Geology Department

Practical Course of Ore Microscope

(4th class students-all branches)

BY

HASSAN M. RAGEH

•Demonstrator at, Geology Dept., Faculty of Sci., South Valley University

Contact: hassanmadeh926@gmail.com – hassan 55rageh51@sci.svu.edu.eg

Ore : is the naturally occurring material with industrial application .

Ore minerals : material contain one or more metal which can be extracted .

Hematite : Fe_2O_3

Pyrite : FeS_2

Chalcopyrite : $CuFeS_2$

Difference between ore microscope and Petrography microscope is illumination source .

ore microscope : illumination source above stage .

Petrography microscope : illumination source under stage .

Difference between thin section and polished thin section is

Thin section is section in silicate minerals which are transparency and we use transmitted light to describe them

But polished thin section section in ore minerals which are most of them opaque and we use reflected light to describe them.

Polished pits : all dark areas in polished section that result from polishing process .

scratch lines : line occur in polished thin section that result from polishing process .

How do you prepare polished thin section ?

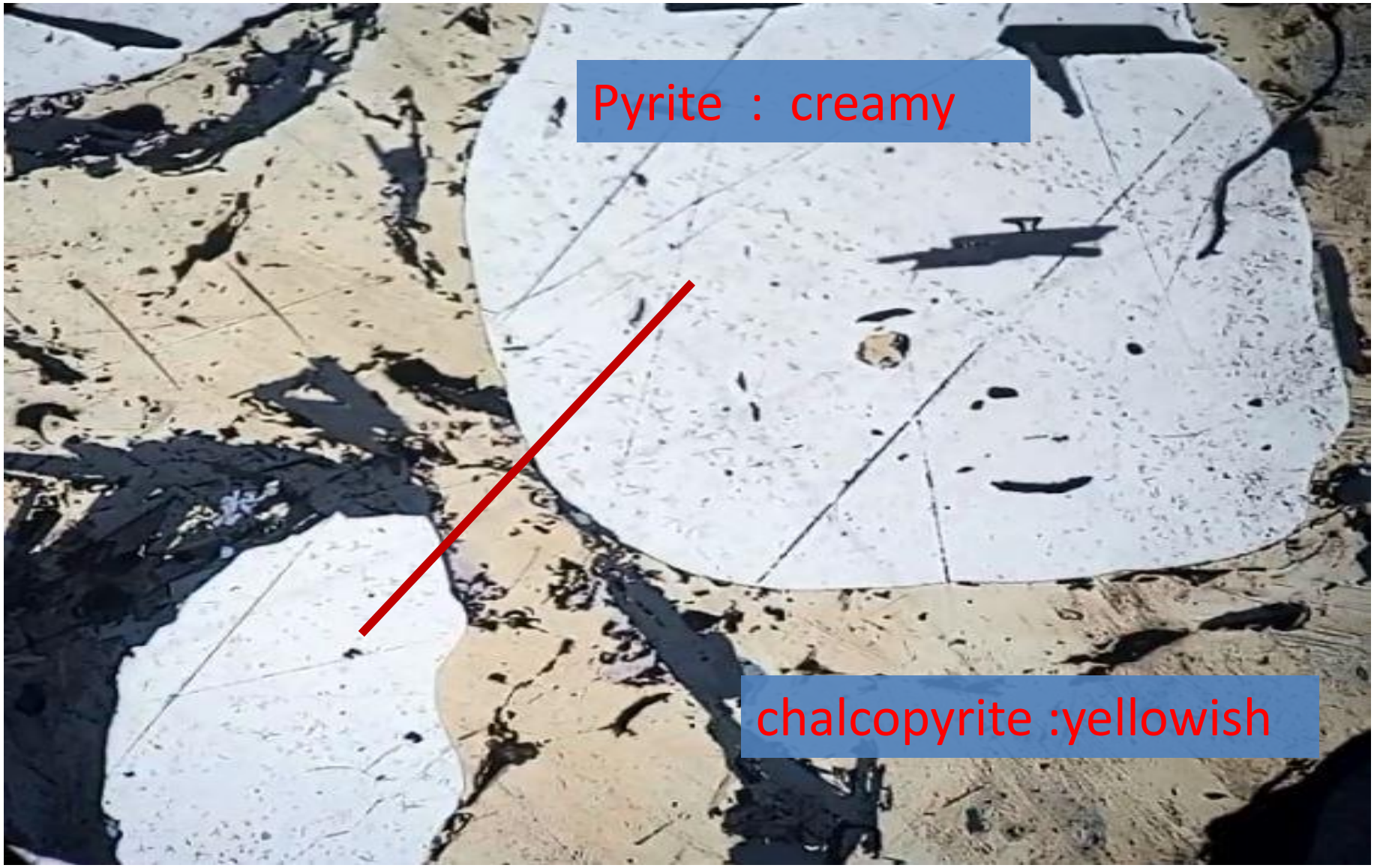
Optical properties of ore minerals

1- optical properties with out analyzer :

A- color : when the light fall on the polished surface , the surface absorb then the light reflect the other which represent the color of mineral .

The color of mineral is influenced by the color of neighboring crystals .

The colors are dependent on the illumination source. (Pentlanite 10)



Polished thin section of pyrite and chalcopyrite

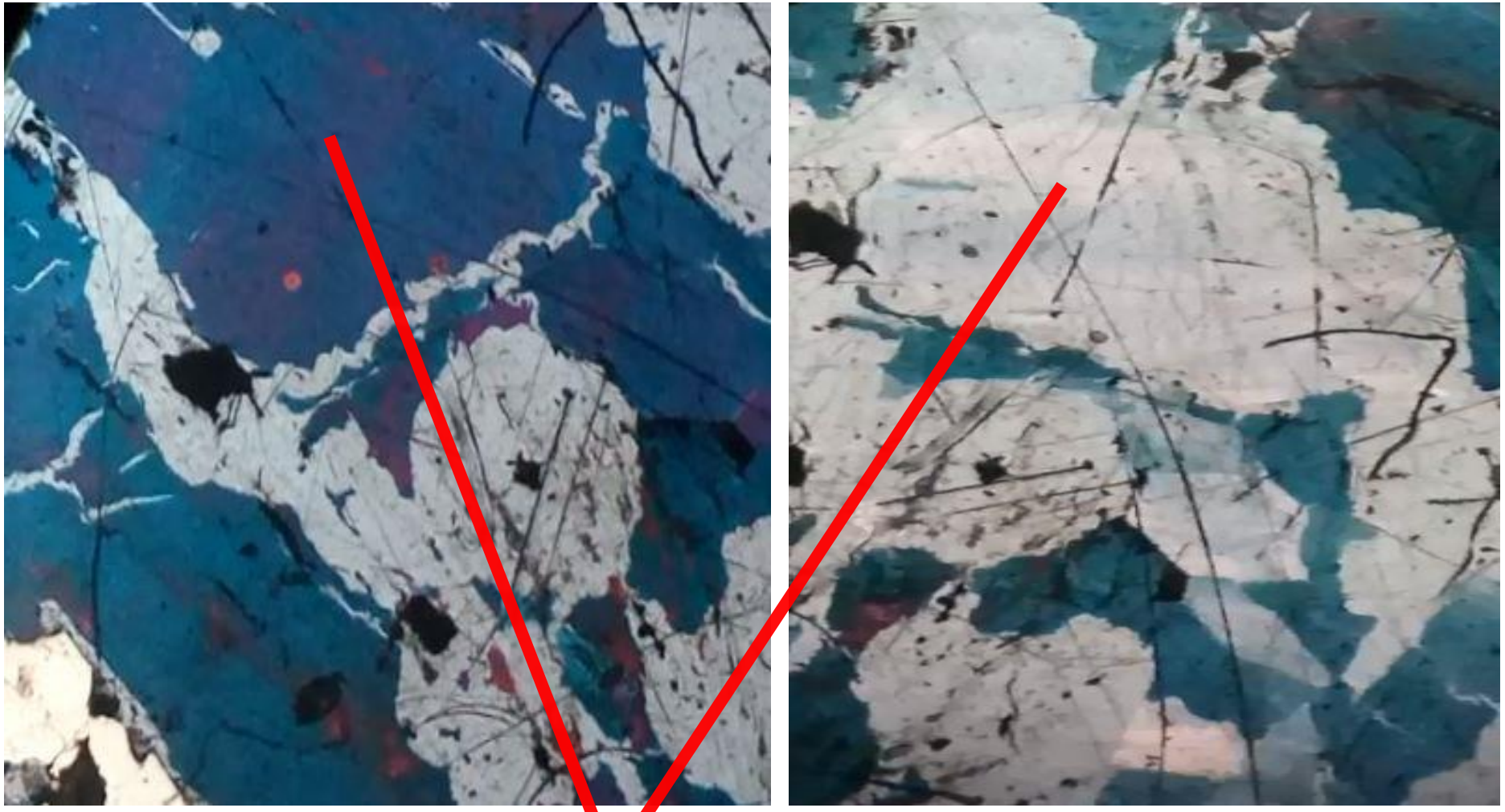
1- optical properties with out analyzer :

