HOW TO DESCRIBE AN IGNEOUS ROCK

HAND SPECIMEN

Note colour, structural features (flow structures etc.), any visible textural features – grain size, porphyritic character etc. Also note the proportion of light and dark minerals, and mention any minerals displaying diagnostic characteristics. The hand specimen description should be completed after examination of the thin section and in the knowledge of what minerals are present.

THIN SECTION

These notes are for guidance only, and may require adaptation for particular specimens.

1. Write down essential minerals with an indication of their relative abundance. For porphyritic rocks indicate what percentage of the rock is made of phenocrysts.

2. Description of each essential mineral in order of abundance. State the mineral group and then describe features which are particular to the mineral being described.
   (a) Colour – if coloured give pleochroism (if any)
   (b) Form – crystal shapes, grain size, porphyritic crystals etc.
   (c) Cleavage – number of cleavages and at what angle they intersect.
   (d) Relief – high, medium or low
   (e) Birefringence – 1^{st}, 2^{nd} or 3^{rd} order colours.
   (f) Extinction – straight or oblique to crystal edges or cleavage – (if oblique give angle)
   (g) Twinning – if present
   (h) Alteration – in any.
   (i) Inclusions – if any

3. Description of accessory minerals.

4. Texture, special features (if any) – DRAW DIAGRAMS OF TEXTURAL FEATURES. Can this tell us anything about how the rock was formed? Can you determine the order of crystallisation?

5. Name and classify the rock.

TERMS USED WHEN DESCIBING IGNEOUS ROCKS

Below is a list of the words most commonly used to describe the textural features of igneous rocks. Some of the terms are illustrated with photomicrographs to help you identify the textures in the rocks you look at. Some however, are uncommon and you may not need to use them. If in doubt, express what you see in simple English!!

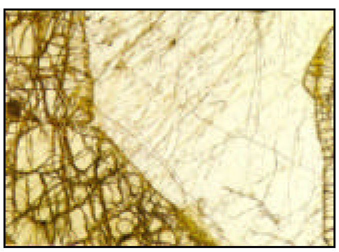
1. DEGREE OF CRYSTALLINITY

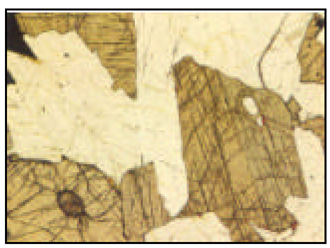
Holocrystalline	composed entirely of crystals.
Vitreous/holohyaline	composed of glass.
Hypocrystalline	composed of both crystals and glass.

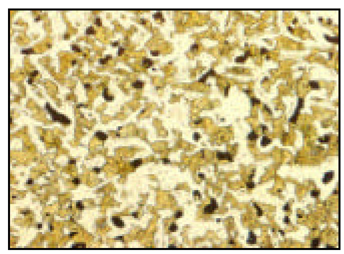
2. GRAINSIZE

Aphanitic	constituents too small to be distinguished with naked eye
Phaneritic	individual constituents visible to naked eye.
Microcrystalline	crystals may be distinguished with aid of a microscope.
Cryptocrystalline	mineral aggregate shown to be crystalline using scanning electron microscope or x-ray techniques but individual crystals not visible under the microscope.

Coarse Grained	*Medium Grained*	*Fine Grained*
Average grain diameter > 5mm	Average grain diameter 1-5mm	Average grain diameter < 1 mm







Equigranular	most crystals the same size.
Inequigranular	crystals of different sizes.

3. SHAPES OF CRYSTALS

Euhedral	crystal is bounded by crystal faces.
Anhedral	no crystal faces developed, often dues to other crystals interfering with their growth.
Subhedral	crystal faces partially developed.

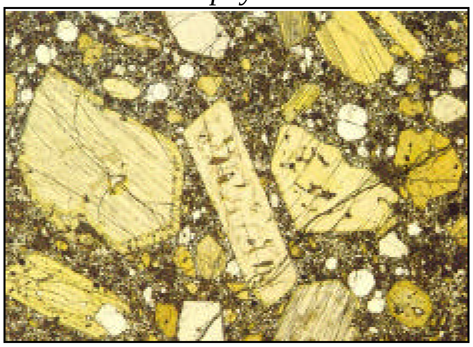
4. MUTUAL RELATIONS OF MINERALS

(a) Equigranular textures

Allotriomorphic/xenomorphic	most crystals anhedral.
Hypidiomorphic	most crystals subhedral.
Panidiomorphic	most crystals euhedral.

