Name: _____

Lab 4: Rocks

Examine each sample closely, with magnification. Look for mineral crystals in each rock. Are the crystals euhedral? Do they interlock? What color are they? How large are the crystals? Are they found in specific zones? Note any other observations or distinguishing features of the samples.

Sedimentary Rocks

Sedimentary rocks are formed by material settling and consolidating into rock. The material can be chunks (*clasts*) broken from pre-existing rocks by weathering and erosion, it can be hard or even soft parts of organisms, or it can be minerals that precipitate from water when conditions change.

S1. Coal

By some reckonings, this is not really a rock, because it is organic. This is compressed and altered remains of plants that were buried, compressed, and heated long ago.

S2. Limestone

This most likely was created from carbonate shells of microscopic dead algae. The algae settled to the sea floor, and over time the muck was compacted. The principle mineral of limestone is calcite, $CaCO_3$, which reacts with acid (H^+) to release carbon dioxide by the reaction

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + H_2O + CO_2.$$

Because of this, the rock fizzes when a little dilute acid is dropped on it. Try it! That is a sure sign that a carbonate mineral is present. All carbonate minerals fizz with acid, but calcite is the most common carbonate.

S3. Fossilliferous limestone (Petoskey Stone)

It is easy to see that this rock is composed of fossil coral. It is made of calcite. Please don't dissolve this rock in acid.

S4. Travertine

This is also limestone, but it precipitated from a chemical process from a mineral hot spring rather than from biological action. Note its irregular layers and pores. This stuff fizzes like crazy in dilute acid.

S5. Chert
Another biological sediment. This is from microscopic diatoms, which have shells made of silica. Over time, the diatom ooze settled and became compacted. Note that the rock fractures in a scalloped fashion, like glass.

S6Shale and mudstone (three samples)
This is compacted fine-grained sediment: silt, mud, or clay. (Strictly speaking, shale contains only very-fine-grained materials: clay-sized. Stuff with bigger fragments is a mudstone or siltstone. We won't be that specific.) Shale fractures along bedding planes; mudstone does not have a preferred cleavage direction.

S7. Sandstone (four samples)
Sandstone is mostly sand, but sand comes in a variety of grain sizes. Carefully studying the grains tells a lot about the environment in which the rains were deposited. The sand grains are cemented by another mineral, usually calcite (limestone) silica, or hematite (red iron ore). If the cement is calcite, the sandstone fizzes in dilute acid.

S8. Conglomerate (two samples)
This is sandstone's bigger cousin. Instead of sand grains, this is made of cemented pebble-, cobble-, or boulder-sized rocks. The clasts in this conglomerate are rounded pebbles. What sort of geologic agent produces such clasts?

Igneous Rocks
Igneous rocks form by solidification (freezing) of molten rock (*magma*) without further alteration. The rocks can be light or dark. The mineral grains making up the rocks range from very large to sub-microscopic. Igneous rocks are basically classified along these two dimensions: mineral composition and grain (mineral crystal) size.

If the magma erupts onto the land or sea surface as lava or ash and solidifies there, the resulting rock is *extrusive*. Cooling at or above the surface is very rapid, so the mineral crystals do not have time to grow very large, if at all. If the magma solidifies underground, the resulting rock is *intrusive*. Intrusive rocks contain fairly large crystals, visible to the unaided eye. Sometimes the magma partially solidifies underground, forming large crystals of the minerals with high melting points, then erupts to the surface where the remaining melt cools rapidly. The resulting *porphyritic* rock contains both large and small crystals.

Many minerals are found in igneous rocks. *Mafic* minerals have high melting points, are dense, and tend to be dark in color; *felsic* or *silicic* minerals have lower melting points, are less dense,

and are lighter in color. Rocks of the earth's crust, especially at the continents, have a higher proportion of felsic minerals than rocks from deep within the earth.

Grain size	Mineral composition			
	felsic	**intermediate**	**mafic**	**ultramafic**
invisible	rhyolite	andesite	basalt	komatiite
visible	granite	diorite	gabbro	peridotite

When observing the rocks, look for texture, uniformity, and composition. Are the rocks phaneritic, aphanitic, or porphyritic? Do rocks contain any inclusions or xenoliths? Do different minerals weather differently?

11. Pumice

12. Tuff

13. Basalt (scoria)

14. Green cobble

Why do I think this is igneous instead of metamorphic? I don't know what mineral makes this rock green.

15. Basalt

16. Dacite.

This rock is of intermediate composition, around that of andesite.

17. Volcanic breccia

Erupting lava entrained clasts of the country rock it flowed past. What is the relationship of the white rock to the black rock? What are the characteristics of the two rocks?

I8. Volcanic breccia
Another one. Chunks of older rock are cemented together with lava.

I9. Porphyritic texture (two samples)
Note the colors and textures of the red and white parts of the flat rock.

I10. Granite (3 samples)
Granite consists of quartz and feldspar, and sometimes other minerals such as hornblende or mica.

I11. "Granite Canyon" granites
These granites were collected near each other, from the same pluton. How do they differ from each other? What might have caused the differences?

I12. Grainy black rock
What would you call this rock?

I13. "Sybille Canyon"
This rock has enormous crystals and contains some dark minerals.

I14. Peridotite
One of these is a section of an ultramafic intrusive rock. The other is an intact pebble; you can see the weathered exterior

I15. "Limestone" cobble
What do you observe about this rock?

Metamorphic Rocks

Look for foliation and orientation of mineral grains. Are grains distorted? Do any grains intrude into other grains?

M1. Metaconglomerate

I *think* this is a metaconclomerate.

M2. White rock with garnets

Why do I think this rock is metamorphic?

M3. Quartzite

What stresses did this rock experience after metamorphosis?

M4. Slightly altered granite

What sort of alteration did it undergo?

M5. Benner Hill phyllite

Note its luster from oriented mica grains at the surface.

M6. Slates (two samples)

This cleaves into flat slabs, perfect for roof shingles. The rock is much harder than shale (it rings), but not very lustrous.

M7. "Bull Lake" cobble

I don't know much about this rock, but I like it.

M8. "St. Pierre"

Compare this rock to I9. How are they similar? How do they differ?

M9. Baltimore Gneiss
Note the compositional bands and the orientation of the mica grains.

M10 Cockeysville Marble
This rock contains sedimentary layers that were not destroyed by the metamorphism between the layers of marble. What type of rock is in the sedimentary bands?

M11 Serpentine (three hand samples)
What color, luster, and texture do you observe with these rocks?

M12. Serpentine section
Note the alteration of the rock where cracks once were.