

Name: \_\_\_\_\_

## **Laboratory #5**

### **Rocks, Minerals, and Sediments**

This laboratory supports the material covered in various OCN 201 lectures on volcanoes, sediments, and coastal processes. We will cover **igneous** rocks and minerals from continental settings and compare them with those you studied last week from oceanic volcanoes. You will examine **sedimentary** minerals, and study several different types of sand under the microscope. The culminating (i.e., fun, we hope) experience will be the examination of some fluorescent minerals under ultra-violet (UV) light.

KEY WORDS: Biogenous, calcite, color index, crystal, diatoms, evaporitic, extrusive, feldspar, felsic, ferro-magnesian minerals, fluorescence, foraminifers, grain size, granite, gypsum, igneous, intrusive, lithogenous, magma, mica, microcline, minerals, mineraloids, obsidian, olivine, pegmatite, pelagic, phaneritic, provenance, pyroxene, quartz, rock, sand, sediment(ary), stratification, terrigenous, tourmaline, weathering.

### **Laboratory Exercises**

#### **Part 1: Igneous and sedimentary rocks**

A variety of igneous and sedimentary rocks and minerals have been placed on the laboratory table for your examination and are individually labeled, except for a few that are grouped together. Please examine each carefully, noting its distinguishing characteristics. You may take the smaller specimens to look at them under the microscopes because some have relatively small crystals. Some of the specimens have large crystals and the distinguishing characteristics will be plainly evident with the naked eye. You may pick up and handle specimens, however, keep in mind that some are more fragile than others. Please be careful not to drop any specimen; all specimens are from a private collection on loan to the Department of Oceanography, and some are hard to replace. To help you identify the minerals, have a look at the selection of reference books displayed on the table.

- A.** Each of the rocks/minerals on display is described in **Table 1**. Fill in **the letter** of the rock you think matches the descriptions in table 1 (all tables are at the end of the handout).
- B.** Two specimens are labeled X and Y. Identify which one is **mafic** and which one is **felsic**. Record your answers in **Table 1**.

## **Part 2: Sediments**

### **Sands : Microscope ID**

Now turn your attention to the microscope work with various sands. The sands provided for this experiment include biogenic beach sand from O'ahu (coral sand), biogenic sand from Okinawa (Japan), olivine sand from Diamond Head beach, gypsum (selenite) sand from White Sands, New Mexico, quartz sand from the mainland US, and black sand (basically ground up basalt/glass). You will need to change magnification to view the slides, depending on the size of the particles each contains.

After looking at the labeled materials, **examine the various unknown sands and try to identify each sample** based on its characteristics and its resemblance to previously examined materials.

Fill in your observations in **Table 2**.

### **Biogenous sediments (microfossils) : Microscope ID**

Deep-ocean sediments containing at least 30% of biogenous material is called an ooze. Oozes are named after the dominant remnant organism constituting them. The hard shells and skeletal remains of these creatures are made of relatively dense glasslike silica (siliceous ooze) or calcium carbonate substances (calcareous ooze).

You will examine mounted slides of deep-sea oozes and try to identify which organism is dominant: **foraminifera or radiolarian?** Record your answers in **Table 3**.

*Hint:* Have a look at the micrographs of the common shapes of shells for these organisms displayed next to the microscopes.

### **Part 3: Fluorescent Minerals**

The rocks and minerals displayed are part of a private collection and some are very fragile and valuable. **Please be careful when handling!**

1. Examine each of the specimens provided (labeled 1 to 6) in normal light, and see if you can identify any of them based on your observations (don't try too hard...).
2. When you have finished, turn on the UV light. **The lamp has a very strong beam!** Please be careful as extended exposure to UV light damages your skin and is particularly dangerous to your eyes. **DO NOT LOOK DIRECTLY AT THE UV BEAM, IT IS DAMAGAGING TO YOUR EYES.** Pass the UV light over each of the rocks labeled and note what colors fluoresce.
3. Using the information from the handout and the cheat sheets on the table, try to identify the minerals/rocks.

Record your observations in **Table 4**.

**Some commonly fluorescent mineral species are listed below by the color of light they emit.** (minerals in bold are displayed in the laboratory)

**White-near white:** Scheelite , witherite, aragonite, **calcite**, brucite, anglesite, colemanite , ulexite.

**Red or pink:** Corundum especially ruby (strong), spinel, nepheline, **calcite** (sometime strong), chrysoberyl

**Orange:** Zircon (often strong), spodumene, sodalite, pectolite, nepheline, scapolite (often strong), anglesite, aragonite, **barite**.

**Yellow:** Zircon, opal, scapolite, sodalite (sometime strong), apatite, hemimorphite, cerrusite , anglesite, gypsum, chalcedony.

**Green:** **Chalcedony**, opal, **willemite** (often intense), chabazite, , autunite (intense)

**Blue:** Diamond, scheelite (strong), **fluorite** (strong), witherite, brucite, benitoite (strong), danburite, **gypsum** (light blue).

