

# Planning & Logistics

## What is a Flexhibit?

The name Flexhibit comes from two words—it's a "flexible exhibit" package. The package include hands-on activities, attractive banners, and video Podcasts; it gives kids the means to do some fun learning activities and then use their knowledge to do some teaching. The activities culminate with the kids hosting a public science event or installing an exhibit for a science museum or other venue.

While doing the activities, kids build and interact with models and learn to give cool science demonstrations. The kids become the experts—they do the teaching at their event, or they prepare interpretive signs for the props at their exhibit. The package has been tested in a range of situations and places. It has been used successfully in 4-H clubs, classrooms, and after-school science clubs.

## Planning the activity sessions

Flexhibit activities are designed so you can adapt them to the size of your group and the amount of time you have available. For relatively small groups (10 or fewer), all the kids can participate in all the activities. With a larger group, it makes sense to split them into two or more subgroups and have different subgroups work on different activities. If you use this strategy, kids will get some initial practice giving demonstrations and explanations to the other kids.

The sequence of activities is designed to build kids' understanding about Antarctica from concrete and visible concepts to more abstract, global-scale ideas. Within each unit, activities complement one another; kids will develop the most complete understanding if they have some exposure to all the activities, either by participating in the activity session or by having their peers explain the content. Realistically, however, groups may not have the time or resources to cover every activity. To design the most complete learning experience possible, peruse the activities in each unit and decide which ones your group will complete. Check the "Got the Big Idea?" section of the activities for the learning outcomes.

Plan to examine and discuss the banner, read over the unit introduction in the activity book, and watch the video Podcasts before you begin the activities. These introductory materials provide context and background to help kids make sense of the models. Within the activities, the Preview sections are also designed to provide context. If kids are anxious to get started doing the activities, you may choose to summarize the Preview information for them ahead of time, then read and discuss that section more thoroughly after the activity as a way of solidifying their understanding and preparing them to present the material.

### Flexhibits Are Flexible!

You don't need to use all the activities for your Flexhibit event. Decide which activities will be most attractive to and understandable by your kids and your target audience.

## Scheduling the activities

This chart shows one suggestion for a group of 15 kids completing the activities in ten one-hour sessions.

Session	Whole Group Intro	Team-based Activities (Split group into # of teams indicated)
1	Examine and discuss the <b>Antarctica Today</b> banner and the Unit 1 Introduction in the activity book.  Watch Unit 1 Podcasts: Tour of the Cryosphere and ANDRILL  Activity 1A: Postcards from Antarctica	Activity 1B: Antarctica in Maps Break group into pairs and begin examining maps.
2	Have pairs of kids practice giving a brief explanations of the maps they examined to the rest of the group.	Team 1: Activity 1C, Polar Opposites? Team 2: Activity 1D, Animal Insulation  Prep for next session: Prepare ice for Activity 2A and ice sheet for 2B.
3	Teams 1 & 2 practice presenting Activities 1C and 1D to each other.  Examine and discuss the <b>Antarctica's Ice on the Move</b> banner and the Unit 2 Introduction in the activity book.  Watch Unit 2 Podcasts	Team 1: Do Preview and Prepare of Activity 2A. Team 2: Read 2A Preview and prepare model landscape for optional extension.  When Team 1 has completed the individual glaciers, they pass them over to Team 2 to become part of the ice sheet.
4	Activity 2B as a demonstration	In small groups, do Ponder and Practice for Unit 2 activities.  Reconvene the whole group to read the introduction for Unit 3 and examine and discuss the <b>Reading Antarctica's Rock Cores</b> banner.
5	Activity 3A: Build a Model ANDRILL Site	Break into subgroups to complete separate sections of the activity. One subgroup makes layer 1 of Activity 3C.
6	Watch ANDRILL 2006 Video Journals #7, #8, and #9  Activity 3B: Photo Sort: Core Flow	Team 1: Complete Activity 3C Team 2: Activity 3D
7	Examine and discuss the <b>Tiny Clues to Antarctica's Past</b> banner and the Unit 4 Introduction in the activity book.  Watch the <b>Diatom Tour</b> Podcast.	Team 1: Activity 4A (subgroups complete Parts 1, 2, and 3) Team 2: Activity 4B
8	Practice sharing Activities 4A and 4B  Read and discuss Unit 5 Introduction and examine and discuss the <b>Decoding Antarctica's Climate History</b> banner.	Team 1: Activity 5A Team 2: Activity 5B Team 3: Activity 5C
9	Complete work on Unit 5 activities.  Split the group into 5 sub-groups corresponding to the 5 units.	Each group reads through the Practice and Present sections in their unit and prepares their presentations.
10	Flexhibit Setup and Rehearsal	Practice setting up the teaching stations and sharing information with other groups.

