Recognition and Description of Minerals - Knowns

ISOTROPIC MINERALS

Halite	NaCl
Sylvite	KCl
Fluorite	CaF_2
Periclase	MgO
Garnet	$(Ca,Mg,Fe^{2+},Mn)_3Al,Fe^{3+},Cr)_2(SiO_4)_3$

Recognition and Description of Minerals - Knowns

UNIAXIAL MINERALS

Quartz	SiO_2
Calcite	$CaCO_3$
Nepheline	$NaAlSiO_4$
Apatite	$Ca_5(PO_4)_3(F,Cl,OH)$
Zircon	$ZrSiO_4$
Tourmaline	Boro-Silicate

Recognition and Description of Minerals - Knowns

BIAXIAL MINERALS

Olivine	$(Mg,Fe)_2SiO_4$
Orthopyroxene	$(Mg,Fe)_2Si_2O_6$
Clinopyroxene	$(Ca,Mg,Fe,Al)_2Si_2O_6$
Hornblende	$Ca_2(Mg,Fe,Al)_5Si_8O_{22}(OH)_2$
Tremolite	$Ca_2Mg_5Si_8O_{22}(OH)_2$
Actinolite	$Ca_2Fe_5Si_8O_{22}(OH)_2$
Biotite	$K_2(Mg,Fe)_3AlSi_3O_{10}(OH,F)_2$
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Chlorite	$(Mg,Al,Fe)_3(Si,Al)_4O_{10}(OH)_2*(Mg,Al,Fe)_3(OH)_6$
Plagioclase	$(Na,Ca)Al(Al,Si)Si_2O_8$
Alkali Feldspar	$KAlSi_3O_8$

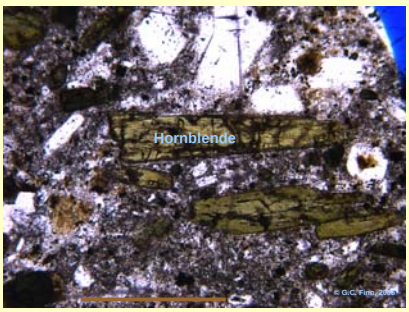
Features Useful in the Identification of a Mineral

- Shape of grains
- Degree of crystallinity
- Cleavage
- Twinning
- Alteration
- Associations

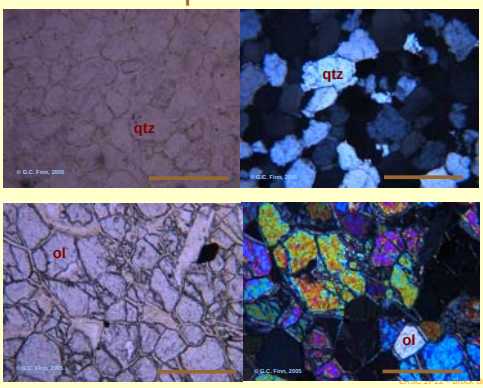
Shape of grains

- Acicular — needle-like grains (actinolite, tremolite)
- Bladed — elongate, slender (hornblende)
- Columnar — elongate with equidimensional cross sections (quartz, pyroxenes)
- Equant — equidimensional grains (quartz, olivine)
- Fibrous — grains form long slender fibers (asbestos, sillimanite)
- Lathlike — flat elongate grains (plagioclase)
- Prismatic — crystal faces defined by prism (apatite)
- Tabular — book shape (plagioclase)

