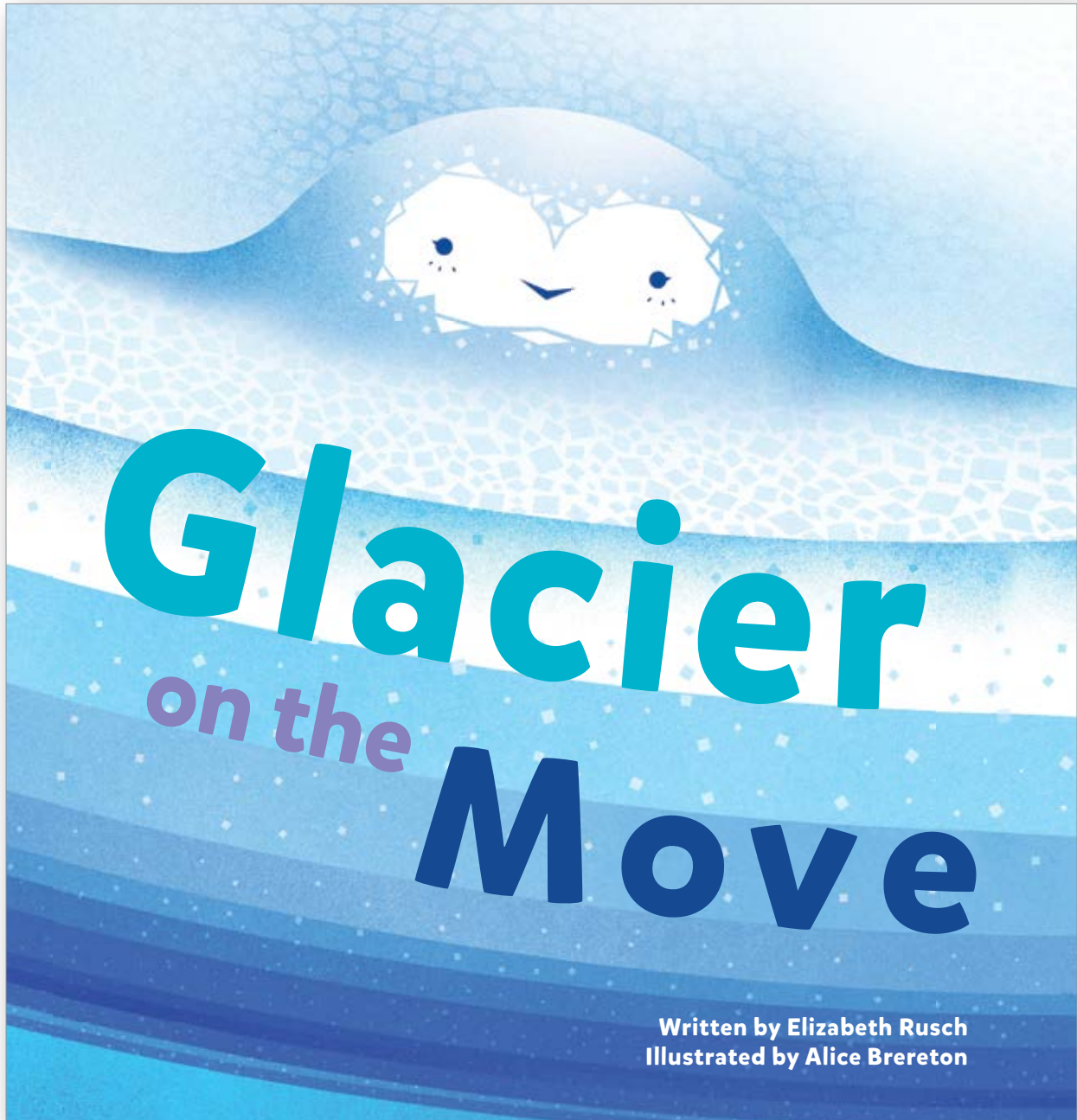




BOOK GUIDE FOR  
*Glacier on the Move*

Written by Elizabeth Rusch  
Illustrated by Alice Brereton



Fry Readability: 3  
Lexile Measure: 610L

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# SUMMARY

Glaciers exist on every continent on Earth, growing, spreading, and shrinking over thousands of years. But what are they, and how are they formed? *Glacier on the Move* tells the story of a glacier named Flo and her slow-motion race to the sea, from the edge of an ice field and down steep cliffs, to muscling her way around mountains, and stretching into a valley. With the help of some ice worms, Flo reveals how glaciers move, change shape, and affect the surrounding world and animals.



