GLY 4200C
Lab Exercise 13

FELDSPATHOIDS
UNIAXIAL INTERFERENCE FIGURES

Feldspathoids

The feldspathoids are silica-poor minerals, which are generally isometric or uniaxial. They are aluminosilicates and contain more of the alkali metals than do the feldspars. Many of their optical properties are similar to the feldspars. The structure is a framework in which the cations and some additional anions are held.

Many feldspathoids show white interference colors. For any mineral showing white interference color determine if the white is first order white or high order white. This may be done by rotating the polarizer 90° to achieve a PN arrangement. If the color remains unchanged the color is high order white. If the color turns reddish the original interference color was first order white. Do not forget to rotate the polarizer back to the crossed nicols position!

Assignment: Examine the following thin sections. (Pink color code except as noted). Sketch any one mineral.

1. Leucite - Leucite is tetragonal below 605°C, isometric above. However some grains may be found at room temperature which are isometric. Leucite occurs in trapezohedral crystals. Twinning, of a complicated polysynthetic nature, is common.

5. (white) Apatite - Uniaxial. Colorless in thin section. Frequent accessory mineral in many rocks. Its presence indicates the presence of phosphorous. The mineral is a phosphate, not a feldspathoid.

8. Lazarite - Generally blue in thin section. An example of an isometric feldspathoid.

Conoscopic observation

In order to observe an interference figure the microscope must be used in the conoscopic mode. This requires that the following conditions be met.

A. Analyzer inserted and crossed with respect to polarizer (CN).
B. Objective lens with a numerical aperture ≥ 0.65 must be used.
C. The condensing lens must be moved (or swing-out lens inserted) to focus the light on a small area.
D. The Bertrand lens must be inserted.

The best procedure is to select a grain whose interference you wish to check. If you believe the mineral is uniaxial, choose a mineral which stays in extinction if one is available. Move the grain to the center of the stage. Focus at low power, then increase (carefully!) to high power. Be sure you are in CN. Insert the Bertrand lens (or remove the eyepiece and look down the microscope tube if the scope does not have a Bertrand lens).

Uniaxial Interference Figures

A uniaxial mineral cut **perpendicular** to the optic axis will give an interference figure as shown in figure 1. The cross is dark (actually in extinction - 1° black) and remains black as the stage is rotated. There may or may not be circular color rings around the center of the cross. If monochromatic light is used these will be alternate bands of light and dark (isochromes). If the stage is rotated the cross will not move if we are truly looking down the optic axis.

If the mineral is not cut perpendicular to the z-axis, the cross will move as the stage is rotated and will not be centered. If the section is **parallel** to the z-axis, a flash figure will be seen.

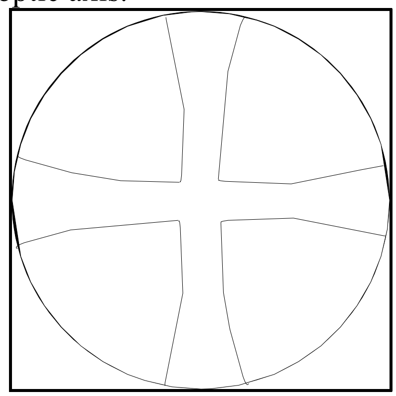

Figure 1

Once a grain showing a cross is located (whether centered or not) the optical sign (+ or -) of the mineral can be determined with the aid of accessory plates. We will deal with minerals with or without isochromes differently in this regard.

For minerals with no isochromes the quartz sensitive tint (gypsum, 1° red) plate may be used. The slow direction of the accessory plate should be oriented NE-SW. For the Olympus and Meiiji microscopes this is automatic.

The quartz sensitive tint plate will change the cross (properly called the **isogyre**) to a 1° red color. The interference figure is divided into quadrants relative to the **melatope**, and the quadrants are labeled as shown in figure 2. With the quartz sensitive tint plate inserted a 2° blue color is seen in two opposing quadrants and a 1° yellow color in the other two opposing quadrants. If this test does not produce satisfactory results a quarter wave plate may be used instead. In this case the opposing quadrants will be 1° white and 1° black. The black will show as two dark dots near the melatope but separate from it.

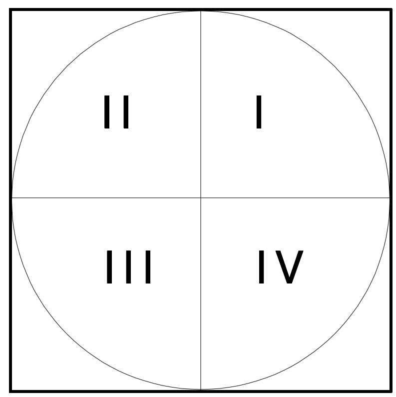

Figure 2

If isochromes are present, the quartz wedge should be used. The slow direction should be NE-SW. The wedge is inserted slowly. The rings will be seen to move toward the center in opposing quadrants and away from the center in the other set of opposing quadrants. The determination of the optical character is summarized in table 1.

Table 1

ACCESSORY PLATE	UNIAXIAL POSITIVE	UNIAXIAL NEGATIVE
1° RED	I & III Blue II & IV Yellow	I & III Yellow II & IV Blue
QUARTER WAVE PLATE	I & III White II & IV Black Dots	I & III Black Dots II & IV White
QUARTZ WEDGE	I & III Isochromes move toward the center II & IV Isochromes move away from the center	I & III Isochromes move away from the center II & IV Isochromes move toward the center

Assignment

Examine the quartz thin section. There are six individual sections on one slide. CAUTION: This is a very expensive thin section. The orientations are from the z-axis. The cuts are at 0, 10, 20, 45, 60 and 90° to the z-axis. Examine the 0° first (marked perpendicular on the slide) then examine the other in order of increasing value. Sketch the interference figure and determine the sign.

Examine the calcite grain mount. Obtain an interference figure and determine the optical sign. Sketch the interference figure you get, and describe how the sign was determined.

Go back to the apatite grain mount. Obtain an interference figure and determine the optical sign. Sketch the interference figure you get, and describe how the sign was determined.

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