B- Pleochroism : change in color of mineral or (tint) during rotating the stage of microscope .

1- pleochrotic : color of mineral change during rotation .

2- Non Pleochrotic : color of mineral don’t change during rotation .

pyrite and chalcopyrite are non pleochrotic



Covellite : pleochrotic mineral the color change from blue color to light blue

1- optical properties with out analyzer :

C- Shape :

Euhedral – Subhedral

Rounded

Anhedral – Irregular

Prism – Elongated

Skeletal crystals – matrix – wood shape

Concentric ring – Concentric banding

Botryoidal shape

Radial shape

Spindle shape

Lamella

Lenses

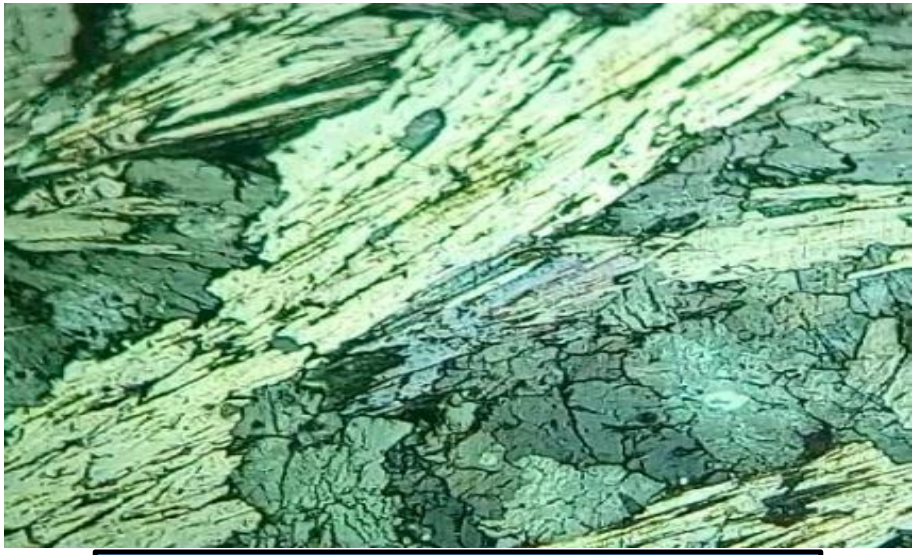
Subhedral crystal

Spindle shape

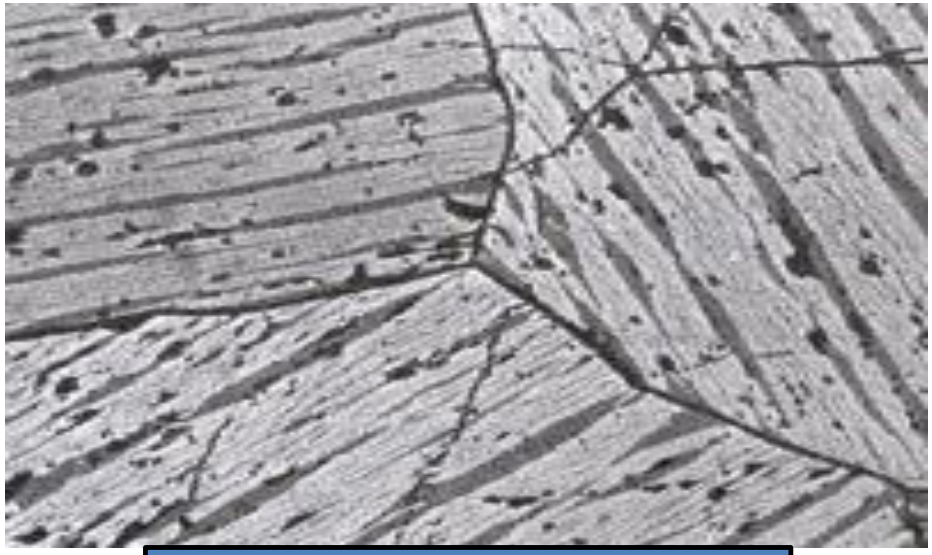
lenses

matrix

Botryoidal shape