## About the Author

Elizabeth Rusch is an author, editor, teacher, and speaker, and has published several award-winning books for children and adults. Through her books, she shares her passion for science, history, art, and nature with her readers.

Elizabeth has climbed up, slid down, and had snowball fights on glaciers in Alaska, California, Montana, Washington, and near her home in Portland, Oregon.

Learn more at [elizabethrusch.com](http://elizabethrusch.com).



## About the Illustrator

Alice Brereton is a children's book illustrator and loves to incorporate colorful textures and shapes into her artwork. She attended the Academy of Art University and has worked on several books ranging from glaciers to fear itself!

Visit her at [pickledalice.com](http://pickledalice.com).

# READING DISCUSSION

1. A glacier is a large, dense mass of ice that constantly moves. In this book, the glacier is named Flo. Why is that her name and how does it relate to her being a glacier?
2. What are the little animals at the edges of the pages who give you information? Are they real? Where do they live?
3. Flo is pretty much the same color on every page. What color is that? Why do you think glaciers are this color? (*Hint: Look to the ice worms for help!*)
4. There are so many animals in the book! Look closely at each page. Can you identify each animal? Which is your favorite animal?
5. Find the page where Flo says, "Woohoo! Check out my racing stripes." What are the "racing stripes" she's talking about? How fast can Flo go? (*Hint: Check the previous page.*)
6. As Flo moves, she changes the land she touches. What happens to the forest as she moves through? What do you think happens to the forest after she retreats? What about the rock collection? What kinds of plants and animals inhabit the places after a glacier retreats?

## Search and Find

Can you find all of these in the illustrations in the book?

6 wolves

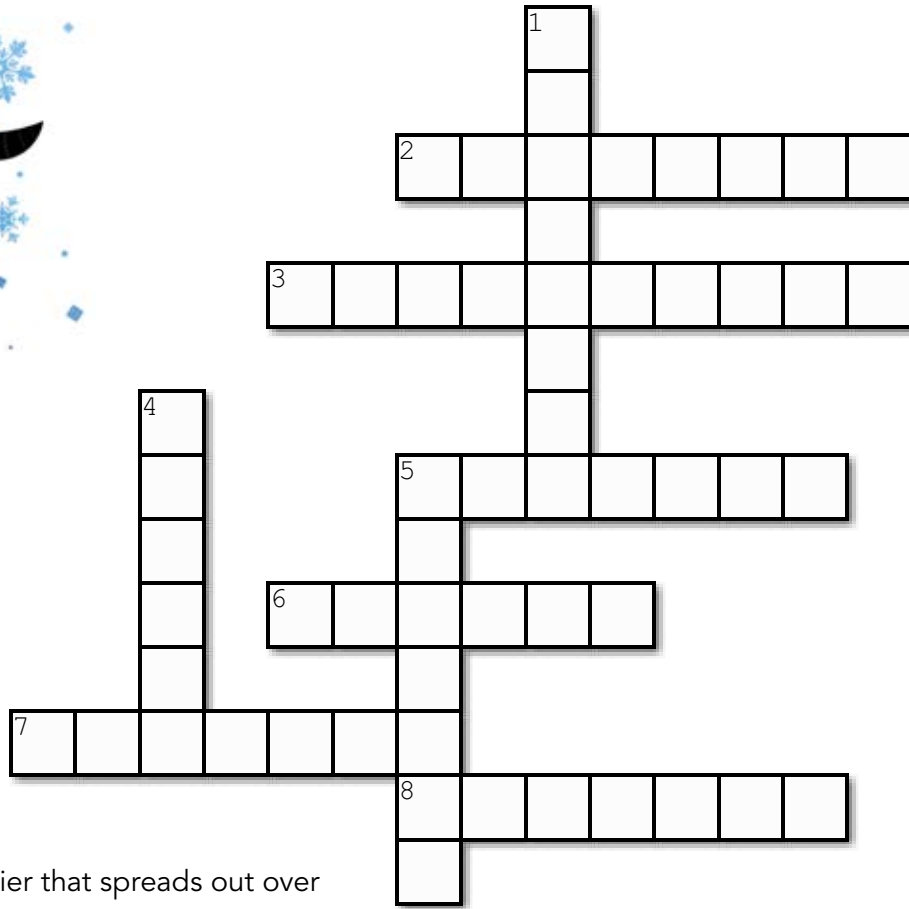
3 bears

4 white harbor seal babies

2 moons

1 aurora (northern lights)

