GEOLOGY 11
Lab 1: Sedimentary Rocks and Sedimentary Structures

Needed: Hand lens, HCl, Metric Ruler, Sedimentary textures handout,

Sedimentary rocks cover nearly 75% of the earth's land surface and blanket the floors of nearly all of the oceans. Most of earth's history is revealed to us through sedimentary rocks which have accumulated since the earth was formed. Sedimentary rocks are of two types: **Clastic** and **Chemical/Biochemical. Clastic** rocks are by far the most abundant comprising nearly 85-90% of all sedimentary rocks. Clastic rocks are composed of minerals and fragments of preexisting rocks. Clastic rocks are classified according to their grain size and the composition of the fragments that make up the rock.

Chemical sedimentary rocks are formed through the precipitation of ions that occur in solution (generally seawater). Evaporation of the solution concentrated the ions in solution and ultimately they precipitate out to form a sedimentary layer. Typically these rocks are composed of calcite ($CaCO_3$), silica (SiO_2) or salt (NaCl).

Biochemical sedimentary rocks include coal (plant material) and limestone (shelly material); both result from the accumulation of organic remains. Before completing the questions for this lab exercise, read through the handout entitled *Sedimentary Processes and Materials.*

STATION 1- TEXTURES

1.1) Describe the grain size, roundness, sorting and textural maturity of samples 1.1A, 1.1B, 1.1C, 1.1D, 1.1D using the rock identification chart.

	Grain Size	Sorting	Roundness	Textural Maturity	Rock name
A)					
B)					
C)					
D)					
E)					

1.2) Which sample traveled the farthest from its source area? Why?

1.3) Which sample was deposited relatively close to its source area?

1.4) Why is well-rounded, poorly sorted sediment extremely rare?

STATION 2 - SEDIMENTARY PARTICLES

Many different particles comprise clastic sedimentary rocks. By far the most abundant *minerals* that comprise sandstones are quartz and feldspar because these mineral are relatively abundant constituents of the earth's crust. *Lithic fragments*, or pieces of preexisting rocks, are also common. Of course, any sedimentary rock can be composed of different proportions of these and other mineral and rock fragments. The dominant constituent of a sedimentary rock is commonly used to modify the rock name. For example, a rock composed of sand sized particles that are mostly quartz grains is called a *quartz sandstone*.

2.1) *Feldspar and Arkosic sandstone* - Feldspar is much less resistant than quartz. Describe the appearance of the feldspar grains. Why do you think feldspar is less durable than quartz?

2.2) a) *Quartz and Quartz sandstone* - Quartz is a hard durable mineral. Sandstones composed largely of quartz are said to be compositionally mature because the weaker, less resistant material has been removed. Describe the appearance of quartz grains in this sandstone.

2.3) *Lithic conglomerate* - This sample is composed of rock fragments. Name some rock types that form the pebbles in this sample. Do you think that these lithic fragments are stable or non-stable in the sedimentary environment? Why?

STATION 3 - SEDIMENTARY STRUCTURES

Sedimentary structures are features produced when the sedimentary particles were deposited. Most sedimentary structures give important information concerning the means by which the sedimentary rocks were deposited (i.e. a river current, beach, submarine landslide, wind, etc.) and therefore are important when determining the *depositional environments* of a sedimentary sequence.

3.1) *Ripple marks* - symmetrical and asymmetrical forms. Sketch and label each type. Denote the direction of the current that produced each. List environments of deposition where these might be produced.

3.2) *Groove and Flute marks* - These bottom or sole marks are found on the base of sandstone and conglomerate beds that were deposited rapidly. Sketch each type and indicate the current direction.

3.3) *Fossils* - These are not really sedimentary structures, but their unique orientation may also give an indication of water currents during deposition. sketch the orientation of several of these fossils and indicate whether a current affected them during deposition.

3.4) *Mudcracks* - What type of sedimentary rock is this? Would this structure form in a sandstone or conglomerate? Why? List environments where mudcracks might form today.

3.5) *Laminated bedding* - What was the energy level during the deposition of this rock? (Hint: What size are the sedimentary particles?)

3.6) *Graded Bedding* - Size grading is typically formed when sediment falls out of suspension very rapidly. Sketch a graded bed and label the change in grain sizes (i.e. mark *sand, silt, clay*, etc.)

3.7) Laminated sandstone - This sort of lamination is typical of windblown sand that forms in sand dunes. The red color indicates that the sediment has been oxidized - the iron in the minerals has "rusted"
What forms the laminations?

3.8) *Flutes on a turbidite* - These bulbous forms occur on the bottom of sediment flows that get deposited on top of muddy fine-grained sediment. These are common on the bottom of turbidites. The sharp bulbous end occurs on the upstream side of the flow. Which way did the sediment flow in this case?

3.9) *Small Trace Fossil.* - The trace fossil is called Chrondrites, and it represents some organism that fed on the bottom sediment, disrupting the sediment as it went along. Trace this form. What makes the trace of this animal path darker than the surrounding rock?

3.10) *Stromatolites*. - These laminated organic structures are very common in hypersaline marine waters such as lagoons. Compare the outside view and the cut away (polished) view. Sketch the top-down view of these organic structures.

3.11) Large Horizontal Trace fossil. Obviously made by an organism larger than the one in 3.9, these horizontal trace fossils represent the movement of something across the ocean bottom. Please sketch the intersection and the general pattern made.

3.12) Silicified Oolites. - These perfectly spherical particles were originally made of calcium carbonate ("limestone") but now they have been silicified (replaced by silica). They represent calcium carbonate that rolled around on the sea floor in very agitated conditions (waves or tides). Where might these form today?

STATION 4 - CHEMICAL SEDIMENTARY ROCKS

Chemical sedimentary rocks constitute < 15% of all sedimentary rocks but many have important economic value to our society. Of these, limestone is the most abundant and we will devote part of next weeks lab to them exclusively. Using the specimens at this station and the handout, list the most diagnostic characteristics of each sample. Finally, turn to the Internet and figure out the economic importance of each of these rocks/minerals?

4.1) Halite

Characteristics:

Economic uses:

4.2) Gypsum

Characteristics:

Economic uses:

4.3) Coal

Characteristics:

Economic uses:

4.4) Limestone

Characteristics:

Economic uses: