Historical Geology with Lab
Lab 2: Earth, Minerals, and Igneous Rocks

Name: _____ Date: _____

Part I. Earth's Internal Structure and composition

Draw and label two figures

1. Show the main compositional layers of the earth choosing either the chemical or physical classification. Mention which system you chose.
2. Show the layering of the upper 300km of the earth according to material properties. Show which portions include the mantle and crust and show a portion that is oceanic crust and a portion that is continental crust.

Questions:

1. Use the names Asthenosphere and Lithosphere and indicate which one behaves as a rigid (brittle) material and which portion moves as a viscous material over time.
2. Which portion of the crust is composed mostly of granite-like rock? Which portion is composed of mostly basalt-like rock?

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Part II. Igneous Minerals

You are responsible for identification of **quartz, potassium feldspar, plagioclase feldspar, mica (light or dark), amphibole, and olivine.**

- **Quartz:** Hard (cannot scratch with a knife), often gray or light-colored, no cleavage, no reaction to acid.
- **Feldspar (light- and dark-colored):** hard, cleaves into right angle sides, no reaction to acid
- **Micas (light- and dark-colored):** soft, forms flakes or sheets
- **Amphibole:** hard, cleaves at 60° and 120° angles, no reaction to acid, looks like wood splinters or coal
- **Pyroxene:** hard, cleaves at 90° angles, no reaction to acid, looks like dark blocks.
- **Olivine:** hard, no cleavage, no acid reaction, light to dark ("pistachio") green

Look at the mineral specimens provided

1. Make an ordered list of the light colored minerals, arranged from softest to hardest

2. Indicate on your list which one(s) exhibit cleavage, and the color of the varieties present.

3. Make a similar list for the dark colored minerals, arranged from softest to hardest. Indicate which ones exhibit cleavage, and the color of the varieties present.

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Part III. Igneous Rocks

Igneous Rocks – You are responsible for identification of **granite, andesite, basalt, and peridotite/gabbro.**

Igneous rocks form from a cooling magma.

The composition (mineral makeup) of igneous rocks can be divided into two main groups:

1. **Felsic (silicic) rocks**: These are lighter colored rocks and include abundant quartz, potassium feldspar. These rocks include **Granite and Rhyolite.**
2. **Mafic Rocks:** These are darker colored rocks and include abundant dark feldspar, pyroxene, and sometimes olivine and/or olivine. These rocks include **Gabbro and Basalt.**

Some rocks are between these two extremes and include less quartz and more amphibole. These rocks include **Diorite and Andesite**

Some igneous rocks are very mafic and we call them "ultramafic". Our one example is the rock **Peridotite.**

We divide igneous rocks into two general categories:

1. **Plutonic or intrusive igneous rocks** are formed from a magma that cools deep beneath the surface. Intrusive Igneous Rocks: **Granite, Diorite, Gabbro, Peridotite**
2. **Volcanic or extrusive rocks** are formed from a magma that cools on or close to the surface. Extrusive Igneous Rocks: **Rhyolite/Andesite, Basalt**

Minerals	Quartz Light Feldspar Mica little Amphibole	Light Feldspar Mica Amphibole little Quartz	Dark Feldspar Amphibole Pyroxene	Pyroxene Olivine (green) Amphibole
Intrusive (Cooled slow at depth, large crystals)	**Granite**	**Diorite**	**Gabbro**	**Peridotite**
Extrusive (Cooled fast on surface, small crystals)	**Rhyolite**	**Andesite**	**Basalt**	
Color	LIGHT →		DARK	DARK GREEN

Examine the "known" samples and refer to the table above.

For each sample indicate:

a) The color of the rock (light, intermediate, or dark)
b) Obvious minerals present (quartz, feldspar, mica, amphibole, pyroxene, olivine), or none present
c) Indicate if the rock is Intrusive or Extrusive

Granite:

Diorite:

Gabbro:

Rhyolite:

Andesite:

Basalt:

Peridotite:

Optional: Describe the characteristics of obsidian and pumice:

Igneous Rocks and the geologic environment – what can we infer from igneous rock?

- Basaltic magma is often generated by partial melting of the mantle. It makes up the bulk of oceanic crust and is associated with rifting of the crust and formation of ocean basins.
- Granitic magma can be generated in several ways, but granitic magma chambers that crystallize to form large bodies (batholiths) of granite-like rocks are often associated with magma generation at subduction zones (convergent plate boundaries).
- Andesitic magma (and lava) occurs in the volcanoes that occur at convergent plate boundaries. These explosive volcanoes are located on the over-riding plate of a subduction zone.

Use what you have learned about igneous rocks to describe the geologic settings that would have existed when the following igneous rocks were formed. What can you infer about the geologic history of these regions?

1. ***Granite of the Idaho Batholith*** - The Idaho Batholith is a mass of exposed (currently at the surface) granitic plutons (masses of intrusive igneous rock) covering approximately 15,400 square miles in central Idaho. The batholith formed primarily during the early- to mid-Cretaceous.

2. ***Andesite flows on Lascar Volcano*** -- Located in Chile, the Lascar volcano is the most active stratovolcano in the central Andes. The most impressive features on the flanks of the volcano are two massive Holocene age andesite flows.

3. ***Flood Basalt province of Ethopia.*** This area located in East Africa near the Red Sea and the Gulf of Aden is composed of layered basalt that erupted from fissures in Holocene times.