## Planning your Flexhibit

Reserve your venue well in advance. If you are using a school building outside of school hours or on a weekend, consider whether you'll need to have a custodian or security person available to unlock doors during your setup time or your event. Plan ahead to have access to water and a place to store ice. Secure a couple of waterproof trash cans so that you'll have a place to throw wet paper towels or other messy trash.

As a practical minimum, you'll need at least one table for each of the five themes. If you have additional space and tables, you can expand. One option is to set the tables around the edges of the room with space for an aisle behind them: this arrangement allows youth presenters to stand behind the tables and visitors to move from one table to another without backtracking. As possible, set up so that it is convenient for visitors to start at Unit 1 and move through the sequence, ending at Unit 5. Visitors may not choose to follow this pattern, but make it available if possible. As each group decides how they'll present the activities from their unit, you may need to make slight spacing adjustments to ensure that all the stations are accessible.

Use whatever resources you have to display the banners at eye level for your intended audience. Ideally, use large tacks or nails to hang the banners by their grommets flat on the wall. If you can't attach the banners to the wall, consider hanging them over frames on easels, across tri-fold cardboard displays, or from the ceiling, using strong string or fishing line.

During your setup time, check to see that banners and props are well spaced rather than clustered in a few locations. Check that there is enough room for people to move between the exhibits. Double check for possible safety issues, considering that young children may handle things in ways you don't expect.



# Materials List

This list details the items needed to complete the activities and produce a single set of Flexhibit props. Flexhibit Kits containing all these items can be purchased. For current pricing or to place an order, send an email to [AntarcticaFlexhibitKits@charter.net](mailto:AntarcticaFlexhibitKits@charter.net)

Description	Quantity	Unit 1				Unit 2		Unit 3				Unit 4		Unit 5		
		A	B	C	D	A	B	A	B	C	D	A	B	A	B	C
duct tape	1 roll				•						•	•				
measuring cups & spoons	1 set															
scissors	2 pair	•	•	•	•			•	•					•	•	
saw (for cutting PVC & wood)	1							•						•		
clear packaging tape	1 roll					•										
colored markers	1 set	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
physical globe (Earth)	1		•	•												
string	4 ft		•													
3-ring binder	1		•													
plastic sheet protectors	1 doz		•													
index cards	1 doz		•													
plastic basin or bowl	1				•											
zipper-lock bags, 1 quart	10				•											
vegetable shortening or lard	2 cups				•											
washcloth	1				•											
insulating materials	misc				•											
cotton balls	30				•											
styrofoam bowls	12					•										
black pepper	2 Tbsp					•										
plastic wrap	1 roll					•										
cardboard 12"x18"	3					•										
9-inch square baking pan	1						•									
paint tray	1						•									
paint tray liner	1						•									
plastic pitcher	1						•									

# Materials List

# Leader Notes

Description	Quantity	Unit 1				Unit 2		Unit 3				Unit 4		Unit 5			
		A	B	C	D	A	B	A	B	C	D	A	B	A	B	C	
blue food coloring	1 bottle						•										
salt	2 Tbsp						•										
yardsticks	4							•									
blue acrylic paint	2 oz							•									
foam paintbrush	2							•									
cardboard box 18"x12"x9"	1							•									
black construction paper	1 sh							•									
cardboard box 12"x9"x2"	1							•									
½" PVC pipe	20 ft							•							•		
sandpaper, medium	1 sh							•							•		
kraft paper, brown, 30"x52"	6 ft							•									
½" diameter wooden dowel	18 in							•									
steel thumb tacks	3							•									
½" diameter round magnet	1							•									
small screw eye	1							•									
nylon cord or string	4 ft							•									
blue cellophane, 30" wide	18 in							•									
plastic mixing bowl	1									•							
large spoons	3									•							
plastic containers, 16 oz	8									•							
pebbles (>½" diameter)	2 cups									•							
gravel (about ¼" diameter)	2 cups									•							
coarse sand	5 cups									•		•					
fine sand & silt	2 cups									•							
clear fluorescent bulb cover	1									•							
1¼" PVC caps	2									•							
plastic funnel	1									•							
plastic jars w/lids, 12 oz	3									•							
green hermit crab sand	2 cups									•							
white sand	2¼ cups									•		•					
cardboard tube, 2"x24"	2										•						

