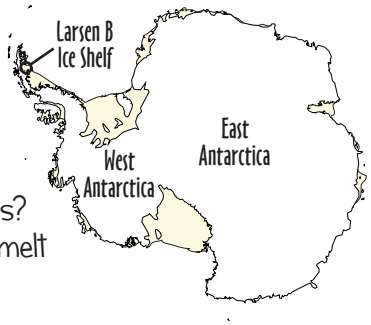
What If the Ice Shelves Melted?

Preview

In February of 2002, a huge section of the Larsen B Ice Shelf collapsed. You can take a look at the **Larsen B Ice Shelf** podcast to learn more about this startling event.

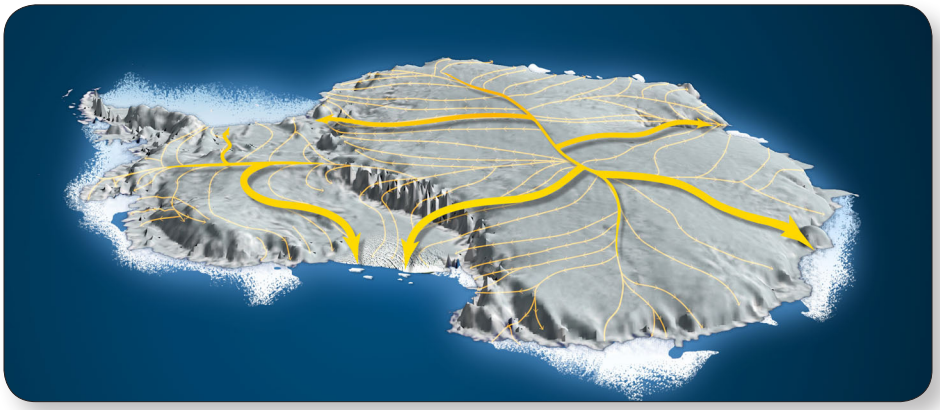


How permanent are Antarctica's other ice shelves? What might happen if they were to break up or melt away?

In this activity, you'll make a model of Antarctica and mix up a white "slime" material to represent the continent's ice. You'll create a demonstration to show how the ice on Antarctica might respond if the continent's major ice shelves were to melt away.

Prepare

Similar to the way rivers flow downhill off the other continents, Antarctica's ice sheets also move downhill toward the ocean. Along the bottom of the ice sheet, right at the boundary between rocks and ice, tremendous pressure builds up. This friction tends to hold the base of the ice on the continent. To model this friction, you'll make an Antarctica-shaped tray with a slight wall around the edge of the land. The wall represents the friction that keeps the ice on the continent.



Antarctic ice flow patterns, NASA Scientific Visualization Studio, modified by Angie Fox.

Time

⌛ 1–2 hours

Tools & Materials

- 🕮 Outline map of Antarctica and major ice shelves (Page 201)
- Aluminum foil
- Wax paper
- Non-hardening modeling clay (1 tablespoon)
- Multi-purpose white glue (Elmer's Glue All, 4 oz)
- Borax powder (20 Mule Team laundry booster, 1 tablespoon)
- Small plastic mixing container
- Stirring stick (craft stick)
- Scissors
- Measuring cups & spoons
- Clear packaging tape
- Colored markers
- \+ Large sheet of construction paper or poster board
- \+ Small plastic container, such as a butter tub
- \+ 1¼ cup water

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

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Make an Antarctica-shaped tray

1. Remove or copy page 201 from this book and place strips of clear packaging tape across the page to give it a water-repellent surface.
2. Cut out the continent along the heavy dark line. Cut out the three additional shapes and set them aside.
3. Set the cut-out continent on a piece of aluminum foil. Trim the foil so it extends about 2 inches beyond the edge of the continent.
4. Make a "T" cut in the foil at the Ronne-Filchner Ice Shelf. Cut in from the edge of the foil and across the front of the ice shelf.
5. Starting with the Antarctic peninsula, roll and pinch the outer edge of the foil upward to make a foil wall ¼ to ½ inch high along both sides of the peninsula.
6. When you get to the Ross Ice Shelf, make another T-shaped cut in the foil. Cut in from the edge of the foil and across the front of the ice shelf.
7. Start building the foil wall again along the end of the Transantarctic Mountains. Keep building the wall around East Antarctica to the Amery Ice Shelf.
8. Make a small T cut for the Amery Ice Shelf. Complete the wall around the outer edge.

