

MINERALS & ROCKS LABORATORY

INTRODUCTION

The identification of minerals and rocks is an integral part of understanding our physical environment. In order to comprehend and explain certain aspects of geology, it is necessary to gain some familiarity with the characteristics of minerals and rocks. Minerals and rocks exhibit a number of diagnostic properties that are used for identification.

PURPOSE

The purpose of this laboratory exercise is to gain some familiarity with the mineral and rock identification process. By doing so, you should be able to better understand the basic principles of minerals and rocks and how they apply to one another. Understanding the basics of minerals and rocks will serve as a foundation in learning the introductory principles of geology.

BASIC DEFINITIONS

A mineral is a naturally occurring inorganic substance with a characteristic chemical composition and definite crystal structure. The composition and crystalline structure determines the properties of a mineral. The main mineral properties used for identification are color, streak, hardness, specific gravity, cleavage and fracture. Other properties such as luster and crystal habit are also important.

Rocks are aggregates of minerals. Rocks exhibit not only different mixtures of minerals, but also various textures. The texture depends upon the size, shape, and arrangement of the mineral grains composing the rock. Mineral assemblage and texture serve in determining the origin and identification of a rock.

MINERAL IDENTIFICATION PROCESS

MINERAL PROPERTIES

COLOR The color of a mineral serves to narrow down the number of possible choices since it is the first and most obvious property noticed. However, because most minerals may exhibit a variety of colors, color is not a reliable diagnostic property.

STREAK The color of the powder of a mineral is the streak. Rub the mineral on a piece of unglazed porcelain (streak plate) to obtain the streak.

HARDNESS Hardness is a measure of resistance to scratching. The hardness of a mineral is based upon comparisons of scratching tests. Mohs Scale of Hardness is the basic comparison test.

<u>Mohs Hardness Scale</u>	<u>Hardness of Test Materials</u>
1 - Talc	2.5 - Fingernail
2 - Gypsum	3.5 - Copper penny
3 - Calcite	5.5 - Masonry nail
4 - Fluorite	5.5 - Glass
5 - Apatite	
6 - Orthoclase feldspar	
7 - Quartz	
8 - Topaz	
9 - Corundum	
10 - Diamond	

Example of hardness determination: If an unknown mineral cannot be scratched by a penny but can be scratched by a masonry nail, then the hardness of the unknown mineral would be between 3.5 and 5.5.

CLEAVAGE Certain minerals have a tendency to part, producing smooth flat surfaces. An example is mica: it cleaves along one plane thus it has one direction of cleavage. Galena breaks into cubes -- three directions of cleavage that intersect at 90 degree angles.

FRACTURE If a crystal does not break along a cleavage surface, it exhibits fracture. Quartz shows no cleavage when it is broken, instead it fractures in a shell shape known as conchoidal fracture. Other minerals with well-developed cleavage may fracture along other surfaces. Common descriptions: conchoidal, splintery, fibrous and irregular.

LUSTER The degree or manner in which the surface of a mineral reflects light is luster. Terms used to describe luster include earthy, glossy, metallic, pearly, greasy, waxy, and vitreous (glassy).

SPECIFIC GRAVITY The weight of a mineral compared to the weight of an equal volume of water is the specific gravity. Gold has a specific gravity of 19, thus a cubic centimeter of gold weighs 19 times as much as a cubic centimeter of water. (One cm³ of water weighs 1.0 grams.) A relative comparison (of what is light and what is heavy) is satisfactory for this laboratory.

DIRECTIONS FOR MINERAL IDENTIFICATION

An unknown mineral will be given a specimen number. If numbers are missing, notify Dr. Woltemade.

Use the mineral identification charts located in your text for reference.