wood shape



lamella

concentric banding

1- optical properties with out analyzer :

D- Cleavage : most of ore don't have cleavage but scratch line may be appeared due to polishing process .

Galena has 3 sets of cleavage .

Bismuthinite has one set of cleavage .

Chromite y – cracks .

Pyrolusite has one sets of cleavage .

Optical properties of ore minerals

1- optical properties under cross Nichols :

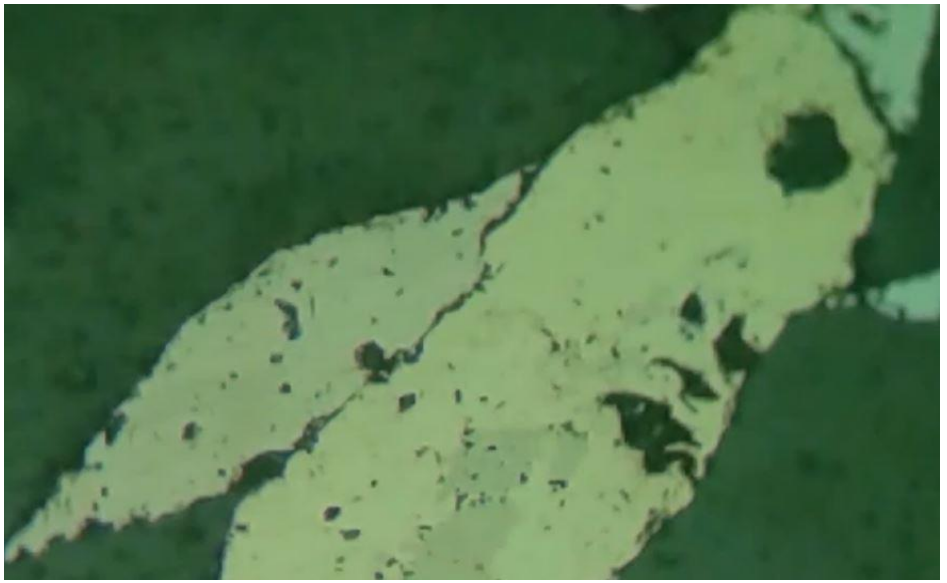
A- Anistropism :

1- Isotropic mineral : the mineral remain dark in all position of the stage.

2- Anisotropic mineral : the mineral will not remain (will change) dark during rotation the stage.

The anisotropy can range from a maximum to zero Depending on which section through the crystal has been polished (orientation of section).

