LAB 4: TEXTURES AND IDENTIFICATION OF SEDIMENTARY ROCKS

OBJECTIVES

1) to become familiar with the properties important in recognizing and classifying sedimentary rocks
2) to become familiar with the textures characteristic of sedimentary rocks;
3) to become familiar with the mineralogy of common sedimentary rocks.

INTRODUCTION

Sedimentary rocks are rocks formed by deposition from a fluid (i.e., water, air, or ice). They are classified on the basis of their **texture**, **grain size**, and **mineralogic composition**.

Characteristics of sedimentary rocks are described in Pellant p. 38-41and 44-45; Marshak, p. 176-186.

Texture:

Sedimentary rocks may have **clastic (**detrital**)** or **non-clastic** texture. **Clastic** sedimentary rocks are composed of grains, fragments of pre-existing rocks that have been packed together with spaces (pores) between grains. These pores may later be filled in with cementing materials such as silica or calcite deposited by groundwater moving through the sediment. Examples of clastic sedimentary rocks are sandstone and conglomerate. Some clastic sedimentary rocks (such as shale and mudstone) are fine enough that the individual grains cannot be distinguished. These fine-grained rocks are said to have an **aphanitic** texture.

Non-clastic textures are found chiefly in rocks that have precipitated chemically from water (**chemical sedimentary rocks**), such as limestone, dolomite and chert. Other non-clastic sedimentary rocks include those formed by organisms (**biochemical** rocks), and those formed from **organic** material, such as coal. Rocks formed mainly from shell fragments are technically clastic rocks, but are commonly classed with the non-clastic ones because they too are chemical precipitates - except that organisms did the precipitating. If non-clastic rocks are fine-grained enough, they too can be called **aphanitic**.

Clastic sedimentary rocks are subdivided on the basis of grain size. Secondary characteristics used to further distinguish clastic rocks are sorting, grain shape, and grain composition.

Grain size:

Clastic sediments are distinguished on the basis of average grain size.

gravel-size particles are larger than 2 mm diameter	
sand-size particles range in diameter from 1/16 to 2 mm	(they feel like sandpaper)
silt-size particles have diameters from 1/256 to 1/16 mm	(they feel finely gritty)
clay-size particles are smaller than 1/256 mm in diameter	(they feel smooth)

Roundness and Sorting:

Roundness is an important characteristics of the texture of clastic sedimentary rocks. **Roundness** is indicates the extent to which the corners of individual grains have been rounded off. The roundness scale runs from **angular** through **subangular** to **subrounded** and **well-rounded**. All other things being equal, the rounder a grain is, the greater distance it has been transported, or the more it has been agitated against other grains.

Sorting is the extent to which the grains making up a clastic rock are all about the same size. A **well-sorted** sedimentary rock consists of grains which are all in the same size range (such as a sandstone that's mostly sand size grains with very little silt or clay mixed in.) A **poorly-sorted** sedimentary rock will contain a large range of sizes; in particular, poorly-sorted rocks will have a lot of silt and clay-size particles in among the coarser grains. Sorting reflects the extent to which the processes transporting or depositing the sediment have been able to separate the different sizes and carry away finer particles.

A sediment or sedimentary rock is said to be **well-sorted** if all clasts are of similar size and **poorly-sorted** if it contains a wide variety of different sized grains, especially if it contains fines in among coarser grains.

Mineralogy:

The most common materials in sedimentary rocks:

- quartz
- feldspar
- clay
- calcite
- dolomite
- rock fragments

less common sedimentary minerals

- gypsum
- halite
- hematite
- limonite

Small amounts of amphibole, pyroxene, and mica may also be found in some sedimentary rocks.

Classification of sedimentary rocks:

A very workable classification of sedimentary rocks is given in the accompanying handout. Brief descriptions of some of the important sedimentary rocks are given below.

Conglomerate is made of rounded gravel particles in a sand or finer-grained matrix; **breccia** is simply a conglomerate composed of angular, rather than rounded, particles.

Sandstone is composed dominantly of sand-size particles. **Well-sorted sandstones** contain little or no silt and clay; **poorly-sorted sandstones** have considerable silt and clay in the spaces between the sand grains. **Greywacke sandstone** is a medium to dark grey, fairly dense, poorly-sorted sandstone typical of submarine trenches.

Siltstone is composed chiefly of silt-size particles (usually quartz). Broken surfaces feel gritty. If you can scrape off some of it and wet it, it will feel finely gritty between your fingers or in your mouth.

Shale consists of finely laminated (thinly layered) clay-sized particles. If this fine-grained material lacks layers, it is called **mudstone** or **claystone**. These rocks are smooth to the touch. Shales and mudstones commonly contain silt-size particles as well as clay.

Limestones consist almost entirely of calcite. **Chalk** consists of minute (microscopic or sub-microscopic) silt-size shells; it has a gritty feel. **Coquina** is made up almost entirely of large shell fragments. Some limestones are very fine-grained (aphanitic) and are formed of limy mud.

Chert is a hard, aphanitic, non-clastic rock composed entirely of microcrystalline quartz. **Diatomite** is a very fine, light-weight chalky white rock formed from the silica shells of diatoms (microscopic one-celled plants). Diatomite has a smooth, powdery feel.

Coal is formed from heating and compression of peat—vegetative material that accumulates in bogs and swamps. (Strictly speaking, coal is metamorphosed peat; but it is usually grouped with sedimentary rocks.)

WHAT TO DO IN THIS LAB

In **Part 1**, you will review some common sedimentary rock-forming minerals.

In **Part 2**, you will study the textures and mineralogy of a variety of sedimentary rocks and learn how to identify them.

In **Part 3**, you will identify a group of unknown sedimentary minerals and rocks.

WHAT YOU ARE EXPECTED TO KNOW

I expect you to be able to determine whether a sedimentary rock:

is clastic or non-clastic
is well-sorted or poorly-sorted
contains angular, rounded, or well-rounded fragments

I expect you to be able to identify the following sedimentary minerals and rocks:

MINERALS	**ROCKS**
quartz	conglomerate (Pellant p. 222)
feldspar	breccia (Pellant p. 223)
calcite	well-sorted sandstone (e.g. orthoquartzite, arkose),Pellant p. 228-229
dolomite	greywacke sandstone Pellant p. 229
clay	siltstone
hematite	shale (Pellant p. 231)
limonite	mudstone (Pellant p. 231)
gypsum	limestone (Pellant p. 233-240)
	dolomite
	coquina
	chert (Pellant p. 246)
	chalk (Pellant p. 237)
	diatomite
	coal (Pellant p. 244)

PART 1 Identify the mineral specimens A through F.

NUMBER	**MINERAL NAME**
A.	
B.	
C.	
D.	
E.	
F.	

PART 2 Examine the specimens numbered 1 through 15 and determine the texture and mineralogy of each. Then use "known" samples and the figures and the photos in Pellant to help identify the specimens.

NUMBER	**TEXTURE** (clastic or non-clastic; plus grain size, rounding, sorting)	**CHIEF MINERAL OR ROCK COMPONENTS** (identify grains you can see)	**ROCK NAME**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

Questions

1, Chert and limestone are both fine-grained sedimentary rocks. What are two tests you can use to tell them apart?

2. Clay and chalk are fine-grained, light-colored, and commonly soft and powdery. How can you tell them apart?

3. What characteristic distinguishes breccia from conglomerate?