(b) Inequigranular textures

Porphyritic



Large crystals (phenocrysts) in a finer grain or glassy matrix.

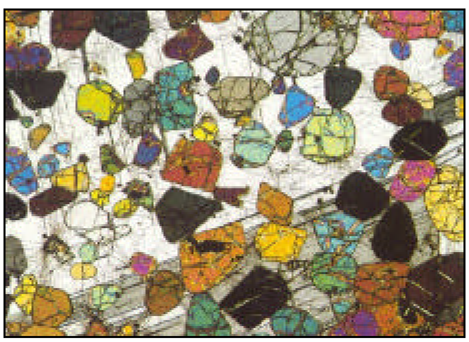
Microphyritic

As above on a microscopic scale.

Glomerophyric

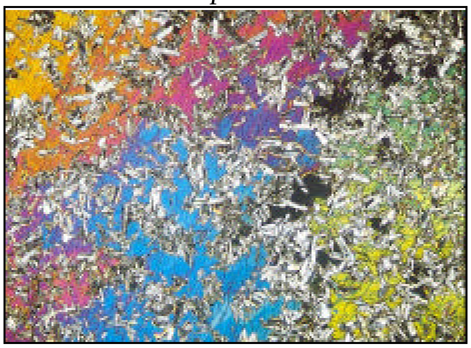
Phenocrysts occur in separated clusters.

Poikilitic



Smaller crystals of essential minerals enclosed in larger crystals of another mineral.

Ophitic

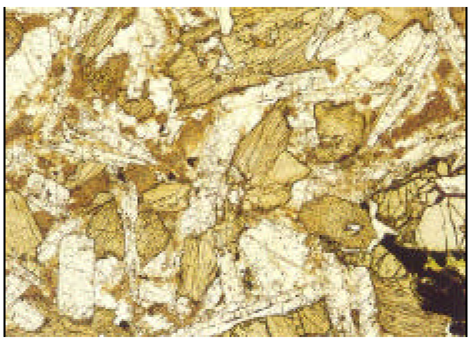


Variety of poikilitic where clinopyroxene (augite) is the host enclosing laths of plagioclase – very common in basalts.

Subophitic

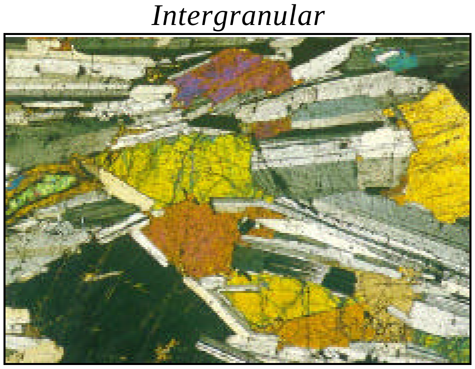
As above but pyroxene only partially encloses plagioclase laths.

Intersertal



Wedge shaped interspaces between crystals are filled with glass or late-stage mineral such as analcime.

Intergranular

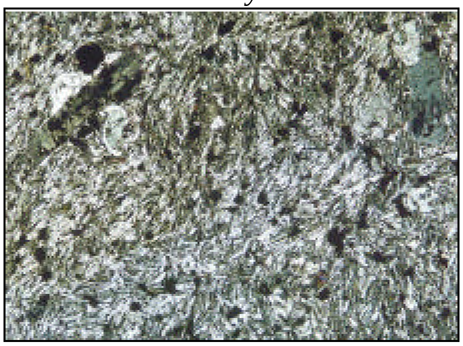


Anhedral crystals of a mineral occupy spaces between sub- euhedral crystals of another. In basalts and similar rocks, clinopyroxene fills gaps between plagioclase.

(c) Directive textures

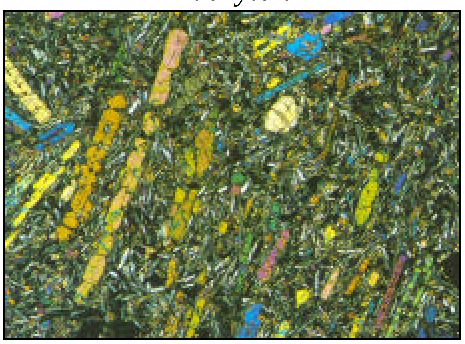
Since magma is a fluid, it can flow. If elongate crystals, such as feldspar are present in the magma whilst it is flowing, these crystals may well align themselves in the direction of flow. Flow structures are not confined to extrusive lavas, and can be found in plutonic rocks where "flow" in the magma takes the form of convection currents.

