

FAIRLY SIMPLE ROCK IDENTIFICATION

John J. Thomas

Purpose

Much to our surprise, rocks fascinate many students. Everyone loves to bring us a rock and ask what kind it is and why they found it where they did. This exercise is not a comprehensive rock identification course. It is not designed to make you a perfect rock identifier, nor will it. The real purpose is to introduce the students (and you) to how to identify rocks and give them (and you) the tools they need to learn more about rock identification. When you complete the exercise, you may not feel secure with rock identification, the exercise covers a lot of material very quickly, but with practice you should feel comfortable with the rocks and their names. Like people, it takes time and effort to turn a stranger into a friend. You will not be able to do this exercise without first learning how to identify minerals.

Comment - You will see several repetitions in this exercise so that the teacher can copy and distribute only the sheets the students need.

Definitions

Igneous Rock - a rock that crystallized from a melt

Sedimentary Rock - a rock that was deposited from a fluid; water, wind, or ice (yes, ice is a fluid).

Metamorphic Rock - a rock that was recrystallized in the solid.

Mineralogy - the minerals in the rock.

Texture - the way that the grains fit together.

Interlocking - the grains are interlocked. They fit together like the pieces of a jigsaw puzzle.

Clastic - the grains are rounded and fit together like billiard balls in a rack or marbles in a jar.

Grain Size - the size of the grains in the rocks.

Terms used with igneous and metamorphic rocks:

Aphanitic - grains too small to be seen without a magnifying glass

Phaneritic - grains large enough to be seen.

Porphyritic - two noticeably different grain sizes.

Ground Mass - The background material in the rock, usually aphanitic. The material surrounding the minerals you can identify.

Terms used with sedimentary rocks:

Coarse - greater than 2 mm. in diameter. Pebbles, cobbles, boulders.

Sand - 2 mm. to 1/16 mm. in diameter. Sand

Silt - 1/16 mm. to 1/256 mm. in diameter. Dust, gritty.

Clay - less than 1/256 mm. in diameter. Mud or modeling clay.

Cement - the material holding (cementing) the grains together.

For more definitions see the section on each kind of rock.

Equipment

Rock samples

Hardness testers:

Glass plate

Jackknife

Fingernail

Dilute hydrochloric acid (1 acid to 10 water) or vinegar. Vinegar works just as well as hydrochloric acid. Hydrochloric acid will eat through clothes, vinegar will not. Acid is optional. You can identify all the minerals by hardness with out acid. You should check with a supervisor for permission to use acid in the classroom. OSHA has very strict regulations on how acid should be used. The acid used for mineral identification is less acidic than your stomach.

Optional - magnifying glass. You can identify rocks without one, but you can see the minerals and grains much better if you have one. 10X is the best.

Teacher Information

Rock identification may sound scary, but it doesn't have to be. We will give you the clues for rock identification. We do simplify the process, but the techniques that we use are the way a geologist works. So give it your best shot and you should find that you can work with the system.

Identifying Minerals in Rocks:

Test hardness with your hardness testers.

To see cleavage, rotate the rock in the light. If the minerals in the rock have cleavage, they will give a bright, flat reflection of light, like rotating a mirror in the light. Check the number on a single grain and the angle between them.

Look at the luster. Quartz always looks glassy. Feldspar looks shiny, but duller and opaque. Mafic (iron-magnesium) minerals have a metallic luster.

Check color. Quartz is transparent. Feldspar is pink, white, or gray to very dark gray (almost black). Mafic minerals are black or dark green. Calcite looks milky white or gray, dolomite is frequently tan.

Look at the shape of the grains. Calcite is rhombic. Feldspars are rectangular or lath shaped. Mafics are prismatic. Micas are flaky, like students.

Look for special properties. Plagioclase has striations on one cleavage direction. Calcite reacts to acid. Magnetite is magnetic.

IGNEOUS ROCK IDENTIFICATION

Textures

Interlocking - minerals fit together like a jig-saw puzzle
Aphanitic - grains too small to be seen without a magnifying glass
Phaneritic - grains large enough to be seen.
Porphyritic - two noticeably different grain sizes.