Description	Quantity	Unit 1				Unit 2		Unit 3				Unit 4		Unit 5		
		A	B	C	D	A	B	A	B	C	D	A	B	A	B	C
black sand	¼ cup												•			
orange sand	¼ cup												•			
gravel & pebbles	20 pcs												•			
glass seed beads, 4 colors	1¼ tsp ea												•			
paper plates	12												•			
plastic spoons	3												•			
hammer	1												•			
safety glasses or goggles	1												•			
thick plastic zipper bags	4												•			
magnifying glass	2-3												•			
fine-tipped paintbrush	2-3												•			
30-cm rulers	4												•			
black permanent marker	1												•			
shank buttons	86													•		
flat buttons	50													•		
assorted plastic beads	½ cup													•		
polished aquarium gravel	5 cups													•		
3" corrugated plastic drain pipe	30 in													•		
toothpicks	60													•		
adhesive mailing labels	60													•		
sewing needles	3													•		
thread	1 spool													•		
½" PVC slip elbows	2														•	
½" PVC slip tees	4														•	
½" PVC slip caps	4														•	
poster board, 22"x28"	1 sheet														•	
red construction paper	1 sheet														•	
1½" red grosgrain ribbon	3 yd														•	
1½" white grosgrain ribbon	3 yd														•	
1" wide sticky Velcro®, white	18 in														•	
aluminum foil	1 roll															•

Description	Quantity	Unit 1				Unit 2		Unit 3				Unit 4		Unit 5			
		A	B	C	D	A	B	A	B	C	D	A	B	A	B	C	
waxed paper	1 roll															•	
non-hardening clay, brown	1 oz															•	
craft sticks	12												•			•	
white glue	8 oz												•			•	
borax laundry booster	3 Tbsp															•	
8 oz plastic container, w/ lid	1																•
clear plastic container, 8"x5"	2																•
clear plastic container, 4"x4"	2																•
adhesive labels	3																•
overhead transparency marker	1																•

# Activity Notes

## Unit 1 - Antarctica Today

This unit serves as an introduction to the continent of Antarctica. Kids learn that Antarctica is a cold, remote, and unique place where humans are only visitors.

### Activity 1A Postcards from Antarctica

#### Preparation for the Activity Session

If your activity sessions are particularly short, or your group of kids is not especially skillful or safe with scissors or paper cutters, consider using volunteer resources to cut out the postcards before the session.

The postcards are not actually from or to real people. Rather, the messages were written to share interesting facts about living in Antarctica. The stamps shown on the postcards are only replicas: they were designed to look realistic, while avoiding any infringement on postal rules. Because mail to and from McMurdo Station is handled by the U.S. military postal system, the actual cost for sending mail to or from Antarctica is the same as sending mail anywhere within the United States.

#### Flexhibit Station Setup

The postcards can be a stand-alone station. Display the postcards on a tabletop or in a binder of plastic photo sleeves. Lay some of them out with the writing side up so visitors realize that they can learn something from both sides of the postcards.

#### Ponder Answer

There are no wrong answers for the blank postcards. Kids may write about

- the beauty of the icy landscape
- daylight and night lasting for several months per year
- adventurous work such as rappelling on ice cliffs for science research
- the clothing necessary for working outdoors in Antarctica

## Activity 1B Antarctica in Maps

### Preparation for the Activity Session

Before you ask kids to do this activity, work through it yourself. Read through the questions and answers for each of the map pages so that you can assist kids in understanding the concepts. Note which maps or questions may be challenging for your kids and be ready to help them. Work to build kids' confidence in their ability to read maps.

### Flexhibit Station Setup

Display the globe and maps where visitors can handle them. Place the open binder of maps on a tabletop, or post the maps on a bulletin board.

### Ponder Answer

Examples of words and phrases that describe Antarctica:

Freezing, Cold	Remote, Isolated
Surrounded by Ocean	Large
White	Snowy, Icy
Windy	Dry
South of every place else on Earth	Covered with ice
Partly below sea level	Has penguins around its coast
Dangerous	Discovered after all other continents
Place for Adventure and Discovery	Governed by the Antarctic Treaty
No military presence	No official flag
Distorted on maps	No one owns it

## Activity 1C Polar Opposites?

### Preparation for the Activity Session

Come up with at least one practical method for making a large Venn diagram. If your kids don't come up with a way to make the two circles themselves, you'll be able to suggest it.

If you don't think your kids will be able to resist looking at the answers before they sort the cards, you may want to cover the answers with sticky notes.

In order to help kids distinguish between the two polar regions, plan to wrap up the activity with a focus on Antarctica. Gather and put away all the Arctic-only cards. Display the cards that show features of Antarctica and ask for volunteers to share ways of helping everyone remember which items are Antarctic.

## Flexhibit Station Setup

The Venn diagram circles can be arranged horizontally or vertically, depending on the facilities and the space available. If feasible, consider placing the circle that represents the Arctic to the north of the circle that represents the Antarctic. This can reinforce the physical locations of each polar region.

## Ponder Answer

Examples of unlikely pairings of polar animals include penguins and polar bears, sled dogs and penguins, and penguins and walruses.

