

# 4.2 Hot and cold

The Earth's geological history goes back in time millions of years. Unfortunately we cannot state with any certainty what life on Earth was like millions of years ago. Some scientists say the Earth goes through a continuous natural cycle of climate change, and past ice ages — as covered in this spread — are signs of this process. Other scientists present evidence — as you'll see in the next spread — to suggest that the present rate of warming, which is much more rapid than in past ages, is cause for serious concern.

Despite the depth of ice at the poles and the existence of many glaciers, most scientists argue that the Earth has been in a 'warm' cycle for the past 10 000 years. Some argue that it is due to cool down soon. In fact, there was a 'little ice age' during the 1800s, when the Earth's temperature decreased noticeably. An ice age is a period of time in the history of the Earth when the world cooled down and large parts of its surface were covered by ice.

Scientists disagree about exact time spans, but it is generally considered that there were four major ice ages during geological eras in the distant past, each about 20 to 50 million years long:

- about 2.3 billion years ago, during the Precambrian time
- 800–600 million years ago, at the end of the Precambrian time
- 460–430 million years ago, during the Ordovician period
- 350–260 million years ago, during the Carboniferous period.

Many authorities suggest that the Earth's last significant ice age occurred during the Pleistocene epoch — beginning about 2 million years ago and ending about 10 000 years ago. Some suggest that during that time there may have been up to 18 glaciations (when ice

sheets thickened and advanced away from the poles, after having retreated during a short warmer period, called an interglacial). At times ice sheets are thought to have advanced so far south that they covered most of the continent of North America, and northern parts of Europe and Asia.

FIGURE 1



▲ Perito Moreno Glacier in Argentina — a sea of ice

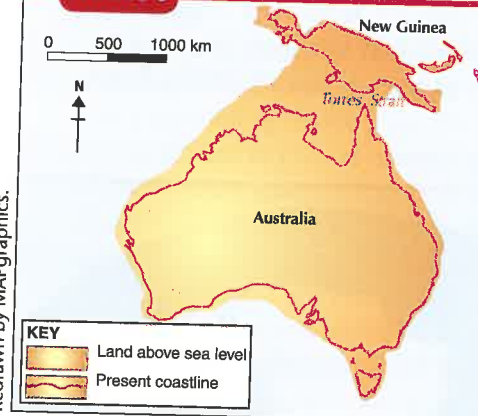
FIGURE 2



- ◀ This ice core sample is from Antarctica and is around 240 000 years old. Locked within is information about what the Earth's climate and atmosphere were like when this ice was laid down.

During an ice age, sea levels dropped steeply, exposing areas of land previously covered by water. The reverse happened during an interglacial, when sea levels rose again, forming huge bodies of water such as the Great Lakes of North America.

FIGURE 3



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- ▲ Figure 3 depicts what some scientists think the Australian land mass looked like around 18 000 BC. Areas then land are now covered by sea. People, animals and plants once free to migrate to adjoining land areas became cut off and isolated.

## Changing ice sheets

Maps based on geological evidence show changes in the extent of ice sheets (see the two maps below). In 200 000 BP (i.e. 200 000 years before the present era), ice covered

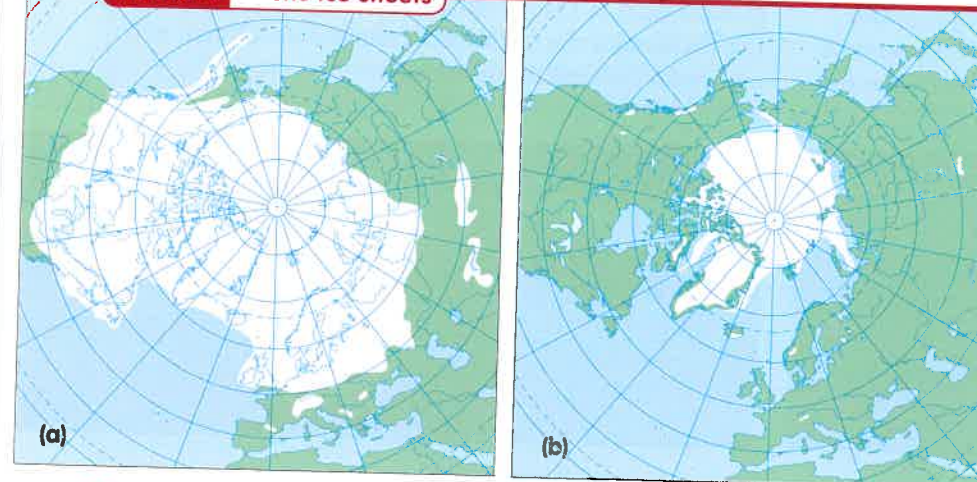
approximately one-third of the Earth's surface. Today it covers about 10 per cent. About 18 000 years ago most of Canada and England were covered by ice.

## Getting hot . . . growing cold

In the previous spread we saw some of the natural factors influencing climate patterns. Scientists say there are also longer term factors that can affect the Earth's overall temperature. These include:

- *the action of plate tectonics.* Movements in **tectonic plates** can change the position and form of land masses. Uplifts at plate boundaries can affect circulation patterns in the atmosphere and oceans, and through volcanic eruptions can cause massive discharges into the atmosphere of gases and ash that may create an **enhanced greenhouse effect** or block sunlight.
- *changes, over thousands of years, in the Earth's cycles.* These include slight variations in the shape of the Earth's orbit around the sun and in the angle of its axis, which can affect the direction in which the North Pole points.

FIGURE 4 Arctic ice sheets



- ◀ Extent of Arctic ice sheets (a) 200 000 years ago and (b) today  
Source: © 2003 Philip's Great World Atlas.

## Activities



Student worksheet  
4.2

### REMEMBER

- 1 What do you understand by the term *ice age*?
- 2 During which geological eras have there been major ice ages?
- 3 What features of the Earth's surface are reminders of former ice ages?
- 4 What evidence on these pages shows that the world's climate has not always been the same?

### THINK

- 5 Use figure 4 showing changes in glaciation to write a short paragraph for each to describe how the following have been affected by changes in the ice sheets over the past 200 000 years: Canada, Scandinavia, Russia, northern Europe, the Atlantic Ocean, Greenland. Use an atlas if you need to.

### ICT

- 6 Using advanced search techniques, apply key words such as *climatologists*, *geologists* and *ice ages* to discover the methods used and evidence gathered by scientists to confirm that ice ages existed on Earth. Use desktop publishing to present a report on your findings (include both images and data).
- 7 Use the internet to find out more about ice core samples — how they are collected and what we can learn from them. Share your findings with other members of your class via a class blog.

### enhanced greenhouse effect

the extra heating of the Earth's atmosphere caused by increased levels of greenhouse gases (such as carbon dioxide and methane) in the atmosphere

**glacier** a slow-moving 'river of ice' that moves over a landmass (often downhill) changing the shape of the land

**tectonic plates** large pieces of the Earth's crust that float on the Earth's mantle (semi-molten layer) and are moved by the convection currents within the mantle