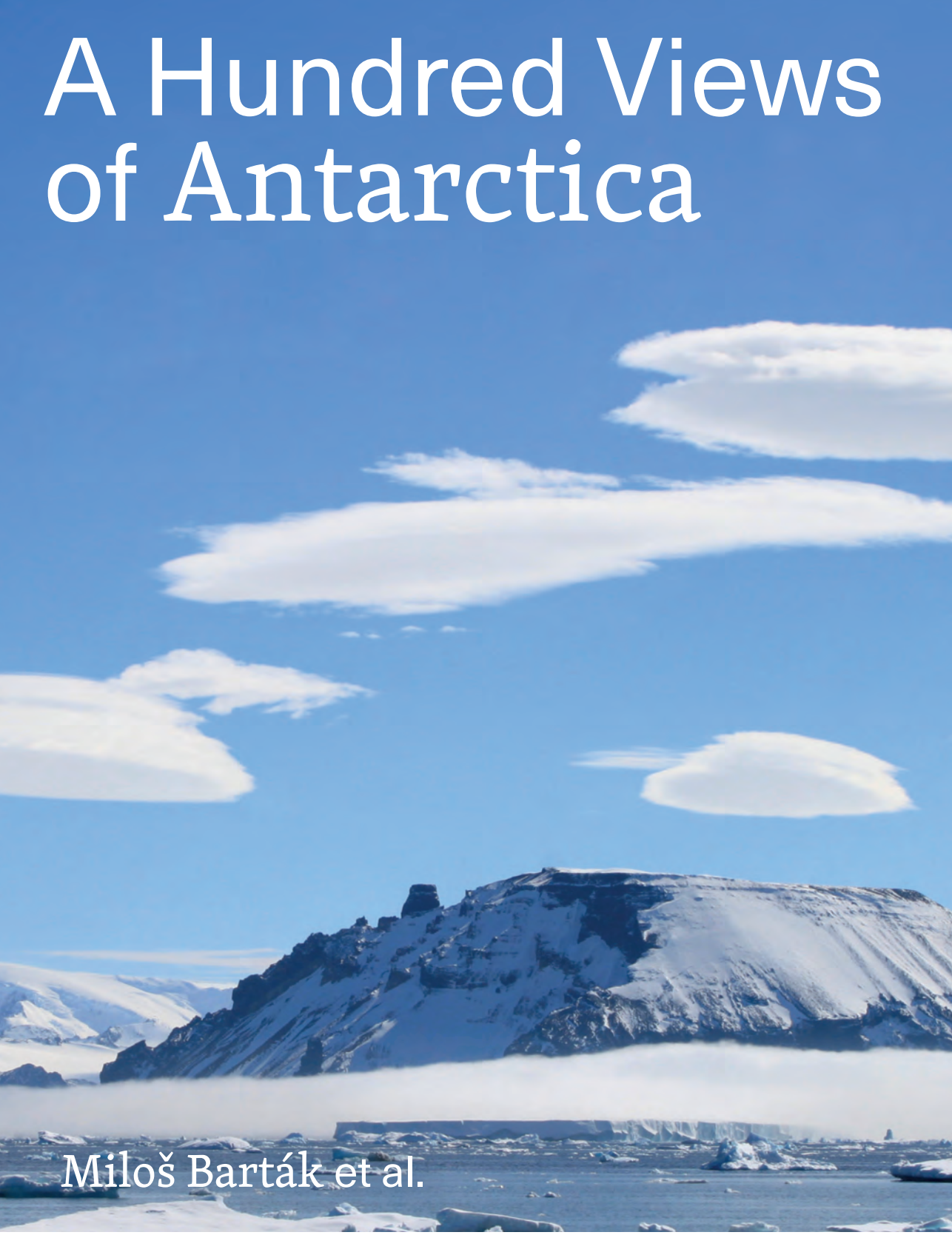
A Hundred Views of Antarctica



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Introduction

Antarctica is Earth's sixth continent. It is situated in the southern hemisphere from roughly the 63rd parallel to the South Pole. It is often called the white continent due to its permanent ice cover and has been a subject of interest for experts and the general public since the first great expeditions by explorers like Amundsen and Scott. Most people's knowledge of Antarctica is made up of an often colourful patchwork of classroom learning and impressions conveyed by popular-science books and geographic films. In recent times, this has been supplemented by information available on the internet. Although in this age of electronic media and the global information network 'everything is on the Web', there are still many interesting things that are not common knowledge, and for the average person with an interest in Antarctica some information is difficult to access. That is why we, as a group of authors with extensive experience of research into Antarctica, have put together a popular-science book for the curious reader entitled A Hundred Views of Antarctica. We hope that as well as being engaging and entertaining, it will also be a source of useful technical information. In addition to interesting facts about the continent, we have also incorporated a short history of the 'Czech presence' in Antarctic, particularly information about the construction and operation of the *J. G. Mendel* Czech Antarctic station on James Ross Island. The book has been conceived as a hundred topics, often in the form of questions and answers covering various aspects of science and knowledge about Antarctica. However, those hundred entries are by no means exhaustive, because research in this area is truly multifaceted and diverse and Antarctica itself so inspiring that we were forced to select just a small fraction of what ought to be in the book but wouldn't fit in. The individual entries are accompanied by pictures with the same numbering, but we have also added a little 'something extra' in the form of illustrative photographs. Some of them are directly related to the text, while others have been included because they complement the numbered photographs and document the sheer variety of the Antarctic continent. The illustrative photographs are not numbered.

In terms of structure, the book is divided into several parts. The first part deals with the Antarctic continent and the history of exploration. The next part focuses on geology, with particular attention being paid to glaciers. This is followed by a section devoted to climatological issues focusing on the impact of global warming in Antarctica. The biological

