

Antarctica's Climate Secrets

Hands-on Activities for Hosting a
Showcase of Antarctic Climate Research



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Antarctica's Climate Secrets

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Welcome to Antarctica's Climate Secrets

Antarctica is the last-discovered, least-visited, coldest, windiest, and driest continent on our planet. What kind of climate secrets does it have, and why do they matter?

About this book

This book presents background information and hands-on activities about Antarctica. It shows how geoscientists gather clues about Earth's past climates and use them to predict our planet's future.

The activities highlight a scientific project called ANDRILL, for (An)tartic geology (drilling). ANDRILL scientists collect and study rocks from beneath the ice around Antarctica. They read clues in the rocks to learn how the amount of ice on Antarctica has changed over time in response to changes in climate. With an understanding of how climate has changed in the past, scientists are better able to predict how it will change in the future and how these changes affect the rest of the world.

During activity sessions, you'll build models and work with photographs and maps. You'll become an expert with the props, and then you'll use them to host a public science event. You'll share what you've learned in a flexible exhibit—a "Flexhibit"—that can be held at a museum, school, or other location. In addition to the exhibit props you build, your group can obtain professionally designed graphic banners and video Podcasts to display at your Flexhibit.

Everyone who does these activities or attends a Flexhibit is participating in an event called the International Polar Year, or IPY. The IPY is a worldwide effort to learn more about Earth's polar regions. An important goal of the IPY is to raise public awareness about these sensitive parts of our planet.

Join us for an exciting Antarctic adventure!



Gentoo penguins and a scientific research vessel in Antarctica. Photo by Christine Hush, U.S. National Science Foundation.



Find out more about ANDRILL

Go to <http://www.andrill.org>



Find out more about the IPY

Go to <http://www.ipy.org>

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About the Flexhibit package

This activity book is just one part of a package: the full package also includes five graphic banners and a set of video Podcasts that were filmed in Antarctica. The banners, activities, and Podcasts complement one another to build knowledge. Exploring illustrations on the banners, doing hands-on work with the activities, and discussing explanations in the video clips will help you tie the concepts together and build your confidence for teaching them to others.

Flexhibit URLs

Banners

<http://www.andrill.org/flexhibit/flexhibit/materials/index.html>

Activity Book Documents

<http://www.andrill.org/flexhibit/flexhibit/materials/activities/index.html>

Podcasts

<http://www.andrill.org/flexhibit/flexhibit/materials/podcasts/index.html>

Video Journals

<http://www.andrill.org/iceberg/videos/index.html>

Materials Kit

Email AntarcticaFlexhibitKits@charter.net

About the five P's

Every activity has five parts. The five parts help you learn new information AND prepare you to teach it to others. Here's what to expect in each activity:

Preview — An introduction and background material to read and discuss

Prepare — Step-by-step instructions for building models or interacting with materials

Ponder — An opportunity to check your learning

Practice — Tips for getting ready to demonstrate or explain the activity

Present — Ideas and suggestions for how to help Flexhibit guests get the most out of their visit

About materials

The activities require materials that are commonly available in homes and from hardware, office supply, grocery, and pet supply stores. Comprehensive materials lists are included with each activity, and a complete materials list is provided at the end of the book. Materials for some of the activities require detailed preparation. For your convenience, a kit containing the prepared materials is available for purchase.

About SAFETY

Some of the preparation steps and activities call for using tools such as saws, knives, and sharp scissors. Adult supervision is necessary whenever youth or students use these tools. In some cases, adult intervention is better. Your leader or teacher will decide whether you should complete the steps that call for these tools or have them performed by an adult.

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About ANDRILL

The ANDRILL project involves more than 200 scientists, technicians, and educators from around the world in the study of Antarctica's climate history. The group is drilling into rocks under the ice around the continent to recover and interpret sedimentary rock cores. Their purpose is to better understand the history, as well as the future, of Earth's climate.

The project's scientists are trying to learn the full story about how the amount of ice on Antarctica has changed over time. Specifically, they want to know how fast and how often ice sheets have advanced off the continent and retreated again. Sedimentary rocks deposited around the outer edge of Antarctica are a natural record of these changes, so project staff drill into these rocks and bring them up for study. As ANDRILL scientists learn how Antarctica's ice has responded to past changes in global temperatures, their results will help modelers make better predictions about how the ice will behave in the future, when global temperatures are projected to be several degrees warmer.

About the people

Individuals and groups from the United States, New Zealand, Italy, and Germany are all working together on the ANDRILL project. A wide variety of jobs contribute to making the project happen.