Mineral Identification

Quartz: hardness of 7
usually clear, may be a little grayish
glassy
always irregular grains, they fit between everything else
fractured
looks like broken bits of glass

Potassium Feldspar: hardness of 5 1/2 - 6 1/2
opaque
pink, white to light gray
two good cleavages at right angles
rectangular grains (lath shaped)
opaque, rectangular minerals with good cleavage

Plagioclase: hardness of 5 1/2 - 6 1/2
opaque
white, light gray to very dark gray
two good cleavages at right angles
rectangular grains (lath shaped)
striations on one cleavage
opaque, rectangular minerals with good cleavage and striations

Other minerals: normally not used for identifying igneous rocks.

Muscovite - clear mica

Mafic (iron-magnesium) minerals:
Biotite - black mica
Hornblende - needle-like prismatic black crystals
Pyroxene - dark green or black stubby prismatic crystals
Olivine - yellowish-green rounded and transparent crystals. Usually the size of sand grains.

Igneous Rock Identification

<u>Phaneritic</u>	<u>Minerals</u>	<u>Aphanitic</u>
Granite	Quartz more than 10% of the rock Potassium feldspar noticeably greater than plagioclase Not many other minerals Light color, may look pink	Rhyolite
Diorite	Usually no quartz, always less than 10% Potassium feldspar and plagioclase approximately equal Noticeable other dark minerals Intermediate color, salt and pepper rock, may look gray	Andesite
Gabbro	No quartz Usually the only feldspar is plagioclase. There can be some potassium feldspar Very dark gray, may look black	Basalt
Ultramafic	No quartz, no potassium feldspar, little plagioclase, all dark mafic minerals Dark green to black Volcanic glass, solid, black Volcanic glass, frothy, light gray	Obsidian Pumice

SEDIMENTARY ROCK IDENTIFICATION

Textures

Interlocking - the grains are interlocked. They fit together like the pieces of a jigsaw puzzle.

Clastic - the grains are rounded and fit together like billiard balls in a rack or marbles in a jar.

Clastic Grain Size - the size of the grains in the rocks.

Coarse - greater than 2 mm. in diameter. Pebbles, cobbles, boulders.

Sand - 2 mm. to 1/16 mm. in diameter. Sand

Silt - 1/16 mm. to 1/256 mm. in diameter. Dust, gritty.

Clay - less than 1/256 mm. in diameter. Mud or modeling clay.

Cement - the material holding (cementing) the grains together.

Sorting - the rock may be all one grain size (well sorted) or more than one grain size (poorly sorted).

Mineral Identification

Quartz: hardness of 7, usually clear, may be a little grayish, glassy looks like grains of glass.

Potassium Feldspar: hardness of 5 1/2 - 6 1/2, pink to light gray, two good cleavages at right angles, opaque, rectangular minerals with good cleavage.

Plagioclase: hardness of 5 1/2 - 6 1/2, gray, two good cleavages at right angles, striations on one cleavage, opaque, rectangular minerals with good cleavage and striations.

Clay: aphanitic, soft, usually gray, but can be red or green, looks muddy.

Calcite: hardness of 3, fizzes in acid.

Dolomite: hardness of 3, fizzes in acid when it is powdered. To powder the mineral, scratch it with a knife, steel nail, or other metal object.

Halite: hardness of 2, tastes salty.

Gypsum: hardness of 2, does not taste salty.

Sedimentary Rock Identification

Clastic Sedimentary Rocks (particles or granular texture)

<u>Texture</u>	<u>Rock</u>	<u>Identifying Characteristic</u>
Coarse	Conglomerate	Rounded particles. Contains rock fragments
	Breccia	Angular particles. Contains rock fragments.
Sand	Sandstone Quartzose	Mostly quartz
	Arkose	Usually red to pink in color, noticeable amount of feldspar, may contain rock fragments.
	Graywacke	Poorly sorted, lots of clay and unstable minerals, dark colored, may contain rock fragments
Silt	Siltstone	Foliated (layered in sheets) or massive, gritty, gray to tan
Clay	Shale	Soft, foliated (layered in sheets), gray, red, green, sometimes tan

Chemical Sedimentary Rocks (interlocking or jigsaw puzzle texture)

<u>Mineralogy</u>	<u>Rock</u>	<u>Identifying Characteristic</u>
Calcite	Limestone	Hardness of 3. Calcite fizzes in acid, frequently has fossils.
Dolomite	Dolomite	Hardness of 3. Dolomite fizzes when you powder it by scratching it with a knife. Usually does not have fossils.
Halite	Rock Salt	Hardness of 2. Tastes salty.
Gypsum	Gypsum	Hardness of 2. Does not taste salty.
Silica	Chert, Flint	Hardness of 7. Luster is glassy to waxy. Shows conchoidal fracture.