← The fissured surface of a glacier on Half Moon Island, part of the South Shetland Islands, Antarctica. Photo: A. Meneghini (Reuters).

Sunrise over Vega Island. In the foreground, sea ice at the border between Herbert Sound and the Prince Gustav Channel. The low cloud cover in the foreground is the result of the condensation of moisture in the air during the short night (approximately 4 hours in the summer) near the coastline of James Ross Island. Photo: P. Váczi.

sciences are represented by the two following parts: Animals That Live in the Antarctic and A World of Extremophilic Plants and Microorganisms. The final section of the book, entitled Czech Antarctic Expeditions, is dedicated to the Czech Antarctic Research Programme and interesting facts about the J. G. Mendel station and James Ross Island, where it is located.

Miloš Barták, on behalf of the team of authors

Part One

The Continent of Antarctica

1. The exploration of Antarctica
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1. The exploration of Antarctica

The ancient Greeks had hypothesized about the existence of a continent in the area around the South Pole, because they believed that there had to be a rotational balance on Earth between the countries of the northern hemisphere known at that time and the hitherto unexplored southern hemisphere. They named this hypothetical country *Anti-Arctos* (i.e. lying opposite the Arctic). Over the following millennia, it became a mythical undiscovered continent which was marked on maps as *Terra Australis Nondum Cognita*, i.e. 'the unknown southern land'. The exploration of Antarctica began in the late 18th century during expeditions by both anonymous whalers and famous seafarers, and it can be divided into three main periods. The first one (1770–1830) encompasses the voyage of Captain James Cook, who didn't sight Antarctica but did reach a latitude of 71°10' South and indicated that there might be land, albeit still inaccessible at that time, located to the south. During the same period, Captain F. F. Bellingshausen sailed around Antarctica. In the second period (1831–1894) a very significant expedition was led by Captain James Clark Ross. He discovered the Ross Ice Shelf, Ross Island and the region called Victoria Land. In the third period, known as the 'Heroic Age' (1895–1915), famous expeditions took place, including a Belgian one (led by A. de Gerlache aboard the Belgica) and a British one (led by the Norwegian polar explorer C. Borchgrevink). Later, in the early 20th century, R. F. Scott, J. B. Charcot, E. Shackleton and R. Amundsen followed in their footsteps with expeditions of their own.

View of Red Island, located in the middle of the Prince Gustav Channel. During the Antarctic summer, the channel is usually unfrozen, covered only with ice floes, floating remnants of sea ice. Photo: M. Barták.