On your worksheet, identify the following:

- Color:** The visible color.
- Streak:** The color of the powder of the mineral by grinding it on the streak plate.
- Hardness:** The approximate hardness by comparing scratch tests – report a range based on your lab results, such as 2.5 – 3.5. The only materials you should use in testing hardness are: finger nail (2.5), penny (3.5), masonry nail (5.5), glass (5.5).
- Cleavage:** The number of directions of cleavage and the angle of intersection, if cleavage occurs.
- Fracture:** The type of fracture, if it occurs.
- Luster:** The type of luster the mineral exhibits.
- Specific Gravity:** The relative weight of the mineral (very light, light, medium, heavy, very heavy).

The unknown minerals are: quartz, galena, augite, hornblende, muscovite mica, kaolinite, olivine, calcite, and dolomite.

Remember the purpose of this exercise is for you to understand the identification process by using the diagnostic properties. Try to identify the minerals correctly, although that is not the most important part of the lab.

ROCK IDENTIFICATION PROCESS

COMPARING IGNEOUS, SEDIMENTARY, AND METAMORPHIC ROCKS

Each of the three rock types has a unique appearance that helps to distinguish one type from another.

IGNEOUS ROCKS

Igneous rocks are composed of inter-grown mineral crystals formed by the cooling of magma or lava. Igneous rocks are classified based on the mineral composition and texture.

The texture of igneous rocks is very useful in identifying unknown rocks. Those igneous rocks with large crystals (crystals seen with the naked eye) are termed phaneritic and are intrusive. Those igneous rocks with small crystals (crystals that cannot be seen with the naked eye) are termed aphanitic and are extrusive. The texture or the size of the crystals within a rock is determined by the rate of cooling of magma or lava. Rapid cooling produces very small crystals while slow cooling allows larger crystals to form. For this lab, the relative size of the crystals, either visible or not, is satisfactory.

The mineral composition (type and percentage) is a specific indicator. This does not have to be applied to this exercise due to its complexity.

The general color of an igneous rock (light, intermediate, or dark) can be useful in identifying the general mineralogy (felsic - lighter colors, or mafic - darker colors).

SEDIMENTARY ROCKS

Sedimentary rocks are made up of lithified sediments or precipitated materials. Sedimentary rocks can be distinguished from igneous and metamorphic rocks since they form in layers or strata. Another key feature that sets them apart is their fossil content. Fossils are rarely found in igneous and metamorphic rocks.

Sedimentary rocks can be classified by three important factors. (1) Detrital or clastic rocks containing particles from pre-existing rocks, which are divided by particle size and sorting. (2) The term organic indicates that the rock is made from shells or other fossil fragments, silica based mineralization (chert), carbonaceous development (limestone) or carbon based development (coal). (3) The term chemical indicates the minerals were produced by chemical precipitation.

METAMORPHIC ROCKS

Metamorphic rocks are rocks that have been altered and deformed physically and/or chemically by heat and pressure.

Metamorphic rocks can have foliated or non-foliated textures. Foliated textures contain parallel planes of platy minerals. Non-foliated textures do not contain any parallel planes, but do exhibit alterations such as the textural changes due to obliteration of mineral grains.

NOTE: CONSULT YOUR TEXT FOR FURTHER DISCUSSION OF THE DIFFERENCES BETWEEN IGNEOUS, SEDIMENTARY AND METAMORPHIC ROCKS.

DIRECTIONS FOR ROCK IDENTIFICATION

An unknown rock will be given a specimen number. If numbers are missing, notify Dr. Woltemade.

Use the rock identification charts located in your text.

First, divide the rock samples into separate groups of rocks: igneous (4 rocks), sedimentary (3 rocks), and metamorphic (3 rocks). Then, on your worksheet identify the following:

For igneous rocks: Texture (large or small crystals -- phaneritic or aphanitic)
Color (light, intermediate, dark)

For sedimentary rocks: Grain size (small, medium, large)
Grain shape (rounded, angular) and
sorting (well-sorted, poorly-sorted)

For metamorphic rocks: Foliated or Non-foliated

The unknown rocks are: conglomerate, sandstone, shale, basalt, granite
rhyolite, gabbro, quartzite, gneiss, and schist.