

# Voyager



For kids of all ages

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## ICE AGES

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**A**T VARIOUS TIMES IN EARTH'S LONG HISTORY, IT HAS BEEN VERY COLD WITH MORE THAN NORMAL AMOUNTS OF ICE COVERING LARGE PARTS OF THE PLANET. THESE PERIODS OF TIME ARE CALLED "ICE AGES," WE ARE LIVING IN ONE OF THESE ICE AGES NOW.

During an ice age, ice expands into areas away from the North and South poles. In the winter, snow falls and accumulates. If the temperatures are not warm enough to melt the snow during summer, ice grows thicker and thicker each year. Eventually, under the pressure of its own weight, a glacier flows downhill, bending and flowing around the many obstacles in its way.

A glacier moving down a mountain.



Glaciers act like bulldozers pushing over tall trees and huge boulders, scraping the land clean. As glaciers spread across land, rivers, and lakes, they drastically change the shape of the landscape. Some glaciers make their way to the ocean, where large pieces break off and form icebergs.

Today, glaciers cover 10 percent of Earth's surface. Many glaciers can be found in Europe, Canada, and the northwestern United States. Sheets of ice cover Greenland near the North Pole and Antarctica at the South Pole. Glaciers also exist in tropical areas that we think of as hot and steamy—but at high elevations where the air is cold. A glacier caps Mount Kilimanjaro in Africa even though it sits just 330 kilometers (205 miles) south of the equator.

A glacial lake in North America.

## A HISTORY OF ICE

Throughout Earth's 4.5-billion-year history, there have been many ice ages. Ice ages have fluctuations, with glacial and interglacial periods. Compared with glacial periods, interglacial periods have less ice, it's warmer, and sea level is higher.

During an interglacial period, glaciers retreat and expose the altered landscape. Past glacial periods carved out large holes in the ground that later filled with water and became lakes. This is how the Great Lakes in North America were created. The ice also sculpted mountains into unusual shapes and carved deep valleys. Many of the landforms that you see today were formed during the last glacial period.

# EARTH'S MOST RECENT

# ICE AGE

The last glacial period on Earth ended about 10,000 years ago. Earth has experienced numerous ice ages throughout its history, so the most recent glacial period is sometimes referred to as “the Ice Age.”

The Ice Age produced glaciers that spread across North America and parts of northern Europe. In North America, glaciers spread from the Hudson Bay area, covering most of Canada and going as far south as Illinois and Missouri. Glaciers also existed in the Southern Hemisphere in Antarctica. At that time, glaciers covered about 30 percent of Earth’s surface. You can probably imagine how cold it was in those places!

Even with all of this ice, there were some places where there were no glaciers. In much of Africa and South America, except on the tops of mountains, the climate was warm, with plants, animals, and human beings thriving there.

## THE LAST ICE AGE: People and Animals

The first people who came to North America may have taken advantage of the warming at the end of the Ice Age. While the sea level was still low, much ground was exposed between Russia and Alaska, which allowed people to walk across a “land bridge” between the two continents.

At least a few people were trapped and frozen in the ground. Sometimes woolly mammoths and other “ice mummies,” including

humans, fall out of melting ice today. These frozen treasures offer rare glimpses into the world of our ancestors—what animals they hunted, their clothing, how they wore their hair. Some of them are so well preserved that those who find them don’t know whether to contact scientists or detectives.

Our ancestors hunted huge animals like the woolly mammoth and saber-tooth tiger during the last Ice Age.

# SCRIPPS SCIENCE and

# ICE AGES

Neal Driscoll is a Scripps geologist who studies ice ages. One of his studies involves the ice ages that began 3 million years ago in the Northern hemisphere. There are several theories explaining what caused these ice ages.

Way back then, there was a narrow open seaway between Central and South America near modern-day Panama. Before it began to close, the seaway let water move between the Pacific and Atlantic oceans. When the seaway closed, it changed the way the oceans flowed near the equator by deflecting currents northward. This change in circulation increased moisture levels and temperatures in places far away.

Dr. Driscoll believes that increased amounts of moisture increased the amount of river water flowing into the Arctic Ocean by Russian rivers thousands of miles away. This caused the ocean to become layered by salinity and limited the amount of ocean heat that went into the atmosphere. The fresh water might have also allowed sea ice to form at higher temperatures, which would decrease ocean heat transfer into the atmosphere as well as change the albedo, or reflectivity, of the region to sunlight. This gradual change along with other changes may have allowed the climate to cool. The colder climate began to spread farther and farther, creating an ideal environment for the beginning of an ice age.

Making observations and gathering data are at the heart of forming scientific theories. Dr. Driscoll travels the globe to investigate ice ages and study sites of previous glaciations.

Almost 90 percent of an iceberg sits underwater, as shown here in this composite illustration.

## SEA LEVELS

During the Ice Age, much of Earth's water was trapped in glaciers. Most of the water came from the ocean—so much that sea level dropped by 125 meters (400 feet)! But what happened when the huge glaciers melted? Sea level rose back up, covering up much of the coastal plains.