Cubic-amourphous- cut c



Arsenopyrite : anisotropic mineral : light yellow to light blue

Stibnite : anisotropic mineral : brown to grey shades

Covellite : anisotropic mineral : dark blue to light blue to red

Optical properties of ore minerals

1- optical properties under cross Nichols :

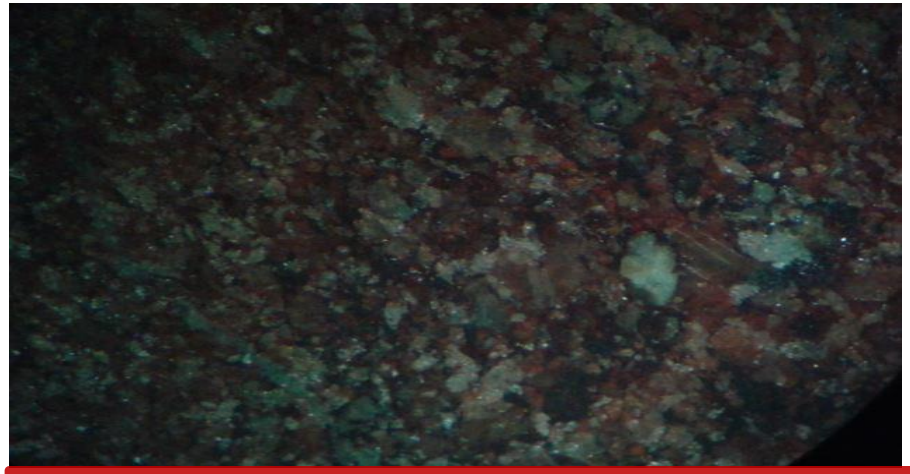
B- Internal reflection : light will appear as diffuse areas or patches .

Most anistropic minerals don't give internal reflection.

Difference between anistropism and Internal reflection is the internal reflection is one color but Anistropism is different color .

Wurtzite : Internal reflection : yellow to brown

Geothite :Internal reflection: brown



Hematite:Internal reflection: red

Texture of ore minerals

Texture : describe the relationship between the grain .

1- Primary texture : texture formed from direct crystallization from magma and hydrothermal solution.

2- Secondary texture : texture result from alteration , replacement and deformation of pre existing ore minerals .

Texture of ore minerals

1- Primary texture : texture formed from direct crystallization from magma and hydrothermal solution.

A- Cumulus texture : form from magma by accumulation of early formed ore minerals with early formed silicate minerals . Ex : chromite

Indication : the co – occurrence of olivine and chromite .