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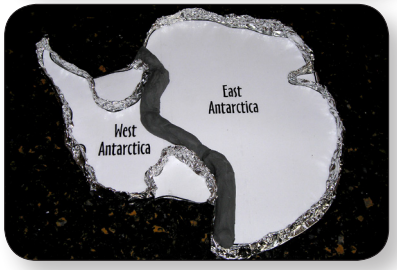
Ice Streams in a Traffic Jam



Ice at and near the surface of Antarctica's ice sheets can flow downhill in ice streams. Arrows in this visualization show the general direction of ice movement off the continent. Notice that much of the ice is funneled toward the major ice shelves. With large volumes of ice moving into limited areas, a sort of "traffic jam" occurs. Ice that was moving downhill has to slow down when it becomes part of the ice shelf. In turn, the slower ice holds up ice that is behind it, keeping it from flowing freely off the continent. You'll build foil walls on the INSIDE edge of each of the major ice shelves to model their tendency to hold back the flow of ice.

1. Use foil to build the same type of wall you made around the continent along the boundaries of each of the three ice shelf pieces you cut out.
2. Place the ice shelves where they belong on the continent, holding them in place by pinching the ends of their foil walls together with the wall that surrounds the continent.
3. Roll the clay to add a line of mountains across the continent, along the label and mountain symbols. Make the roll a little higher than your foil walls. Pinch the clay to form a few valleys in the long mountain chain.

Prepare a saturated solution of borax

1. Put 1 tablespoon of borax powder into a plastic cup.
2. Add ¾ cup water and stir for about 1 minute with a craft stick.
3. Allow the undissolved powder to settle to the bottom of the cup. The liquid in the cup is a saturated solution of borax.

Mix up some white slime!

1. Wash your hands and cover your work area with wax paper. Put about 4 ounces of white glue and ½ cup water into a plastic tub or bowl and mix them thoroughly. Be careful not to splash.
2. While stirring the glue mixture with a craft stick, slowly drip about a tablespoon of the borax solution into it. Keep stirring and a ball of slime will form around your stirring stick!
3. Use your hands to collect the ball of slime from the stick. Put the slime aside in another plastic container.
4. Stir the glue and water mixture again and drip another tablespoon of the borax solution into it. Continue stirring and collecting the slime that forms on your stirring stick. Repeat this step until most of the glue and water mixture has been transformed into slime.

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5. Work with it! Pick up the slime and squish it through your hands. You'll be amazed at the non-sticky feel of this polymer material you made.

Add the slime to your continent

1. Place "blobs" of your slime onto your continent. Start with East Antarctica, adding enough slime to cover the continent to a thickness that is a bit higher than your foil wall.
2. Add slime to West Antarctica and the Antarctic Peninsula as well.
3. Within about 5 minutes, the blobs of slime will relax, leaving a smooth cover of model ice over the whole continent. If any slime flows over the foil walls, put it back into the plastic container.

Melt away the ice shelves

The average temperatures of Earth's atmosphere and oceans have increased in the past 50 years. Evidence suggests that temperatures will continue to increase for at least 50 more years. Because Antarctica's ice shelves are floating on ocean water, they are at risk of melting.

1. Remove the ice shelves and their walls from your continent to model the melting of floating ice.
2. Note what happens to the "ice" on Antarctica over the next 10 to 15 minutes.

Clean up your slimy mess!

1. After you've seen the results, collect as much of the slime as possible and put it in an airtight plastic bag. Store it in a refrigerator.
2. Use a damp paper towel to clean the continent. It's okay if some of the slime remains stuck in the foil walls; it will make them stronger for the next time you use it.

Revisiting the Larsen B Ice Shelf

Though the model you built for this activity is simple, it illustrates a process that is happening in the real world. After the collapse of the Larsen B Ice Shelf, scientists measured the speed of glaciers that flow down to the site where the ice shelf was. In 2004, they found that the glaciers were moving up to eight times faster than they did before the collapse of the ice shelf in 2002.

