

## Plagioclase, Olivine, Orthopyroxene, and Clinopyroxene

### *Introduction* □

The goal of the first four lab exercises is for you to learn to identify some common igneous and metamorphic rock-forming minerals and to become fluent in the techniques of optical mineralogy. You should familiarize yourself with the properties of each mineral before looking at it under the microscope or in hand sample (refer to the handouts). Notice that many of these properties vary with the composition of the mineral; this information is often essential both in assigning rock nomenclature and in understanding the conditions of crystallization. The following properties are useful for identifying minerals in thin section:

grain shape	cleavage, parting and fracture
relief	color
pleochroism	absorption
maximum birefringence	twinning
extinction angle	sign of elongation
order of interference color	type of optical indicatrix
optic sign	2V
optic orientation	dispersion

You can read about these properties in Bloss and Kerr.

The minerals introduced in this lab are plagioclase feldspar (pl), olivine (ol), orthopyroxene (opx), and clinopyroxene (cpx). They are common constituents of plutonic, volcanic, and metamorphic rocks, and may show extreme compositional variation. Rocks that are composed only of olivine and/or pyroxenes are known as ultramafics. Plutonic rocks composed of plagioclase and clinopyroxene are gabbros, while those composed of plagioclase and orthopyroxene are norites. Volcanic rocks containing plagioclase and clinopyroxene are basalts.

Classification of ultramafic rocks:

<u>Mineral Assemblage</u>	<u>Rock Name</u>
90-100% ol:	dunite
90-100% cpx/opx:	pyroxenite
ol+cpx+opx:	lherzolite
ol+opx:	harzburgite
ol+cpx:	wehrlite
opx+cpx:	websterite

Related plagioclase-bearing rocks:

<u>Mineral Assemblage</u>	<u>Rock Name</u>
90-100% pl:	anorthosite
pl+cpx±ol:	gabbro
pl+opx±ol:	norite

## **Exercises**

### **Hand Samples:**

For these, just look at them and try to become familiar with the properties of each mineral or rock:

#1- Bronzite crystal. Bronzite is a variety of orthopyroxene. It shows the typical orthopyroxene cleavage.

#2 – Various samples of olivine. Note the color and conchoidal fracture.

#3 – Spodumene showing the characteristic color and cleavage.

846 – aegirine granite- The aegirine crystals are the slender green crystals. Notice the crystal habit, color and cleavage.

B-VIII-10 – An augite porphyry. The large crystals are outstanding specimens of augite. Note the color, crystal form, and cleavage where broken (Please no breaking the samples).

#15, #16 – Olivine gabbro samples. Try to pick out the different minerals present.

#9, #10 – Gabbro samples. Again, try to pick out and identify the different minerals.

#22, #26 – Norite samples.

**Unknown hand samples:** For these samples identify the rock or mineral.

495 – Identify the green mineral in this sample.

1310 – Identify the dominant mineral present and name the rock.

110 – Identify the dominant mineral present and name the rock.

**Thin Sections:**

#15 – This section contains spodumene.

#4 - This section contains hypersthene, plagioclase and hornblende (an amphibole; you will look at this mineral in the next lab). Hypersthene is readily distinguished by its pink and green (some say gray) pleochroism when cut parallel to (100) and its low, first order interference colors. Locate a grain with the proper orientation to give you an interference figure, then determine the optic sign and 2V. Pick any pyroxene grain and give a full description of it (birefringance, cleavage, shape, extinction, etc.)

ML-1907 – Identify the large phenocrysts in this section and determine the optic sign and 2V if possible. Also give a full description of the grains (birefringance, cleavage, shape, extinction, etc.)

#5 – This section contains inverted pigeonite. Pigeonite will invert to augite + opx. Find out why this happens and what it indicates when find in thin section.

#9 – Identify the green mineral in this section.

#20 – Identify the large phenocrysts in this section and give a full description.

K-5a – This section contains phenocrysts of olivine, plagioclase and pyroxene. Note the differences between them and identify the pyroxene present.