## List of Rocks and Minerals Displayed in Laboratory

### IGNEOUS

Peridotite Mantle Xenolith (Hualalai, Hawaii)

Mixed Peridotite-Pyroxenite Mantle Xenolith (Hualalai, Hawaii)

Smoky Quartz, Feldspar, Mica (Ocean View, Pala, San Diego, California)

Smoky Quartz (Ocean View, Pala, San Diego, California)

Pegmatite (muscovite, feldspar, quartz) (Ocean View, Pala, San Diego, California)

Lepidolite (Warner Springs, San Diego, California), Lepidolite (Minas Gerais, Brasil)

Pematite (quartz, albite, feldspar, garnet, tourmaline) (Mesa Grande, San Diego, California)

Pegmatite with black Tourmaline (Mount Palomar, San Diego, California)

Oligoclase (Incline, Washoe County, Nevada)... looks like a brick

Microcline feldspar (Incline, Washoe County, Nevada)

### SEDIMENTARY

Calcite, spary rhombohedral (Laie, Oahu, Hawaii) This also fluoresces blue-white

Calcite, scalenohedral (Laie, Oahu, Hawaii), Calcite, stalagtitic (Laie, Oahu, Hawaii)

Selenite (aka Gypsum Rose)(Saudi Arabia)

Painted Sandstone, Colorado

Pyrolusite (Mn oxide) dendrite bearing calcite (Summit County, Colorado)

Jasper (NW Territories, Australia)

### SANDS

Olivine sand (Diamond Head Beach, Oahu, Hawaii)

Gypsum sand (White Sands, New Mexico)

Quartz sand (mainland US)

Black sand (Kauai, Hawaii)

Biogenic Sand (Okinawa, Japan)

Biogenic Sand (Oahu, Hawaii)

### FLUORESCENT

Chalcedony from Eastern US (fluoresces bright green)

Fluorite (Flosterley, County Durham, England), fluoresces blue

Barite. Orange fluorescence in stripes (Hot Springs, North Carolina)

Various Calcite (red-orange), Franklinite (no fluorescence) and Willemite (Green) specimens (Franklin New Jersey)

Selenite (Winnipeg, Manitoba, Canada) fluoresces whitish-grey, phosphoresces whiteish blue

**Table 1. Igneous and Sedimentary Rocks**

**Fill in the letter that corresponds to the description**

**Igneous Rocks (A-G)**

| Letter | Name  | Color            | Description  |
|--------|---|------------------|--|
|        | Peridotite Mantle Xenolith                  | Green            | Rounded to subangular shape; multiple small, glassy olivine crystals           |
|        | Mixed Peridotite/Pyroxenite Mantle Xenolith | Green/Black      | Rounded to subangular shape; multiple small, glassy olivine and pyroxene       |
|        | Smoky Quartz w/Feldspar and Mica            | Grey/Cream/Green | Hexagonal (quartz), plates (muscovite, mica), and cream (feldspar)             |
|        | Lepidolite                                  | Pale Violet      | Hexagonal plates are single crystals, also includes small grain crystals       |
|        | Pegmatite w/Tourmaline                      | White/Various    | Hexagonal quartz on blocky feldspar with large black tourmaline crystals       |
|        | Oligoclase                                  | Tan              | Blocky with striated surface that looks like weaved fabric, looks like a brick |
|        | Microcline Feldspar                         | Cream/Beige      | Tubular triclinic with varying sizes of interlocking crystals                  |

**Sedimentary Rocks (H-M)**

| Letter | Name                         | Color                | Description   |
|--------|------------------------------|----------------------|---|
|        | Calcite - spary rhombohedral | Transluscent (clear) | Clear crystals with rhombs (cleavage planes)                            |
|        | Calcite - scalenohedral      | Cream/Yellow         | Numerous dog-toothed shapes (crystal size ~ 5 mm)                       |
|        | Selenite/Gypsum Rose         | Grey-Cream           | Interlaced plateau blades   |
|        | Painted Sandstone            | Yellow/Brown/Black   | Wave patterns in a sandy matrix   |
|        | Pyrolusite                   | Grey/Black           | Black dendritic Mn oxides, fern-like patterns                           |
|        | Jasper                       | Red/Cream/White      | Amorphous (no crystal shape) except for glassy crystals within cavities |

**Igneous Rocks: Color Index (X-Y)**

|  |        |
|--|--------|
|  | Mafic  |
|  | Felsic |

**Table 2. Sands : Microscope ID**

*A. Observations*

| Type                   | Colors | Crystals (Y/N) | Characteristics |
|------------------------|--------|----------------|-----------------|
| Olivine Sand           |        |                |                 |
| Gypsum Sand            |        |                |                 |
| Quartz Sand            |        |                |                 |
| Black Sand (Kauai)     |        |                |                 |
| Biogenic Sand (Hawaii) |        |                |                 |
| Biogenic Sand (Japan)  |        |                |                 |

*B. Unknown Classification*

| Unknown Sand | Colors | Crystals (Y/N) | Characteristics | Closest match from above |
|--------------|--------|----------------|-----------------|--------------------------|
| Unknown #1   |        |                |                 |                          |
| Unknown #2   |        |                |                 |                          |
| Unknown #3   |        |                |                 |                          |

Hint: can be a mixture of 2 sand types....

**Table 3. Biogenous sediments: Microfossils ID**

| Unknown ooze | Dominant organism | Ooze classification |
|--------------|-------------------|---------------------|
| Ooze #1      |                   |                     |
| Ooze #2      |                   |                     |
| Ooze #3      |                   |                     |

*Dominant organism: foraminifera or radiolarian*

*Ooze classification: calcareous or siliceous*

**Table 4. Fluorescent Minerals**

| Rock Number | Color(s) during UV fluorescence | Mineral(s) Identification |
|-------------|---------------------------------|---------------------------|
| 1           |                                 |                           |
| 2           |                                 |                           |
| 3           |                                 |                           |
| 4           |                                 |                           |
| 5           |                                 |                           |
| 6           |                                 |                           |

*Hints:*

Chalcedony (fluoresces creamy green)

Fluorite (fluoresces blue)

Barite (fluoresces orange)

Calcite (fluoresces reddish-orange)

Willemite (fluoresces brilliant green)

Selenite (fluoresces light green/blue & phosphoresces)