## Glacier on the Move CROSSWORD PUZZLE



### Across

2. Type of glacier that spreads out over gently sloped land.
3. Deep grooves glaciers leave in the ground.
5. An \_\_\_\_\_ has anti-freeze in its tissues that allow it to thrive at freezing temperatures.
6. Cooling period that happened many thousands of years ago.
7. Mass of rocks and soil carried by a glacier that can build up on the sides and front.
8. Glaciers absorb red and yellow light, but \_\_\_\_\_ blue light.

### Down

1. Deep crack often found in glaciers.
4. Coldest season of the year.
5. Large, floating chunk of ice.

*Answers on page 14*

# HISTORY

How old is Flo? Flo says she was born during the Little Ice Age, but what does that mean? Research online or at the library to answer the following questions:

- What is the Little Ice Age? Why was this period called that?
- When did the Little Ice Age occur? How long did it last?
- Why do you think glaciers formed during this period?
- How do you think glaciers have changed from the Little Ice Age to their current state today?



# CREATE A GLACIER TIMELINE

Create a glacier timeline and see for yourself how real glaciers can change and move dramatically over time.

Choose a glacier and look it up online to find some photos of it from many years or seasons. Try to find photos of the glacier in the same location. Print and cut out the photos of the glacier and arrange them in chronological order. Does the glacier look different? How so? What do you think caused these changes?

## Names of some glaciers

**ALASKA:** Hubbard Glacier, Muir Glacier, Columbia Glacier (tidewater glaciers); Mendenhall Glacier, Ruth Glacier (mountain); Carroll Glacier (a tidewater glacier that has retreated back to its mountain source)

**CALIFORNIA:** Whitney Glacier (Mount Shasta); Palisade Glacier, Dana Glacier (Sierra Nevada)

**COLORADO:** Tyndall Glacier, Taylor Glacier

**IDAHO:** Seven Devils Mountain Glaciers

**MONTANA:** Grinnell Glacier, Blackfoot Glacier

**NEVADA:** Wheeler Peak Glacier

**OREGON:** Palmer Glacier, Elliot Glacier (Mount Hood)

**WASHINGTON:** Mount St. Helens crater glacier; Adams Glacier, Mazama Glacier, Klickitat Glacier (Mount Adams); Tahoma Glacier, Emmons Glacier, Nisqually Glacier (Mount Rainier)

**WYOMING:** Sphinx Glaciers, Gannett Glacier

## GEOGRAPHY

The next two pages are maps of the United States and the world. Research and color in where glaciers are located on both maps. (You can also use the maps of the World Glacier Inventory:

[https://nsidc.org/data/glacier\\_inventory/browse.html](https://nsidc.org/data/glacier_inventory/browse.html))

What regions have the most glaciers?

Why? Draw the equator and the major mountain ranges onto the maps.

What impact do latitude (how far north or south from the equator) and elevation (the height of the land) have on glaciers?

