

EXERCISE 5D SEDIMENTARY ROCK IDENTIFICATION

PURPOSE: To learn the SYSTEMATIC PROCEDURE for sedimentary rock identification.

To learn to recognize the TEXTURE and COMPOSITION of the sedimentary rocks.

To use the texture and mineral composition of sedimentary rocks to interpret the GEOLOGIC HISTORY of their formation.

DEFINITION:

Sedimentary rocks are formed when the weathering products of pre-existing rocks are TRANSPORTED, DEPOSITED, COMPACTED, and CEMENTED together or when they CHEMICALLY PRECIPITATE from solution in sea water.

Sedimentary rocks constitute only about 5% of the entire earth, but they make up about 70% of the rocks exposed on the surface of the earth and therefore, provide nearly all

CLASSIFICATION:

All rocks are classified based on TEXTURE and MINERAL COMPOSITION. For the sedimentary rocks, texture refers more to the size and shape of the grains; the arrangement is less important.

The minerals in sedimentary rocks are primarily quartz and the weathering products of

I. TEXTURE

A. SIZE

The size of the mineral grains in a sedimentary rock depends on how far the grains have

1. COARSE-GRAINED minerals are $>1/16$ millimeter and are visible to the naked eye.
 - a. SAND-sized grains are 1/16 mm to 2 mm and feel like medium to coarse sandpaper. Another name for sand-sized is MEDIUM GRAINED
 - b. Grains greater than 2 mm are divided into three groups:
 - 1) PEBBLES - up to marble-sized grains
 - 2) COBBLES - up to fist- or brick-sized grains
 - 3) BOULDERS - anything larger than cobbles
2. FINED-GRAINED minerals are less than 1/16 mm. They are not visible to the naked eye.
 - a. SILT-sized grains are 1/256 mm to 1/16 mm and may feel like fine sandpaper.
 - b. CLAY-sized ($< 1/256$ mm) is another term for VERY FINE-GRAINED. These minerals are not even visible with a microscope

B. SHAPE

The shape of the mineral grains in a sedimentary rock depends on the cleavage of the

1. **ANGULAR** - mineral grains have sharp, unrounded edges.
 - a. Indicates short length of transport.
 - b. Indicates transport by wind or ice.
2. **ROUNDED** - mineral grains have smooth, rounded edges.
 - a. Indicates long length of transport.
 - b. Indicates transport by water.



C. ARRANGEMENT

1. Orientation of minerals in the rock:
 - a. **RANDOM** - mineral grains are NOT PARALLEL to one another.
 - b. **LAYERED** - mineral grains ARE PARALLEL to one another.

Layered arrangements occur primarily in rocks which contain minerals with one direction of cleavage e.g. the clay minerals.

2. Spacing of minerals in the rock:
 - a. **INTERLOCKING (Crystalline)** - minerals were precipitated from water so that they that NO SPACES exist between the minerals.
 - b. **GRANULAR** - minerals have been compacted and cemented together, but SPACES EXIST between the mineral grains. GRANULAR rocks are often PERMEABLE meaning that liquids are able to soak into these pore spaces in the rock.

II. COMPOSITION

A. MAJOR MINERALS – luckily there is usually only one major mineral in sedimentary rocks, so you can test the rock easily.

CLASTIC SEDIMENTARY ROCKS are composed of the weathering products of pre-existing rocks such as igneous rocks. Therefore, we might expect to find the following minerals because they are stable after weathering at the surface of the earth:

QUARTZ – Harder than glass (one of the few in sedimentary rocks)

CLAY – always fine grained, softer than glass

UNWEATHERED ROCK AND MINERAL FRAGMENTS

CHEMICALLY PRECIPITATED SEDIMENTARY ROCKS are composed of minerals that form from soluble ions in water. These soluble ions are also products of weathering and include Ca, Na, Mg, K, Cl, CO₃ (carbonate), SO₄ (sulfate), and SiO (silica). Under the right conditions these ions will combine with one another to form:

QUARTZ – Harder than glass (one of the few in sedimentary rocks)

CALCITE - Softer than glass and reacts to acid

DOLOMITE - Softer than glass and reacts to acid only when powdered

GYPSUM - Softer than fingernail

HALITE - - Softer than glass, tastes salty

ORGANIC (BIOCHEMICAL) SEDIMENTARY ROCKS are made of the remains of animals or plants. There are two of these: LIMESTONE - made of CALCITE which was formed by a clams, coral, algae etc when they were alive, and accumulated to form sediment after they died; COAL is made of partially decayed PLANT MATTER.

B. MINOR MINERALS

1. CEMENT:

Clastic rocks (except shale) will contain minor amounts of either silica or calcite cementing the grains together

2. STAIN:

Unlike igneous rocks, the color of a sedimentary rock is not indicative of the minerals it contains. The color is due to small amounts of the following:

ORGANIC CARBON: - black

HEMATITE - red

LIMONITE - yellow

REDUCED IRON - green

PROCEDURE FOR SEDIMENTARY ROCKS IDENTIFICATION

- Step 1. Obtain a set of Sedimentary Rocks, glass plate, acid, paper towel and hand lens.
2. Determine COMPOSITION of the rock by performing tests in this order:
- A. Test hardness relative to glass
If harder, the major mineral is _____
 - B. If the rock is softer than glass see if it reacts to acid
If it reacts to acid the major mineral is _____
 - C. If the rock does not react to acid, use the corner of a glass plate and powder a small area.
If it reacts when powdered, the major mineral is: _____
 - D. If the rock still doesn't react to acid, see if it is softer than your fingernail.
If softer, the major mineral is _____
 - E. If the rock is harder than your fingernail, taste it.
If it tastes salty, the major mineral is _____
 - F. If none of the above, the major mineral is most likely _____
3. Determine TEXTURE of the rock:
- a. SIZE - COARSE GRAINED, MEDIUM GRAINED or FINE GRAINED
4. On the last page of the lab list the TEXTURE as indicated in #3 and COMPOSITION (list mineral name(s) only).
5. Place specimen on top of the description or in the same order you have identified it.
6. Use the classification chart on p. 7 to determine the rock name.
(There may be more than one example of some rocks)
7. Have the lab instructor check your identifications.

SEDIMENTARY ROCK IDENTIFICATION CHART

COMPOSITION	TEXTURE	DESCRIPTION	NAME
rock fragments	coarse-grained, rounded	looks like gravel	CONGLOMERATE
quartz	medium grained		SANDSTONE
clay	very fine-grained	layered	SHALE
quartz	very fine grained	waxy, sharp-edged	CHERT
gypsum	fine or coarse grained	softer than fingernail	GYPSUM ROCK
halite	fine or coarse grained		ROCK SALT
dolostone	fine to medium grained	reacts only when powdered	DOLOSTONE
calcite	Varies: Fine or coarse medium very fine grained fine with fossils very fine grained coarse grained	reacts to acid layered, crystalline sandy massive, compact writes on board broken shells	LIMESTONE: Travertine Oolitic Micritic Fossiliferous Chalk Coquina
carbon	fine grained	low density, burns	COAL

[illegible]