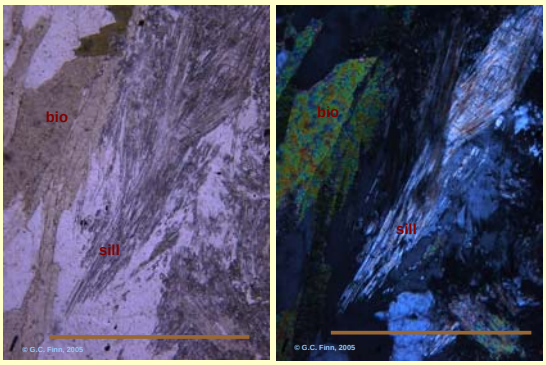
Bladed Grains



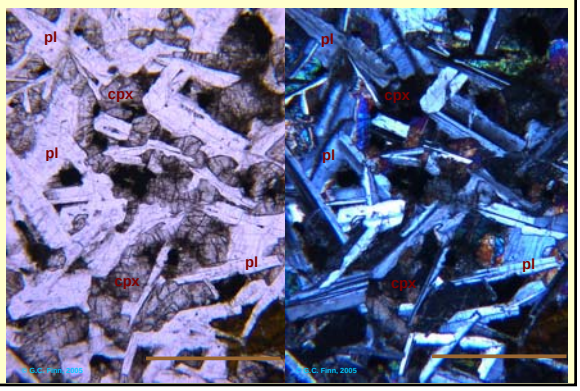
Equant Grains



Fibrous Grains



Lath-like Grains



Prismatic Grains

Degree of Crystallinity

- _____
  - grains have well formed crystal faces

- _____
  - poorly formed and/or irregular crystal faces

- _____
  - no regular crystal faces

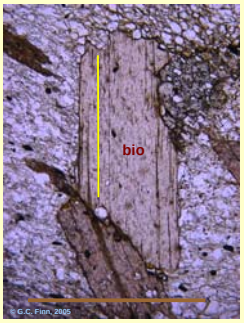
Cleavage

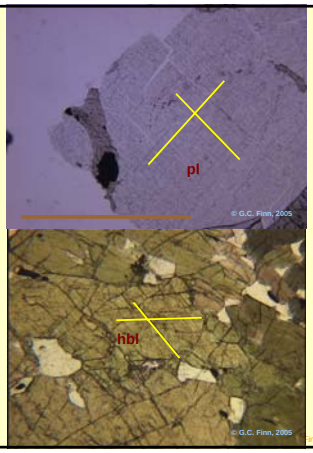
- In grain mounts, _____ on grains indicate the presence of _____
- In thin section, cleavage is difficult to recognize in minerals with a low relief, under normal circumstances
- By closing the aperture diaphragm cleavage is more readily seen

Cleavage

- Grains at the edge of the section may exhibit cleavage more so than grains in the centre
- _____ between cleavages is useful for identifying the broad mineral group
  - Pyroxene - 2 at 90°
  - Amphibole – 2 at 56°/124°
  - Alkali Feldspar - 2 at 90°
  - Plagioclase – 2 cleavages at 94°

Cleavage



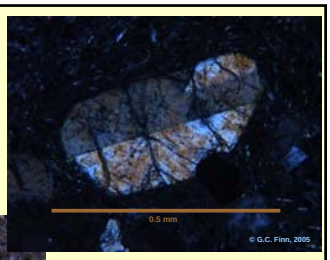


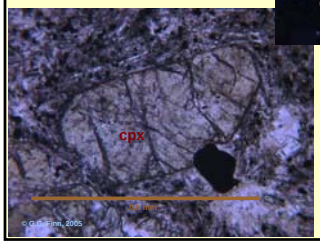
Twinning

- Presence and nature of the twins may be _____
- A variety of twin laws may be observed in thin section

Simple Twin

Two segments of one grain go extinct at different times on rotating the stage





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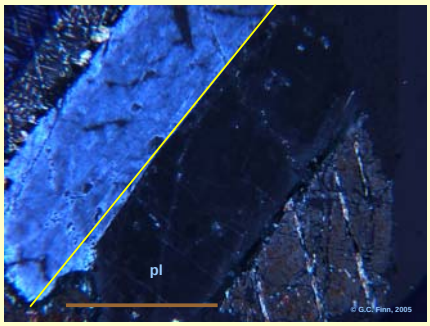
Contact Twins

Joined by a smooth twin plane separating the segments

Carlsbad-albite Twin Plane



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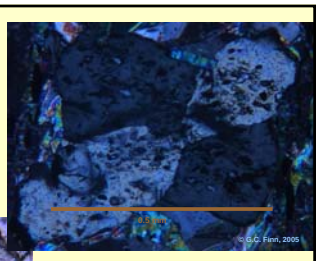
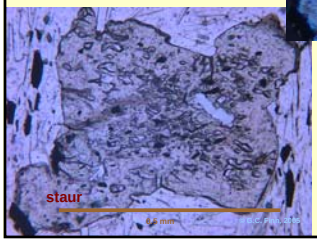
Penetration Twin

Joined by an irregular contact





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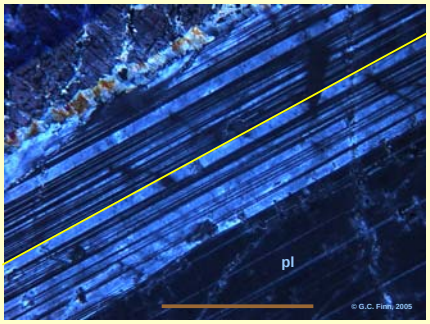
Polysynthetic Twin

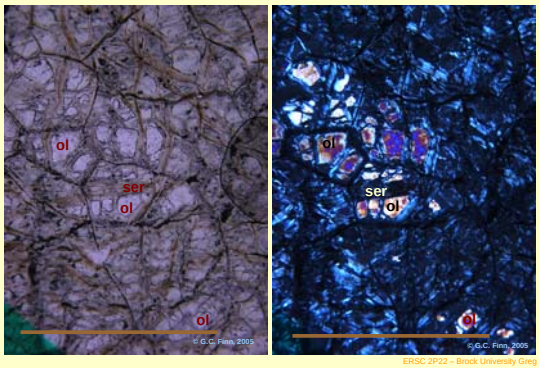
Consists of numerous twin segments joined on parallel twin planes