## WRITING

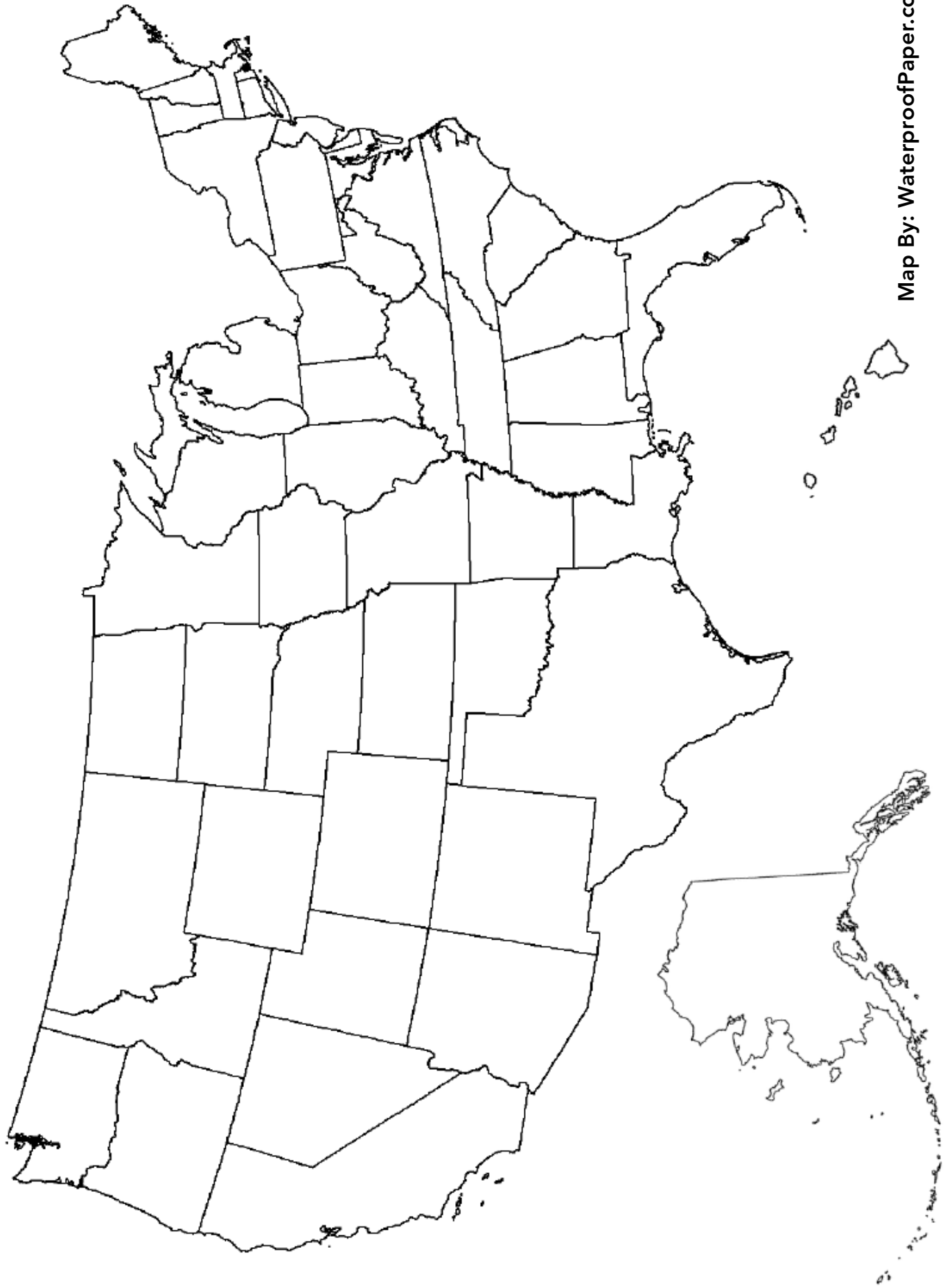
Glaciers don't talk, but the author decided to imagine a glacier telling her own story. Pick something else from nature—a leaf, a rock, a cloud, a volcano, a river, a lake, an animal.

Give it a name and write a story where it narrates its own experience. What personality would it have?

What would it want? What would it observe? What events might happen to it, and what would it say about those events? What obstacles might it face and what would it do about them? What jokes or puns would it tell?

## ART

Glaciers do not have eyes or a mouth, but the artist gave Flo a face so we could see her emotions. Draw the object you wrote about. Add eyes and a mouth. What shapes could the eyes and mouth have to express different emotions?



Map By: [WaterproofPaper.com](http://WaterproofPaper.com)





# HANDS-ON SCIENCE ACTIVITIES

## CAN A SOLID FLOW?

Flo is a solid (ice) that moves. This experiment lets students explore how materials with different levels of viscosity (fluidity) move and demonstrates how some materials that seem solid can change shape and move under pressure.

