THE ICE CONTINENT

With an area of 14 million km², Antarctica is over twice the size of Australia. Less than 2% of Antarctica is ice-free and the icesheet, which has an average thickness of around 2.3 km, is up to 4.8 km thick in the Australian Antarctic Territory. Antarctica contains about 70% of the world's freshwater—if it were to melt, world sea levels would rise by approximately 70 m. The mean altitude of the ice surface is approximately 2.3 km, making Antarctica the continent with the highest average elevation. In contrast, Australia's average elevation is only 340 m. The Australian Antarctic Territory also features the highest point of the ice sheet (4.1 km) and has recorded the lowest temperature on Earth (-89.6°C in 1983).

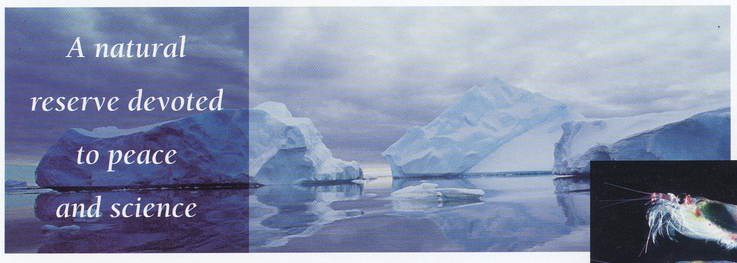
Antarctica plays a major role in the environment of the Earth. Its ice sheet and surrounding sea ice have a profound influence on the climate, particularly of the Southern Hemisphere.

The Antarctic ice-sheet is dynamic. It is fed by snowfall, although only 50 mm or less precipitation is received per year inland—this is less than half the equivalent rainfall in the world's hot deserts. The accumulated snow compacts to become ice. Snowfall on Antarctica is balanced by drainage of ice towards the coast, initially at speeds as low as a few metres per year. Closer to the coast much of the ice drains via large glaciers which may move at hundreds of metres per year. The largest glacier in the world, is the Lambert Glacier which feeds the Amery Ice Shelf, a huge floating slab of ice up to 800 m thick. Ice is eventually lost as icebergs which drift into the surrounding ocean and melt.

Coastal Antarctica is often windy. The wind results from the atmospheric pressure gradients and the slope of the ice sheet. A shallow layer of cold air slides down the ice sheet, producing winds commonly known as katabatics near the coast. Occasionally these winds are extremely strong.

Few living things permanently inhabit the continent. Plants (such as mosses, lichens and algae) and microorganisms (such as bacteria and fungi) are found in ice-free areas. Microscopic animals are associated with these plant communities. A few flowering plants occur near the tip of the Antarctic Peninsula. The seals, penguins and other birds characteristic of Antarctica spend most of their lives at sea, only coming ashore to breed and moult.

Antarctica was part of the ancient super continent of Gondwana which separated to form Antarctica, Australia, Africa, South America and India. 600 million years ago, Australia and Antarctica were over the Equator. The entire super continent moved south and for the last 350 million years, Antarctica has been near or over the South Pole.

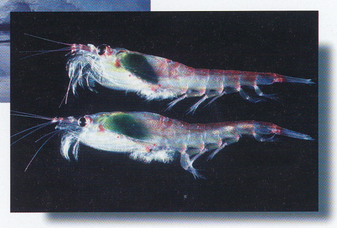


About 160 million years ago, Gondwana broke up with the other continents moving north. Once the continents separated, water could circulate around Antarctica in the Circumpolar Current, isolating the continent from the warm waters to the north.

THE SOUTHERN OCEAN

Within the prevailing easterly Antarctic Circumpolar Current is the Polar Frontal Zone, an oceanic boundary situated around 55°S where the cold, dense Antarctic water meets and dips beneath warmer northern waters. The relatively large temperature decrease across the Polar Frontal Zone acts as a barrier to marine organisms. Water temperatures range from the freezing point of sea water, -1.8°C in the southern parts of the Antarctic Circumpolar Current to about 2°C at the Polar Frontal Zone. The Antarctic Circumpolar Current is the world's largest ocean current and carries a vast amount of water, heat, salt and carbon dioxide between the worlds oceans; it is a key component of the Earth's oceanic system.

In the spring and summer, high light levels and locally abundant nutrients promote the rapid growth of the microscopic floating plant cells (phytoplankton), which in turn support the rich marine fauna. The most abundant animal is the 5 cm long shrimp-like Antarctic krill *(Euphausia superba)*, whose total population has been estimated to be around 500 million tonnes. Krill feeds on the phytoplankton, and often forms vast swarms. Krill is important in the diet of a large range of fish, squid, penguins and other birds, seals and whales. Many birds and mammals also feed on fish and squid, which in their turn consume krill. The large populations of great whales migrate to Antarctic waters each summer to fatten up and feed on krill.



