Cooling climate, changing species.

The enormous quantity of heat within the Earth is an key factor in Antarctica becoming the coldest continent, as it provided the energy for plate tectonics to occur. This movement of continents, along with physical changes in Earth's atmosphere and climate, and the evolution of new species, means Antarctica has had a very varied past:

- 210 - 140 mya. The world's climate was warm and wet. This must have included Antarctica as the rocks of the Antarctic Peninsula contain fossils of luxuriant conifer forests, cycads, ferns, tree ferns, ginkgos and ancient herb like plants. Despite the warmth, surviving the long polar night would still have been a considerable challenge for any species.
- *80 mya.* The first Antarctic flowering plants (angiosperms) appeared, which suggests an average temperature of 19°C and frost-free polar winters.
- *55 mya*. The presence of cold-tolerant trees in Antarctica suggests major climate change was underway, with the average temperature dropping to 10°C. These cold climate plants would have made Antarctica look like New Zealand's southern beech forests of today.
- *32 mya.* Serious Antarctic cooling starts, as the tip of South America separates from the Antarctic Peninsula. This created the stormy Drake Passage, through which the massive, salty Circum-polar Current began to flow, encircling Antarctica and isolating it from much of the world's warmer weather, resulting in the formation of the continent's massive ice sheets.
- *To the present.* Despite the steady onset of cold to produce todays icehouse world, there have been regular warmer intervals, allowing some unique plant and animal communities to become established as the ice temporarily retreated.

A warmer past

In 2000 within a Victoria Land Dry Valley the fossilised remains of a community of plants and animals was discovered. It showed that 14 million years ago an alpine lake formed behind a glacial moraine, a lake surrounded by grasses, herbs and small, weather beaten southern beech 'trees' - amongst which weevils and other insects thrived.

For such organisms to have survived, the average temperature must have been close to zero, 20°C warmer than the same valleys today.

Remarkably these fossilised remains show no signs of decomposing, suggesting that on one day 14 million years ago, this hardy community froze, and has stayed so ever since

Image: David Saul, Wikicommons

Adapted from material by *Bryan Storey, University of Canterbury* by *Donald Reid, iMatters.co.nz* in association with *Gateway Antarctica, University of Canterbury.*
Curricula: Science L4 - 8, Social Studies L3 - 4, Geography L6 - 8.

Finding an Antarctic meteorite. Image: NASA

Antarctic meteorites

Meteorites regularly land all over the Earth but are seldom discovered. In Antarctica however they are more easily found as they are concentrated by ice flows and their blackness stands out against the expanse of white. Even ancient meteorites buried in ice can be exposed, as the dry katabatic winds steadily evaporate the ice cover away. These process have resulted in a 3 km by 7 km section of the Beardmore Glacier yielding over 1500 meteorites. To date more than 16000 Antarctic meteorites have been found providing a unique record into our early solar system, and the origin of asteroids, comets, Moon and Mars.

Antarctica is also home to possibly one of the biggest meteorite craters known on Earth. It lies almost 2 km beneath the ice of Wilkes Land and was only detected by remote sensing techniques. Little is known about this crater except it is approximately 250 million years old and is likely to have caused a huge mass extinction, one even bigger than that which led to the demise of the dinosaurs.

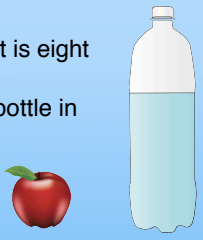
Practical Task: Estimating the weight of a meteorite.

Introduction

Meteorites are always surprisingly heavy, simply because they are composed of such dense materials. Iron rich meteorites are the heaviest, as they have a density about eight times that of water.

What to do

1. Weigh a piece of fruit.
2. Fill a plastic bottle with water until it is eight times the weight of the fruit.
3. Hold the fruit in one hand and the bottle in the other. What are your impressions?
4. Extension: Could you lift an iron meteorite, the size of a netball, onto the skidoo? Show your working.



Relevance

- Antarctica is an excellent source of meteorites.
- Meteorites differ from rocks.
- Transporting meteorites in Antarctica is difficult.