Dead Diatoms Do Tell Tales!

You probably already know that scientists who study fossils are called **paleontologists**. Though some paleontologists study large fossils such as dinosaur bones or ancient seashells, many examine tiny fossils that can only be seen under a microscope. These scientists are called **micropaleontologists**, and diatom skeletons are one of the kinds of fossils they study.

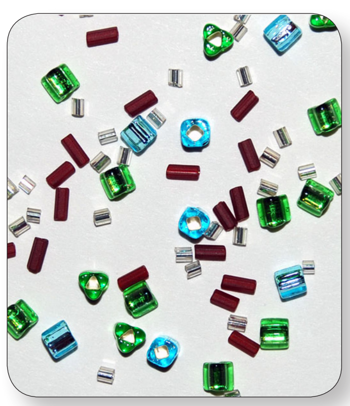
Scientists who study past environments are pleased when they discover fossil diatoms in their sedimentary rock samples. The types, numbers, and conditions of diatom skeletons tell something about the environment that existed when they were deposited. Diatom species that lived for relatively short time spans can also provide important clues about the age of sediments.

Preview

In this activity, you'll use glass seed beads to represent fossil diatom skeletons. Like diatoms, seed beads are small, and both items are made of glass. You'll prepare four artificial rock cores with sediments and seed beads. Once the cores are prepared, you and others will take samples of the sediments and use a magnifying glass to find and identify the model diatoms. Just as micropaleontologists do, you'll separate the "diatoms" from the rocks, check to see if they've been broken or crushed, and identify the species they represent. You'll read the dead diatoms' tales to infer what type of environment existed when they died.

Three Environments that Preserve Fossil Diatoms

After diatoms die, their skeletons sink and accumulate on the ocean floor. If this happens in an ice-free **open ocean**, most of the skeletons remain whole and unbroken, even after they are buried by other layers and compressed into rock. During times that Earth's climate is cooler, **ice sheets** expand off the continent over the former seafloor. The motion of ice and rocks grinding over diatoms crushes them into small fragments. Under an **ice shelf**, broken diatoms from the base of the ice sheet are deposited in layers with other sediments.



Different colors of glass seed beads represent different diatom species.

Time

- 2–3 hours

Tools & Materials

- 📖 Core Log Sheet (page 155)
- Clear plastic fluorescent bulb guard (two 10-inch pieces split in half lengthwise)
- Duct tape
- Coarse sand (3 cups)
- Dark sand (¼ cup)
- White sand (¼ cup)
- Orange or red sand (¼ cup)
- Gravel (15-20 pieces)
- Four different colors of glass seed beads (1½ teaspoons each)
- Heavy-duty plastic zipper-style bags (4)
- Paper plates (6)
- Magnifying glasses (2-3)
- Craft sticks (4)
- Fine-tipped paintbrushes (2-3)
- Clear-drying white glue
- Permanent marker
- Scissors
- Hammer
- Safety glasses or goggles
- Colored markers
- Large sheet of construction paper or poster board

📖 Items found in this book
Items included in the Flexhibit Kit, available from **http://www.andrill.org/flexhibit.**
+ Additional items

Prepare

Part 1 – Break some beads!

Diatom skeletons can be broken apart in nature. Glass beads can also be broken — with a hammer!

1. Assign each of your four colors of beads to one of the four diatom names below. Read the pronunciations aloud to learn how to say their names. Write the color of bead you'll use to represent each type of diatom on this chart.

Diatom Name	Pronunciation	Bead Color
Thalassiosira	thuh-**lass**-ee-oh-seer-uh	
Chaetoceros	ka-**tah**-seer-us	
Fragilariopsis curta	frah-jill-airy-**op**-sis **ker**-tuh	
Fragilariopsis species	frah-jill-airy-**op**-sis	

2. Put your *Thalassiosira* beads in a heavy zipper-type plastic bag.
3. Lay the bag on a hard surface such as a concrete floor or sidewalk. Shake it gently to spread the beads into a single layer.
4. Put on safety glasses or goggles to protect your eyes.

5. Tap the hammer on about two-thirds of the beads, so that many (but not all) of them are broken.
6. Pour the contents of the bag onto a paper plate. Shake the plate gently to help separate the bead fragments by size.
7. View the beads with a magnifying glass. Use a fine-tipped paintbrush to sort the pieces into three piles: whole beads, large pieces, and small fragments. Your sorting doesn't need to be perfect, just good. You should end up with about the same amount of each of the three sizes. If necessary, return some of the whole beads to the plastic bag to break more of them.

8. Repeat this breaking and sorting process two more times, once each for your *Chaetoceros* and *Fragilariopsis curta* beads.
9. For your *Fragilariopsis* species beads, only tap the hammer on about one-quarter of the beads so you keep most of them whole. Use gentle shaking and the paintbrush to separate them on their paper plate into the three sizes.