Every winter the sea around Antarctica freezes to an average thickness of about one metre, more than doubling the area under ice. At its maximum in September some 20 million km² is covered. The annual freezing and melting of such a large area of sea is one of the greatest seasonal events on the planet. It has a profound influence on the global oceanic circulation, heat flow between atmosphere and ocean and the biology of the Southern Ocean.

UPPER ATMOSPHERE PHENOMENA

THE AURORA AND THE OZONE HOLE

The Aurora Australis or Southern Lights appear as complex light patterns which may extend across the entire sky. They are produced by the excitation of gases at around 100 km above the Earth through the collision of charged particles, emitted from the sun. The most common colour is green due to the excitation of oxygen. Red light from the excitation of oxygen and nitrogen is also common. The occurrence of auroras is correlated with the 11 year sunspot cycle, the 27 day rotation period of the Sun and the Earth's seasons.

Since the mid 1970's, the concentration of stratospheric ozone over Antarctica during spring has decreased by about 70%. This phenomenon is linked with the release of chlorofluorocarbon gases primarily from the Northern Hemisphere. Stratospheric ozone depletion is now recognised as a global problem, having an impact on the amount of solar ultraviolet radiation that reaches the Earth's surface at all latitudes. The increase in ultraviolet radiation may be having significant impacts on the components of ecosystems.

THE ANTARCTIC TREATY SYSTEM

The Antarctic Treaty entered into force in 1961. It is a landmark agreement which ensures the peaceful use of Antarctica, guarantees freedom of scientific research and removes the potential for sovereignty disputes between Treaty Parties.

The 26 countries active in Antarctica meet annually to discuss issues as diverse as scientific cooperation, management of tourism and preservation of historic sites. Measures adopted under the Treaty also ensure protection of the Antarctic environment. These include rules for conserving flora and fauna in the Southern Ocean and the Antarctic Continent, protecting seals and conserving marine living resources such as fish and krill.

The Protocol on Environmental Protection to the Antarctic Treaty was adopted in 1991. It designates Antarctica as a "natural reserve, devoted to peace and science", prohibits mining and subjects all activities to prior assessment of their impacts. It also provides rules relating to waste disposal, management of protected areas and prevention of marine pollution.

THE AUSTRALIAN ANTARCTIC PROGRAM

Australia has had a continuous presence in Antarctica since 1947, building an international reputation for the quality of its scientific work, environmental management and its contribution to the Antarctic Treaty System. The Australian Government currently has four key goals for the Antarctic program:

- understanding global change;
- protecting the Antarctic environment, including management of the Antarctic marine ecosystem;
- undertaking scientific work of practical importance (eg. for meteorology); and
- maintaining the Antarctic Treaty System and Australia's influence in the System.

ANTARCTICA

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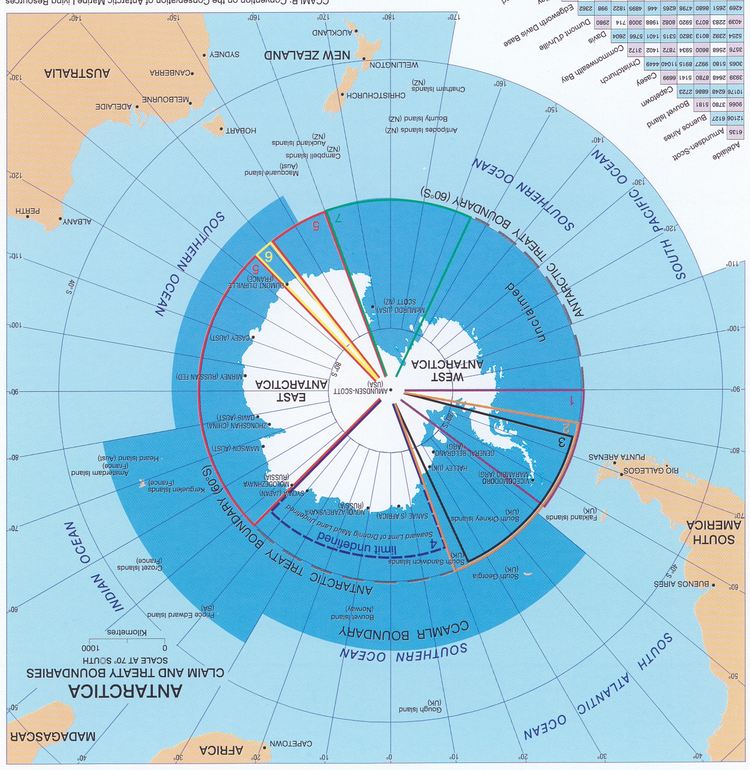

Photographs: Cover photo-G. Robertson, albatross-G. Robertson, krill-R. Williams, icebergs-M. Thomes