

## ANTARCTICA - THE TERRA AUSTRALIS

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Terra Australis (Latin for *South Land*) is a hypothetical continent that was later named as Antarctica. Antarctica, the last known of the seven continents, is the 5<sup>th</sup> largest continent, covering about 14 million sq km or 9.8 percent of total land surface of the world. It is roughly circular in outline and forms an eccentric hub around the South Pole. As compared to its relative size, it is about 4.3 times larger than India and China put together, with no permanent habitation. This is a place of midnight sun and a continent where darkness prevails for months together during the polar winters. Antarctica is known to be the highest, coldest, windiest, blizzardly, icy or glaciated, driest, mountainous, desolate, inhospitable and most inaccessible continent of the world. The ice-cap stores about 70% of the World's freshwater and over 90% of World's total glacial ice which forms more than 4 km thick ice sheet over the continent. Temperature in Antarctica ranges from slightly above the freezing point along to coast to -30° C in the summer months (December-February) while in winter months (April-September) it lowers up to -65° C. The lowest temperature recorded was -89.2° C in July, 1983. The indomitable eagerness of man to know the unknown resulted in discovery of Antarctic Continent in 1821. Since then hundreds of great explorers went to Antarctica, the notable of them are Norwegian polar explorer Roald Amundsen who first reached the geographic South Pole on December 14, 1911 and Captain Robert Falcon Scott, a famous British explorer, the second man who reached the South Pole on January 17, 1912. Hundreds of scientists all over the world are engaged in researches in Antarctica on earth science, biological, atmospheric and medical sciences and engineering and communication. India like 15 other countries has also established their research bases (Dakshin Gangatri – presently abandoned, Maitri and Larsemann Hills) in Schirmacher Oasis, East Antarctica for conducting scientific researches. The first Indian Antarctic Expedition was launched in December, 1981 from Goa under the leadership of the eminent scientist Dr. S. Z. Qasim. Since then, Antarctic expeditions are being launched every year with participation of 30-40 scientists from different disciplines of science. Geomorphologically, the Antarctica is twin continents, the Greater and the Lesser Antarctica separated by some deep under ice channels. The Greater Antarctica is the Eastern Antarctica as it mostly lies in the East between Longs. 55°W and 180°E. The Trans-Antarctic Mountain Range (over 3000 km long) with highest elevation of 4528 m is present in this part. The western part of the continent including Antarctic Peninsula is the Lesser

Antarctica which is roughly bounded by Longs. 55°W to 180°W. The West Antarctica is the youngest of the three geographic regions due to the buckling and folding of the Earth's crust, and is characterized by huge mountain ranges both above and below sea level. The Antarctic Peninsula is the northern most section of Antarctica as well as the most moderate in climate due to its latitude. About 2% or 8000 km<sup>2</sup> of Antarctic rock and soil are exposed from the ice.

**Antarctic Ice:** 98% of Antarctica is covered by thick ice sheets that contain about 90% of world's 'permanent' ice and 70% of its fresh water. The coastal line of Antarctica is girdled by ring of immense expanse of sea ice which is more extensive (about 2, 00, 00,000 km<sup>2</sup> extending northwards to about Lat. 55°S - an area larger than the continent itself), in winter (September) than in summer (February, about 40, 00,000 km<sup>2</sup>) when it melts due to moderate temperature. In Peninsular region the sea ice extends 240 - 280 km in north-west direction in winter and much less in summer.

### **Antarctic Icebergs:**

The icebergs are large floating mass of ice calved from ice shelves. It is of varying shapes and sizes having a covered area of about 31,000 km<sup>2</sup> with about 335 km in length and 97 km in width.

### **Life in Antarctica**

**Plants:** Only two species of native flowering climbers viz., the Antarctic hair grass *Deschampsia antarctica* and a cushion-forming pearlwort, *Colobanthus quitensis* are found to grow in Western Coast of Antarctic Peninsula (56°S) and nearby islands. Algae, lichens and mosses are also found in Antarctica. There are 300-400 species of algae which grow on rocks, ice and in sea. Lichens are best adapted to survive in the harsh polar climate. They have proliferated in Antarctica mainly because there is little competition. More than 200 species of beautifully colored lichens are known from Antarctica. Only a little more of one hundred moss species and 25 species of liverworts are found in Antarctica. Mosses mostly grow surrounding the glacier lakes. They may be deep green or brown in colour and 1 cm to 30 cm thick. **Planktons:** Due to highly fertile sea the phytoplankton shows enormous growth and very rich in population. As the zooplanktons live on phytoplanktons, they are also very rich both in quality and quantity. The most important and unique zooplankton is a Crustacea - the Krill (*Euphausia superba*). These pinkish prawn-like animals of 2"-3" long are present in sea in such a number (5-6 billion ton or more) that the color of water turns reddish.

