5.3 Weather and Climate

In this topic you will:

- learn the difference between weather and climate
- make observations of the weather.

Getting started

With a partner, write down as many words about the weather as you can. Be prepared to share them with the class. You must be ready to explain the meanings of the words you write down.

Key words

atmosphere
climate
climatology
humidity
meteorology
statistics
visibility
weather

What is Weather?

Weather is the state or condition of the variables of the atmosphere at any given location for a **short** period of time.

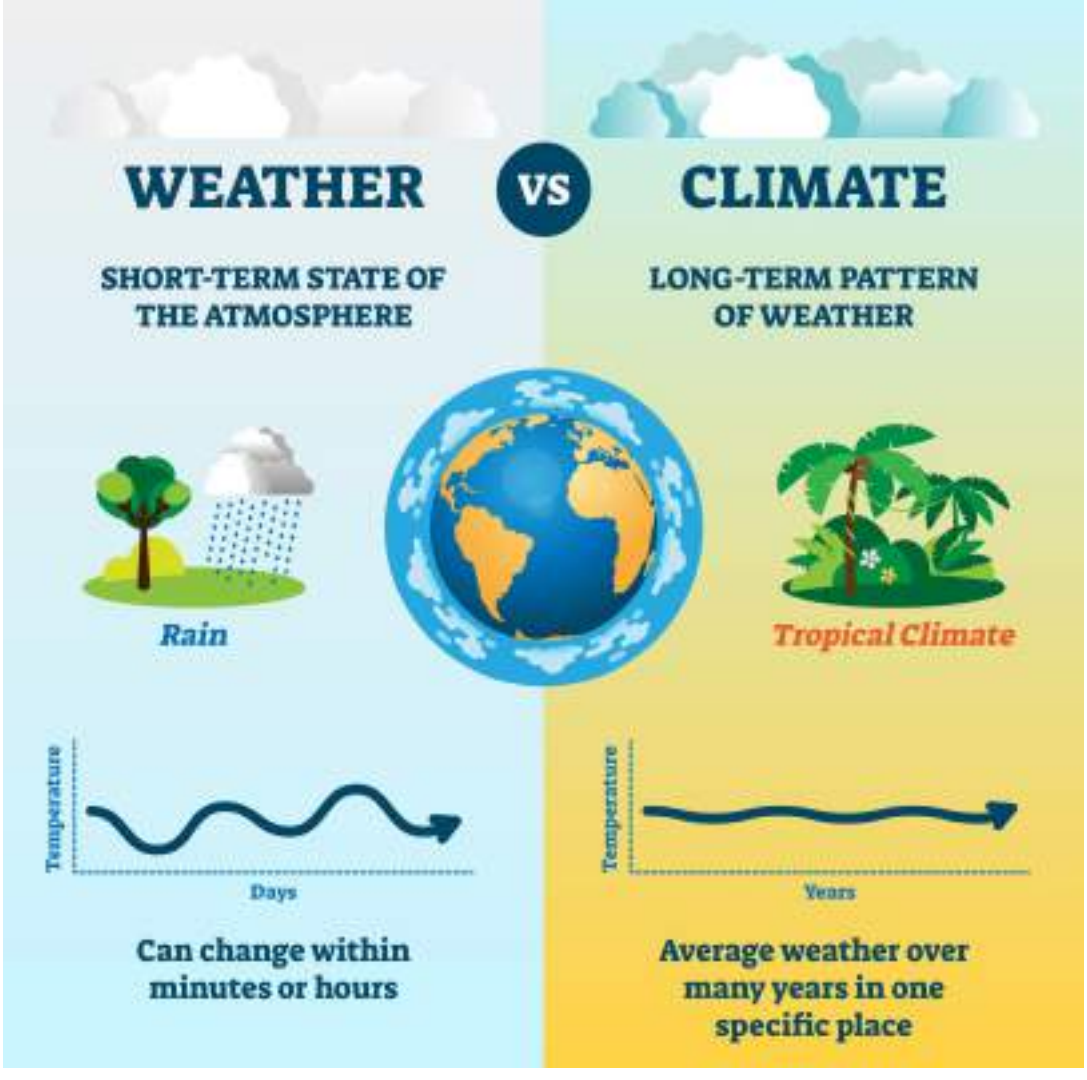
Weather is affected by factors:
Temperature, humidity, cloudiness, precipitation

Weather is carefully measured:

- To help predict what will happen next
- To see patterns in weather
- To provide information about weather to be prepared

Different countries, states, and continents have different weather.

