Earth Science 409 Environmental Geology Spring 2008

**Laboratory #1 MINERAL IDENTIFICATION**

Your Name _____

Lab section _____

The purpose of this lab is to become familiar with the properties of minerals, to use these properties to identify minerals in hand sample, and to learn some of them by sight. The samples were chosen to include some of the most common minerals, which you will also encounter when we study rocks, and a few others of economic or environmental importance.

A mineral is a naturally occurring inorganic, solid compound having particular physical properties, which are an outward manifestation of a specific chemical composition. Each different mineral will thus have certain diagnostic properties, which allow us to identify it and distinguish it from others. Often we cannot rely on a single property to identify a sample - - we must look at several of its attributes. Some properties such as color may be misleading if impurities are present.

**Part I: Six Unknowns**

For each of the first set of six samples, describe the three properties explained below, and any other properties that seem diagnostic (see next page). Consult keys provided in lab (tables attached) and/or Montgomery 8ed, p.534-535, to assign a name to each sample.

| | PROPERTIES | MINERAL NAME |
|---|---|---|
| 1) | _____ | _____ |
| 2) | _____ | _____ |
| 3) | _____ | _____ |
| 4) | _____ | _____ |
| 5) | _____ | _____ |
| 6) | _____ | _____ |

Mineral Properties to note for all samples:

- Cleavage: The crystalline structure of many minerals is not the same in all directions. A sample may break along planes of weakness known as cleavage planes. A mineral may have one, two or more directions of cleavage. *Cleavage planes* are often smooth and shiny, and may be recognized as small step-like surfaces. In some minerals the internal structure is such that a crystal does not break along one plane in preference to another, but rather it breaks along an *irregular fracture*, or a curved surface called *conchoidal fracture*.
- Hardness: The resistance of a mineral to scratching is termed its hardness. *Moh's scale* of ten minerals is used as a relative reference scale; your fingernail, a penny, or steel nail can also be used if you don't have a set of Moh's minerals handy. Refer to attached figures on Moh's hardness scale.
- Luster: Luster is the manner in which a mineral reflects light. It may be shiny like a metal (*metallic*), or non-metallic, for example shiny like glass (*glassy* or *vitreous*). Other terms for non-metallic lusters are: *waxy*, *greasy*, *silky*, *pearly*, *earthy*, or *dull*. Note: metallic minerals are also opaque (see next page).

Other properties that may be useful:

- Opacity: Minerals may range from completely *opaque*, to *translucent* (allow light to pass), or even *transparent*, especially on thin broken edges.
- Streak: The color of the powdered mineral, usually obtained by rubbing the mineral on a porcelain *streak plate*. (Caution: minerals harder than the plate's hardness will only scratch the plate and thus by definition have no streak.)
- Specific gravity: The ratio between the mass of the mineral and the mass of an equal volume of water. In hand sample this property is how heavy the mineral feels when hefting it. You can compare samples to similar sized samples of known minerals. For example, quartz and most silicate minerals have average specific gravity (~2.5 times heavier than water). Note only if exceptionally heavy or light.
- Acid reaction: A few minerals react readily in weak HCl to release bubbles of $CO_2$, called effervescing or "*fizzing*". Take your sample to the sink to test it, and rinse afterwards.
- Crystal form: When a mineral grows in an unrestricted locale, it develops natural crystal faces which reflect an orderly internal molecular structure. These crystal faces will be arranged at distinctive angles to each other. Cleavage or fracture may cut across the faces.
- Color: Color is usually not very reliable except in the broadest sense, as some minerals may show a wide variety of colors due to a range in chemical composition, or due to staining from exposure to air or water. Only a few minerals have reliable, unique color.
- Miscellaneous properties: Magnetism - - attracted to a magnet
  Taste or odor - - rinse samples before and after tasting!
  Striations on crystal faces or cleavage.

More information on these properties can be found in *Essentials of Geology* (Lutgens and Tarbuck, Chapter 2). A copy of this book is available in lab for reference.

**Part II. More Minerals**

Now identify the second set of minerals, but this time list only the most distinctive properties, referring to the tables as before, and choosing from the following ten mineral names. Write down the reference number (from the boxes) for each of the ten minerals.

| MINERAL | REFENCE NUMBER |
|---|---|
| Halite | |
| Quartz | |
| Dolomite | |
| Muscovite | |
| Feldspar | |
| Magnetite | |
| Biotite mica | |
| Talc | |
| Native Sulphur | |
| Graphite | |

**Part III:** Questions
When your identifications from Parts I and II are completed, answer the following questions, referring to your results and the textbook or class notes as needed.

1. Examine the set of 10 samples that are used to illustrate Moh's hardness scale. Name the 2 minerals which have been misplaced and briefly explain how you chose and identified them. Please do not rearrange the minerals in this set!

2. Explain how streak can be more reliable than color in mineral identification, using examples from the minerals that we have studied.

3. Quartz and most feldspars are common, light-colored, and relatively hard. What property will be most useful to distinguish quartz from feldspar when we encounter them as small crystals in rocks? Explain.

4. The minerals calcite, halite, and gypsum are light, non-metallic, and softer than a nail.
   a. Name one property for each which would distinguish it from the other two:
      Calcite: _____ Halite: _____ Gypsum: _____

   b. What is the economic importance of each?
      Calcite: _____
      Halite: _____
      Gypsum: _____

5. What two properties of quartz allow it to survive transport by rivers over long distances? (It is one of the main components of beach sand in New England.) Explain your reasoning.

6. Which mineral or minerals from among those you've observed would not hold up well to acid rain?
   _____

7. What products in your house, dorm, apartment, or car might be made from these minerals?

   Quartz _____ Gypsum _____

   Hematite _____ Graphite _____

   Galena _____ Feldspar _____

8. Which of the rocks from Parts I and II are silicates?