2. The first whaling stations: Grytviken in the South Georgia archipelago

It is very difficult for a landlubber to imagine what being a whaler in the polar regions entailed. As well as profit, the exploration of Antarctica also played an important role in whaling expeditions. In 1902 the Norwegian captain C. A. Larsen discovered the site of an old base on the coast of South Georgia (a sub-Antarctic archipelago), and in 1904 he established his own whaling station, named Grytviken, there. For the next 60 years, intensive whale fishing was carried out in sub-Antarctic and Antarctic waters from this place. In Grytviken whale blubber was acquired on an industrial scale, with the other parts of the whale carcasses usually being left unprocessed. That is why in many places in Antarctica today we can still find 'whale graveyards' full of skeletons scattered along the coast. Intensive fishing resulted in the decimation of whale populations. Together with growing international efforts to protect whales, this led to the cessation of whaling activities in Grytviken. It is now home to a small settlement with a museum. It was also in Grytviken that one of the discoverers of Antarctica, Ernest Shackleton, died in January 1922.

3. The race to the South Pole (the difference between success and failure being a matter of five weeks)

One of the 'big stories' associated with the exploration of Antarctica is the rivalry between the British expedition (led by R. F. Scott) and the Norwegian expedition (led by Roald Amundsen) in their attempts to conquer the South Pole between 1911–1912. A great effort was made to reach the Pole first, and both expeditions proceeded from various points along the coast into the interior of Antarctica (Ross Island, Cape Evans, and Whales Bay, Ross Sea). Amundsen and several members of his crew were the first to set foot on the Pole on 14 December 1911. Scott reached the South Pole less than five weeks later (15 January 1912) and was extremely disappointed to find he was 'in second place'. What's more, on the journey back to the coast, Scott's expedition was overtaken by very poor weather and all five members of the group froze to death just 11 miles (approximately 20 km) from a supply point, a camp known as One Ton Depot. Amundsen continued to work as a polar researcher after returning to Norway and died on 18 June 1926 during a rescue operation to the North Pole for the Nobile expedition. His death is linked to another 'big story' from the exploration of the polar regions: the wreck of the airship Italia and the survival of its stranded crew in the 'Red Tent'. There is also a 'Czech story' here, thanks to F. Běhounek, a specialist in cosmic rays, who was rescued by the crew of the icebreaker Krasin after spending several weeks marooned on an ice floe.

1. Bertius' map of the southern polar hemisphere, published in 1616. The map represents the ideas held about the southern continent (Magallanica sive Terra Australis Incognita) at that time and incorporates both the actual coastline, which had already been identified by seafarers, and unfounded ideas and legends about the southern continent. Coloured copper engraving.

2. The whaling settlement of Grytviken played a significant role in the exploration of Antarctica. The simple harbour and the buildings whalers used to process the whales they had caught have been preserved to this day. It currently serves as a destination for tourist trips thanks to the well-known South Georgia Museum, which is located in the settlement, and the grave of Ernest Shackleton. Situated near the settlement is the *King Edward Point* research station, which is operated by the British Antarctic Survey.
Photo: J. Coleman (see also Online Resources).

The Continent of Antarctica

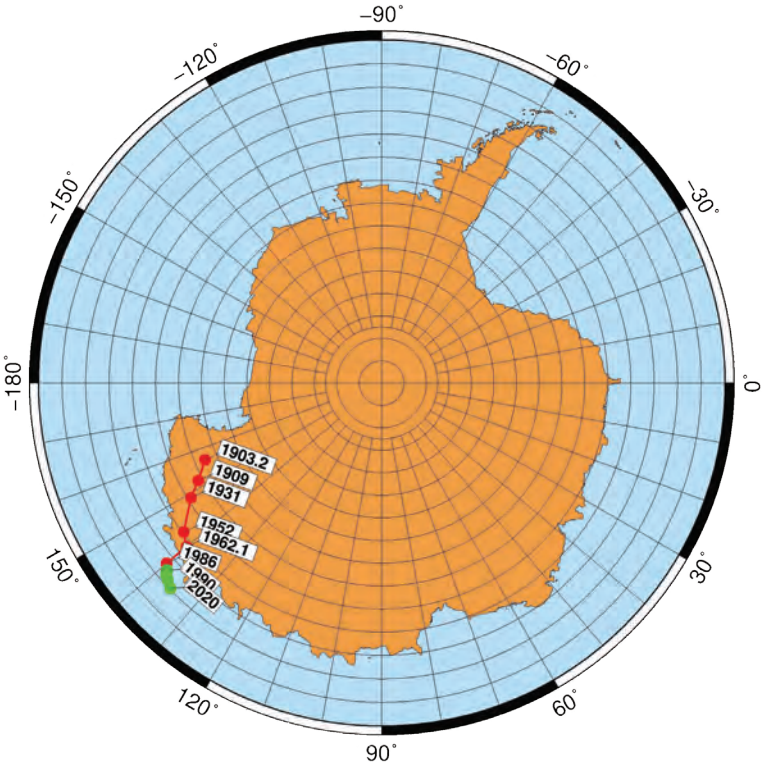
3a. Period photographs of two men whose lives were intimately bound up with the exploration of Antarctica and the famous ‘race to the South Pole’. Top left: Roald Amundsen; top right: Robert Falcon Scott. Bottom: photograph of a dog sled team used during the first expeditions to Antarctica. Source: see Online Resources.