- If it's raining in New York, it may be sunny in California!
- Or snowing in Antarctica!

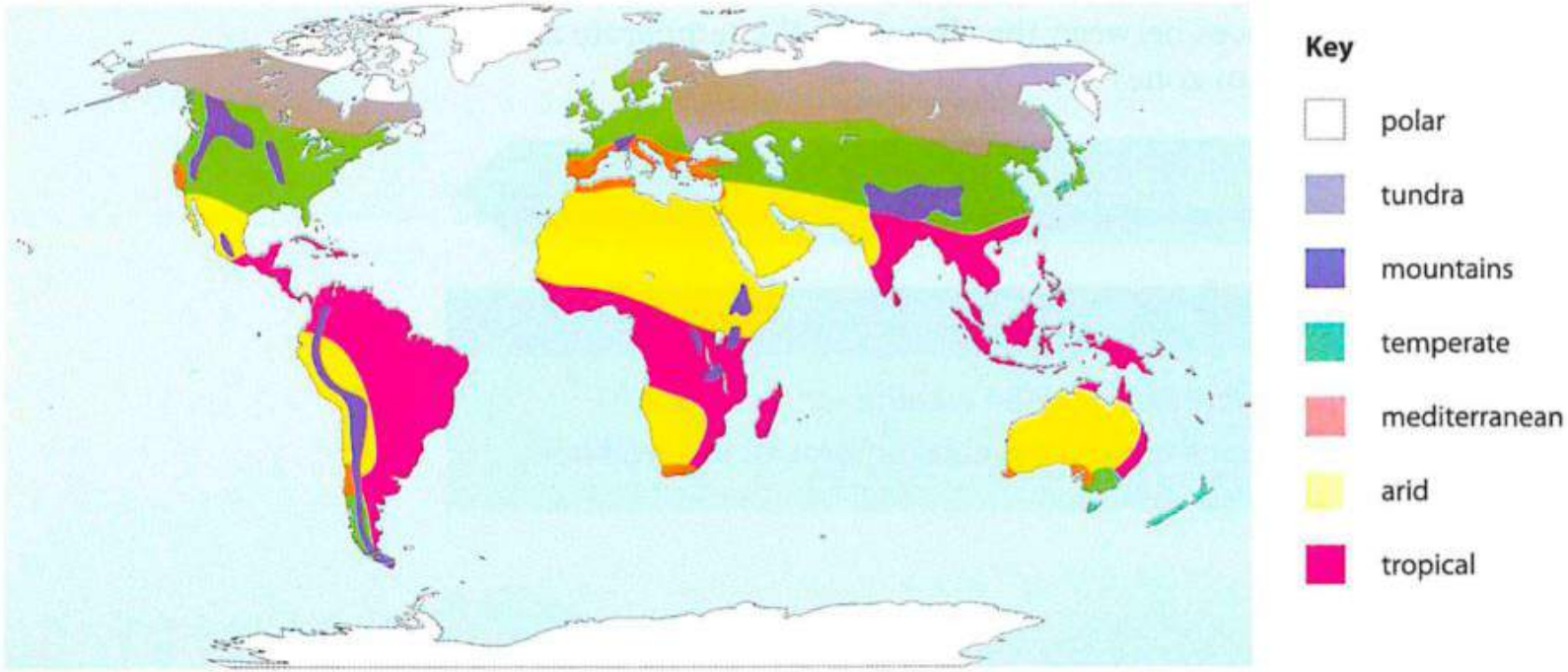


Climate information includes the **statistics** of weather information that tells us about the normal weather and also the range of extreme weather at that place.

Study of weather - meteorology

Study of climate - climatology

Climate zones on Earth



Climate zones on Earth

Each zone has a characteristic climate.

