern of the minerals in a metamorphic rock. Some minerals are elongated, or flattened in shape (e.g., platy minerals like muscovite, biotite, needle-like minerals like amphibole, or tabular minerals like feldspar). When these minerals are all elongated or flattened in the same direction, the rock develop a planar fabric or foliation (Fig. 5). Non-foliated rocks show overall similar size, size, shape, and arrangement of crystals in all directions (Fig. 6).

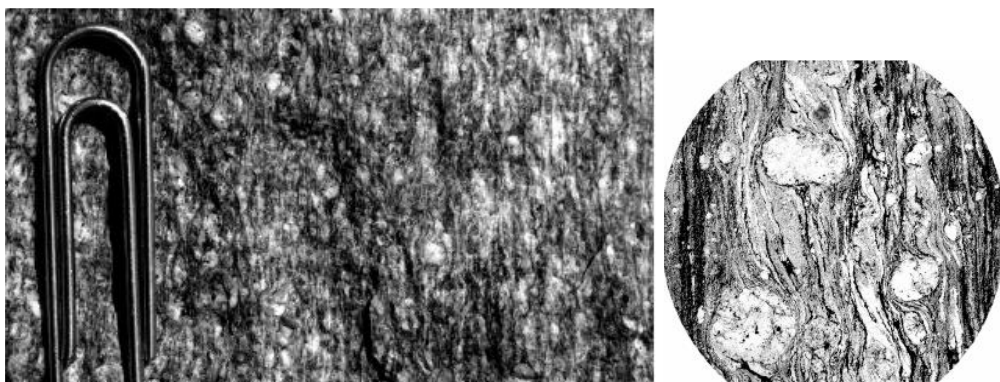


Fig. 5. A foliated metamorphic rock in hand sample (left) and in thin section (right)

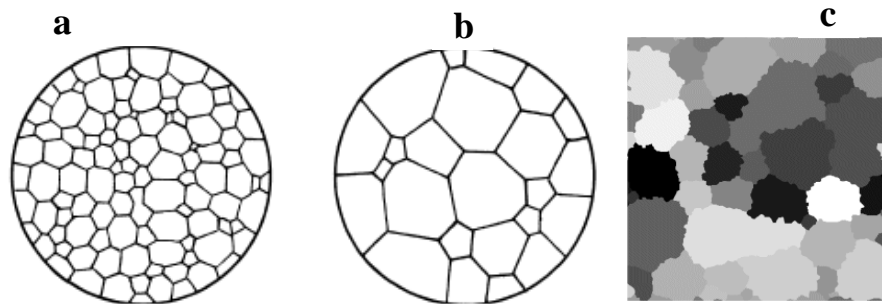


Fig. 6. A non-foliated metamorphic rock (a, b): schematic diagrams, (c) in thin section,

Some common textural/fabric terms in metamorphic rocks and their definition:

Cleavage	Planar fabric of preferred fracture, sub-parallel orientation, non-penetrative.
Foliation	Any penetrative set (within the whole rock, not only visible in a given surface) of more or less parallel surfaces caused by directional alignment of minerals.
Lineation:	Any penetrative set of more or less parallel linear feature.
Granoblastic:	a mosaic texture of more or less uniformly size, equidimensional, anhedral grains produced by recrystallization
Lepidoblastic:	Abundant platy minerals (e.g., chlorite, biotite) with strong preferred orientation.
Nematoblastic:	Abundant linear minerals (actinolite, hornblende, etc) with strong preferred orientation cause lineation.
Poikiloblastic:	Large, metamorphic grains that enclose numerous small inclusions; somewhat analogous to poikolitic igneous texture.
Porphyroblastic:	Large metamorphic crystals in a matrix of smaller grains; somewhat analogous to porphyritic igneous texture.

Relic porphyritic: Relic porphyritic texture (pre-existing igneous texture) that survived the effects of metamorphism.

Porphyroclastic: Large relict crystal of pre-existing mineral in a finer-grained matrix of recrystallized material, associated with shear deformation.

hornfels: random fabric of interlocking grains produces a tough rock called hornfels.

Mylonitic: Very fine-grained texture produced in zones of intense ductile deformation (grain size reduction), where pre-existing grains are deformed and recrystallized into finer grains with development of mylonitic fabric.

Flaser texture: Mylonitic fabric with ovoid (egg-shaped) megacrysts of relict crystals in very fine grained matrix; a type of porphyroclastic texture.

Classification

Common strongly foliated, weakly foliated and non-foliated rocks (after Yardley, 1990) are given in Table 2:

Table 2

STRONGLY FOLIATED	WEAKLY FOLIATED	NONFOLIATED*
Slate	Gneiss	1. Greenstone
Phyllite	Migmatite	2. Amphibolite
Schist	Mylonite	3. Eclogite
		4. Granofels
		5. Charnockite
		6. Quartzite
		7. Marble
		8. Hornfels
		9. Serpentinite

On the basis of presence or absence of foliation, metamorphic grade, and other diagnostic properties, the metamorphic rocks are classified as shown below (Table 3):

Types of Rocks	Grain Size	Diagnostic Properties	Metamorphic Grade	Original Rock	Rock Name
Foliated	Not Visible	Looks like shale but sheets break of smoother and easier. Usually black or dark gray in color	Very Low	Shale	Slate
	Not Visible	Overall crystals not visible, but there might be a few large crystals interspersed. Color is usually shiny silvery color	Low	Shale	Phyllite
	Visible	Usually composed with an abundance of micas. Sometimes contains other minerals like amphibole. Minerals grains are visible and form sheets in the rock	Medium	Shale	Schist
	Visible	The rock is banded. This is where similar colored (light or dark) minerals align in parallel bands across the rock giving it a striped appearance	High	Shale, Granite	Gneiss
Non-Foliated	Massive (yes but difficult)	Rock scratches glass. Also has no visible alignment of minerals	Varies	Quartz Sandstone	Quartzite
	Massive (yes but difficult)	Rock reacts with acid. May have some lines of different colored minerals, usually not in parallel lines though.	Varies	Limestone or Dolostone	Marble

Continued....

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