ES486 - Sedimentary Rock Lab Review

Update Jan 2023 Part 1 A. Cambridge Intro Rock Video Questions (ROCKSandMINERALS_cambridge_science.mpeg; Time Mark: 12:40) 1. What is the definition of a "rock"

- 2. What are the three basic types of rocks?
- 3. How do igneous rocks form?
- 4. How do extrusive or volcanic igneous rocks form?
- 5. How do intrusive or plutonic igneous rocks form? Provide a common example of an intrusive rock?
- 6. What are sedimentary rocks? Where do they form and why?
- 7. List four types of surface environments in we find sediments that form sedimentary rocks?
- 8. What are the two types of sedimentary rocks?
- 9. In detrital sedimentary rocks, what is the difference between gravel, sand, silt and clay? What is the distinguishing characteristic?
- 10. Provide an example of biochemical or chemical sedimentary rocks. How are chemical rocks classified?

(End Video on Time Mark 18:53)

Part 1B. Sedimentary Rock Video Exercise(Earth Revealed: Sedimentary Rocks)Watch the video in the lab and answer the questions below.

- 1. Who first explored the geology of the Grand Canyon? How did the Grand Canyon form?
- 2. How many years of Earth history are contained in the sedimentary rocks of the Grand Canyon?
- 3. What is the general goal of sedimentary geology?
- 4. What is sediment? How is it formed?
- 5. List and describe 3 examples of loose sediment at the Earth's surface.
- 6. How is loose sediment transformed into hard sedimentary rock?

- 7. True or False: sedimentary rocks most commonly occur inside the Earth, while igneous rocks are common at the Earth's surface. Explain your answer.
- 8. Define the term "clastic".
- 9. What is the smallest size of sediment particle called? What is the largest size of sediment particle called?
- 10. List and briefly describe 2 examples of how sediment may be transported at the Earth's surface.
- 11. List and describe 3 places at the Earth's where you would likely find sediment deposits. Why do you find deposits in these places?
- 12. Define the term "lithification". What are 2 processes that result in lithification of sediment?
- 13. List and describe 2 environments where chemical sediments may form.
- 14. What is the name of a sedimentary rock that forms from the skeletons and hard parts of dead sea animals?
- 15. Where does coal form? What is coal composed of?
- 16. What is the motto for the "principle of uniformitarianism"? What is the principle of uniformity and how is it used to interpret Earth history?

End Video at Uniformitarianism.

Part 2. Recognition of Sedimentary Process (refer to 10th Edition of AGI Lab Manual)

1-1. Based on your pre-lab questions and **p. 165 (Fig. 6.10)** of your lab manual, match the sedimentary process term on the right with the sedimentary rock on the left.

- ____1. Sandstone
- _____2. Conglomerate
- _____3. Shale
- _____4. Rock Gypsum
- _____5. Coral Reef Deposits
- _____6. Sand on the beach
- _____7. Bonneville Salt Flats of Utah
- _____8. Shells on the beach
- _____9. Coal
- ____10. Breccia

- A. Detrital Origin (weathering / fragmental)
- B. Biochemical (biologically-derived rock)
- C. Chemical (Physical-Chemical Process)

Part 3. General Questions on Sedimentary Texture

2-1. Using the attached grain size chart and the Wentworth scale, determine the grain-size of the following detrital sedimentary rock samples (derive the grain-size to the level of fine sand, medium sand, etc.)., and determine the sorting (well sorted, moderately sorted, poorly sorted).

Sample No.	Grainsize (list ~diameter and term)	Sorting	
11			
9B			
15			
4			
6			
14			
Sample Jar S2-1			
Sample Jar S2-7			

2-2. Compare and contrast the sedimentary texture of sample 11 and sample 4. Which one do you think has sediment that was more greatly transported during it's formation?

2-3. Observe the characteristics of sample 35. Is this detrital or biochemical? What is this specimen?

2-4. Examine the deposit in the beaker labeled "2-4". Explain how this deposit formed. Is it chemical or detrital?

Part 4. Sedimentary Rock Identification

Using the sedimentary rock analysis guides on **p. 158-159 (Fig. 6.2, 6.3)** and identification key on **p. 164 (Fig. 6.9)** of the lab manual, complete the table below for the samples listed.

Sample Number	Detrital, Chem., or Biochem?	Composition: choose all that apply: quartz, feldspar, clay, plant frags., calcite, halite, gypsum, iron minerals	Grain Size (for detrital) / Crystal Size (for chemical / biochemical)	Other Characteristics (e.g. fossils, grain shape, fizzes with HCl, scratchable, taste, etc.)	Rock Name
30					
1B					
14					
9B					
11					
8					
3					
13					
31					
32					
20					
16					
2					
7					
15					
12					
10					
6					
37					
4					

Name_

Note: this worksheet will be uploaded to the ES486 Canvas Course Shell Assignment Page

Part 1. Lab Manual Exercises

Open the Sedimentary Rocks Lab Manual Exercise as posted on the class web site, located at the following URL: https://people.wou.edu/~taylors/es486_petro/lab_exercises_sed_rks.pdf

Section A. Reading review questions. Read pages 153-160. Define the following key terms and answer review questions as presented in the reading.