Climate zone	Description of climate
Polar	very cold and dry all year
Temperate	cold winters and mild summers
Arid	hot and dry all year
Tropical	hot and wet all year
Mediterranean	mild winters and hot, dry summers
Mountains/tundra/taiga	very cold all year

Questions

3 Which climate zone do you live in?

4 Name **two** countries that are in the arid zone. (You may need to use an atlas to help you.)

5 Name **two** countries that have areas with a Mediterranean climate but are not near the Mediterranean Sea.

6 Name **three** countries that are in the tropical zone.

7 What is the difference between the climate in the arid zone and the tropical zone?

8 What are the differences between the climate in the temperate zone and the Mediterranean zone?

5.4 Climate and Ice ages

Ice sheets

Permanent layer of ice covering an extensive tract of land, especially a polar region

Many parts of world covered by ice sheets 25000 years ago (shown in map)

Activity 5.4.1

Where in the World is there ice?

Working in a group of three or four, use an atlas to find out which parts of the Earth are covered with ice today.

Compare this with what the Earth looked like 25 000 years ago. Be ready to share your ideas.

Questions

1 Name a part of the Earth that was covered with ice 25 000 years ago, but is no longer covered with ice.

2 When you look at the parts of the Earth that are covered with ice today, what do they have in common?

Glacial and interglacial periods

Time when the earth was completely frozen - **glacial period** (covered with ice sheets)

Over last 450 000 years, Earth's climate has swung a lot

When two glacial periods are separated by a relatively warm condition - **interglacial period** (no ice sheets)

Today, Earth is in interglacial period

- Interglacial period - permanent ice close to North and South poles
- Glacial period - ice spreads much further from poles

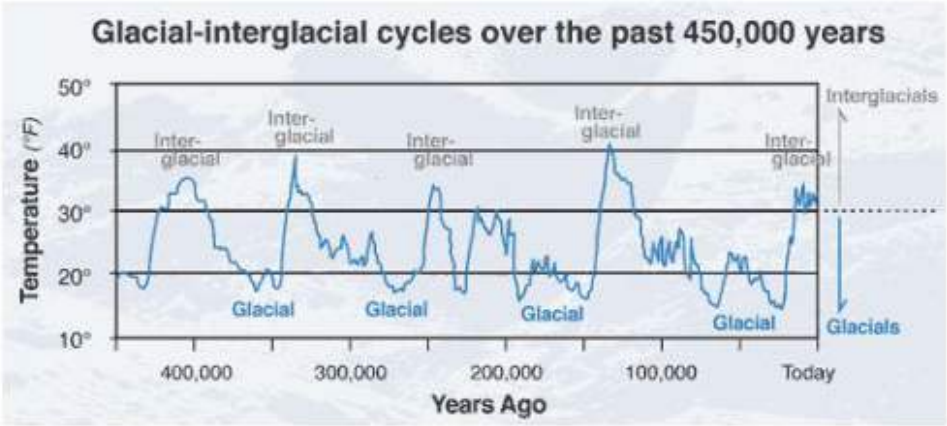


Figure: Glacial-interglacial cycles over the past 450,000 years to present.

The last glaciation ended about 11,000 years ago. But the period between 11,000 years ago and 2 million years ago (the Pleistocene epoch) was a time of many glacial and interglacial ages.

A new glaciation has been expected to begin; however, due to human induced climate change or anthropogenic climate change, the next glaciation is being delayed anywhere from a few thousand to hundreds of thousands of years. Therefore, it is expected that the Holocene interglacial may last at least another 150,000 years.

