

Laboratory #2 ROCK IDENTIFICATION – IGNEOUS AND METAMORPHIC

Your Name _____
Lab Section _____

This week we will study examples of the predominant rock types of the earth's crust in hand specimens. We will see samples from 2 of the 3 major categories: *igneous* and *metamorphic*. **For homework you will choose ONE sample from one category and write an essay describing (1) the process by which you named it and (2) the process by which the rock formed, in other words, relate the sample to the Rock Cycle** (Montgomery, p.37-39). You might also compare it to other rock types with which it might be confused, or look into its economic or environmental importance. We expect a well organized, grammatically correct, thoughtful, factual essay. Be creative with it! Maximum length: two typed pages using 12 font and double line spacing. If you use sources other than your textbook and lecture notes, give the authors proper credit, or cite a URL address.

I. Igneous Rocks. Formed by the cooling of melted rock material (*magma*) generated by heat within the earth, igneous rocks comprise about 80% of the volume of continents, and over 90% of the oceanic crust. Crystallization of magma produces a mineral aggregate, which reflects the chemistry and cooling history of the magma. **Texture** (e.g., size of mineral grains, or lack of grains) reflects the cooling history: slower cooling produces larger crystals. Some magma may cool so rapidly that no minerals have time to crystallize, resulting in volcanic glass. **Composition** reflects the magma source chemistry. Most magmas have a silicate composition with or without additional volatile components. Igneous rocks thus will be composed mostly of silicate minerals, with minor sulfides or oxides. The type of magma available at depth determines the distribution of igneous rock types. *Felsic* igneous rocks are only found within continental areas; *mafic* igneous rocks can be found anywhere, but especially under ocean basins and the mantle. Rocks of *intermediate* composition are most common at continental margins where mixing of continental and oceanic materials occurs.

Use Montgomery Table C.2 (p.537) and descriptions (p. 33-37) and below figure to help you identify the eight igneous samples. Two are entirely non-crystalline, *glassy* rocks: **pumice**, which has extremely low specific gravity, and **obsidian**. Record your observations regarding texture (*glassy, aphanitic, porphyritic, phaneritic*; definitions on Table C.3) and composition (*felsic, intermediate, or mafic*) on the igneous rock worksheet to come up with the correct rock name. In the "minerals" column, list only visible, identifiable minerals in the rock. Once you have named the six **crystalline rocks**, arrange them according to the figure below ((Lutgens and Tarbuck). Consider cooling history to determine if the rocks formed *intrusively* or *extrusively*. Note the range of rocks that particular minerals can exist in, e.g. plagioclase feldspar. Further information on igneous rocks can be found in Chapter 3 of 'Essentials of Geology' (Lutgens and Tarbuck) which is kept in the lab room.