Sentences about Antarctica should emphasize that Antarctica is a continent located near Earth's South Pole.

## Activity 1D Animal Insulation

### Preparation for the Activity Session

You may want to provide additional insulating materials for testing, such as down, feathers, fake fur, or pieces of old jackets or other clothing.

### Ponder Answer

Kids' descriptions will vary. They may suggest that animals go into the water, lie on the ice, or pant to cool down. Similarly, kids will have different reactions to the idea of SCUBA diving under Antarctica's ice.

### Flexhibit Station Setup

This station requires a supply of extra ice to add to the container of ice water as it melts. One point is crucial to this station's success: be sure kids remove the gloves from the ice water when they are not being used. If the blubber becomes chilled, there will be no difference in the temperatures of the blubber and control gloves.



## Unit 2 - Antarctica's Ice on the Move

This unit gives kids a chance to chill out with ice. They learn that solid ice flows downhill, carrying rocks with it. Antarctica has four major types of ice. These are **ice sheets** on land, **ice shelves** over ocean water, and floating **icebergs**—chunks of ice that broke free from ice shelves; **sea ice** is frozen ocean water.

### Activity 2A Build a Model Glacier

#### Preparation for the Activity Session

Building a model glacier requires snow, shaved ice, or crushed ice. If you plan to use shaved ice, be sure to freeze water in the appropriate molds ahead of time. If you have a local shaved-ice retailer, consider asking them to donate ice for your activity or event.

#### Flexhibit Station Setup

Decide ahead of time if you will use the optional mountain landscape to demonstrate how glaciers can coalesce to form an ice sheet. If so, be sure that you have a way to contain the considerable amount of water the melting ice will produce.

#### Ponder Answer

Annual snow layers and tree rings are very similar. Each layer marks a single year. The thickness of the light-colored wood and the white portion of each layer of snow indicate something about the conditions during the year it was formed. In tree rings, the thicker layers indicate good conditions for growing, with plenty of access to water. In layers of snow, thicker layers indicate years with abundant snowfall. Annual snow layers also trap bubbles of air that serve as tiny samples of the atmosphere from the time that the snow fell.

### Activity 2B When Ice Meets the Sea

#### Preparation for the Activity Session

Freezing the ice sheet with sediments in the bottom of it well in advance is necessary for this activity. Also, when you are ready to remove the ice sheet from the pan, it's important to dip the bottom of the pan in warm water just long enough to loosen the ice, but not so long that the sediments begin melting out.

#### Flexhibit Station Setup

Prepare several ice sheets ahead of time and keep them in a freezer or cooler for use at the Flexhibit. Making the ice sheets slightly thicker than the 1 cm suggested for the activity is one way to make the demonstration last longer.

### Ponder Answer

Sediments at point A would be of all sizes and shapes. This is where they would initially melt out of the bottom of the ice sheet.

At point B, there would be fewer sediments because most of them melted out and dropped to the seafloor at point A. Some of the sediments that had piled up at point A may move downhill to form layers at point B.

Point C would have the fewest rocky sediments from the ice sheet. Plants or animals that live in the open ocean may die and accumulate on the seafloor at point C.

## Unit 3 - Reading Antarctica's Rock Cores

Kids get to the core of the matter in this unit: they learn that scientists drill into the seafloor around Antarctica to retrieve rock cores. The scientists study the rocks to understand how Antarctica's climate and environment have changed over time.

### Activity 3A Build a Model ANDRILL Site

#### Preparation for the Activity Session

Consider whether the kids you are working with can safely handle sawing through PVC and making holes through cardboard with scissors. If not, complete those steps yourself.

#### Flexhibit Station Setup

Set the drill model on the floor so people can reach it.

#### Ponder Answer

The scale of the model is inaccurate. Though the ice shelf and ocean water are proportional to their real-world thicknesses for drilling through an ice shelf, the diameter of the PVC pipe and the length of the rock cores are exaggerated.

### Activity 3B Photo Sort: Core Flow

#### Preparation for the Activity Session

If you think your kids won't be able to resist looking at the descriptions before they sort the photos, you may want to cover the answers with sticky notes.

#### Flexhibit Station Setup

Lay the photos out on a table or countertop. Let kids decide if all, some, or none of the photos should be laid out in the proper sequence for visitors.

### Ponder Answer

Though some of the photos show processes that overlap, the general sequence is listed below. Kids should tell their stories from the point of view of a rock core, generally following a sequence similar to the photos, beginning with step 3 or 4.

