Lab: Exploring Marine Sediments

Modified from "Life on an Ocean Planet" & NOAA

Background: The field of marine geology is generally recognized as beginning with James Cook and the *Challenger* voyages that collected rudimentary data on sediment samples. The *Challenger* expedition from 1872 to 1876 headed around the world taking samples at more than 350 stations, including organism trawls, dredge samples and core samples. One of the most important developments of the 1900s was the electronic echo sounder, which allowed scientists to take many samples at a faster pace. In 1968 the Deep Sea Drilling Project drilled more than 600 sites and helped confirm the theories of seafloor spreading and plate tectonics.

Sediment of the benthic environment is a key factor in determining organisms living there. Sediments are generally classified by size, texture and composition among other characteristics. The Wentworth Scale classifies sediment by grain size (see Figure 1). Sediments are also classified by origin. There are four types: lithogenous, hydrogenous, biogenous and cosmogenous. *Lithogenous sediments* come from land via rivers, wind and other erosional processes. Lithogenous sediment tends to dominate near the edges of continents and islands due to heavy contributions form land based sediment sources. *Biogenous sediments* come from organisms like plankton when their exoskeletons break down and often dominate in deeper ocean areas. Ooze refers to deep-ocean sediment that is comprised of more than 30% biogenic material. *Hydrogenous sediments* come from chemical reactions in the water. Hydrogenous sediments make up only a small portion (less than 1%) of ocean sediments. *Cosmogenous sediments* come from space, filtering in through the atmosphere or carried on meteorites. Cosmogenous sediments are the least abundant of all sediment types. This lab will focus on sand, which is a lithogenous sediment. It is easy to obtain and study in the exploration of important sediment properties.

Figure 1

Wentworth Scale

Classification	Grain Diameter	Example
Clay	smaller than 0.0004 mm (.00002")	Talc or fine powder
Silt	0.0004 mm to 0.0625 mm (.00002" to .003")	Powder
Sand	0.0625 mm to 2mm (.003" to.079")	Sugar crystals
Granule	2 mm to 4 mm (.079" to 16")	Aquarium gravel
Pebble	4 mm to 64 mm (16" to 2.5")	Grape
Cobble	64 mm to 256 mm (2.5" to 10")	Cobblestone
Boulder	256 mm and larger (10")	A brick or larger

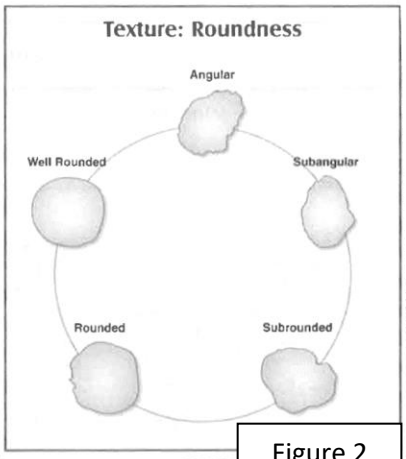

Figure 2

Prelab Questions:

1. Why is studying benthic sediments important?

2. Identify the two most common sources for benthic sediments.

3. Why is sand the sediment chosen for this lab?

Activity: Use the following characteristics to compare and contrast the sand samples provided.

A. **Color(s):** The color of sand can be used to help classify origin and may be dark, light, or specific shades.
B. **Size:** The size of grains helps clarify what transported it and for how long. The longer sediment is abraded, the smaller it will become. Use the Wentworth Scale (Figure 1) and graph paper underneath each sample to estimate size.
C. **Texture:** Roundness is a measure of how much the corners and edges of a grain have been rounded by erosion. Traveling very long distances in streams or being washed back and forth by waves at the beach produce well-rounded sands. Use Figure 2 to classify the texture of each sample.
D. **Sorting:** Sorting is a measure of how similar the size of the sand grains are. In well-sorted sand, the grains are all the same size. In poorly-sorted sand, large and small grains are mixed. Use Figure 3 to classify the sorting of each sample.
E. **Composition:** The composition of the sand is what the sand is made of. Use Figure 4 to classify the major components of each sample.

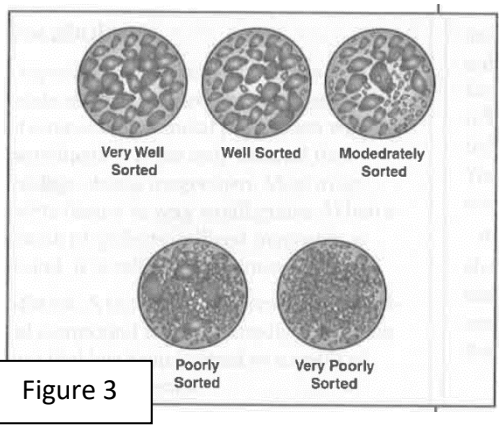

Figure 3

Figure 4

Common Components of Sand

Minerals	Feldspar: clear, yellow, or pink, squarish grains; cleavage may be visible; may come from weathering of granite or other intrusive igneous rocks.
	Garnet: burgundy red or brown colored, glassy; from metamorphic rocks.
	Hornblende: black, elongated shape, shiny; from granite, diorite, or andesite.
	Magnetite: black, submetallic appearance; will be attracted to a magnet. Commonly comes from mafic igneous rocks like basalt or gabbro.
	Mica: shiny, paper thin, translucent sheets. It may be white or light-colored (muscovite) or black possibly iridescent (biotite); from granite or schist.
	Olivine: translucent, glassy, and green; from basalt or gabbro.
	Quartz: clear or transparent, glassy; may be white or tan; if rounded may appear polished. Commonly derived from erosion of granite or sandstone. It is the most abundant mineral found in continental sand.
Rocks	Basalt: dull, black or dark gray; fine-grained.
	Granite: light-colored to pink, salt and pepper pattern of mineral grains.
	Obsidian: fragmented, black (possibly reddish), glassy, can have sharp edges.
	Volcanic rock fragments: andesite or rhyolite fragments are dull with no discernible minerals; green, gray, or pastel in color.
	Other rocks: sedimentary or metamorphic rock fragments may be present.
Biological Material	Coral: white, tan, sometimes orange; tiny pores may be visible; made of calcium carbonate.
	Foramnifera: single-celled organisms that build calcium carbonate shells. They may look like highly polished tiny snail shells.
	Shells: fragments of large and small clam and snail shells are usually easy to identify based on patterns of ridges or whorls.

Data:

Sand Sample Observations					
Sample Location	**Color**	**Size**	**Texture**	**Sorting**	**Composition**

Analysis Questions:

4. Identify two ways in which the sand samples were similar.

5. Identify two ways in which the sand samples were different.

6. Based on the samples you observed, what is the primary source of sand in North Carolina? Why was this your conclusion?

7. Based on the samples you observed, what is the primary source of sand in the Caribbean? Why was this your conclusion?

8. Identify another type of sand not included in this lab. Where might you find that sand type?

9. How might differences in sand affect interstitial organisms living there?

10. Why is the study of benthic habitats important?