investigating ice cores

Ice core data provides an insight into the past trends of the Quaternary period.

credit: Photo taken from the Ocean Explorer website, NOAA

We can find out facts about climate change and ice ages in the past by using the ice core record.

Major past changes have taken place in the average temperature of the Earth's atmosphere. 100 million years ago at the time of the dinosaurs, conditions were much hotter than today.

There have also been many cold phases called **ice ages**. Some scientists believe that the coldest chapter of Planet Earth's took place 700 million years ago. They describe it as the "Snowball earth" era.

Our last major cold period, the **Pleistocene**, started 1.8 million years ago and ended just 10,000 years before today. Since then, conditions have been warmer.

This most recent 10,000 years is called the Holocene. The Pleistocene and the Holocene form the **Quaternary Period** of Earth history.

Above: Antarctica: a place where ice core evidence is found by scientists

We know that temperatures were much colder during much of the Pleistocene. A range of evidence tells us this.

The most important data source is ice cores extracted from polar ice caps. Snow has been falling and building up into thick ice there for many thousands of years.

Ice cores are cross-sections drilled through the snow and ice. They allow us to look back in time. Over the past few decades, several long cores of ice *between 3 and 4 km long* have been pulled up from the Greenland and Antarctic ice sheets to investigate long-term climatic change. Parts of the Antarctic ice were an amazing 500,000 years old!

The ice was taken to a laboratory and melted, releasing bubbles of ancient air. Changes in air content – especially hydrogen – were then analysed, showing scientists how temperatures have warmed and cooled over time (Figure 2.1).

The Greenland scientists called their ice core projects GRIP (Greenland Ice Core Project) & GISP2 (Greenland Ice Sheet Project Two) cores. Antarctic scientists called their work the EPICA project (European Project for Ice Coring in Antarctica).

The pockets of air trapped within the ice enable scientists to reconstruct the gaseous composition of the atmosphere in the past, notably the concentrations of carbon dioxide (CO_2)

The ice can also be examined for concentrations of dust, volcanic ash and various

A long cylindrical core of ice is removed from the thick Arctic ice pack. After drilling and extracting the core, scientists can begin to sample and analyse the ice.

credit: (Photo by Emory Kristof, National Geographic Society.) taken from the Ocean Explorer website, NOAA

chemicals – all giving evidence of what was in the atmosphere at various times in the distant past.

Another important data source for science is the fossil record. This shows whether animals preferring warm or cool conditions were alive and thriving at different times in Earth's past.

The key findings are of GRIP and EPICA are:

1. The current levels of carbon dioxide in Earth's atmosphere today is now known to be higher than at any time in the last 800,000 years.

2. There is a close relationship between the level of carbon dioxide in the atmosphere and air temperature through time according to ice core evidence.

Exercise. **The numbers that are included in the table below are based on ice core data as well as some more modern readings. Plot this data as a graph. What does it tell you about rising levels of carbon dioxide?**

Year	1800	1820	1840	1860	1880	1900	1920	1940	1960	1980	2008
Carbon dioxide (parts per million)	280	282	283	287	291	295	299	310	323	347	386