- 1 Tractor pulling containers
- 2 Pipes ready for drilling
- 3 Drilling montage
- 4 Delivering core from the drill rig
- 5 Washing the core
- 6 Hand-guided saw cutting core
- 7 Whole core scanning
- 8 Transporting the cores to McMurdo Station
- 9 Core curator splitting the core
- 10 Slabbed core under imager
- 11 Scientist pointing at core
- 12 Flags along core
- 13 Micropaleontology studies
- 14 Cutting the working half apart for samples
- 15 Petrologist examining core image
- 16 Hand drawing of clasts in core
- 17 Examining core material
- 18 Boxes of core halves packed for shipping

### Activity 3C Mix Up a Model Rock Core

#### Preparation for the Activity Session

Plan to do this activity outdoors if possible, or in an area where spilled gravel, sand, and ice can be cleaned up without permanent damage. Part 1 takes about 20 minutes to mix the rocks and fill the tube, plus an hour or more of melting time. If possible, schedule your activities to do Part 1 during one activity session and finish Parts 2 and 3 during the following session.

## Flexhibit Station Setup

If you have access to a ring stand (available in chemistry classrooms), you can use it to hold the core in a vertical position.

## Ponder Answer

Student sketches should show the bottom layer of mixed sediments indicating an ice sheet, the layered rocks that indicate presence of an ice shelf, and the green diatomite, which indicates open marine conditions.

Taken together as one continuous story, the rock layers signify that an ice sheet existed and then shrank, ending with open ocean covering the area. Essentially, this is a story of a warming climate.

Any one of the three layers might be mentioned as the best model for the rock type it represents. The sediments mixed with the ice is a model for the bottom of an ice sheet, the spoonfuls of rocks settling through water represent material that flows downhill in underwater landslides, and the green sand grains suspended in water represent diatoms.

## Activity 3D Mess-free Model Rock Cores

### Preparation for the Activity Session

Cutting across and along poster tubes can be quite difficult. Consider completing this step in advance, giving yourself plenty of time to achieve good results.

### Flexhibit Station Setup

These cores can lie on a table top. Presenters may want to lay them next to a diagram that describes the layers. Take the rubber band off at least one of the split cores so visitors can take the halves apart and fit them back together.

### Ponder Answer

Splitting each meter of core into two pieces means that one half can be cut apart for samples and the other half will remain intact. If a scientist discovers something odd in the working half of the core, other scientists can examine the archived half of the core to confirm or deny those findings.

Using digital images of rock cores is more convenient than traveling to the archive facility to look at the actual cores. The digital images can also be enlarged to show details of the sediments that make up the rock layers. One disadvantage of examining images instead of the actual core is that scientists can't feel the texture of the rock or get a sample of it for testing.



## Unit 4 - Tiny Clues to Antarctica's Past

In this unit, kids use beads and buttons to represent diatoms. Diatoms are microscopic algae that produce unique "skeletons" of their cell walls. Fossil diatoms found in rock cores provide clues about past environments.

### Activity 4A Dead Diatoms Do Tell Tales!

#### Preparation for the Activity Session

Cutting the clear plastic tubes is not particularly difficult, but kids may not have the control to make the cuts straight. Consider whether your participants will be able to handle this task or if you should complete it for them.

#### Flexhibit Station Setup

Display the model cores, along with craft sticks for sampling and magnifying lenses or examining the samples. Include the chart for finding the names and environments indicated by the beads. Be ready to sweep up spilled sand and beads between visitors' turns with the materials. As possible, encourage your presenters to return samples taken by visitors to the same location where they came from along the core.

#### An Alternative Exhibit Idea

The sampling portion of this activity is designed as a realistic simulation of what micropaleontologists do. By conducting this activity in a controlled environment, kids can model the scientific process by finding and categorizing the model microfossils, including interpreting the environments indicated by their color and condition.

In the festive and faster-paced atmosphere of a Flexhibit, you may want to offer visitors the opportunity to search for larger, unbroken plastic beads of different colors and match them to a chart to find their names. Younger children are generally more interested in searching for and finding beads buried in sand than in focusing on the condition of the bead and what it says about the depositional environment. To offer this option at your Flexhibit, prepare a set of 6 to 10 core holders by cutting paper towel or bathroom tissue rolls in half and then covering them with foil. Use 4 different colors or shapes of plastic beads to represent the diatoms mentioned in the activity. Bury 4 or 5 of the beads in moist sand in each core holder, and prepare a chart of their names. After visitors have found the beads and moved on to the next station, put the beads and sand back into the core holder and pat the surface smooth so another visitor will be able to search for the beads.

### Ponder Answer

Beginning at the bottom of the Core Log for Core 4, kids should describe the environments indicated by the sediments and model diatoms found in the core. The sequence will vary, but each of the three environments described for Cores 1, 2, and 3 in the "Check your core interpretation" section should be included.

