



## **BREEF Teacher Training Workshop**

**Lesson Title** Investigating Sand - Lab

**Lesson Purpose /Rationale:**

This activity allows students to take a closer look at sand, it answers questions about what makes up sand, and how it is formed. Students will also be able to develop hypotheses based on difference in grain size about the environmental conditions at the beaches on which they were found.

All sand in The Bahamas is made of calcium carbonate ( $\text{CaCO}_3$ ), but it comes from a number of different sources. Sand collected from different beaches has special characteristics based on where and how the sand was formed.

**Objectives:**

**At the end of the lesson students will be able to:**

1. Describe the physical characteristics of sand grains and use the information to help determine its origin.
2. Determine the percentages of the different particle sizes in various sand samples and relate this to where the sample may have been collected.
3. Perform chemical and microscopic analyses to determine the composition of sand samples

**Materials:**

2 Sand samples (quarter cup each), 4 petri dishes, vinegar, hand lens/microscope, sieves (2 different sizes of mesh), small beaker, water, bleach, beam balance, measuring cup, teaspoon, tablespoon, lab data sheet

**Collecting sand samples** – beforehand

1. Collect about  $\frac{1}{4}$  cup of sand per lab group per sample.
2. Collect and label samples from approximately the same location at each beach e.g.: near water line, so that samples are comparable. (You may also wish to conduct a separate activity that compares sand at different locations on the same beach)
3. Rinse samples in fresh water and allow to dry completely. Observe the colour of the water after you have washed the sand. Is it clear or muddy? Are there pieces of plant material floating in it?

**Introduction**

*Ask students to think about the sand on their favourite beaches e.g.:*

- What does it feel like (smooth, gritty, sharp)?
- What color is it?
- Are the particles uniform in size, are there pieces of rock, coral shells in it?

Have students brainstorm what sand is made of. There are three basic sand types

- **Biogenic** – fragments of marine animals and plants that have hard calcium carbonate skeletons e.g. mollusks, algae, coral, foraminifera (these single celled animals are pink in color and are what give the pink Bahamian sand their colour)
- **Detrital** – rock fragments produced by weathering and erosion of the Earth's crust.
- **Precipitated** – made from the direct precipitation of calcium carbonate out of sea water. Sand formed in this way is known as **ooïd** sand.

Have students brainstorm what affects particle size: Particle size is affected by

- The material from which sand is made, and how easily it is broken down.
- Wave size and energy – a high energy beach (Windward/Eastern side of Bahamian Islands) will have coarser sand particles because the smaller particles will be transported out to sea by the large waves. A low energy beach (Leeward/Western side) is likely to have smaller particles.

**Procedure:** Divide the class into small groups.

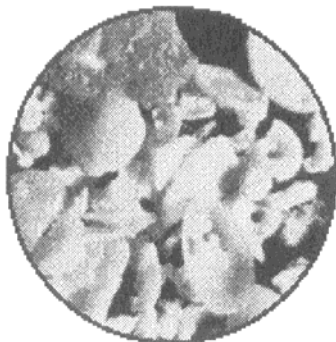
**A. Determine the relative percentage of particle sizes in each sample**

1. Weigh each sample and record.
2. Use the sieve to sift the dry sand sample through each mesh size so that the sand is separated into three sections based on particle size: small, medium, and large
3. Weigh each section and calculate the percentage of small, medium and large particles in the sample. Record your data.
4. Repeat this for the second sample.

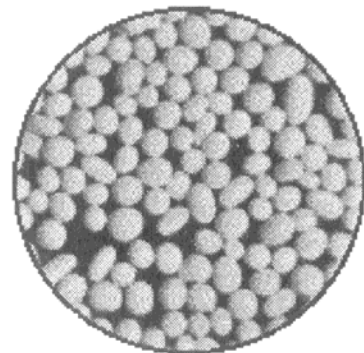
**B. Determine the type of particles in each sample**

5. Observe and record the color of each sample.
6. Use the microscope/hand lens to observe the types particles in each sample. What types of fragments can you identify (coral, shells, marine algae etc)? Are the edges smooth or rough? Are they all the same size? Are they large or small? Are they biogenic or precipitate sand (see diagrams below)? Record your observations.

Biogenic/Skeletal sand – grains are made of fragments of marine animals and plants



Precipitate sand – egg-shaped grains called 'ooïds' produced by the precipitation of sand from sea water



### C. Determine the chemical nature of sand - Reaction with acid

7. Place  $\frac{1}{4}$  teaspoon of each sand sample in a petri dish and spread them out into an even layer. Pour 1 tablespoon of vinegar into each dish and observe.
8. Vinegar reacts with the calcium carbonate in biogenic sand particles to produce carbon dioxide. The bubbles that you see will see is evidence of this reaction.
9. Observe both samples and note whether one bubbles more that the other. Record your observations. Does particle size affect the rate or amount of bubbles produced?
10. Use your findings to answer the questions on the worksheet

#### **Extension:**

Sand in The Bahamas is made up of the remains of marine animals and plants including calcareous algae such as Halimeda. You can have students perform investigations on the make up of Halimeda.

Materials: Fresh Halimeda algae, 2 Petri dishes, bleach, vinegar.

Procedure:

Place samples of Halimeda in each Petri dish. Add 1 tablespoon of bleach to one dish and 1 tablespoon of vinegar to another and Observe.

Bleach dissolves the organic matter in the algae leaving the calcium carbonate skeleton. Wash the Halimeda with fresh water and have students feel the texture and observe under a microscope.

Vinegar dissolves the calcium carbonate skeleton leaving the organic matter behind. Have students feel the texture and observe under the microscope.

Adapted from:

TEACHER BACKGROUND - Beach Sand—Littoral Sediments, Literary Sentiments  
Beach Today, Gone Tomorrow Activity #1Coastal Unit 1 - Sand Analysis Lab

Name \_\_\_\_\_ Date \_\_\_\_\_

### Investigating Sand - Lab Data Sheet

	<b>Sample 1</b>	<b>Sample 2</b>
Mass of sample (g)		
Mass of large particles (g)		
Percentage of large particles (%) Show working		
Mass of Medium particles (g)		
Percentage of medium particles (%) - Show working		
Mass of small particles (g)		
Percentage of small particles (%) - Show working		
Sample color (s)		
Based on microscopic observation, describe the grains present in each sample		
Based on the vinegar test compare the rate at which bubbles are produced in each sample.		

**Questions:**

1. Based on your findings, what is sand in The Bahamas made up of? Explain your answer.

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2. Based on the differences in sand grain size between the two samples, develop a hypothesis about the environmental conditions at both collection sites i.e. wave action, and whether samples were collected from the windward or leeward side of the island.

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3. Do you think that the particle size of sand found on our beaches may vary at different times of the year? Explain your answer.

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4. Could there be any relationship between the size of sand particles and the slope of the beach? Explain.

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