METAMORPHIC ROCK IDENTIFICATION

Textures

Interlocking - the grains are interlocked. They fit together like the pieces of a jigsaw puzzle.

Foliated - layered in sheets. The texture looks like a stacking of leaves or papers.

Non-foliated - the texture of the rocks is massive. There is no layering.

Mineral Identification

Quartz: hardness of 7, usually clear, may be a little grayish, glassy looks like grains of glass.

Potassium Feldspar: hardness of 5 1/2 - 6 1/2, pink to light gray, two good cleavages at right angles, opaque, rectangular minerals with good cleavage.

Plagioclase: hardness of 5 1/2 - 6 1/2, gray, two good cleavages at right angles, striations on one cleavage, opaque, rectangular minerals with good cleavage and striations

Muscovite: hardness 2 1/2 - 3, 1 excellent direction of cleavage, clear mica.

Biotite: hardness 2 - 2 1/2, 1 excellent direction of cleavage, black mica.

Chlorite: hardness 4-5, 1 excellent direction of cleavage, green mica.

Calcite: hardness of 3, fizzes in acid.

Dolomite: hardness of 3, fizzes in acid when it is powdered. To powder the mineral, scratch it with a knife, steel nail, or other metal object.

METAMORPHIC ROCK IDENTIFICATION

Foliated

<u>Rock</u>	<u>Texture</u>	<u>Identifying Characteristics</u>
Slate	Foliated Luster = Dull	Clay. Looks like shale, but shale is soft and slate is hard. Red, green, gray, black
Phyllite	Foliated Luster = Moderate, Silky	Tiny micas. The micas are not large enough to see, but do give the rock a slightly shiny surface.
Schist colored	Luster = Shiny, Metallic	Shines like polished metal. The rock contains coarse grained micas. May have other large crystals, commonly dark amphibole, pyroxene, and garnets.
Gneiss	Light and dark bands	Phaneritic minerals in light and dark bands or layers. Light layers are quartz and feldspars. Dark bands are dark micas, hornblende, pyroxene, garnets, and others.

Non-foliated

<u>Rock</u>	<u>Texture</u>	<u>Identifying Characteristics</u>
Quartzite	Massive, may	Mostly quartz with an interlocking Texture, may have color or grain patterns.
Marble	Massive	Mostly calcite, may be dolomite. May have colored patterns. Commonly white but colored patterns can be a variety of color including pink, purple, and green.

DISTINGUISHING CHARACTERISTICS OF THE ROCK TYPES

<u>Rock type</u>	<u>Unique Features</u>
Igneous	2/3 or more of the rock is feldspars Ultramafic rocks
Sedimentary	Clastic texture. Rocks with well-preserved fossils Rocks with 90% or more quartz with a clastic texture Rocks with 75-100% calcite.
Metamorphic	Foliated texture and mineralogy of phyllite, schist, and gneiss Rocks with 90% or more quartz with an interlocking texture. Rocks with 75-100% calcite.

Crossovers

Ultramafic rocks: can occur as metamorphic rocks. They will usually be foliated.

Shale and slate: have the same grain size and the same texture. Shale is usually soft and slate is usually hard. Slate should have a ring to it when you hit it with metal.

Limestone and marble: have calcite and/or dolomite. Both are interlocking. Limestone tends to be finer grained, marble coarser. Limestone is more likely to have well preserved fossils.

Sandstone and quartzite: both are predominantly quartz. Sandstone has clastic texture. Quartzite has interlocking texture.

ROCK IDENTIFICATION SHEET

Sample Number _____

Texture: Interlocking Clastic Foliated
 Phaneritic (visible) Aphanitic (not visible)
 Grain size in mm. _____

Mineralogy:

Special Features:

Rock Type (Igneous, Metamorphic, or Sedimentary): _____

Rock Name: _____

Sample Number _____

Texture: Interlocking Clastic Foliated
 Phaneritic (visible) Aphanitic (not visible)
 Grain size in mm. _____

Mineralogy:

Special Features:

Rock Type (Igneous, Metamorphic, or Sedimentary): _____

Rock Name: _____