

*A
Seminar
On*

METAMORPHIC TEXTURES



CONTENTS

1. Introduction

2. Agents of metamorphism

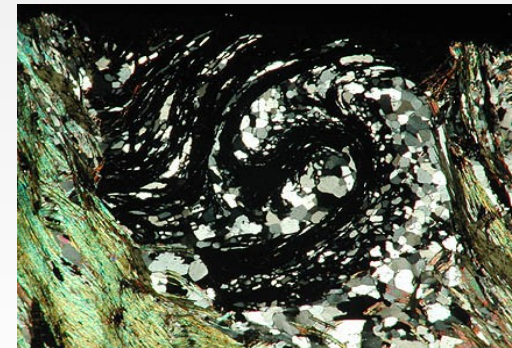
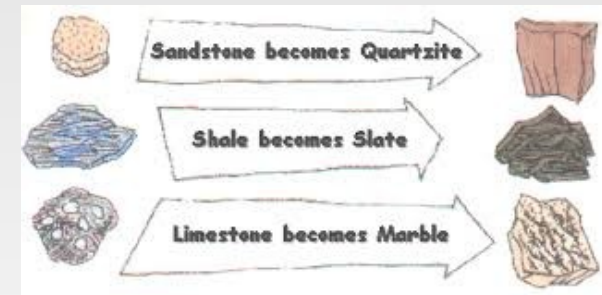
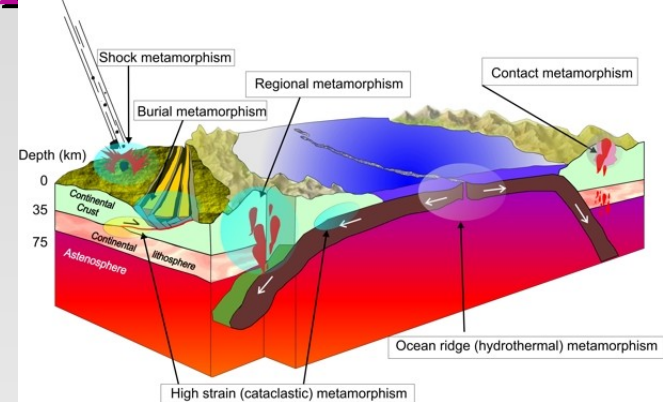
3. Types of textures

4. Conclusions

5. References

INTRODUCTION

- **Metamorphism:-** Metamorphism is the process in which rocks are altered in composition, internal structure or texture by extreme heat, pressure, and the introduction of new chemical substances.
- **Metamorphic rock:-** The rocks which have formed by various types of metamorphic processes on the pre-existing igneous and sedimentary rocks involving changes in structures, textures and mineralogical composition.
- **Texture:-** Texture refers to the physical appearance or character of a rock, such as grain size, shape, arrangement, and pattern at microscopic surface feature level.



AGENTS OF METAMORPHISM

heat



pressure



chemically active fluids



Heat:

- Most important agent of metamorphism.
- It provides the energy to drive the chemical reactions that recrystallize minerals.

Pressure:

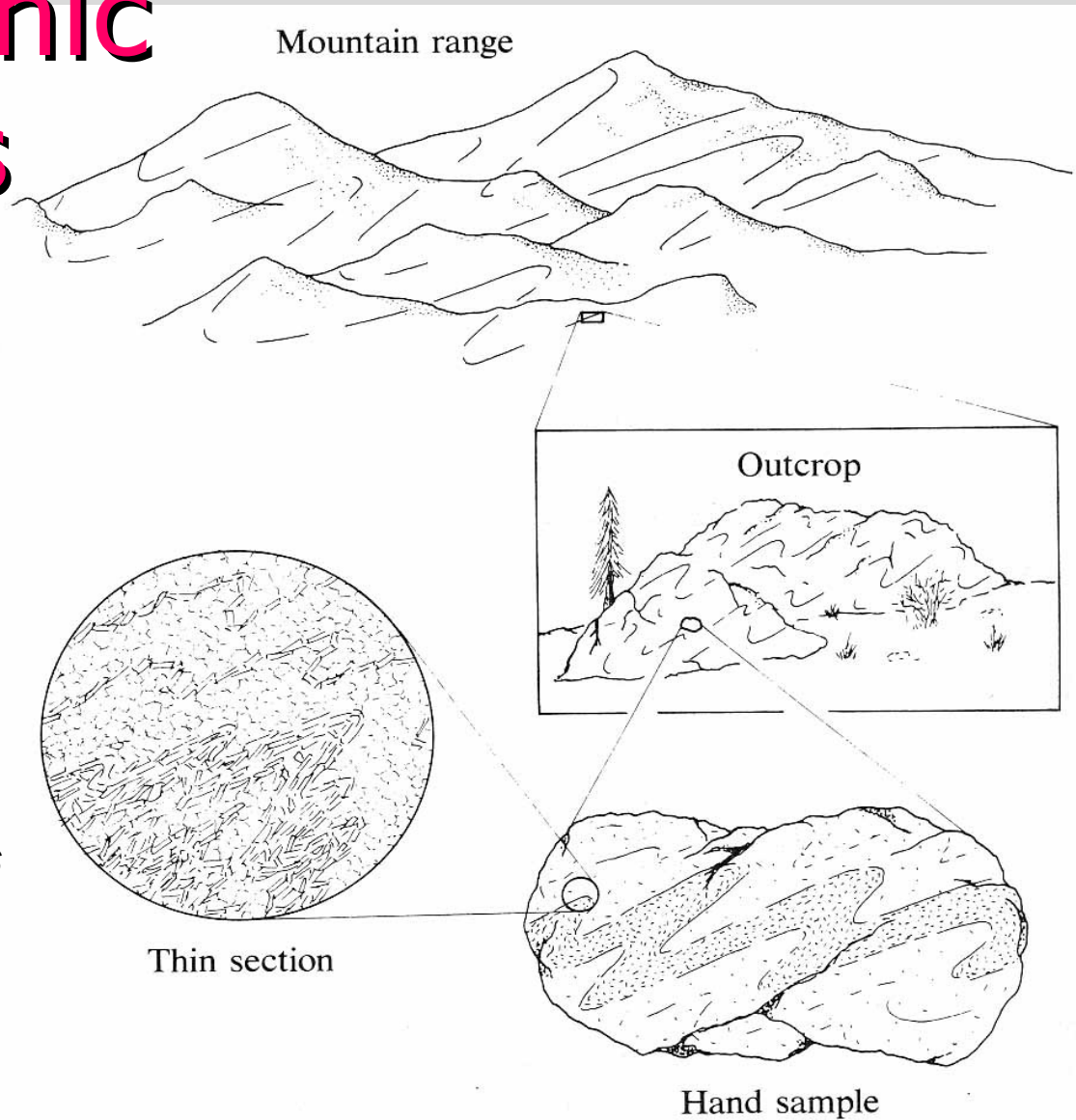
- The weight of the material above which causes compressional forces to act equally in all directions
- Stress caused by compressional forces as tectonic plates push against one another. These forces are directional and cause the rock to be squeezed which may result in folds and a foliated texture

