Deep Earth Academy
CONSORTIUM FOR OCEAN LEADERSHIP

Activity of the Month – April, 2008
How Small? How Big? How Much?

Summary

In this activity, students investigate relative size using foraminifera. They explore averages, magnification, and the importance of forams to the oceanic food chain.

Learning Objectives

Students will be able to:

- Measure forams
- Describe the size of a foram relative to their fingers
- Compute an average
- Determine the magnification of a foram photo from a real foram

National Science Education Standards

- Content Standard A: Science as Inquiry
- Content Standard D: Earth and Space Science
- Content Standard E: Science and Technology

National Council of Teachers of Mathematics Standards

Students will:

- develop fluency in adding, subtracting, multiplying, and dividing whole numbers;
- develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results;
- select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tools.

Target Age: Grades 3-6

Time Estimate: 2 to 3 class periods

Materials

- Paper
- Pencils
- Foraminifera samples (Request these through www.oceanleadership.org/learning/materials/core_samples.)
- Centimeter rulers
- Hand lenses
- *Microfossils: the ocean's storytellers* posters (one per student or group of students – request at: www.deepearth-academy.org
- Masking tape
- Microfossil floor tiles from Deep Earth Academy (Optional - contact us at learning@oceanleadership.org to find out how to borrow this unique floor to enhance your lesson.)

Background

Using the *Microfossils: the ocean's storytellers* poster from Deep Earth Academy, this lesson will help students understand the size of microfossils found in core samples and that an almost incomprehensible number of microfossils are deposited in seafloor sediments worldwide. Students will also gain a better grasp of the idea that even though something is very small, it can be quite significant.

Big Ideas:

1) Materials exist throughout our physical world. The structures of materials influence their physical properties, chemical reactivity, and use. 2) Earth's dynamic system is made up of the geosphere (solid Earth), atmosphere (air), biosphere (life), hydrosphere (water), and cryosphere (ice). Interactions among these spheres have resulted in ongoing changes to the system. Some of these changes can be measured on a human time scale, but oth-

Activity of the Month

Teaching for *Science* • Learning for *Life*™ | www.deepearthacademy.org ers occur so slowly that they must be inferred from geological evidence. 3) Math can be used to solve problems outside of the mathematics classroom. Math is built on reason and always makes sense. Classifying helps build networks of mathematical ideas and using precise mathematical language helps express these ideas.

What to do

Day 1

1. Tell students that today they will be exploring the size of some very small ocean critters. Have students begin their investigation by making a pencil dot on paper and measuring the dot's diameter using a centimeter/millimeter ruler. Ask students, "How big is the dot?" Compare answers for the whole class and have students compute a class average. Using the dot size as a unit of measure, ask students to determine how long their pinky fingers are, in dots. Ask, "How many dots long is your finger? Find a class average."
2. Briefly discuss microfossils and in particular foraminifera (forams)—what they are and where they can be found. Pass out foram samples. Ask, "How big is a foram compared to the dot you made?"
3. Ask students to place a foram on the dot they made. Is it larger or smaller? By how much? Have students measure their forams with a ruler and compute a class average. Why might some be smaller/larger (e.g., different sized organisms because they are different species, juveniles/adults, some are whole and some broken)? How many forams would fit down the length of your pinky finger? Have students make hypotheses before computing. Save these data for the second day of the lesson.
4. Pass out hand lenses and allow students to investigate magnified forams in groups. Does your foram look whole? Does it look the way you thought it would? Have students measure the magnified image with rulers. How much bigger does it appear? How many times larger is that than the actual size? Have students compute the magnification multiple. Discuss magnification if necessary.
5. Hand out *Microfossils* posters. Have students locate the photos of magnified foraminifera. Ask students to measure one of the enlarged forams. How many times larger is this image compared to actual size? How big would your pinky finger be if it were enlarged that many times? Have students mark off that length on the floor of the classroom with masking tape.
6. Have students draw a foraminifera that would fit on an 8.5" x 11" piece of paper. What would be the magnification of your drawing?
7. Explain to students that the next day they will consider the actual size of forams and try to determine the number of forams that might be found in a particular volume of core sample. (Explain core samples, if necessary.) For homework they could determine the number of forams that it would take to occupy the size and shape of a quarter.

Day 2

1. Briefly review material from the previous day, reminding students of the class-average-size foraminifera. Compare answers from the homework assignment.
2. Show students a section of a core. Ask, "How many foraminifera do you think there are in a sample this size?" Discuss approaches to finding the answer. Note that the quantity of microfossils will vary in different kinds of sediment. A white, chalky sediment will have many more forams per unit volume than a dark, muddy continental margin sediment. Give students time to compute an answer and find a class average. Express average in standard form and also as a product using scientific notation.
3. Show students a satellite image of a plankton bloom as seen from space using available technologies. (See, for example, *www.genomenewsnetwork.org/articles/02_02/bloom_art.shtml or www.lcamediabase.com/exweb/blooms/index.html*.) Explain to students that these images contain many, many millions of tiny critters, including forams. Many of these organisms are so tiny that they cannot be seen with the naked eye, but we can see huge quantities of them from space!
4. Facilitate a discussion of the importance of forams to the food web and pyramid; e.g., they are individually quite tiny but form the basis for large portions of oceanic food webs and pyramids. Larger animals eat huge quantities of them to survive. Help students to come to the conclusion that even though something may be quite small, its impact may be large!

Submitted by

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