### Materials

Baking sheet or tray

Milk

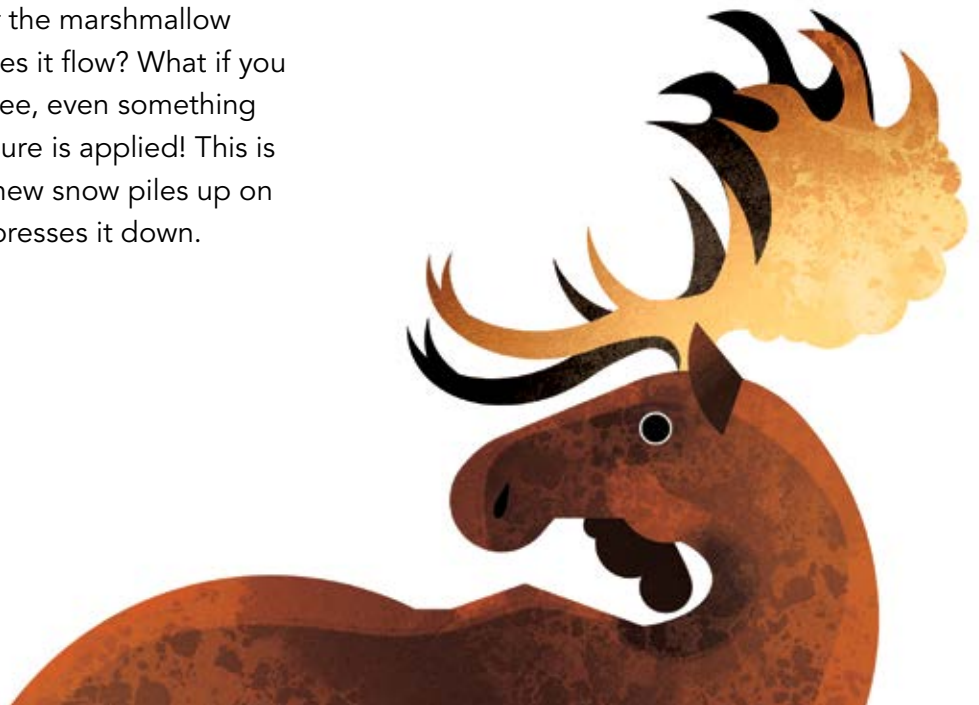
Maple syrup

Yogurt or pudding

A banana or a marshmallow

### Steps

1. Place one end of the baking sheet on top of something so it is set at an angle.
2. Pour some milk at the top of the sheet and watch it flow. What do you observe?
3. Repeat with the maple syrup, and then with the yogurt or pudding. Notice how the movement changes.
4. Now perch the banana or the marshmallow on the top of the tray. Does it flow? What if you press it with your palm? See, even something solid can flow when pressure is applied! This is just what happens when new snow piles up on a glacier and the weight presses it down.



## Hands-On Science Activities continued

### GLACIAL GAK ON THE MOVE

In this experiment, students make gak as a model for glacial ice. As gravity pulls the gak downhill, students can observe how different layers of the gak move and what happens when the gak approaches and overtakes rocks and pebbles.

#### Materials

Measuring cups and spoons  
3 bowls  
Baking sheet or tray  
2 bottles school glue  
Blue food coloring  
Water  
Borax  
Some fist-sized rocks, gravel,  
and/or pebbles



#### Steps

1. Squeeze each bottle of glue into its own bowl.
2. Fill the empty glue bottles with water and add one bottleful to each bowl. Stir till smooth.
3. Add a few drops of blue food coloring into one of the bowls. Leave the other white.
4. In the remaining unused bowl, mix  $\frac{1}{2}$  cup hot water with  $\frac{1}{2}$  teaspoon of Borax. Stir.
5. Pour the mixture into one of your glue bowls. Repeat step 4 and pour the mixture into the other bowl.
6. Stir each mixture until it thickens. Knead with your hands.
7. Taking the blue gak and white gak, twist and fold them together until they are swirled into the shape of a ball. It should look a bit like glacial ice!
8. Place one end of the baking sheet on top of something so it is set at an angle.
9. Place your glacial gak at the top. Observe how it moves downhill. Notice how the patterns change as it moves.
10. When it reaches the bottom, pick the gak back up, reshape it into a ball, and reset it at the top of the cookie sheet. Place a few rocks in its way and watch what happens. Are the rocks picked up and carried downhill? Or does the glacial gak flow around them?