Chemically Active Fluids:

- Has a strong influence on the metamorphism of rocks
- Water located in pore spaces of rocks is perhaps the most common fluid involved in metamorphism.

Metamorphic Textures

Diagram showing that structural and fabric elements are generally consistent in style and orientation at all scales. From Best (1982). *Igneous and Metamorphic Petrology*. W. H. Freeman. San Francisco.



TYPES OF METAMORPHIC TEXTURES

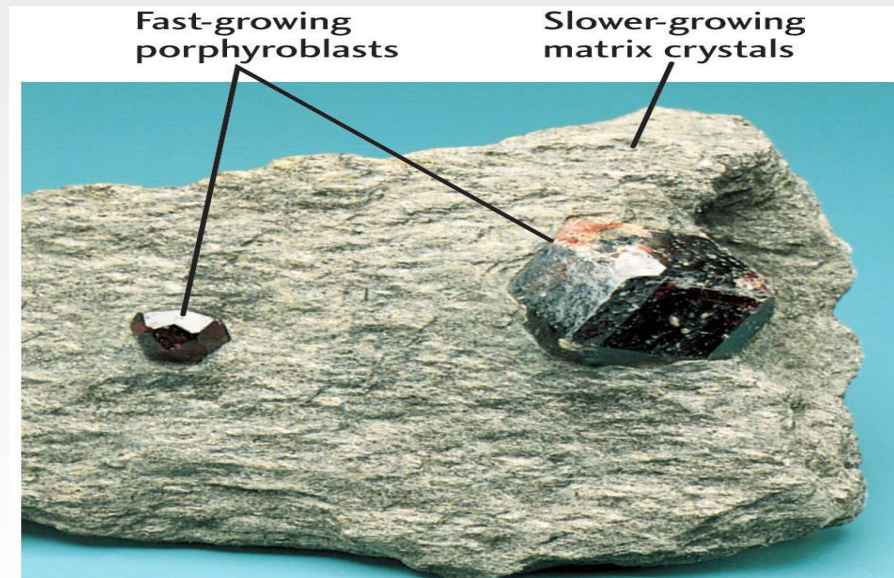
Metamorphic textures can be grouped into four groups:

- **Typomorphic textures.**
- **Relict textures (palimpsest textures).**
- **Super-imposed/ Reaction textures.**
- **Replacement textures.**