## Activity 4B Evidence of Ice-Free Seas

### Preparation for the Activity Session

In order for the assortment of buttons used in this activity to be meaningful at all, be sure that your kids understand two things. First, that *Eucampia* diatoms grow longer chains when they receive sunlight, and second, that the ends of the chains are different from the middle forms. Plan to spend sufficient time on the Preview section; check that your participants can see the difference in the two sets of diatoms on page 160 and the similarities between the images at the bottoms of page 159 and page 161.

### Flexhibit Station Setup

Set up the core and the *Eucampia* Index Chart beside it. Prepare a set of the toothpick flags for people to record the number of each type of diatom.

### Ponder Answer

Storyboards or cartoon strips should show short *Eucampia* chains under sea ice and longer *Eucampia* chains in ice-free conditions. Kids might include diagrams like the ones in the middle of page 160. Sets of *Eucampia* diatoms with many more middle forms than end forms indicate relatively warm climates, when the sea was free of ice.

## Unit 5 - Decoding Antarctica's Climate History

### The BIG Idea for Unit 5

Antarctica's environmental changes are related to changes in its climate. Removal of ice shelves and melting of ice sheets in Antarctica would affect the entire globe by raising sea levels.

### Activity 5A Charting Temperature Changes

#### Preparation for the Activity Session

Give sufficient time for reading and discussing the information in the Unit 5 Introduction. This section establishes that changes in Antarctica's climate are not the result of continental motion.

#### Flexhibit Station Setup

Place the PVC frame on a table where people can see and move the thermometer ribbons.

#### Ponder Answer

Descriptions should include mention of warmer and colder periods of different durations over the last 50 million years. The amount of ice on Antarctica would be lower during warm periods and higher during colder periods.

### Activity 5B What If the Ice Shelves Melted?

#### Preparation for the Activity Session

Encourage kids to read the directions carefully and look at the pictures to understand that the foil wall goes around the **outer** edge of the continent, but on the **inner** edges of the ice shelves.

#### Flexhibit Station Setup

Kids may want to make photographs or diagrams showing the model before, during, and after the placement of the slime. This would allow visitors to visualize the various stages of the model without waiting for the slime to flow.

#### Ponder Answer

Sketches should show the slime piled on the continent before removal of the ice shelves, and flowing off the continent after the ice shelves are removed.

## Activity 5C How Does Melting Ice Affect Sea Level?

### Preparation for the Activity Session

Freeze several of the shallow blocks of ice ahead of time and store them in a plastic bag in a freezer. It is important to make sure that the ice blocks are all the same size. Adding a few small houses, such as the plastic hotels from a Monopoly® game, to the simulated land can help kids understand the effects of rising sea level.

### Flexhibit Station Setup

Kids may want to make **Before** and **After** photos or drawings to share at the Flexhibit. The ice can melt very slowly, so if you have an extra set of containers, you could set up the station with one pair of containers with the ice and another pair showing the ice completely melted.

### Ponder Answer

Rising sea level would gradually cover some of the beach and may eventually submerge the lower-lying buildings and roads. In some areas, seawalls or levees might be built to protect the property from the rising sea level.

As demonstrated in the activity, melting of sea ice would not affect sea level around the world, but it might have other effects on climate or wildlife.

The activity shows that the melting of large ice sheets would add water to the world's oceans, causing sea level to rise. Low-lying coastal areas would be most affected, with large areas of land being covered by the rising water.

# National Standards

Activity Name	Standards Category	Standards Covered
<p><b>1A</b> Postcards from Antarctica</p>	<p>National Science Education Life Science Content Standards for Grades 5-8</p>	<p>Regulation of an organism's internal environment involves sensing the internal environment and changing physiologic activities to keep conditions within the range required to survive.</p>
		<p>An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger are based in the species' evolutionary history.</p>
		<p>Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.</p>
<p><b>1B</b> Antarctica in Maps</p>	<p>National Science Education Earth Science Content Standards for Grades 5-8</p>	<p>Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.</p>
	<p>National Geography Standards</p>	<p>Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.</p>
<p><b>1C</b> Polar Opposites?</p>	<p>National Geography Standards</p>	<p>THE WORLD IN SPATIAL TERMS: STANDARD 2: How to use mental maps to organize information about people, places, and environments.</p>
		<p>PLACES AND REGIONS: STANDARD 5: That people create regions to interpret Earth's complexity.</p>
		<p>PHYSICAL SYSTEMS: STANDARD 8: The characteristics and spatial distribution of ecosystems on Earth's surface.</p>