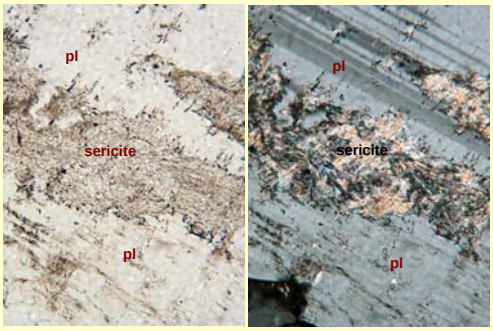
Alteration

- The type of alteration product observed within an individual grain may be used to identify that grain
- e.g.
  - iddingsite alteration of olivine
  - sericite alteration of plagioclase
  - clay minerals from alkali feldspars

Olivine altering to Serpentine



Plag altering to Sericite



From: http://www.union.edu/PUBLIC/GEODEPT/COURSES/petrology/ig_minerals.htm

Associations

- Knowing the common mineral associations in a variety of rock types may aid in making an "educated guess" as to the identity of an unknown mineral
- Knowing the mineral association for a given rock may aid in the identification of a specific mineral which might otherwise have been overlooked
- Appendix C of Nesse lists the common igneous, metamorphic and sedimentary rocks and expected mineralogy in each

Mineralogy of Common Igneous Rocks

Rock Type	Major (>10%)	Minor (<10%)	Accessory
Felsic (granite, rhyolite, granodiorite, etc.)	Quartz, K-feldspar, plagioclase (Ab-ol)	Muscovite, biotite, hornblende	Allanite, apatite, epidote, magnetite, ilmenite, hematite, fluorite, garnet, monazite, sillimanite, tourmaline, zircon
Intermediate (diorite, tonalite, dacite, andesite)	Plagioclase (And), hornblende	Quartz, biotite, muscovite, opx, cpx	Allanite, apatite, epidote, magnetite, ilmenite, hematite, zircon
Mafic (basalt, gabbro, norite, peridotite)	Plagioclase (Lab - By), cpx, opx, olivine	Biotite, hornblende	Apatite, chromite, magnetite, ilmenite, hematite, spinel
Si-deficient (syenite, phonolite)	K-feldspar, plagioclase (Ab-And), nepheline, leucite, sodalite	Biotite, muscovite, Na-amphibole, Na-pyroxene	Apatite, epidote, magnetite, ilmenite, hematite, melilite, Rare-Earth minerals

From: Nesse 2004, Appendix C.1

Mineralogy of Common Sedimentary Rocks

Clastic	Carbonate	Evaporite
Quartz K-feldspar Plagioclase Clay Chalcedony Calcite Muscovite Biotite Glauconite Magnetite Ilmenite Hematitie Zeolites **PLUS MANY MORE**	Calcite Dolomite Clay Glauconite Clastic material Skeletal remains	Anhydrite Calcite Chalcedony Dolomite Gypsum Halite Sulfur Sylvite Clastic material

From: Nesse 2004, Appendix C.2

Mineralogy of Common Metamorphic Rocks

Rock Type	Common	Accessory
Pelite (shale)	Quartz, plagioclase, muscovite, chlorite, biotite, garnet, chloritoid, andalusite, kyanite, sillimanite, staurolite, K-feldspar	Apatite, epidote, graphite, hematite, ilmenite, magnetite, tourmailine
Mafic (basalt)	Plagioclase, amphibole, cpx, biotite, quartz, titanite, calcite, chlorite, epidote, garnet,	Apatite, hematite, ilmenite, magnetite, spinel, zircon
Carbonate (limestone)	Calcite, dolomite, epidote, garnet, cpx, amphibole, biotite, olivine, quartz, aragonite, wollastonite, talc, scapolite, periclase, brucite	Corundum, graphite, hematite, ilmenite, magnetite, titanite
Granitic Gneiss (felsic, sediments)	Quartz, K-feldspar, plagioclase, biotite, cordierite, hornblende, opx	Allanite, apatite, epidote, garnet, hematite, ilmenite, magnetits zircon
Metagraywacke (high and low pressure rocks)	Quartz, plagioclase, epidote, pumpellyite, lawsonite, chlorite, biotite, stilpnomelane, muscovite, omphacite, Na-amphibole, calcite, aragonite, garnet, serpentine, titanite, zircon	Apatite, hematite, ilmenite, magnetite, prehnite, ziorcon

From: Nesse 2004, Appendix C.3