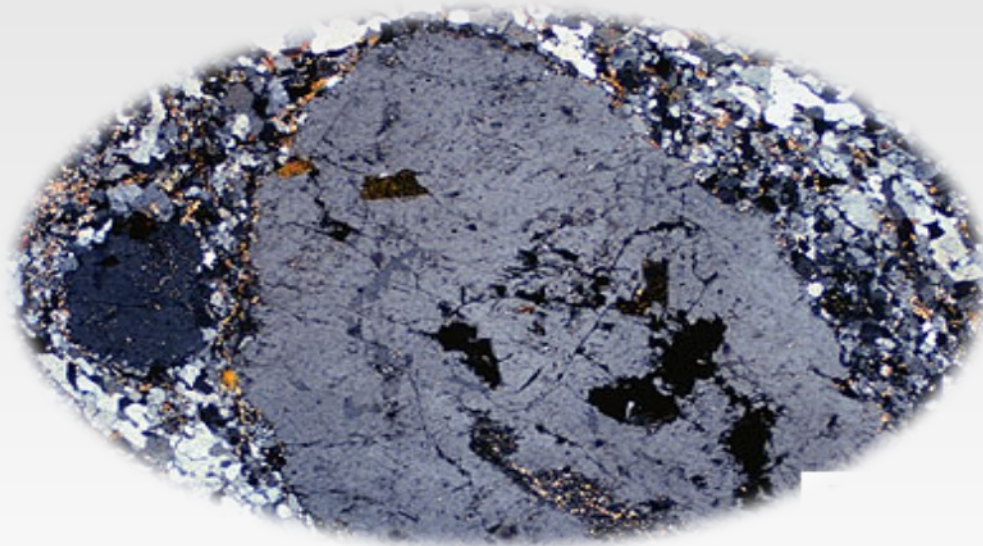
Typomorphic texture

Textures characteristic of metamorphism. Eg. Mortar, poikiloblastic, Porphyroblastic etc.

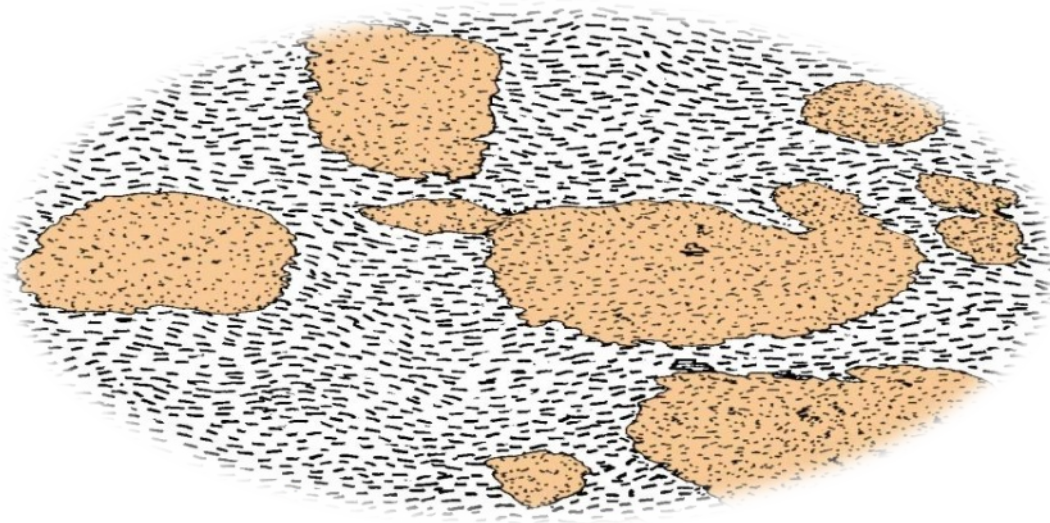
- **Porphyroblast**:- Large crystal mineral like garnet or andalusite grown in a metamorphic rock which is surrounded by smaller grain of other minerals, similar to a phenocryst of an igneous rock.



➤ **Porphyroclast**: A large strained or broken grain in a finer-grained matrix; a xenoblast originating commonly by breakage.-



- **Nodular**:- Result from the growth of oval-shaped porphyroblasts in cordierite or scapolite in association with other randomly oriented minerals.



➤ **Mortar:** Deformational texture resulting from reduction in grain size in matrix surrounding larger original grains.-



Granoblastic:- Consist of a coarser mosaic, anhedral grains, equidimensional grains, as in granulites. Eg. Quartzite.

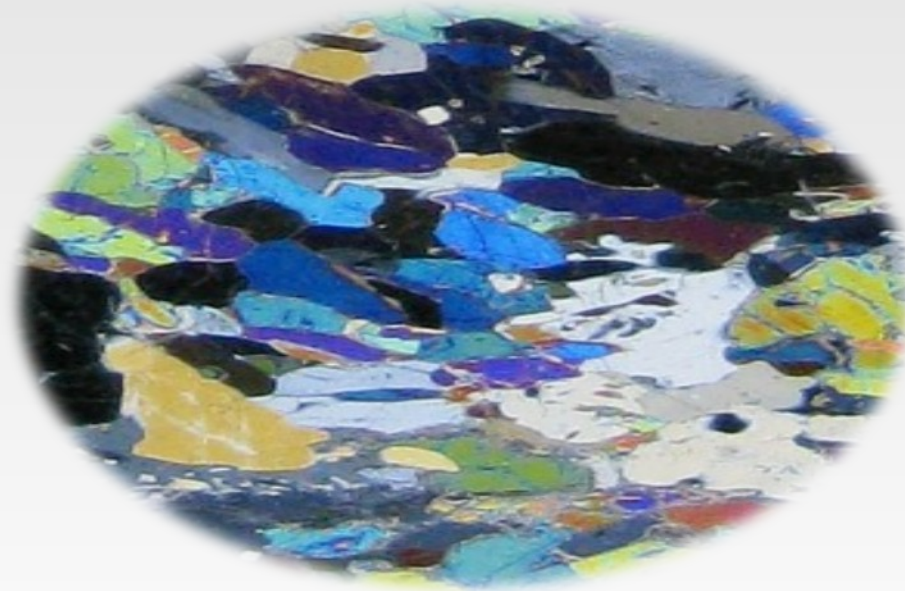


- **Poikiloblastic**:- Small grains of one or more mineral lie within larger porphoroblasts of another. Eg. Tourmaline, mica schist.