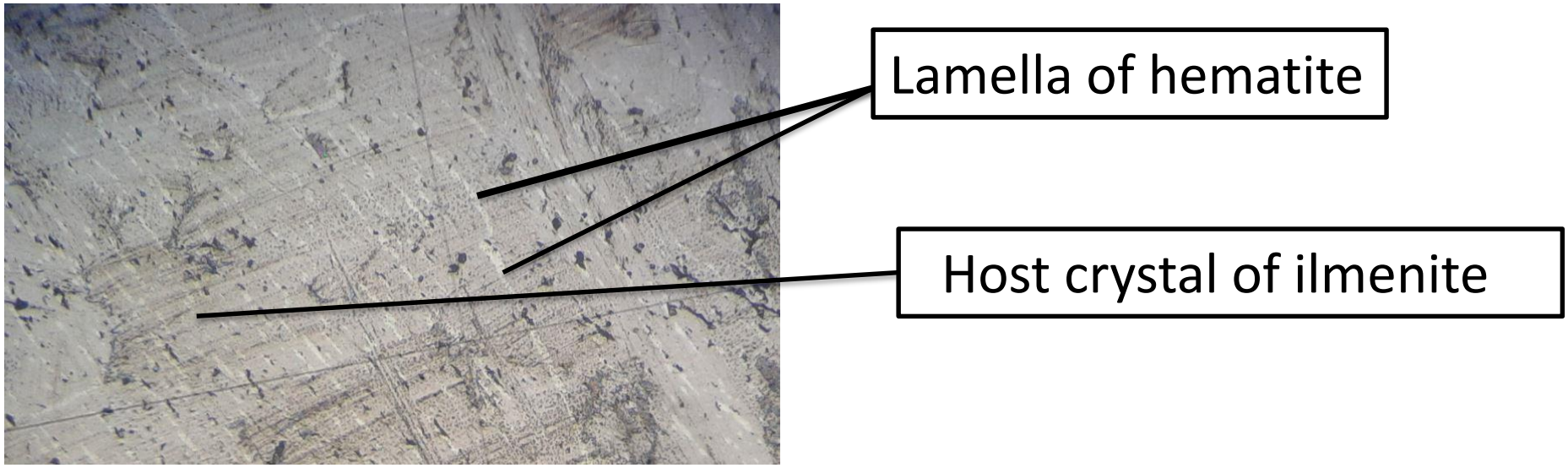
Cumulus texture of chromite

Texture of ore minerals

B- Exsolution texture : form from magma .

Exsolution relationship between hematite and ilmenite of vice verse .

Indication : lamella of hematite appear in host crystal of ilmenite .



Texture of ore minerals

1- Primary texture : result from hydrothermal solution .

a- Open space filling by hydrothermal solution .

Indication : Well developed crystals .

Ex : pyrite with chalcopyrite .

well developed crystals

Texture of ore minerals

C- Primary texture : result from hydrothermal solution .

b- colloform texture .

Indication : concentric ring - band – botryoidal – radial

Ex : Wurtzite – Sphalerite – Geothite .

botryoidal

band

radial

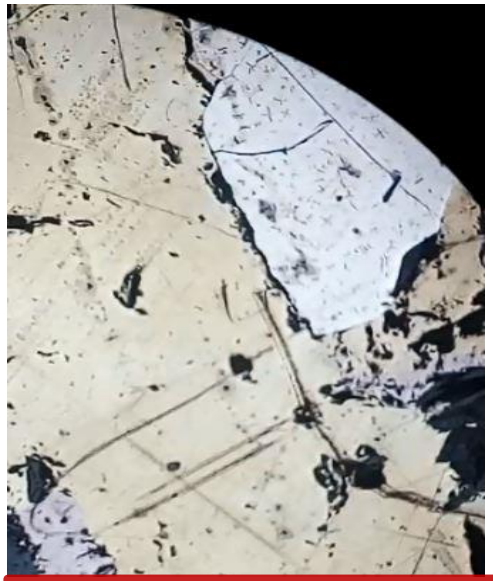
Texture of ore minerals

1- Secondary texture : texture result from alteration , replacement and deformation of pre existing ore minerals .

A- Replacement :

Indication : concave – convex grain boundary
non – matching walls
fracture widening
remains of original phase .
paths of replacement occur along fracture and along boundary .

fracture widening



concave – convex grain boundary

replacement along boundary

remains of original phase

Texture of ore minerals

A- Deformation :

Indication : curvature of cleavage plane
pressure lamella
kink band

Pressure lamella

curvature of cleavage plane

Elements of Description

1- Chemical group :
2- Chemical composition :
3- Color :
4- shape :
5- pleochrism :
6- Anisotropism :
7- Internal reflection :
8- Texture :

Sulfide minerals groups

1- Pyrite : FeS_2 (cubic)
2- Chalcopyrite : $CuFeS_2$
3- Marcasite : FeS_2 (orthorhombic)
4- Covellite : CuS
5- Bornite : Cu_5FeS_4
6- Chalcocite : Cu_2S
7- Arsenopyrite : FeAsS

Sulfide minerals groups

1- Sphalerite : (Zn,Fe)S
2- Wurtzite : (Zn,Fe)S
3- Galena : PbS
4- Stibnite : Sb_2S_3
5- Bismuthinite : Bi_2S_3
6- Pentlandite : $(Fe,Ni)_9S_8$

Hydroxides and Oxid minerals groups and native mineral group

1- Geothite : $FeO(OH)_2$
2- Cuprite : Cu_2O
3- Chromite : $FeCr_2O_4$
4- Ilmenite : $FeTIO_3$
5- Hematite : Fe_2O_3
6- Pyrolusite : Mno_2
7- Malachite : $Cu(CO_3)(OH)_2$ (Carbonate)
8- copper : cu (native mineral)