Activity Name	Standards Category	Standards Covered
<p><b>1D</b> <b>Animal Insulation</b></p>	<p>National Science Education Life Science Content Standards for Grades 5-8</p>	<p>Regulation of an organism's internal environment involves sensing the internal environment and changing physiologic activities to keep conditions within the range required to survive. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.</p>
<p><b>2A</b> <b>Build a Model Glacier</b></p>	<p>National Science Education Earth Science Content Standards for Grades 5-8</p>	<p>Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.</p>
<p><b>2B</b> <b>When Ice Meets the Sea</b></p>	<p>National Science Education Earth Science Content Standards for Grades 5-8</p>	<p>Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.</p> <p>Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.</p> <p>The Earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.</p>

Activity Name	Standards Category	Standards Covered
<p style="text-align: center;"><b>3A</b> <b>Build a Model</b> <b>ANDRILL Site</b></p>	<p>National Science Education Standards: Science as Inquiry</p>	<p>Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.</p>
	<p>National Science Education Standards: Science and Technology</p>	<p>Evaluate completed technological designs or products. Students should use criteria relevant to the original purpose or need, consider a variety of factors that might affect acceptability and suitability for intended users or beneficiaries, and develop measures of quality with respect to such criteria and factors; they should also suggest improvements and, for their own products, try proposed modifications.</p>
		<p>Communicate the process of technological design. Students should review and describe any completed piece of work and identify the stages of problem identification, solution design, implementation and evaluation.</p>
	<p>Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size and speed. Technology also provides tools for investigations, inquiry, and analysis.</p>	
<p>National Science Education Earth Science Content Standards for Grades 5-8</p>	<p>The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.</p>	
<p style="text-align: center;"><b>3B</b> <b>Photo Sort:</b> <b>Core Flow</b></p>	<p>National Science Education Standards: History and Nature of Science</p>	<p>Women and men of various social and ethnic backgrounds — and with diverse interests, talents, qualities, and motivations — engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.</p>
	<p>National Science Education Standards: Science and Technology in Society</p>	<p>Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.</p>

Activity Name	Standards Category	Standards Covered
<p><b>3C</b>  <b>Mix Up a Model Rock Core</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.</p> <p>The Earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.</p>
<p><b>3D</b>  <b>Mess-free Model Rock Cores</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Living organisms have played many roles in the Earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.</p>
<p><b>4A</b>  <b>Dead Diatoms Do Tell Tales!</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Fossils provide important evidence of how life and environmental conditions have changed.</p> <p>Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.</p>
<p><b>4B</b>  <b>Evidence of Ice-Free Seas</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Fossils provide important evidence of how life and environmental conditions have changed.</p>
<p><b>5A</b>  <b>Charting Temperature Changes</b></p>	<p>National Science Education                      Standards: Science as Inquiry</p>	<p>Develop descriptions, explanations, predictions, and models using evidence. Students should base their explanation on what they observed, and as they develop cognitive skills, they should be able to differentiate explanation from description — providing causes for effects and establishing relationships based on evidence and logical argument.</p>
<p><b>5B</b>  <b>What If the Ice Shelves Melted?</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.</p>
<p><b>5C</b>  <b>How Does Melting Ice Affect Sea Level?</b></p>	<p>National Science Education                      Earth Science Content Standards                      for Grades 5-8</p>	<p>Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.</p>

Activity Name	Standards Category	Standards Covered
<p><b>Presenting at any Flexhibit station or event</b></p>	<p>National Science Education Standards: Science as Inquiry</p>	<p>Communicate scientific procedures and explanations. With practice, students should become competent at communicating experimental methods, following instructions, describing observations, summarizing the results of other groups, and telling other students about investigations and explanations.</p>



# Glossary of Terms

## ANDRILL

Antarctic geology drilling project. An international scientific research project to recover sedimentary rock cores from the margins of Antarctica

## ANDRILLian

A scientist, driller, technician, or educator who works on the ANDRILL project

## annual

Once every year

## Antarctic

The region from 66.6 degrees south to the South Pole

## Antarctic Circumpolar Current

Ocean current of water moving in a clockwise direction around Antarctica

## archive

Collection of records

## archive half

Half-cylinder of rock core stored away for future use

## Arctic

The region from 66.6 degrees north to the North Pole

## Arctos

A constellation of stars located above the North Pole

## atmosphere

Gases that surround Earth

## aurora

Displays of light in the night sky, often seen in polar regions. Auroras are generated by interactions of charged particles from the sun with Earth's magnetic field.

## carbon dioxide

Gaseous molecule in Earth's atmosphere consisting of one carbon and two oxygen atoms. Carbon dioxide is largely responsible for Earth's greenhouse effect. Measurements that began in 1960 show that the amount of carbon dioxide in Earth's atmosphere has been increasing over time.