➤ **Decussate**:-Characterised by interlocking, randomly oriented, somewhat elongated, prismatic or sub-idioblastic crystals.

Eg. Granulite



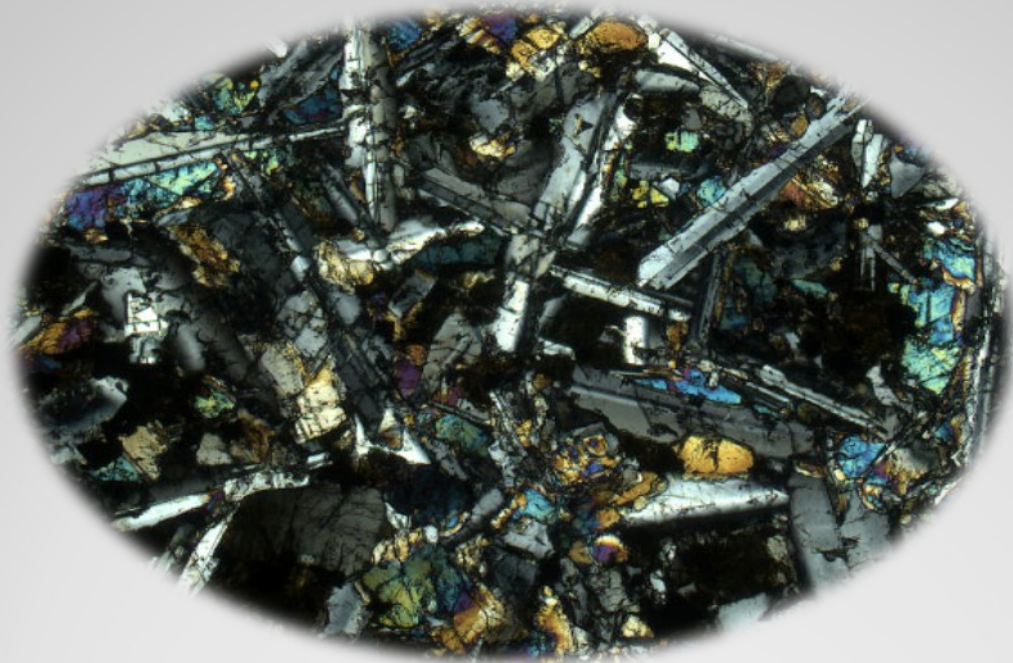
Relict texture

Textures inherited from the original rock type, and which have survived metamorphism. Eg. Porphyritic, oolitic, intergranular etc.

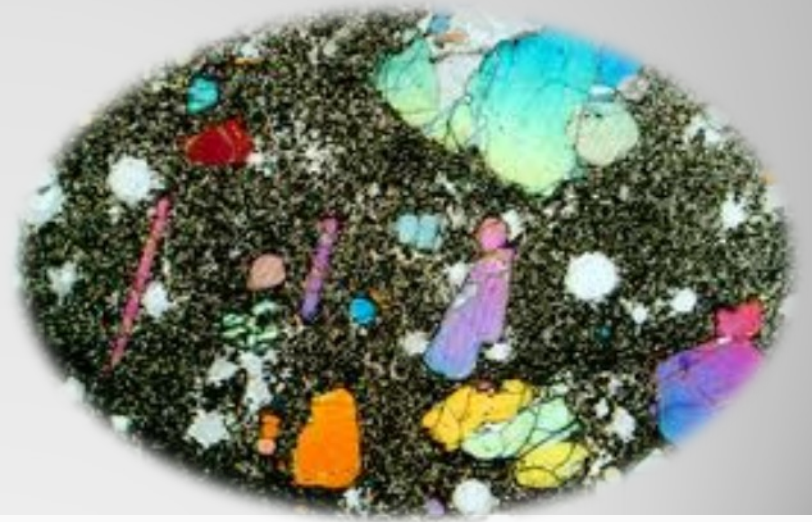
- **Ophitic**:- Laths of plagioclase in a coarse grained matrix of pyroxene crystals, where plagioclase is totally surrounded by pyroxene grains. Eg. Augite.



Intergranular texture:- A texture with angular interstices between plagioclase grains are occupied by grains of ferromagnesium minerals such as olivine, pyroxene, or iron titanium oxides.