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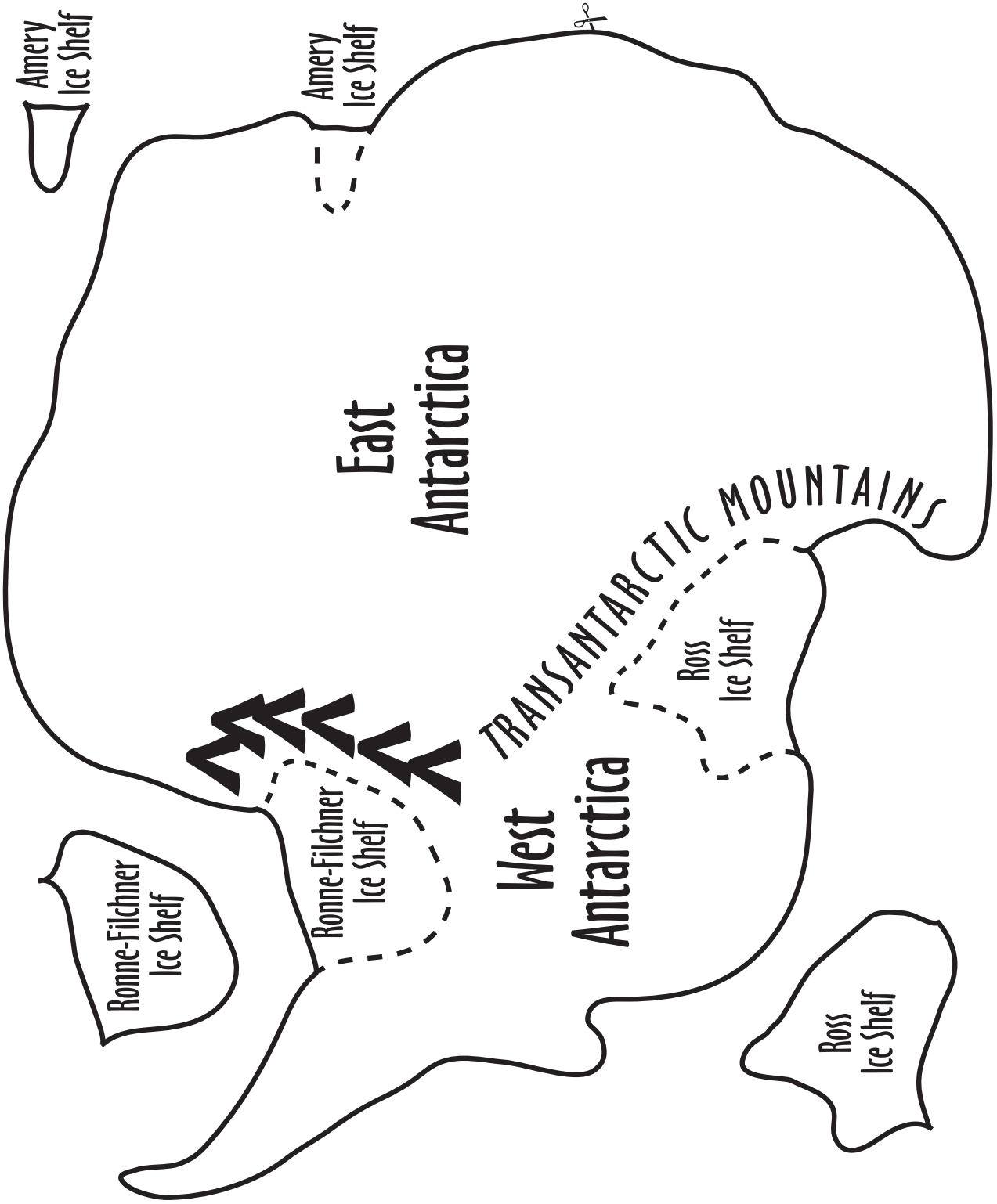
Cut out pieces along the solid lines…



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Ponder. . .

Sketch two pictures of your model, one from before you removed the ice shelves and one showing how it looked 10 or 15 minutes after you removed them.

Write about your experience with the model: How realistic do you think it is? What differences did you see between East and West Antarctica?

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Practice

Got the Big Idea?

Ice shelves tend to keep ice on Antarctica. If the major ice shelves were to melt or collapse, ice may move off the continent more freely than it does now. West Antarctica is much more vulnerable to melting than East Antarctica.

Get ready to present

Come up with an introductory comment or question you can use to invite people to check out your slimy model. You may want to keep a sample of slime available for visitors to touch. Another idea is to use the Podcast of the Larsen B Ice Shelf collapse as an introduction to this activity.

It may be helpful for you to make a chart with drawings or photographs of the model both before and after the ice shelves are removed. Another option would be to prepare two or three of the Antarctica-shaped trays and additional slime so that Flexhibit attendees can see the model in different phases.

Read over the introductory sections of this activity and discuss it with your team members. Be sure you can explain what the wall of foil represents, including why the wall is on the outside of the continent but on the inside of the ice shelves.

Present

Get the slime out of the refrigerator at least two hours before you need it so it can warm up to room temperature. Have the materials on hand to mix up some additional slime if you'll need it to fill the tray or for a sample that visitors can touch.

For visitors who are interested and engaged with the activity, you can discuss your ideas about how realistic the model is.

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