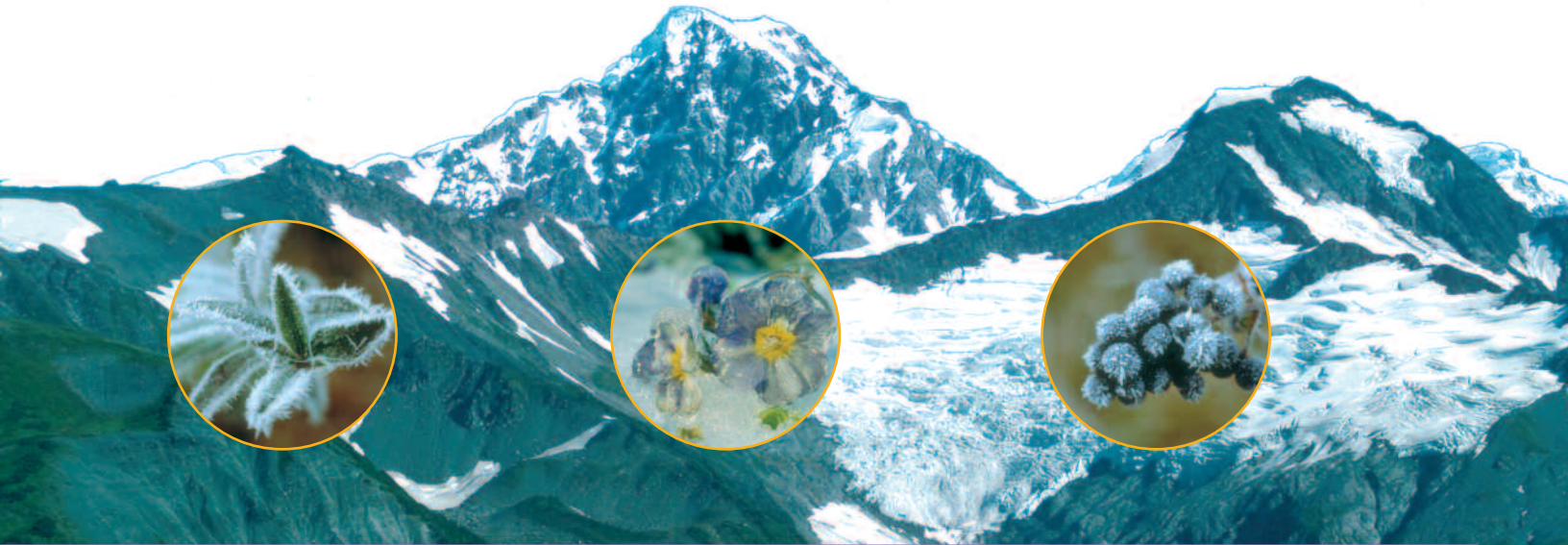
ABOUT 20,000 YEARS AGO, GLACIERS COVERED NEARLY 30 PERCENT OF EARTH'S SURFACE.



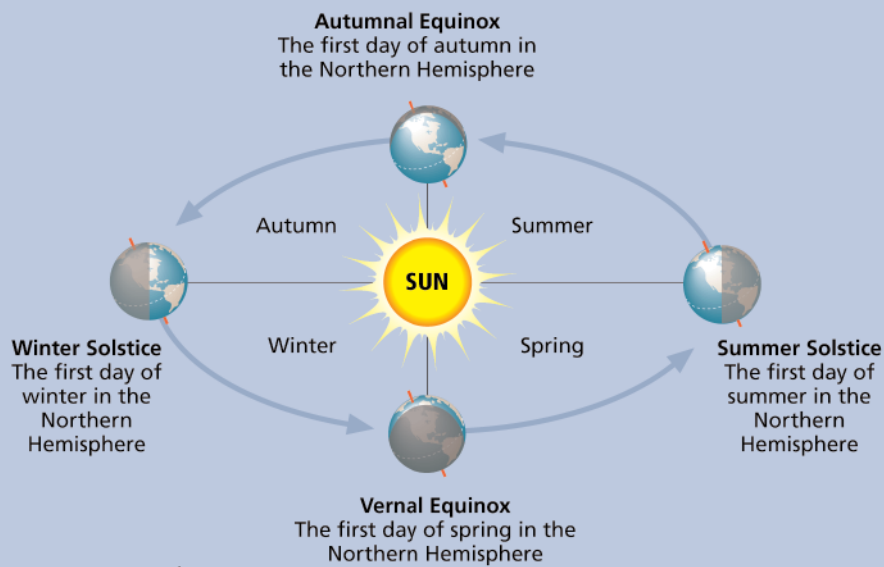
# THE NEXT ICE AGE

Some scientists believe that conditions may be set for another ice age. But when looking at history, it seems the next ice age is still a long way away. The exact causes of ice ages are complicated.

Will the glaciers return from their break and help us out with our global warming problem? Or will global warming set conditions that invite the next ice age? Scientists at Scripps and from around the world are working to answer these questions.



## WHY DO ICE AGES COME AND GO?



Note: not to scale

Most scientists agree on a theory that explains the timing of ice ages and interglacial periods. Recent ice ages seem to come and go every 20,000 and 100,000 years.

Why do the ice ages come and go at this rate? In the same way that Earth's rotation explains the rhythm of night and day taking place every 12 hours, the orientation of its axis of rotation and its motion around the Sun explain some of the climate rhythms taking place over thousands of years.