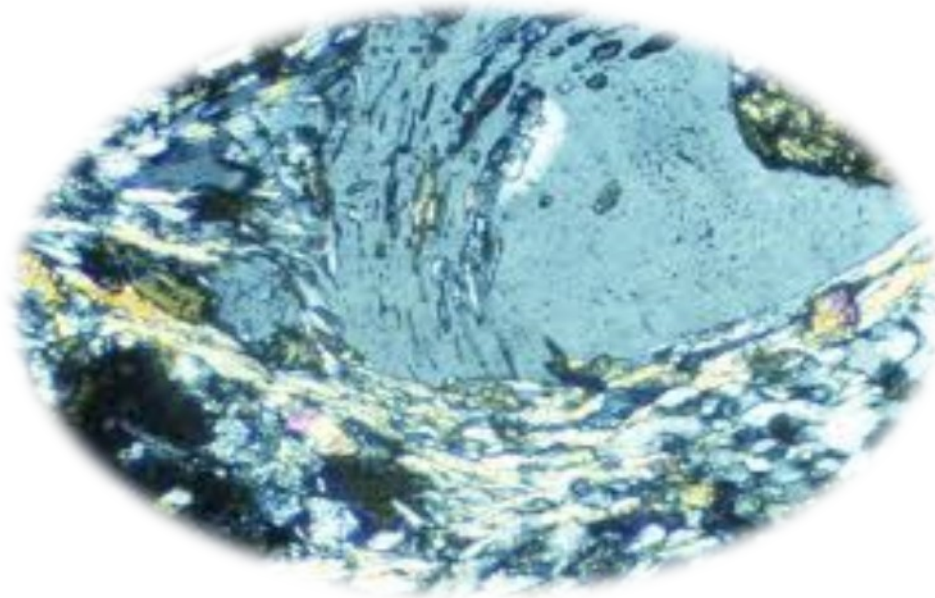
- **Porphyritic**:- Rocks with larger grains are contained in a finer grained matrix. It may occur in either intrusive or extrusive rocks, but it is most common in extrusive rocks such as basalt, andesite, dacite, and rhyolite.



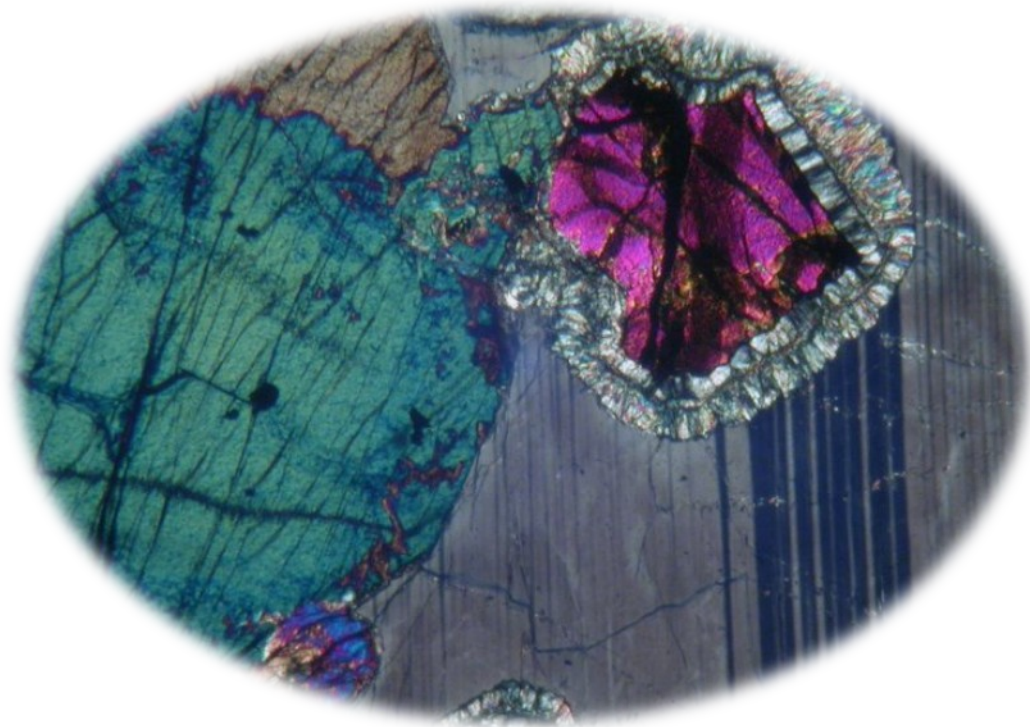
Reaction texture

➤ **Helicitic**:- Consist of contorted lines of inclusion within a poikiloblastic crystal.

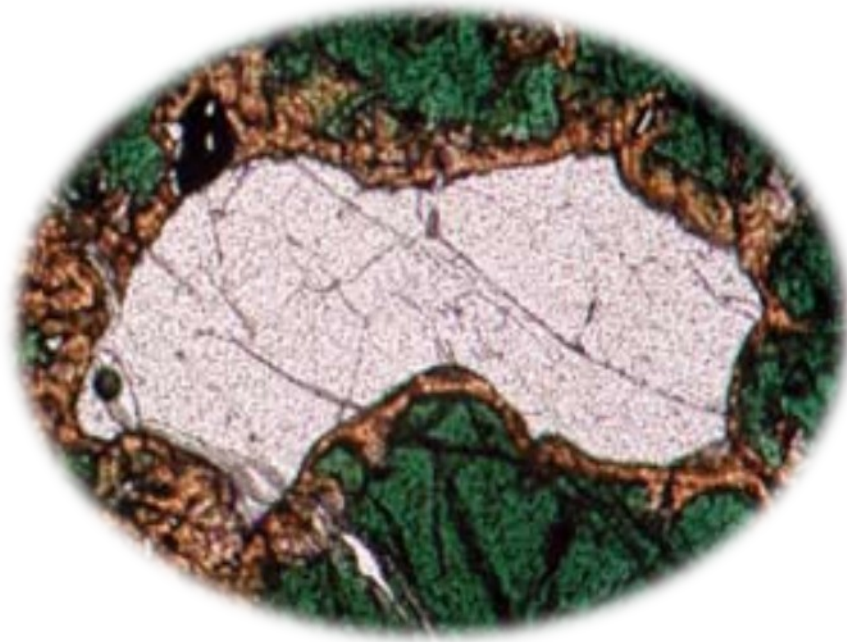
Eg. Albite, Andalusite.