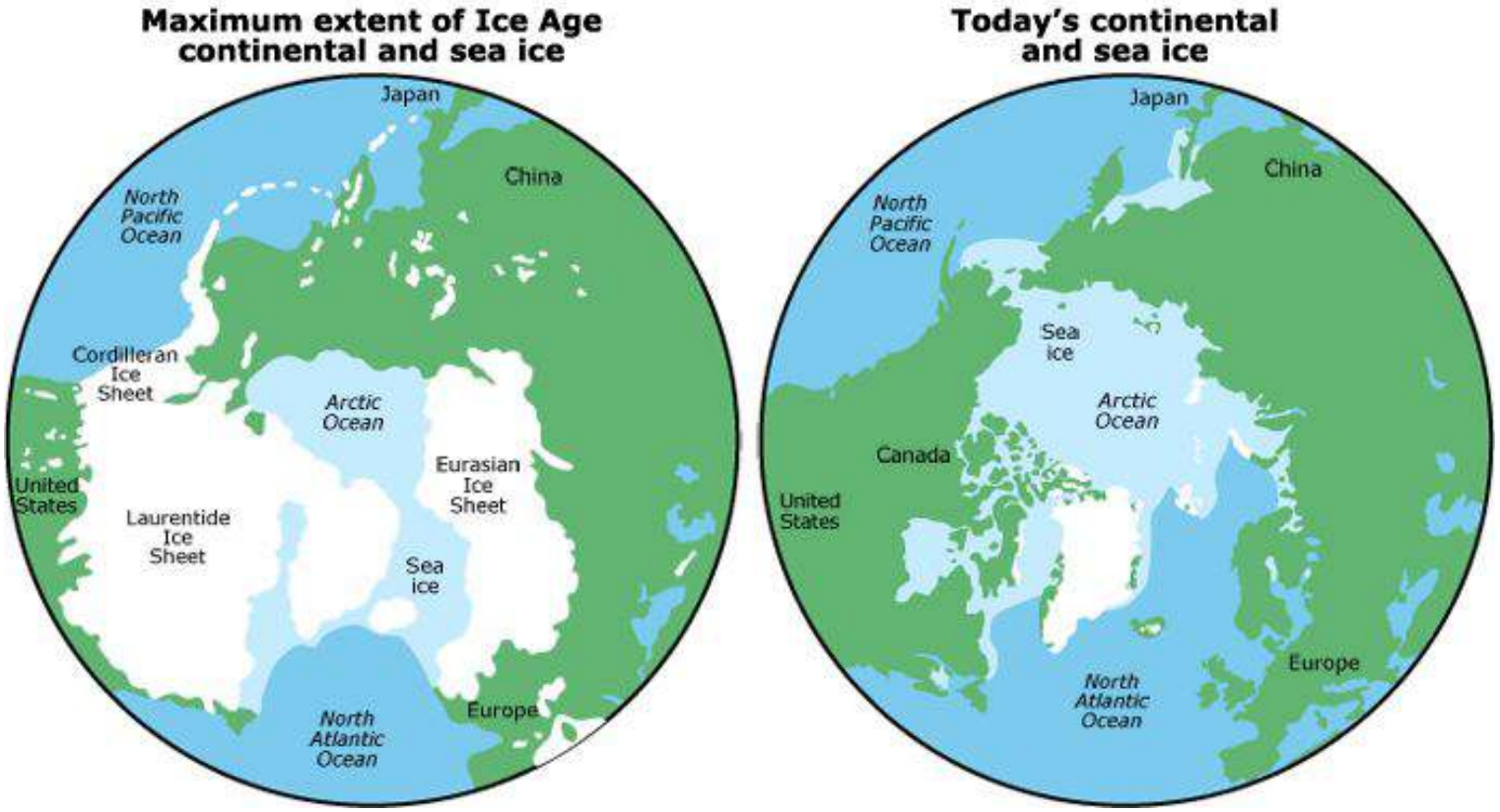
Ice age

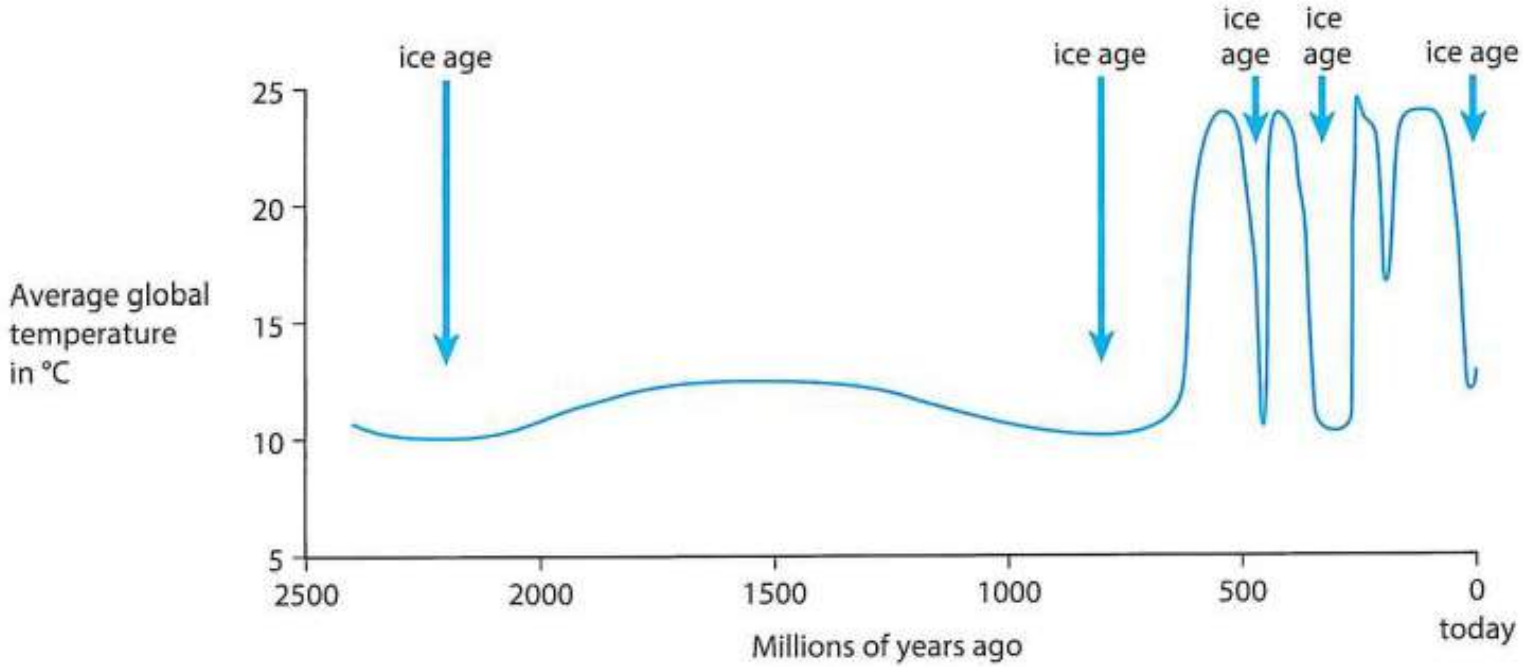
An ice or glacial age refers to climate change to such an extent that global temperatures drop so significantly over extensive areas (millions of billions of square kilometers) that there is permanent ice sheet covers for fairly long period of geological time.

During an ice age, a **glacial (large ice sheet)** is the period of time where glacial advancement occurs.

When two glacial periods are separated by a period of relatively warm condition, then this period is called **interglacial period (without large ice sheet)**.

During an ice age, a inter**glacial** is the period of time where glaciers **retreat and sea levels rise.**


Maximum extent of Ice Age continental and sea ice
Japan
China
North Pacific Ocean
Cordilleran Ice Sheet
Arctic Ocean
Eurasian Ice Sheet
United States
Laurentide Ice Sheet
Sea ice
Europe
North Atlantic Ocean
Today's continental and sea ice
Japan
China
North Pacific Ocean
Sea ice
Arctic Ocean
Canada
United States
Europe
North Atlantic Ocean


ice age
ice age
ice age
ice age
ice age
Average global temperature in °C
25
20
15
10
5
2500
2000
1500
1000
500
0
today
Millions of years ago

Evidences showing that Earth was so cold in the past

Boulders (big rocks) - in California, USA, stand in their strange positions; being carried there by ancient glaciers

Glaciers - rivers of ice that move slowly downhill (formed from snow, over many years, becomes compressed into thick masses of ice), carry rocks with them. When glacier melts, rocks are left behind.

Fossils of animals and plants found in very warm places now indicate that these organism were once adapted to cold places

GLACIERS: are massive, long lasting, moving mass of compacted snow and ice that forms on land, moves down slope or spreads outward under its own weight.

The Arctic region takes millennia to accumulate the huge amount of snow and ice needed to form a glacier.

Most modern glacier contain snow that fell over 100,000 years ago.

Melting of Arctic Glaciers

Pollen evidences showing glacial and interglacial periods

As plants die, they decay. Sometimes, the decay is very slow (less oxygen, acidic conditions) leading to formation of a **peat bog.**