- 1. Briefly describe the difference between "sediments" and "sedimentary rocks"
- 2. Briefly describe the difference between "chemical weathering" and "Physical weathering", and related, the difference between "chemical sediment" and "detrital sediment".
- 3. Examine Figure 6.1. Summarize the processes of weathering, sediment transport, deposition, and lithification at or near the Earth's surface.
- 4. Describe and define the process of lithification, what is it and how does it occur?
- 5. Examine Figure 6.2 on op. 158. Based on composition and origin of sediment, list the three primary types of sedimentary rocks. What is the difference between the three classes of rocks?
- 6. For detrital sediment, define / describe the differences from clay, silt, sand, and gravel. What is the primary factor that separates each class of sediment?
- 7. What is the difference between the process of sediment "rounding" and sediment "sorting", provide examples of how each is affected by sediment transport process.
- 8. Examine Figure 6.5 on p. 161, provide an example of the process of lithification and cementation of sand to form sandstone.
- 9. Examine Figure 6.6 on p. 161, describe the process of the formation of limestone.
- 10. Examine Figure 6.8 on p. 162, describe the process of the formation of chemical sedimentary rock "rock salt"
- 11. Examine the Sedimentary Rock Classification Chart Figure 6.9 on p. 164. List the three procedural steps for identifying sedimentary rocks.
- 12. Continue examining the Sedimentary Rock Classification Chart Figure 6.9 on p. 164. Describe the primary differences in composition and texture that distinguish the following sedimentary rocks (what is the basis of identification and naming for each, and list whether they are detrital, biochemical, or chemical in origin):

Conglomerate vs. Breccia Quartz Sandstone vs. Arkose Sandstone Siltstone vs. Shale Fossiliferous Limestone vs. Micrite *(Bonus Question - True or False: limestone fizzes with hydrochloric acid)* Rock Salt vs. Rock Gypsum Chert

- 13. Examine the sedimentary environments block diagram Figure 6.10 on p. 165. List the types of environments where the following sediments and resulting sedimentary rocks may form near the Earth's surface. In your answer, identify whether they occur in non-marine or marine settings, or both.
 - Chert Limestone Rock Salt Rock Gypsum Sandstone with marine shell fossils Sandstone with terrestrial plan fossils Conglomerate Breccia Coal Mudstone or Shale

Type of sample	Sample grade	Method of analysis		
Unconsolidated sediment	Boulders Cobbles Pebbles	Manual measurement of individual clasts		
	Granules Sand	Sieving or settling tube analysis		
	Clay	Pipette analysis, photohydrometer, Coulter counter		
Lithified sedimentary rock	Boulders Manual measurement of individual of Cobbles Pebbles			
	Granules Sand	Thin-section measurement		
	Clay	Electron microscope		

TABLE 5.2 Methods of measuring sediment grain size

TABLË 5.1	Grain-size scale for sediments, showing Wentworth size classes, equivalent phi (ϕ) units, and sieve
numbers of 1	.S. Standard Sieves corresponding to various millimeter and ϕ sizes

	U.S. Standard sieve mesh	Millimet	ers	Phi (ф) units	Wentworth size class
		4096 1024 256	256	 -12 -10 - 8	Boulder
GRAVEL		64	64	<u> </u>	Cobble
	=	16		 - 4	Pebble
	56 7 8 10	4 3.36 2.83 2.38 2.00	4 2	 - 2 - 1.75 - 1.5 - 1.25 1.0	Granule
	12 14 16 18	1.68 1.41 1.19 1.00	1	- 0.75 - 0.5 - 0.25 - 0.0	Very coarse sand
SAND	20 25 30 35	0.84 0.71 0.59 0.50	- V2	0.25 0.5 0.75 1.0	Coarse sand
	40 45 50	0.42 0.35 0.30 0.25	V.	1.25 1.5 1.75 2.0	Medium sand
	70 80 100	0.210 0.177 0.149 0.125		 2.25 2.5 2.75 2.75	Fine sand
	140 170 200 230	0.105 0.088 0.074 0.0625	/8 1/18	 3.25 3.5 3.75 4.0	Very fine sand
	270 325	0.053 0.044 0.037 	- 1u 1/32	4.0 4.25 4.5 4.75 5.0	Coarse silt
8		0.0156 0.0078 0.0039	¹ /84 1⁄128 1⁄256	 6.0 7.0 8.0	Medium silt Fine silt Very fine silt
×	CLAY	0.0020 0.00098 0.00049 0.00024 0.00012 0.00012		9.0 10.0 11.0 12.0 13.0 14.0	Clay





Figure 6.4 Chart for the field estimation of sorting (modified from Folk 1968).

COMPOSITIONAL CLASSIFICATION OF SEDIMENTARY ROCKS

A. DETRITAL (SILICICLASTIC) - made mostly of rock fragments, quartz grains, feldspar grains, or clay minerals



Breccia: made mostly of angular gravel (usually rock fragments)



Mudstone and Shale: made mostly of clay minerals



Conglomerate: made mostly of rounded gravel and sand grains (usually quartz grains)



Arkose: made mostly of feldspar grains

B. BIOCHEMICAL (BIOCLASTIC) - made mostly of grains that are fragments or shells of organisms (plants or animals)



Biochemical/Bioclastic Limestone: made mostly of shells and shell fragments



Peat: made mostly of plant fragments



Coal: made of carbon/charcoal from plants

C. CHEMICAL - made mostly of mineral crystals precipitated from aqueous solutions and/or chemical residues (e.g., rust)

Dolostone:



Rock Gypsum: made mostly of gypsum mineral crystals



Chemical Limestone: made mostly of calcite (or aragonite) mineral crystals



Ironstone: made mostly of iron-bearing mineral crystals like this hematite



made of microcrystalline quartz varieties



Ironstone: made mostly of iron-bearing residues like this limonite



Chert

FIGURE 6.2 Compositional classification of sedimentary rocks. Scale for all images is ×1

Rock Salt:

made mostly of halite

mineral crystals