3b. There are currently two different designations for the point that defines the South Pole. The first is the Ceremonial South Pole, which is represented by a silver ball mounted on a red-and-white-striped wooden stick sunk into the snow near the *Amundsen–Scott* station. This point is surrounded by flagpoles with the flags of the 12 countries which were founding members of the Antarctic Treaty in 1959. Most visitors to the South Pole, be they scientists or tourists, have their photo taken by this ball, which acts as a convex mirror thanks to its polished surface. The actual (Geographical) South Pole is much less ostentatious, marked by a metal stake with a round top (see photo). The location of this stake changes every year due to the shifting position of the Geographical South Pole. To be more precise, each year a new stake is made and placed at the current location of the South Pole. Pictured here is the stake installed in 2021. Photo: P. Horký.

4. Do you know where the South Magnetic Pole is located?

Thanks to the race between Amundsen and Scott and to knowledge acquired from textbooks, almost everyone has a general awareness of the history of the discovery of the South Pole. However, not many people know where the South Magnetic Pole is, or who was first to set foot on it and when. This happened on 16 January 1909, when a group led by Professor Edgeworth David, Douglas Mawson and Dr Alistair Mackay made it to this point at 72°25′ South and 115°16′ East. This happened as part of the famous expedition led by Ernest Shackleton, who was attempting to reach the South Pole. He came close to succeeding. He made it as far as 88°23′ S, i.e. a distance of 180.6 km from the South Pole. However, he did not complete his trek to the Pole due to concerns about being able to return safely. If things had been just a little different, it might have been Shackleton and not Amundsen who we learned about as the first man to conquer the Pole.

4a. The shift in the South Magnetic Pole recorded over the twentieth century. The Pole is currently located outside the Antarctic continent. Source: see Online Resources.



4b. Historical image of the Australian polar explorers who set foot on the South Magnetic Pole on 16 January 1909. From left to right: A. F. Mackay, T. W. Edgeworth David and D. Mawson. Douglas Mawson gave his name to the Australian Antarctic station *Mawson*, which was established in 1954 and is the longest continuously operating station located in continental Antarctica south of the Antarctic Circle. *Mawson* station is situated in Holme Bay in the region of Mac. Robertson Land. Source: Australian Academy of Science.

5. How Czechs discovered Antarctica: from Václav Vojtěch to Jiří (George) Dufek

The first Czech to set foot on Antarctica was Dr Václav Vojtěch, born in the town of Skřivany in eastern Bohemia, a ship's stoker and a researcher 'in his spare time'. He did so on 27 January 1929.

In the 1950s and 1960s, a number of Czechs went to Antarctica as part of Soviet expeditions, including Antonín Mrkos, Oldřich Kostka and Stanislav Bártl, to name just a few of them. Josef Sekyra took part in the American *Deep Freeze* expedition. After their return, these polar explorers wrote engaging articles and books about Antarctica. The meteorologist Oldřich Kostka died there in 1960 when a fire broke out in part of the *Mirny* station.

One particularly interesting figure is George Dufek, born in the USA to Czech parents. The young Dufek first set eyes on Antarctica as a member of Byrd's 1939 expedition. After World War II, he took part in a large-scale exploratory Antarctic expedition called Operation *Highjump*. However, he went down in history for his famous landing on the South Pole on 31 October 1956 (twin-engine aircraft R4D-5 Skytrain). George Dufek attained the rank of Rear Admiral in the US Army and retired in 1959 after joining another Antarctic expedition, *Deep Freeze*.

