

GEOL.3100L – IGNEOUS MINERALS IN THIN SECTION

1. Introduction

In this laboratory we will investigate the optical properties of the common minerals found in igneous rocks. This is a preparatory exercise for following labs that will require you to identify minerals in igneous rocks. The only way you can become proficient at identifying minerals in thin section is to look down the microscope and make observations. Taking pictures with your cell phone camera and then trying to match them with pictures on the web is not a successful strategy.

2. Common minerals in igneous rocks

The major rock forming minerals/mineral groups in igneous rocks are olivine, pyroxene, amphibole, mica, plagioclase, K-feldspar, and quartz. Each of the thin sections you will look at today contains one or more of these minerals. As a starting point you may want to look at the several reference books available in the laboratory which list the optical properties for the various minerals. In many cases there are distinctive properties that will help you quickly identify a mineral.

As I have mentioned many times in class, one should start to examine a thin section using plain light at the lowest possible magnification. This allows you to see both a significant area of the slide and to quickly pick-out colored minerals. If a colored mineral is pleochroic, the change in color will help you identify the mineral. Another thing you should look at is the shape of the mineral – elongate, stubby, equant, flakey, etc. Shape can be a very useful property. Relative relief can also be a useful property. Once you have seen all you can see in plain light, cross the polars while still on low magnification and look at the birefringence of the various minerals.

What are some of the obvious characteristics that can help you identify the common minerals in igneous rocks?

Olivine – high relief and high birefringence

Pyroxene – moderate relief and moderate birefringence. Grains are often tabular.

Amphibole – similar to pyroxene. How do you tell them apart? Look at a cross-section of the mineral (i.e. the long axis of the mineral is oriented perpendicular to the microscope stage) and determine the cleavage directions. If the cleavage intersects at 90° it is most likely pyroxene. If the cleavage intersects at 60° and 120° angles it is most likely amphibole.

Micas - generally flake like. Biotite is pleochroic while muscovite (which is colorless) shows a significant variation in relief upon rotation of the microscope stage. Both minerals have high birefringence. The birefringence of muscovite is greater than that of biotite.

Plagioclase – tends to be tabular and the grains have low birefringence. A very useful characteristic for identifying plagioclase is the presence of albite twinning.

K-feldspar – low birefringence. It does not have albite twinning but often has Carlsbad twinning. K-feldspar frequently occurs as perthite.

Quartz – low birefringence and often shows undulatory extinction.

Once you start looking at igneous rocks, one of the important properties you need to determine is the composition of the plagioclase found in the rock. This can be done using one of the twin laws, either the Michelle-Levy (albite) twin law or the Carlsbad-albite twin law. Your instructor will explain how to make this determination.

On the course web site you will find links to several items that will help you with the above – Optical Microscopy Features and diagrams (Michelle-Levy and Carlsbad-albite) that can be used to determine plagioclase compositions.

3. Identification of Igneous Minerals in Thin Section

For each of the thin section slides identify the mineral or minerals of interest. The table below lists the thin sections and a characteristic(s) that can be used to determine which mineral(s) you are to identify. In the Characteristics field list those properties that **you** found most useful in identifying the mineral (not simply a listing of properties from a book). Once completed, this table can help you identify minerals in igneous rocks in subsequent laboratories.

Slide #	Mineral(s) to Identify	Mineral	Characteristics
X-0251	Dominant mineral		
1	Green mineral in plain light		
3	Large mineral which occurs in a finer-grained matrix		
8	Large orangish grains in plain light		
10	Large tannish grain in plain light		

Slide #	Mineral(s) to Identify	Mineral	Characteristics
X-0371	Orangish brown lath like mineral		
83	Colorless lath-like mineral		
X-1371	Mineral with undulatory extinction		
6	Determine the composition of the plagioclase		
11	Three major minerals (low birefringence) and the pleochroic mineral		