Trachytic



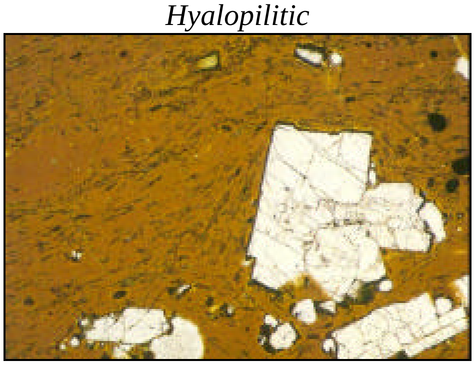
Groundmass crystals, usually feldspar, have a sub-parallel arrangement. Very common in trachytes unsurprisingly!!

Trachytoid



Alignment of minerals other than feldspar in basic rocks.

Hyalopilitic



The alignment of microlites in glassy rocks.

(d) Intergrowth textures

Intergrowth textures are when a crystal of one mineral appears to be completely embedded within a crystal of another mineral. The crystals concerned are typically anhedral but one or both may be skeletal, dendritic or radiate.

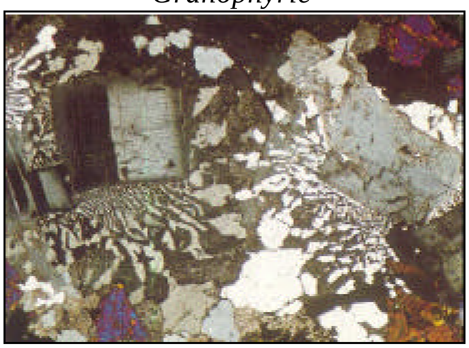
Graphic

Irregular intergrowth of two minerals in which the apparently isolated wedges and rods of one mineral in the other have the appearance of cuneiform writing – visible with the naked eye!

Micrographic

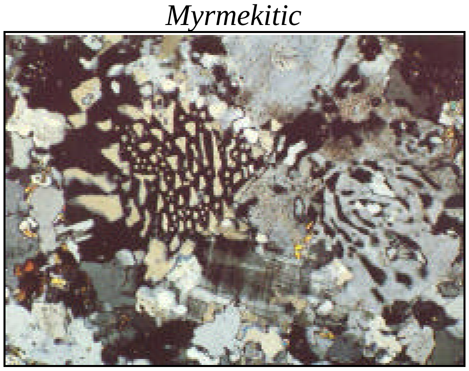
Graphic intergrowths only visible under the microscope.

Granophyric



Graphic intergrowth of quartz and alkali feldspar.

Myrmekitic

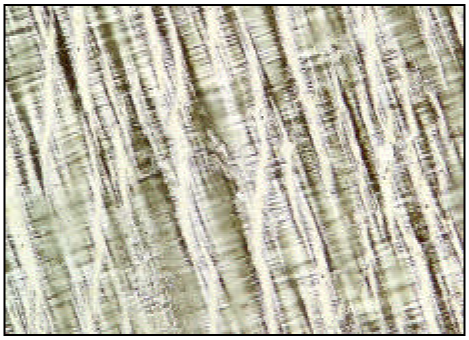


Graphic intergrowths of plagioclase and quartz.

(e) Exsolution/intergrowth textures

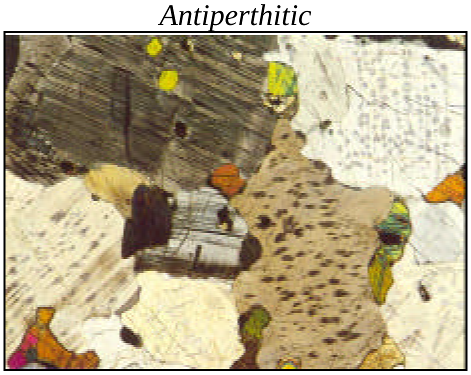
Parallel lamellae, or trains of blebs, of one mineral, and all of the same optical orientation, are enclosed in a single "host" crystal of another mineral. Either forms by the coprecipitation of the two minerals, or via the solid-state exsolution (separation) of the two phases.