Part 2 – Prepare a key to your model diatoms

1. Prepare a page-sized piece of poster board or construction paper with a chart like this.

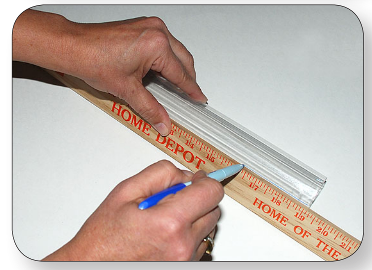
Example of Beads	Diatom Name	Pronunciation	Environment where they lived
	Thalassiosira	thuh-**lass**-ee-oh-seer-uh	Open ocean
	Chaetoceros	ka-**tah**-seer-us	Open open
	Fragilaropsis curta	frah-jill-airy-**op**-sis **ker**-tuh	Sea ice
	Fragilariopsis species	frah-jill-airy-**op**-sis **spee**-sees	Open ocean

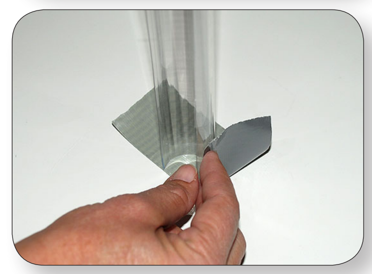
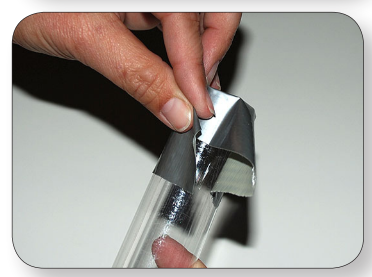
2. Glue two or three of the beads that represent each type of diatom into the **Example of Beads** column and set the chart aside to dry
3. Prepare another page-sized chart like this.

Condition of Beads	Relative Number of Beads	Depositional Environment
Whole	Many	Open Ocean
Broken	Some	Under an Ice Shelf
Crushed	Few	Under an Ice Sheet

Part 3 – Prepare holders for four artificial rock cores

1. Cut two 10-inch lengths of the clear plastic tube.
2. Use a ruler to mark two straight lines, on opposite sides, along the length of each tube.
3. Cut each tube in half lengthwise. You will end up with four half-cylinders.


4. Use eight 4-inch pieces of duct tape to close both ends of the half-cylinders as shown in the photos.
5. Using a permanent marker, label the duct tape at one end of the holder as the TOP of the core and the other end as the BOTTOM.
6. Add an additional piece of duct tape to the side of each core holder to label them as Core 1, Core 2, Core 3, and Core 4.

Which way is "UP"?

When working with rock cores, the standard practice is to always keep the TOP of the core to the left. That way, everyone knows that the older rock is at the right end (BOTTOM) of the core and the rock gets younger as you move to the left.

Part 4 – Make some model cores

Preparing the sand

1. Add just enough water to your sand so it sticks together — you want a consistency like what you'd use for building sand castles.
2. Add moist sand along the length of all four core holders so each trough is about ½ to ⅔ full. Press the sand gently to make a flat surface.

Making Core 1

1. Take about one-quarter of each color of the **Crushed** bead fragments and sprinkle them along the surface of the sand.
2. Smooth the surface gently so that most of the bead fragments are covered but are still within the top several grains of the surface.
3. Put 8-10 pieces of gravel on the core's surface. Press them flat into the sand so the surface looks like a cut core.

Making Core 2

1. Use a spoon to move some of the sand in the core holder out of the way. (Anywhere along the length of the core is fine.) Add a spoonful or two of another color of sand to make a new layer that crosses the core from side to side. Repeat this process two or three times to give this core a layered appearance.
2. Sprinkle about half of the **Broken** bead fragments of the four species in separate horizontal layers across the surface of this core. Add about half of the remaining **Crushed** bead fragments to this core as well.
3. Smooth the surface gently so that the bead fragments are covered by sand but are still within the top several grains of the surface.

4. Add 2-3 small pieces of gravel along the bottom of the layers you made and press them flat into the sand. These represent the larger rocks that settled first after an underwater landslide.

Making Core 3

1. Make a thick horizontal layer of the **Whole** *Fragilariopsis species* beads crossing the surface of Core 3. Use about ¾ of your supply.
2. Sprinkle about ¾ of the **Whole** *Thalassiosira*, *Chaetoceros*, and *Fragilariopsis curta* beads in separate horizontal layers across the surface of the core.
3. Add about half of the remaining **Broken** beads and **Crushed** beads to the surface. This core surface should be almost covered with beads.