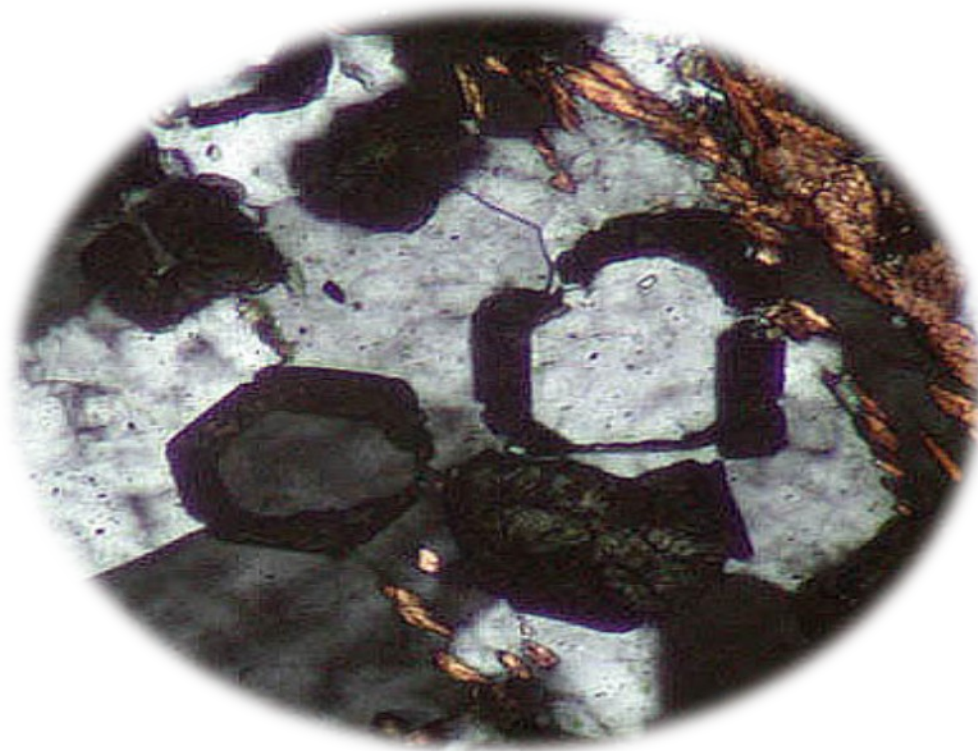
➤ **Corona**:- Consist of grains of a new mineral that have formed a rim around a mineral that is no longer in its field of stability.



- **Reaction-rim texture**:- When one mineral replaces another along its rims, suggesting a reaction between both phases. The contacts between both phases are irregular.



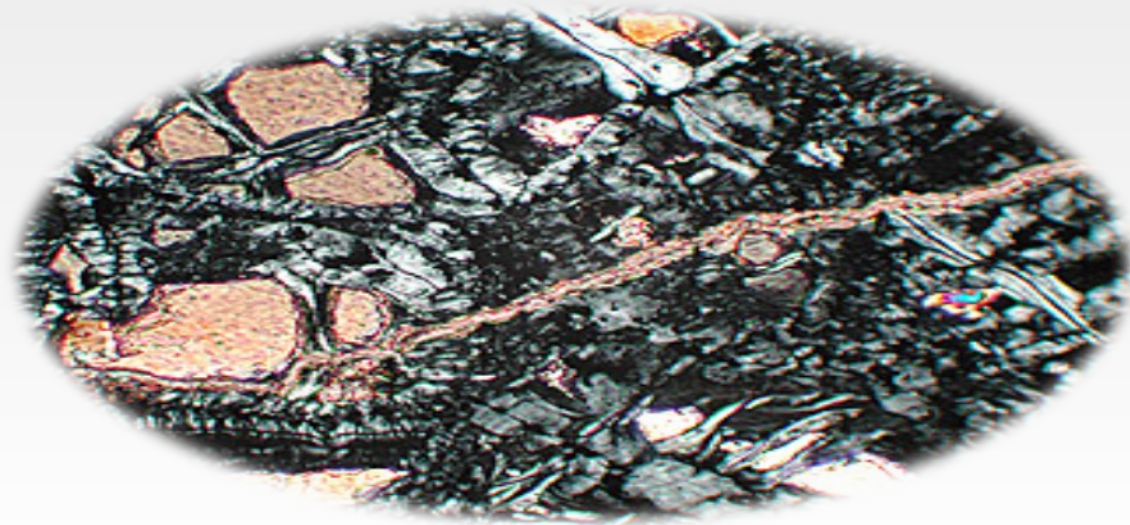
- **Atoll texture**:- The core of a mineral is dissolved or replaced leaving behind a surviving rim. Such textures usually form due to an original compositional zoning within the mineral with the replaced core.