5. Picture of Edmund Hillary, the first man to conquer Mt Everest in the Himalayas (on the left), and George Dufek (on the right), a prominent representative of the American Antarctic programme in the 1950s and 1960s. George Dufek was an American of Czech descent, born in the USA to parents from Prague. Source: see Online Resources.

6. Drifting continents, or How Antarctica split off from Gondwana

The world's continents are made up of tectonic plates which move over the surface of the planet slowly (on the scale of geological time). On Earth, the breakup of the supercontinent of Pangea produced a continent called Gondwana which approximately 180 million years ago began to break down further into the individual future continents, travelling into the positions we find them in today. The first to split off were Africa (178 to 132 million years ago) and South America (130 million years ago). They were followed by a large section of Antarctica (what is known as East Antarctica, 122 million years ago). The last to split off approximately 35 million years ago was the part of Antarctica we now know as the Antarctic Peninsula. This is a strip of land roughly 1,100 km long jutting out from the Antarctic continent towards South America.

6. Illustration of the division of the protocontinent into a northern (Laurasia) and southern part (Gondwana). The parts that make up today's Antarctic continent gradually split off from the southern part. Source: see Online Resources.

A small section of one-year sea ice (a floe just a few metres in size) which has broken off and become stranded in shallow waters at low tide in an inclined position. At high tide the floe is 'released' again and floats freely onward, carried by sea currents. Photo: Archive of Czech Antarctic Research Programme, MU.

7. Antarctica is one of the places on Earth where the largest number of icebergs can be observed. These floating chunks of ice, which are formed when ice breaks off from an ice shelf, often reach enormous dimensions, as is clear from a comparison of the size of the research vessel Roger Revelle and the tabular iceberg in whose vicinity the ship is operating. The ship is implementing a research programme from the University of California and the University of North Carolina (USA) focusing on the impact of climate change on Antarctica's icebergs. Photo: C. Martin.

7. Antarctic 'records'

Antarctica covers an area of over 14 million km^2 and is relatively untouched by human activity. It is also the least populated continent. The numbers of people who make up the expedition crews of permanent research stations in Antarctica are in the hundreds or low thousands, and on top of that these crews do not constitute a settled population. Antarctica is also the coldest continent, since it is one of the few places on Earth where the average annual temperature, with the exception of a few coastal areas, does not rise above freezing. Recently, with the help of modern technology, the record continental temperature was measured in central Antarctica (for more information, see entry no. 30).

8. Are there active volcanoes in Antarctica?

There are several active volcanoes in Antarctica. The best known is undoubtedly Mt Erebus on Ross Island. This stratovolcano has been continuously active since 1972 and has two lava lakes located at the bottom

8. The volcano Mt Erebus, an aerial view of the area with the volcano's summit craters as seen from the east:
A = active main crater,
B = side crater and
C = septum separating the two craters where the tracking device monitoring the centre of the crater is located. Mt Erebus is the second highest volcano in Antarctica (after Mt Sidley). It is situated on Ross Island near the coast of Victoria Land.
Photo: C. Oppenheimer.

of its caldera, thus representing by far the most southerly active volcano on Earth. The volcano was last active in October 2019 (massive eruptions of lava lake gas). In addition to Mt Erebus, there are two other, dormant volcanoes on Ross Island: Mt Terror and Mt Bird. The two larger volcanoes were named by James Clark Ross in January 1841 after the two ships used in his expedition, which were called Erebus and Terror. Another active Antarctic volcano is Deception Island in the South Shetland Islands. The whole island is actually the giant, sea-flooded caldera (Port Foster) of a still-active volcano which erupted repeatedly in the 1960s, destroying a Chilean research station. The volcanic activity on Deception Island also has its advantages. At some points on the coast, warm vents heat up the sea water so much that it is possible to bathe in the water as if at a thermal spa. However, you have to be careful not to scald yourself on the very hot water near the vent. Mt Melbourne should also be counted among Antarctica's active stratovolcanoes. Fumarolic activity from this volcano was documented in 1972 and 1983. Similarly, volcanic fumarolic activity was detected in the late 20th century from several volcanic cones in the Seal Nunataks group off the east coast of the Antarctic Peninsula. However, there are also many other volcanoes in Antarctica that were active several thousand years ago. They include Mt Siple, Mt Sidley, Paulet Island, and the Marina and Elba cones on James Ross Island.

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