Lab #16: *Geology 4* (Chapter 10)

Petrology

INTRODUCTION:

The objective of this lab is to learn how to identify basic rock types, like those found in the Grand Canyon.

MATERIALS

- Rock kit (e.g., www.cornerstone-edsupply.com) that includes rock testing equipment

METHODS

1. Preparation: The teacher should remove all of the rocks from the box and mix them.
2. Preparation: The teacher should place the rock placement sheet that is provided in the kit beside the empty rock kit box, with the rock name side up (with the rock images face down).
3. Students: Read the general information below, review how the three types of rocks (sedimentary, igneous, and metamorphic) form, and study the rock identification charts.
4. Identify the more distinctive rocks first (e.g., coal, obsidian, coquina, limestone, and pumice). Place the identified rock in the correct spot in the rock kit box, corresponding to the name chart beside the box.
5. Attempt to identify the soft metamorphic rocks (soapstone, slate, and marble) using the chart and hardness scale.
6. Attempt to identify the remaining metamorphic rocks using the following process:

   Is it metamorphic?

   - Does it shine/shimmer in light? (non-foliated often won't, but foliated often will)
   - Stripes/banding/ribbons? (not "stacked" like sedimentary rock)
   - Lots of reflective flecks? (use magnifier if necessary)
   - Organized patterns in the grains, flowing in the same direction?
   - Foliated (stripes/bands)? (some metamorphic won't)
   - Overall gray, but very distinct black and white bands/foliations cutting through it? (gneiss)
   - Can it scratch glass? (slate, marble cannot)
   - If it can't scratch glass and its grains seem to have no clear orientation/pattern, large crystals with random distribution, non-foliated, typically white or gray, it may be marble. (test it with the acid test)
   - Flat sheet layers and can't cut glass? (slate)
7. Attempt to identify siltstone and sandstone using the chart.
8. Use the chart to identify the remaining igneous rocks.

RESULTS/DISCUSSION

1. Given the way in which sedimentary, igneous, and metamorphic rocks form, discuss whether (and

why) we would expect to find all three types in the Grand Canyon.

2. What would we expect to be the most predominate form of rock in the Grand Canyon above the "Great Unconformity"? Why?
3. What might we expect to be the predominate form of rock in the Grand Canyon below the "Great Unconformity"? Why?
4. The rocks below the "Great Unconformity" in the Grand Canyon are granite, schist, and gneiss. Identify which of the three types of rocks each of these are.
5. The rocks above the "Great Unconformity" are sandstone, shale, and limestone. Identify which of the three types of rocks each of these are.

GENERAL INFORMATION

- Igneous rocks (e.g., granite, basalt, obsidian, etc.) form when magma (melted rock) from within the Earth cools and hardens. Igneous rocks have little texture or layering. Rocks like these contain mostly black, white and/or gray minerals; large crystals.
- Sedimentary rocks (e.g., limestone, sandstone, shale, gypsum, etc.) form when sediments (e.g., sand or mud) or organic materials (e.g., shells, plants, bones, etc.) accumulate and get buried and compacted. Once they are dense enough, they become a rock. So, sedimentary rocks are hardened sediment with sandy or clay-like layers (strata). They are usually brown to gray in color and may have fossils and water or wind marks.
- Metamorphic rocks (e.g., marble, slate, schist, gneiss, etc.) form when sedimentary, igneous, or even other metamorphic rocks are subjected to major pressure or heat that changes their composition. Metamorphic rocks, such as marble, are tough, with straight or curved layers (foliation) of light and dark minerals. They come in various colors and often contain glittery mica. Often look crystalline and with a "squashed" texture.
- The hardness of a rock is measured using the Mohrs scale and is based on the minerals that comprise a rock. If a rock can scratch another object, it is harder than the object, and vice versa. The hardness of the following items is used to determine the hardness of rocks/minerals:

  Fingernail: 2.5; Penny: 3.0; Nail: 4-5; Glass plate: 5.5; Streak plates: 6.5

[Rock information gathered primarily from "Everything You Need to Identify Rocks (thoughtco.com) and "How to Identify Metamorphic Rocks: 12 Steps (with Pictures)" (wikihow.com)]

Metamorphic Rock Identification

Foliation	Grain Size	Usual Color	Other	Rock Type	Hardness
foliated	**fine**	**light**	**very soft; greasy feel**	Soapstone	**2.5**-3.5
foliated	**fine**	**dark**	**soft**; strong cleavage	Slate	**2.5**-4
foliated	coarse	**mixed dark and light**	**wrinkled foliation; often has large crystals (sparkling)**	Schist	5-6.5
foliated	coarse	**mixed**	**Parallel mineral bands**	Gneiss	6-7
nonfoliated	**coarse**	**light**	**soft**; calcite or dolomite by the acid test; architecture	Marble	**3**
Nonfoliated/or weak foliated	fine	**green**	Tough, dark	Greenstone	4-5

Sedimentary Rock Identification

Grain Size	Composition	Other	Rock Type	Hardness
coarse	clean quartz	White, **gray**, to brown; **compressed sand**	Sandstone	Hard, 6-7
fine	**very fine sand; no clay**	feels gritty on teeth; red/gray	Siltstone	Hard, 4.5-5.5
fine	carbon	**black**; burns with tarry smoke	Coal (bituminous)	**Soft, 2**
fine	calcite	Dense; **fizzes with acid; formed from shells, coral**, etc.	Limestone	Soft, 3-4
coarse	**fossil shells**	**mostly pieces**	Coquina	**Soft, 2-3**

Igneous Rock Identification

Grain Size	Usual Color	Other	Composition	Rock Type	Hardness
fine	**dark**	**glassy** appearance	lava glass	Obsidian	6-7
fine	**light**	many small **bubbles**	lava froth from sticky lava	Pumice	6
fine or mixed	**dark**	has no quartz	low-silica lava; may shine/glimmer	Basalt	5
coarse	**light**	**wide range** of mixed color (**pink**, gray, white, etc.) and grain size	feldspar and quartz with minor mica, amphibole or pyroxene; used in counter tops; may shine/glimmer	Granite	5.5-6
very coarse	**any color**	usually in small intrusive bodies	typically granitic	Pegmatite	7