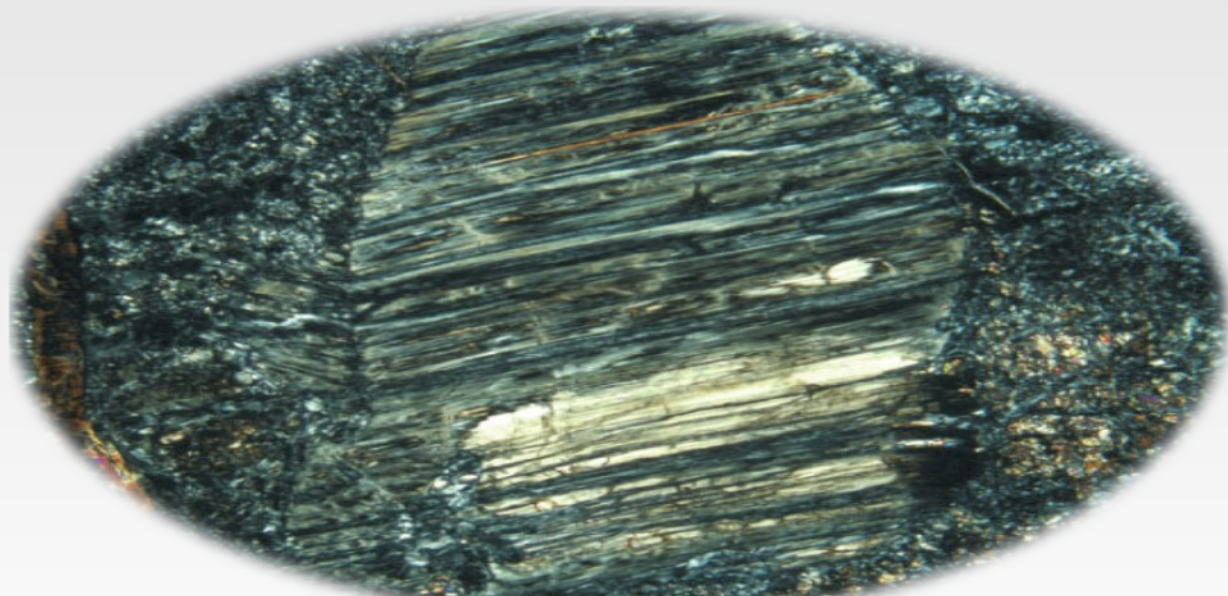
Super-imposed/Replacement texture

Texture which are altered by or modified due to post-metamorphic event like alteration, weathering, ... etc. Eg. Mesh texture, Bastite texture etc.

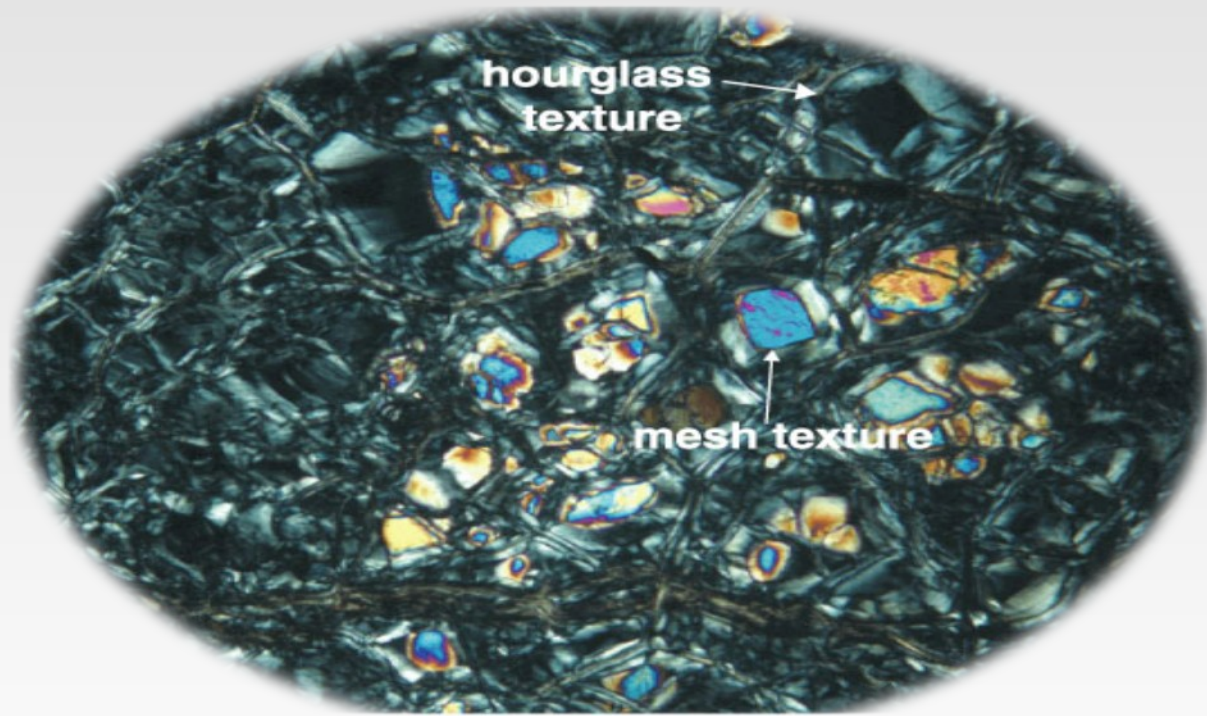
- **Mesh texture**:- Develops in serpentinites, where the needle shaped serpentine minerals occur in aggregates interwoven like a mesh.