## Chaetoceros

A kind of diatom that lives in open marine conditions around Antarctica

## circumpolar

Around Earth's polar regions

## climate

Long-term conditions of temperature and precipitation

## CO<sub>2</sub>

Carbon dioxide

## contour

An outline showing the points of equal elevation of land or ice

## core

Cylinder-shaped material produced by a hollow drill

## cryosphere

Earth's ice

## decode

Analyze and interpret; make sense of

## diamictite

Rock type with mixed grain sizes. Usually deposited by ice sheets

## diatom

Single-celled microscopic algae that produce intricately patterned cell walls of silica

## diatomite

Rock type that contains a high percentage of diatoms

## ECW gear

Extreme Cold Weather clothing including parka, wind pants, boots, long underwear, hats, and gloves. Issued on loan to everyone who works in Antarctica.

## elevation

Height above sea level

## environment

Main conditions of an area, including climate and landcover

## ***Eucampia antarctica***

A species of diatom in which individuals grow in a chain. These diatoms live in ocean water and under sea ice around Antarctica.

## ***Eucampia index***

A unitless measurement comparing the number of middle forms of *Eucampia antarctica* diatoms to the number of end forms.

## **evidence**

Facts or information used to support a theory

## **Flexhibit**

A flexible exhibit event in which presenters share demonstrations and information with visitors

## **fossil**

A sign or trace of ancient life

## **Fragilariopsis curta**

A kind of diatom that lives in sea ice around Antarctica

## **Fragilariopsis species**

A kind of diatom that lives in open marine conditions around Antarctica

## **friction**

Force of resistance to moving one surface over another

## **geochronologists**

Scientists who gather evidence to learn the timing of geologic events

## **geology**

Study of Earth, especially its solid structure

## **geosphere**

Solid structure of Earth including the core, mantle, and crust

## **glacier**

Snow that has accumulated to the point that individual snowflakes are compressed into solid ice. The weight of overlying snow results in the ice moving downhill under the force of gravity

## **Gondwana**

Southern super-continent that existed from 180 to 120 million years ago. Africa, South America, Australia, India, and Antarctica were all connected at a location near the South Pole.

## **happy camper school**

Snowcraft I: a two-day course to prepare Antarctic workers for survival in extremely cold conditions

## **hydrosphere**

Earth's waters

## **ice sheet**

A mass of glacial ice that covers an area greater than 50,000 km<sup>2</sup>

## **ice shelf**

Platform of glacial ice that forms where an ice sheet flows off a continent and floats on the ocean surface

## **iceberg**

Floating chunk of ice that breaks off an ice shelf

## **igneous**

Rocks that formed by cooling and solidifying from hot melted rock

## **krill**

Small shrimp-like animals that live in the ocean around Antarctica

## **layered rocks**

Rocks that show a series of flat or tilted beds, often distinguished by the gradual change from larger to smaller grains

## **lengthwise**

Along the long axis

## **marine**

Having to do with the ocean

## **mattracks**

Tank-like treads that bolt on to vehicles in place of ordinary wheels

## **metamorphic**

Rocks that have been changed by heat and pressure

## **micropaleontologist**

Scientist who studies microscopic fossils

## **model**

A physical or conceptual representation of an object or process

## **ozone**

Gaseous molecule in Earth's atmosphere consisting of three oxygen atoms. Ozone in Earth's upper atmosphere blocks ultraviolet wavelengths of light from reaching Earth's surface.

# Leader Notes

## ozone hole

Area where the concentration of ozone in Earth's upper atmosphere is less than 300 Dobson units

## paleontologist

Scientist who studies fossils

## photosynthesis

Process by which plants make food using energy from sunlight plus water and carbon dioxide

## plate tectonics

Theory that Earth's surface is composed of rigid pieces that move relative to one another

## polar

Directly opposite in character or location

## pressure ridge

In map view, a line of sea ice that is pushed upward as an ice shelf presses against it horizontally

## relative

Compared to

## sea ice

Ice that forms on the surface of the ocean

## sea level

Global average height of the sea

## sedimentary

Rocks formed from pieces of other rocks

## sediments

Pieces of rock material produced by weathering and erosion

## simulate

Imitate the appearance or character of something

## technician

Person who takes care of technical equipment or performs practical work in a laboratory

## Thalassiosira

A kind of diatom that lived in open marine conditions around Antarctica

# Glossary of Terms

## Transantarctic Mountains

Linear chain of mountains that crosses most of the continent of Antarctica, separating it into East and West Antarctica

## variation

A change in condition

## Venn diagram

A diagram with two or more overlapping circles to show sets of objects based on their differences and similarities

## volcanic ash

Molten lava that solidifies into very small pieces of rock during eruption of a volcano

## West Antarctic Ice Sheet (W.A.I.S)

Ice sheet that covers West Antarctica. The WAIS is a marine-based ice sheet whose base is below sea level; its edges flow into floating ice shelves

## working half

Half-cylinder of rock core that is sampled by scientists