Perthitic



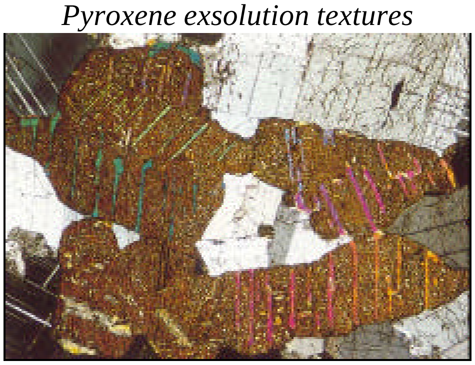
Parallel streaks and blebs of Na-rich feldspar (albite) within a host of potassium-feldspar (orthoclase or microcline). Very common in some granites, and it may be possible to distinguish several generations of exsolution.

Antiperthitic



Parallel streaks and blebs of potassium-feldspar (orthoclase or microcline) within a host of Na-rich feldspar (albite). Common in syenites and in some granites.

Pyroxene exsolution textures

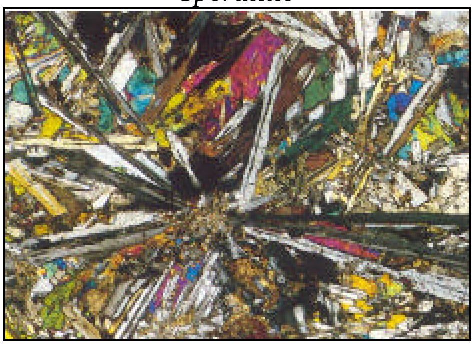


In slowly cooled basic rocks (e.g. gabbros, norites) the pyroxenes may show lamellae structures. These are either blebs of orthopyroxene in a host of clinopyroxene or visa versa.

(f) Radiate structures

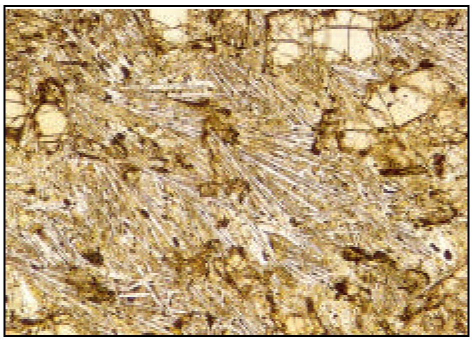
Radiate textures are those in which elongate crystals diverge from a common nucleus. They are most frequently found in fine grained rocks, but not exclusively.

Sperulitic



Sperulites are approximately spheroidal bodies in a rock, composed of an aggregate of fibrous or elongate crystals of one or more minerals radiating from a nucleus, with glass or crystals in between.

Variolitic



A fan-like arrangement of divergent, often branching, fibres. A common arrangement in basic rocks is a fan of plagioclase separated by glass or pyroxene.

(g) Crystal zoning

Because most common igneous minerals belong to solid-solution series, and equilibrium crystallisation is exceedingly rare, many minerals in igneous rocks become zoned during growth. Zoning occurs when the mineral changes its composition in response to changes in magma chemistry. The result is a crystal which has a continuously changing composition from core to rim, which manifests itself as a subtle change in the optical properties of that crystal. Three major varieties of zoning occur:

Normal zoning
Where the crystal is zoned from the high temperature endmember of the solid solution towards the low temperature endmember. For example, plagioclase would be zoned from Ca-rich to Na-rich compositions.

Reverse zoning
Where the crystal is zoned from the low temperature endmember of the solid solution towards the high temperature endmember. For example, plagioclase would be zoned from Na-rich to Ca-rich compositions.

Oscillatory zoning
Where the composition of the crystal switches from the high temperature to the lower temperature endmember a number of times during growth.

Continuously zoned crystals

Oscillatory zoned crystals

5. OTHER COMMON TERMS

Melanocratic, mesocratic, leucocratic (synonymous with dark-, medium and light-coloured) indicate the colour index of a rock and hence the relative proportions of dark- to light-coloured mineralsm – the boundaries are at 66% and 33% dark minerals respectively. Rocks may be given a prefix in order to further subdivide a group of related rocks e.g. *mela*-gabbro, *leuco*-gabbro.

Essential minerals are those which are necessary to the naming of the rock, but may only be present in minor quantities e.g. a crinanite must contain a small amount of analcite.

Accessory minerals are those which are present in very small amounts (< 1% by volume), and can normally be ignored when naming the rock. However, it may be useful in the name to note the present of a particular accessory mineral in a rock, particularly if that mineral is not normally associated with that particular rock type, and this can be done by adding the mineral name as a prefix e.g. *quartz gabbro*.