Making Core 4

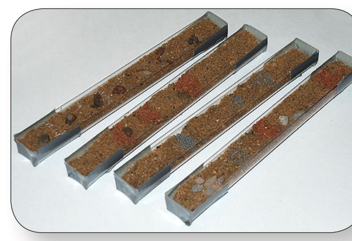
1. Sprinkle your remaining **Crushed** bead fragments along the surface of Core 4. Smooth the surface lightly and add 4-5 pieces of gravel to the bottom third of the core. Press them flat into the sand.
2. Add a thin layer or two of another color of sand across the middle third of the core. Sprinkle your remaining **Broken** bead pieces in separate horizontal layers across this section. Smooth the surface lightly and add two or three small pieces of gravel along the bottom of the sand layers.
3. Sprinkle your remaining **Whole** beads in separate layers across the top third of the core.

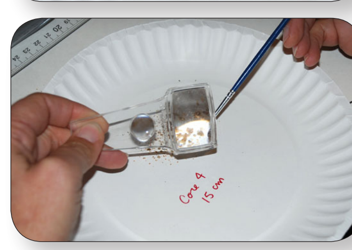
Part 5 – Sample the cores

1. Place your prepared cores next to metric rulers. Line up the bottom of each core with the bottom of the ruler.
2. Choose a place in one of the four cores where you'll take a sample. Write the core number and the distance from the bottom of the core on a paper plate.
3. Use a craft stick to gather a small sample of sediments from the surface of the core. Gather enough to cover the bottom half-inch (1 cm) of the craft stick. Put the sediments on your paper plate.
4. Gently shake the plate or use a small paintbrush to spread the sample out. Use a magnifying glass to examine any diatoms you find.

Studying diatoms

Micropaleontologists who study diatoms learn how to recognize different diatom species by the shape and patterns preserved in small fragments of their skeletons. You'll use color to help you recognize the model diatoms in the artificial cores you make.





5. Compare the diatoms you find in your sample to your two charts. Write the answers to the following questions directly onto your paper plate.
   - What types of diatoms did you find? What environment did those diatoms live in?
   - On the whole, how would you describe the number of diatoms in your sample – Many? Some? or Few?
   - In general, what condition are the diatoms in – Whole? Broken? or Crushed?
   - What environment would you infer was there when they were deposited – an ice sheet? an ice shelf? open ocean?
6. For samples from Core 4, transfer your data to the appropriate spot on the Core Log Sheet.

Core Log Sheet

Initials of Sampler	Distance from Bottom of core (cm)	Relative number of diatoms in sample (Many, Some, Few)	Condition of diatoms (Whole, Broken, or Crushed)	Environment in which diatoms were deposited
	25			
	24			
	23			
	22			
	21			
	20			
	19			
	18			
	17			
	16			
	15			
	14			
	13			
	12			
	11			
	10			
	9			
	8			
	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			

Ponder. . .

Once you've gathered the Core Log information for Core 4, use it to tell the tale of the changing depositional environment. Start your story at the time rocks at the bottom of the core were deposited. Describe the environments that existed through time to produce the sediments and diatoms you found in the core.

Practice

Got the Big Idea?

The types, numbers, and conditions of fossil diatoms found in rock cores are indicators of past environments.

Check your core interpretations

Core 1 – Samples of this core show very few diatoms among the sand grains. Of the diatoms that are present, most have been crushed into small fragments. Along with the mixed sizes of sediments, this indicates that this portion of the core was deposited beneath an ice sheet.

The presence of none or a few diatom fragments tells that rocks were deposited under an ice sheet.

Core 2 – Samples from this layered core show a noticeable number of diatoms among the sand grains. Most of the diatoms are broken, indicating that an ice sheet moved over them at some point. Later, they were arranged in layers by underwater landslides that occur under an ice shelf.

The presence of some diatoms that have been broken and deposited in layers tells that rocks were deposited under an ice shelf.

Core 3 – Samples of Core 3 contain many diatoms, and most of them are whole. The diatoms weren't exposed to grinding and friction, indicating that they were deposited in the open ocean.

The presence of many diatoms that are whole tells that rocks were deposited in the open ocean.

Core 4 – This core represents rocks from unknown environments. Depending on the section you chose, these samples may represent any one of the environments described above.

Get ready to present

Come up with an introductory comment or a question to invite people to look for model diatoms in the cores. Read over the unit introduction and the activity Preview to be sure you can give a simple explanation of what diatoms are. Consider which pictures or text on the "Tiny Clues" banner might help you explain your topic.

You may want to set up your station with samples from Cores 1, 2, and 3 already on paper plates. This will allow you to demonstrate the use of a magnifying glass to look for diatoms in the samples.

Present

Tell visitors what diatoms are. Let visitors know that they can take a sample of the cores to look for model diatoms. When they find model diatoms in their sample, have them match what they found to the diatom key, then figure out what the condition of the diatoms tells. Some people may enjoy trying out the pronunciations of the different diatoms.

For visitors who are interested and engaged, you can tell the environmental history represented by diatoms in Core 4. Start at the bottom section of the core and tell its story, then move up to the next section, and so on. Point out that scientists (and you!) are anxious to learn how the rock record of Antarctica fits into global climate history.