## Hands-On Science Activities continued

### HOW GLACIERS SHAPE THE LANDSCAPE

As glaciers move through the landscape they shape the land they pass through. In this experiment, students make a model of a glacier surrounded by earth. As the glacier grows, it moves. What happens to the soil around it?

#### Materials

Measuring cups and spoons  
Large bowl  
2 cut pieces of wax paper  
Marker  
1 pound cornstarch  
Water  
Gravel or pebbles  
Sand  
Soil



#### Steps

1. Mix 1½ cups of water and 1 pound of cornstarch in a large bowl.
2. Lay out the wax paper on a table. Add a heap teaspoon of the mixture in the center of the wax paper. This is your baby glacier.
3. Place another spoonful of the mixture on top of your glacier, in the center. This is like new snow piling up on the glacier during the winter. What happens to your glacier?
4. Sprinkle sand, gravel, and soil in a two-inch band around the edges of the glacier. This is the terrain around the glacier. Draw the perimeter of the band on the wax paper with a marker. This will help you see how the earth moves.
5. Sprinkle a little more soil on top of the glacier. This represents loose rocks and soil that may dust the glacier.
6. Place one spoonful of the mixture at a time on top of the center of the glacier. Observe what happens as you add spoonful after spoonful.
7. Place the second piece of wax paper on top of the glacier. Carefully turn it over so you can see the bottom of the glacier. What happened to the sand and soil particles?

*Adapted from "How Does Glacial Movement Affect the Earth,"*

by Angela Pike: <https://www.education.com/science-fair/article/glacial-movement-earth-surface/>

## Hands-On Sceince Activities continued

### More Activities To Try

#### EDIBLE GLACIERS (THAT TEACH)

<https://www.khanacademy.org/partner-content/mit-k12/mit-k12-ea/v/glaciers-with-chocolate>  
<http://elementalblogging.com/glacier-study/>

#### MAKE MINI-GLACIERS

(Requires several nights of overnight freezing)

<https://www.youtube.com/watch?v=6-NHzx5qbOk>

#### UNDERWATER ICEBERGS

Experiment that demonstrates how most of an iceberg is underwater  
(Needs access to a freezer)

<http://sweetandsimplethings.blogspot.com/2011/01/iceberg-experiment-and-penguin-snack.html>

#### REFREEZING GLACIER MELT

Eye-opening experiment that shows how quickly a melted glacier can refreeze and rebuild, after melting around a boulder for example. (Needs access to a freezer)

<https://www.bloglovin.com/blogs/teach-preschool-2279064/fun-with-frozen-making-ice-grow-3142183237>

#### COLOR A GLACIER

Coloring sheet of a glacier from Glacier National Park

<http://www.supercoloring.com/coloring-pages/glacier-national-park>



# RESOURCES

## Eye-Popping Videos and Interactives

The life cycle of a snowflake on a glacier

<https://www.pbs.org/wgbh/nova/vinon/glacier.html>

The largest ice field in North American, the birthplace of many Alaskan glaciers

<https://www.smithsonianmag.com/videos/category/science/breathtaking-the-largest-glacier-in-north-america/>

REAL glaciers on the move!

<https://www.youtube.com/watch?v=ghC-Ut0fW4o>

<https://vimeo.com/5414354>

REAL ice worms

<https://www.youtube.com/watch?v=tKEVe-Y6Wqw>

Crazy footage of calving glaciers

<https://www.youtube.com/watch?v=WQv7yLttop4>

<https://www.youtube.com/watch?v=hC3VTglPoGU>

Glaciers in retreat

<https://www.youtube.com/watch?v=ur4l8tYnxP4>

<http://www.thisisclimatechange.org/glacial-retreat/>

How glaciers shape the landscape and leave behind moraines

[https://timeforgeography.co.uk/videos\\_list/glaciation/glacial-deposits-types-moraine/](https://timeforgeography.co.uk/videos_list/glaciation/glacial-deposits-types-moraine/)

- Down
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  5. An — has anti-freeze in its tissues that allow it to thrive at freezing temperatures.
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