Useful Bits of Information for Mineral Identification and Textural Descriptions of Thin-Sections

IMPORTANT

All optical properties of minerals depend on the crystallographic orientation in some way or another. Variations that you observe between two different minerals don't mean that they are two different minerals. You could be looking at differently orientated minerals of the same composition!

Non-crystalline minerals

We use two different terms to describe non-crystalline minerals. Metamict refers to minerals that were once crystalline but are no longer so. Amorphous refers to minerals that have formed from glasses and gels. Saggerson (1986) defines metamict and amphous as follows:

Metamict state refers to a mineral (containing radioactive elements) in which various degrees of lattice disruption and changes have taken place as a result of radiation damage while its original external morphology has been retained.

Amorphous minerals originally formed in the non-crystalline state by rapid cooling froma molten state or by slow hardening of gelatinous material.

Using Birefringence Colours

Interference colours or birefringence is dependent on the crystallographic orientation of the mineral in thin-section. This is why one mineral seems to display a variety of interference colours. For example, clino-pyroxene may show yellow, green, blue and pink colours. The birefringence and hence interference colours that are specified for a particular mineral, are specified for the direction of maximum birefringence. Thus when comparing your mineral in thin-section with those from charts or lists, look around the thin-section for the grain with the highest birefringence and compare this colour with the given colours.

Develop a System

It's easy to look at a new thin-section and get discouraged because you can't identify any of the minerals. In this situation, concentrate on what you do know and not what you don't know. Develop a system for yourself of what to look for to start isolating what types of minerals that you might be looking at. Go through the accompanying flow chart for mineral identification to help you develop a system that works for you and stick to it

Relationship Between Extinction Angle and Crystal Systems

Cubic	Isometric	Isotropic
Tetragonal	Uniaxial	Parallel or symmetrical extinction
Hexagonal, Trigonal	Uniaxial	Parallel or symmetrical extinction
Orthorhombic	Biaxial	Parallel extinction
Monoclinic	Biaxial	Inclined extinction (parallel for some crystallographic orientations
Triclinic	Biaxial	Inclined extinction for all crystallographic orientations

Terminology

There are lots of different terms that are used to describe the textures of minerals and rocks in thin-section. Try to become familiar with the terms and to thus use them appropriately. Most importantly remember that some terms are used to describe metamorphic rocks and some are used to describe igneous rocks. For example, igneous rocks don't contain porphyroblasts and metamorphic rocks don't contain phenocrysts. Polygonal is normally used for metamorphic textures, while subhedral is commonly used to describe igneous minerals (but not always!).

Terms used to describe the habit and shape of minerals: incipient, skeletal, acicular, fibrous, flaky, tabular, bladed, columnar, granular, polygonal, aggregates, euhedral, subhedral, anhedral, porphyroblast, poikioblast, phenocyst, poikiocryst, and lobate.

Terms used to describe the shape and appearance of grain boundaries: straight, curved, ragged, polygonal, embayed, scalloped, cuspate, sutured, lobate, amoeboid, serrated, dentate, rational, unilateral, bilateral, convex, concave, penetrative, replacive, reaction, symplectite, altered and annealed.

Terms used to describe types of twins: simple, paired, twin seams, multiple, multi-lamellar, polysynthetic, repeated, cyclic, sector, complex, parallel, penetration, interpenetrant, geniculate, cruciform, growth, primary, secondary, deformation, cross-lamellar, glide and transformation twins.

Problems with colour

Colour is not a reliable characteristic for identifying minerals because the solid-solution exhibited by many minerals means that most minerals have variable colour. Pleochroism and interference colours are more useful because they relate to specific crystallographic properties of the mineral. For example look at the different micas. Micas have the general structural formula $X_2Y_{4-6}Z_8O_{20}(OH,F)_4$ where X can be K, Na or Ca, Y can be Al, Mg, Fe, Ti or Li and Z is Si and/or Al. There are seven main varieties of mica. OF these four are light colouored and three are dark coloured based on their chemistry.

Light Micas										
Muscovite			K	Al					Si	Al
Lepidolite			K	Al				Li	Si	Al
Zinnwaldite			K	Al	Fe			Li		
Paragonite		Na		Al					Si	Al
Dark Micas										
Biotite			K	Al	Fe	Mg	Ti		Si	Al
Phlogopite			K		Fe	Mg			Si	Al
Glauconite	Ca	Na	K	Al	Fe	Mg			Si	Al

What this shows is that Fe, Mg contents are very important in controlling colour. In particular, minerals that contain a lot of iron are normally strongly coloured

Check List for Thin-Section Descriptions

- ✓ Mineral assemblage, main, minor and accessory
- ✓ Grainsize and grainshape
- ✓ Matrix versus porphyroblasts or phenocrysts
- ✓ Inclusions in porphyroblasts or phenocrysts
- ✓ Mineral associations
- ✓ Grain boundary shapes
- ✓ Retrogression features
- ✓ Structural fabrics
- ✓ Other compositional variation
- ✓ Labelled representative sketch
- ✓ Scale