**Animals:** Faunal diversity in Antarctica is poor but very rich in population. The terrestrial fauna of Antarctica consist only invertebrates, mostly microscopic, living in soil and vegetation. The invertebrates in the continental Antarctica include moss and soil inhabiting wingless collembola (insecta), mite (arachnida), nematoda, protozoa, tardigrada, rotifera and wingless midges (*Belgica antarctica*). Besides these, around 65 species of winged parasitic insects are found in Peninsular Antarctica and neighbouring islands. These animals are capable of tolerating very low temperature. The other animals of Antarctica mostly thrive in the sea are sea anemones, squids, jelly fish, arrow worms, comb jellies, snails, slaps, starfish, penguins and sea birds like skuas, terns, petrels and albatrosses, seals, whales and dolphins. Fish population in Antarctic sea is very rich and over 200 species are known to live in the water. Around 35 species of birds visit Antarctica and nearby islands for breeding or living for a while. They range from magnificent wandering albatross capable of flying thousands of kilometers for feeding and mating to gulls, cormorants and terns. Most of them return to the same site each year. Seventeen species of penguin live south of Equator including southern coast of South America, South Australia, New Zealand, tip of Africa and all around Antarctica.

**Impact of Climate Change on Antarctic Life:** Since the International Geophysical year of 1957-58, Antarctic surface temperatures have remained stable over much of the continent. The majority of stations in East Antarctica showed no significant warming or cooling trends. On the contrary, large and sufficiently significant warming trends are seen at the Antarctic Peninsula. The most rapidly warming part during the past 50 years period is the west coast of the Peninsula. The annual mean temperatures at the Peninsula have risen by nearly 3° C, with the largest warming occurring in winter. The Earth's surface air temperature has increased by 0.06°C per decade during the 20<sup>th</sup> century (IPCC report, 2007) and by 0.19°C per decade from 1979 to 1998 (NRC report, 2000). Fourteen years of continuous weather recording from the shore of Lake Hoare by them revealed that seasonally averaged surface air temperature has decreased by 0.7% per decade. The temperature decreased was more pronounced in summer and autumn. Winter (June-August) and spring (September-November) showed smaller temperature increases. The result of study of vertical warming over the last 30 years has shown that Antarctic atmosphere has warmed below 8 km and cooled above this height. This trend of warming in the troposphere and cooling in the stratosphere indicates increase in greenhouse gasses especially carbon-dioxide. The ice cover of the Peninsula has largely changed, many glaciers have retreated and around 10 ice shelves have been observed to retreat in recent years (Vaughan and Doake, 1996) and some have collapsed totally. 87% of glaciers along the west coast of the Peninsula have greatly retreated resulting sea-level rise at about the same rate as Alaska glaciers. The environmental changes are most

remarkable in the Antarctic Peninsula, where climate change has been most significant. The study in the McMurdo Dry Valleys had evidenced rapid terrestrial ecosystem response to climate cooling in Antarctica. Their spatial analysis of Antarctic meteorological data showed a net cooling on the Antarctic continent between 1966 and 2000, particularly during summer and autumn. They reported decreased primary productivity of lakes (6-9% per year) and declining numbers of soil invertebrates (more than 10% per year). Fourteen years of continuous weather recording from the shore of Lake Hoare by them revealed that seasonally averaged surface air temperature has decreased by 0.7% per decade. The temperature decrease was more pronounced in summer and autumn. Winter (June-August) and spring (September-November) showed smaller temperature increases. They opined that climate cooling has significantly impacted ecosystem properties. It is known that soil is a thermally buffered environment that responds slowly to temperature changes in their column above. Therefore, the biota living within the soil is less likely than the surface vegetation to show large responses to changes in atmospheric temperature. Although climate does not have direct effects on soil biota, soil biota are more strongly affected by vegetation than they are by atmospheric conditions directly. The increase in abundance in vegetation has resulted in increased abundance of soil and other terrestrial fauna in some sites of Antarctic Peninsula. Changes in temperature and precipitation have increased biological production in lakes, mainly due to decreases in the duration and extent of lake ice cover. Some lakes have become more saline due to drier conditions, and resulted in depletion of lake biota. Compared to many marine organisms the terrestrial biota in Antarctica often has a wide environmental tolerance. It includes some of the most robust life forms on Earth, the Cyanobacteria, which can survive extremes of low temperature, water availability, light and high UV radiation. Environmental change is most apparent in the Antarctic Peninsula, where climate change has been largest. The changes have declined in number of Adelie penguins. The number of Emperor penguins has dropped from 300 breeding pairs to just nine in the Western Antarctic Peninsula. The Antarctic marine ecosystem is also severely affected by climate change, especially on the western side of Peninsula, with its warm water and reduction in sea ice. Among the significant cases of decline in population of different marine fauna, decline in Antarctic Krill stocks, decrease in phytoplankton. An increase in the frequency and intensity of freezing events could readily exceed the tolerance limits of many arthropods. With increase in temperature many terrestrial species may exhibit faster metabolic rates, shorter life cycles and local expansion of Antarctica is Earth's most powerful natural laboratory and is a pivotal part of the Earth's climate system and a sensitive barometer of environmental change. For peaceful sustenance of life on Earth the Antarctic continent must be saved along with its fragile environment.