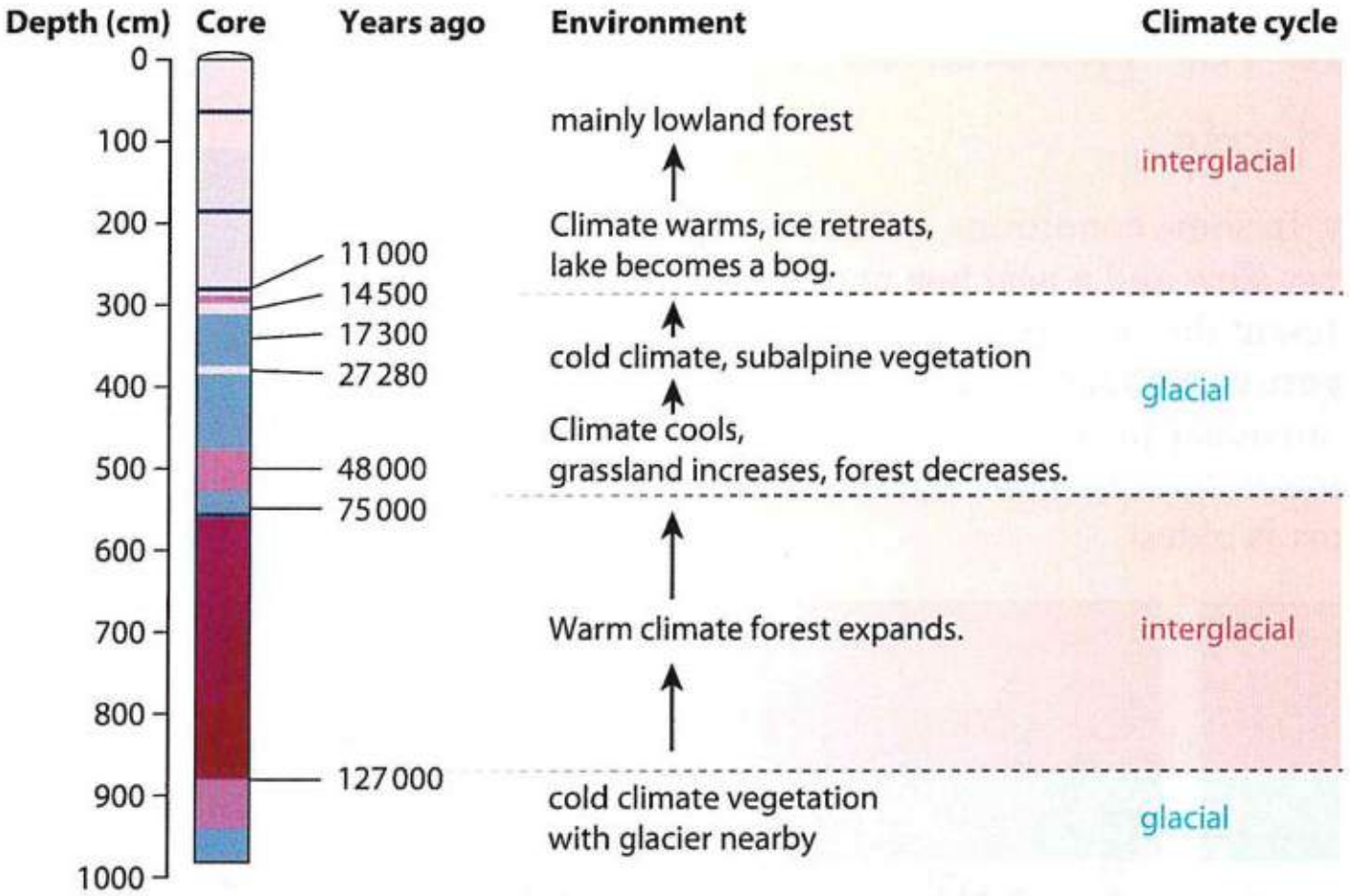
Different layers of peat represent different periods of history

The deeper the peat → the older it is

Samples of the peat bog can be taken carefully

using auger

A core of soil from a peat bog sample extracted in New Zealand showed the deepest level of soil formed 127 000 years ago. Scientists collected pollen from different parts of core and identified the plants pollen came from. Knowing the type of climate of plant in which it grows, the climate 127 000 years ago can be estimated.


Depth (cm)
Core
Years ago
Environment
Climate cycle
0
100
200
300
400
500
600
700
800
900
1000
11 000
14 500
17 300
27 280
48 000
75 000
127 000
mainly lowland forest
interglacial
Climate warms, ice retreats,
lake becomes a bog.
cold climate, subalpine vegetation
glacial
Climate cools,
grassland increases, forest decreases.
Warm climate forest expands.
interglacial
cold climate vegetation
with glacier nearby
glacial