➤ **Bastite texture**:- In serpentinites, Opx crystals were completely replaced by aggregates of serpentine minerals retaining the prismatic shape of the original Opx.



➤ **Hour-glass texture:-** In serpentinites, the serpentine minerals replace the granular olivine crystals giving rise to hour-glass like appearances. Eg. Serpentine.

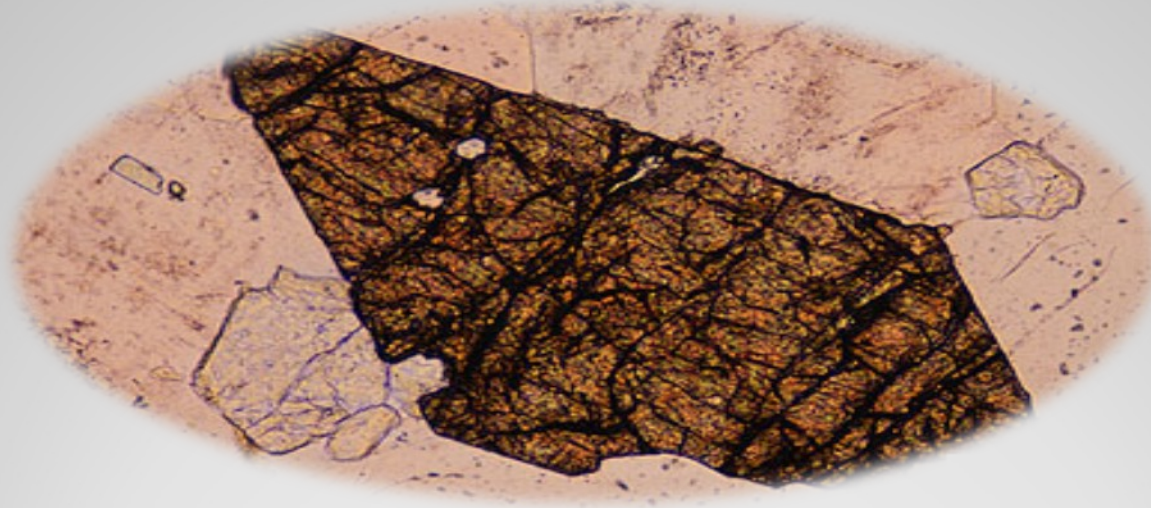


Texture depend on shape

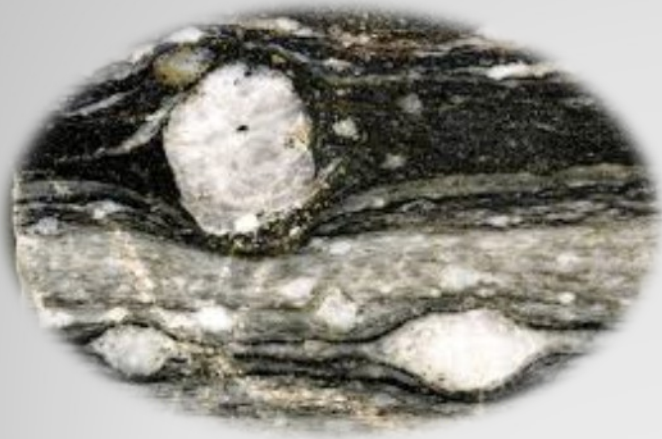
- **Xenoblast**:- An anhedral porphyroblast with one irregular outline, a broken fragment of a phenocryst or porphyroblast. Eg. Sphene.



- **Idioblast**:- An euhedral porphyroblast i.e. one bounded by its own well-developed crystal faces. Eg. Andalusite.



- **Augen** :- Porphyroclasts of felspar, having the shape of an eye in cross section, in a finer-grained gneissic matrix. Eg. Augen gneisses



Conclusion

- Textures of metamorphic rocks depend on the shape of the mineral, mode of growth and arrangement.
- Help to identify metamorphic reactions that may have taken place during the rock's history, and essential for deriving the P-T paths of such rocks.
- Help to identify the original rock type prior to metamorphism.
- "Blastic" or "blasto" is used as a suffix to represent the metamorphic rock equivalent to igneous texture.
- Help to identify the relationship between deformation and mineral growth, which is essential for any tectonic interpretations.

References

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