- **project managers** oversee the planning, obtain financial support for the project, and ensure that all tasks are completed
- **geophysicists** make explosions to send sound waves underground, then analyze the "echos" to predict what types of rock layers exist
- **drillers** design, build, and operate systems for collecting rock samples from below ground
- **core technicians** clean the core, make a log of its physical appearance, and cut it into 1-meter lengths
- **structural geologists** measure fractures and faults in rocks to deduce the direction and force of tectonic stresses in the region
- **physical properties scientists** look at patterns of density and other parameters in rock cores and correlate them to other rock features
- **curators** cut and prepare core samples for study and store the core for future research
- **sedimentologists** look at the shapes, sizes, and arrangements of rock fragments to deduce the type of environment where they were deposited

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- **programmers** develop software to document and visualize information about the rock core and to manage information produced by the project
- **petrologists** figure out where sediments and clasts in the layers originated, then develop models to explain how those sediments were transported and deposited in the area where the core was drilled
- **paleontologists** look at fossils to infer environments and rock ages
- **paleomagnetists** measure the orientation of iron-containing grains and compare them to Earth's changing magnetic field to help establish when the grains were deposited
- **volcanologists** figure out when and where volcanoes erupted
- **down-hole loggers** measure characteristics of the rocks that surround the hole where a rock core was taken
- **educators and outreach staff** ensure that people learn about the project's accomplishments

Operations and logistics of the drilling process are managed by Antarctica New Zealand. The scientific research is administered and coordinated through the ANDRILL Science Management Office, located at the University of Nebraska-Lincoln in the United States.

For more information about ANDRILL, explore pages at <http://www.andrill.org>

About the International Polar Year

The International Polar Year (IPY) is a worldwide effort to learn about and raise awareness of our planet's polar regions. The March 2007 through March 2008 event is the fourth polar year. Previous polar years were held in 1882-3, 1932-3, and 1957-8. In order to have a full year of field seasons in both the Arctic and the Antarctic, IPY 2007-8 covers two full years.

Thousands of scientists from over 60 nations are participating in more than 200 IPY projects, researching a range of physical, biological, and social research topics. Thousands of students, teachers, and other citizens are also participating, becoming more aware of the changing conditions at Earth's poles. The IPY effort encourages international cooperation and data sharing, acknowledging that all nations depend on this single planet for their survival.

For more information about IPY, visit <http://www.ipy.org>

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Books about Antarctica

The following titles for middle-school-age children can supplement the learning activities. Some books may be appropriate for display at a Flexhibit event.

How to Survive in Antarctica, Lucy Jane Bledsoe ISBN-10: 0823418901

Onward: A Photobiography of African-American Polar Explorer Matthew Henson, National Geographic Photographer Series, Dolores Johnson ISBN-10: 079227914X

The Shackleton Expedition, Jil Fine ISBN-10: 0516234897

Trial by Ice: A Photobiography of Sir Ernest Shackleton, K.M. Koystal ISBN-10: 0792273931

Antarctic Journal, Meredith Hooper ISBN-10: 0711216703

Shipwreck at the Bottom of the World: The Extraordinary True Story of Shackleton and the Endurance, Jennifer Armstrong ISBN-10: 0375810498

Antarctica, Charles Neider ISBN-10: 0815410239

Crossing Antarctica, Wil Steger ISBN-10: 0394587146

After the Last Dog Died: The True-Life, Hair-Raising Adventure of Douglas Mawson's 1912 Antarctic Expedition, Carmen Bredeson ISBN-10: 0792261402

Penguins!, Wayne Lynch ISBN-10: 1552094243

My Season With Penguins: An Antarctic Journal, Sophie Webb ISBN-10: 0395922917

Braving the Frozen Frontier: Women Working in Antarctica, Rebecca L. Johnson ISBN-10: 082252855X

Antarctica, Helen Cowcher ISBN-10: 1840590017

Antarctic Journal: Four Months at the Bottom of the World, Jennifer Owings Dewey ISBN-10: 0060285869

Antarctica: Journey to the Pole (Antarctica 1), Peter Lerengis ISBN-10: 0439163870 (Fiction)

Escape from Disaster (Antarctica 2), Peter Lerengis ISBN-10: 0439163889 (Fiction)

Surviving Antarctica: Reality TV 2083, Andrea White ISBN-10: 0060554568 (Fiction)

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About the author

LuAnn Dahlman is an educator and curriculum developer for TERC in Cambridge, Massachusetts. She spent nine weeks in Antarctica, working as a member of the ANDRILL team during the 2006-7 Antarctic field season. She joined the team as a participant in ARISE — ANDRILL Research Immersion for Science Educators. You can read about her adventures as an ANDRILLian at <http://www.andrill.org/iceberg/blogs/luann/all.php>.

