ES202 Lab 3 - Sedimentary Rock Analysis and Classification

Update Jan 14, 2016

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					

TABLE 5.2 Methods of measuring sediment grain size

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

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

		U.S. Standard sieve mesh	Millimeters		Phi (ϕ) units	Wentworth size class
GRAVEL			4096		−12	
			1024		−10	
			256	256	−8	Boulder
			64	64	−6	Cobble
			16		−4	Pebble
		5	4	4	−2	
		6	3.36		−1.75	
		7	2.83		−1.5	Granule
		8	2.38		−1.25	
		10	2.00	2	−1.0	
SAND		12	1.68		−0.75	
		14	1.41		−0.5	Very coarse sand
		16	1.19		−0.25	
		18	1.00	1	0.0	
		20	0.84		0.25	
		25	0.71		0.5	Coarse sand
		30	0.59		0.75	
		35	0.50	½	1.0	
		40	0.42		1.25	
		45	0.35		1.5	Medium sand
		50	0.30		1.75	
		60	0.25	¼	2.0	
		70	0.210		2.25	
		80	0.177		2.5	Fine sand
		100	0.149		2.75	
		120	0.125	⅛	3.0	
		140	0.105		3.25	
		170	0.088		3.5	Very fine sand
		200	0.074		3.75	
		230	0.0625	1/16	4.0	
MUD	SILT	270	0.053		4.25	
		325	0.044		4.5	Coarse silt
			0.037		4.75	
			0.031	1/32	5.0	
			0.0156	1/64	6.0	Medium silt
			0.0078	1/128	7.0	Fine silt
			0.0039	1/256	8.0	Very fine silt
	CLAY		0.0020		9.0	
			0.00098		10.0	Clay
			0.00049		11.0	
			0.00024		12.0	
			0.00012		13.0	
			0.00006		14.0	

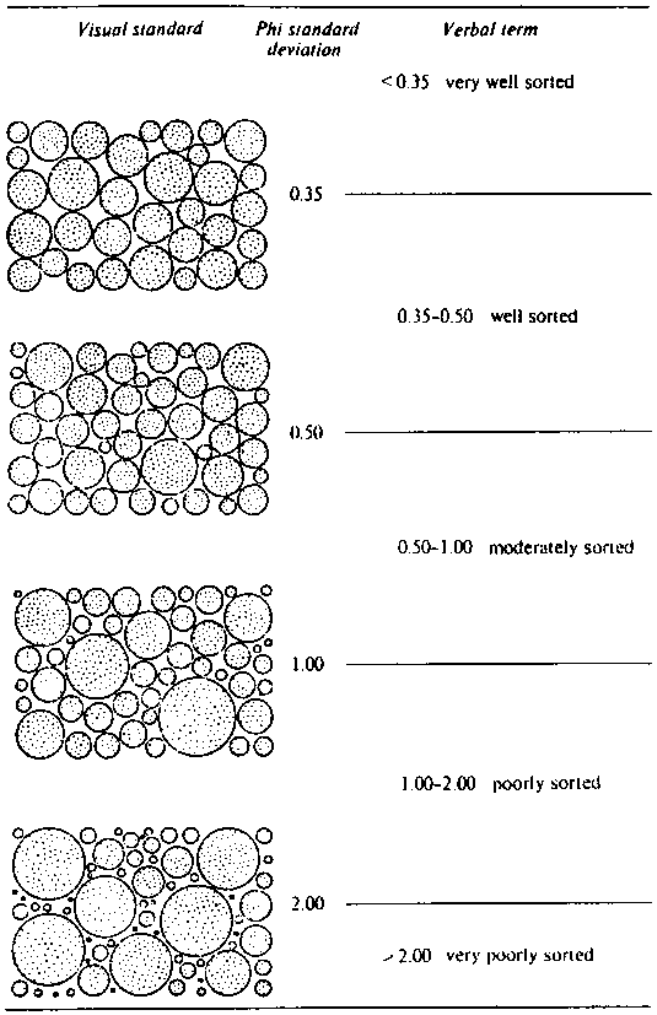

Figure 6.4 Chart for the field estimation of sorting (modified from Folk 1968).

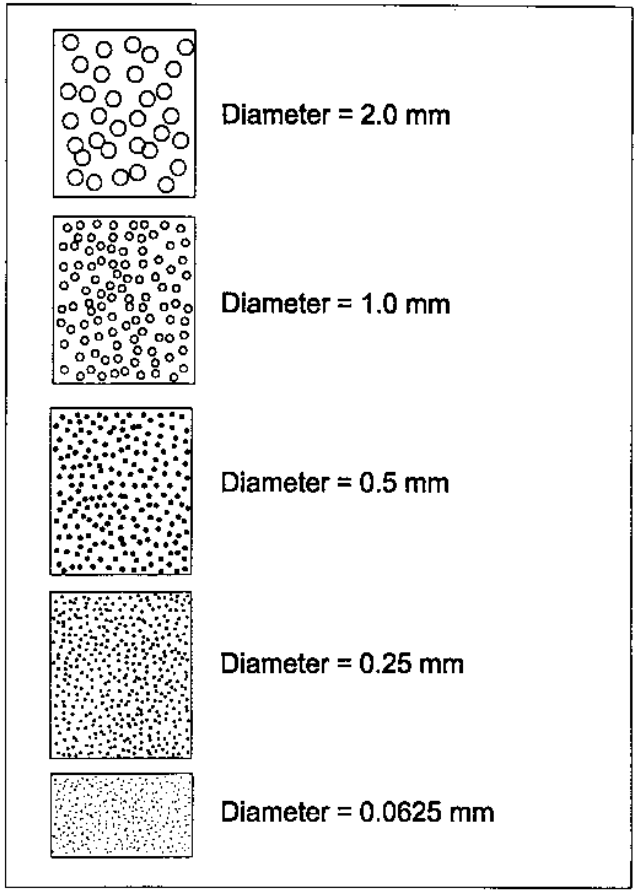

FIGURE 6.2 Compositional classification of sedimentary rocks. Scale for all images is ×1