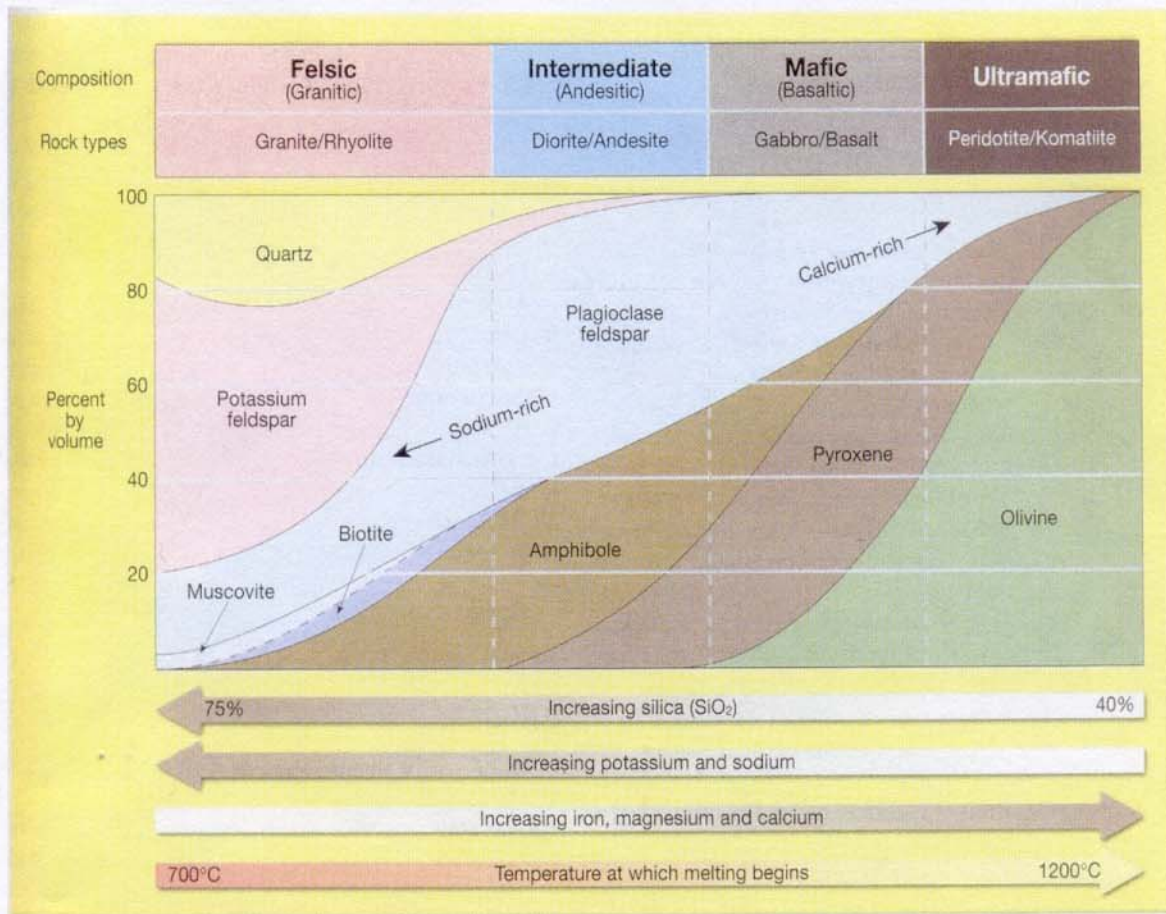


Figure from 'Essentials of Geology' (Lutgens and Tarbuck)

II. Metamorphic Rocks. Rocks form in equilibrium with their environment and therefore are most stable under the conditions in which they form. Since the lithosphere is a dynamic system, over geologic time rocks commonly experience new environments where they are unstable, for example where pressure, temperature, and chemical conditions differ significantly from where they were formed. If these new conditions result in a significant change in texture or mineralogy of the original rock, we say it has been *metamorphosed*, and it becomes a *metamorphic rock*.

Metamorphic conditions may vary from mild and short-lived changes to severe and prolonged, thus producing a continuum of *low grade* to *high grade* effects. Under low-grade conditions some of the original features of the pre-existing rock, such as fossils or clasts, may still be visible.

Heat and fluids escaping from a cooling igneous mass may alter the surrounding country rocks into which the magma has intruded, producing so-called *contact metamorphism*, which fades rapidly as distance from the pluton increases. In contrast, heat and pressure from plate interactions may generate changes over large regions, called *regional metamorphism*. The directed pressure will align sheet silicates or prismatic minerals to produce metamorphic *foliation*. Foliated rocks always indicate regional metamorphism. Non-foliated rocks may result from either contact or regional metamorphism.

As you study the six metamorphic samples, first identify minerals such as quartz, calcite, micas, garnet and amphibole. Record them on the worksheet, also noting grain size and foliation. Refer to the attached Table C.3 and Keller p. 82-85 to name the rocks. Higher-grade metamorphic rocks may be recognized by coarser grain sizes and/or by appearance of *index minerals* such as garnet, staurolite and sillimanite. Make a guess at “protoliths” - - what the rocks were before metamorphism. Further information on metamorphic rocks can be found in Chapter 7 of ‘Essentials of Geology’ (Lutgens and Tarkbuck) which is kept in the lab room.

Rock Identification Worksheet II: Metamorphic Rocks

Name: _____

ROCK NAME	MINERAL(S)	GRAIN SIZE	FOLIATION (Yes or No?)	RELATIVE GRADE	POSSIBLE PROTOLITH
Quartzite				indeterminate	
Marble				indeterminate	
Amphibolite					
Slate					
Schist (2 samples)					
Gneiss					