

A map of the world drawn in 1570 shows 'Terra Australis Nondum Cognita' (the unknown south land).



Expeditions to Antarctica 1770–1830 and 1910–1913

Resource D2

Voyages to Antarctica 1770–1830

1772–75

Cook (Britain)
 Resolution and Adventure

1819
Smith (Britain)
 Williams

1819–20

Bransfield (Britain)
 Williams

1819–21
Bellingshausen (Russia)
 Vostok and Mirnyi

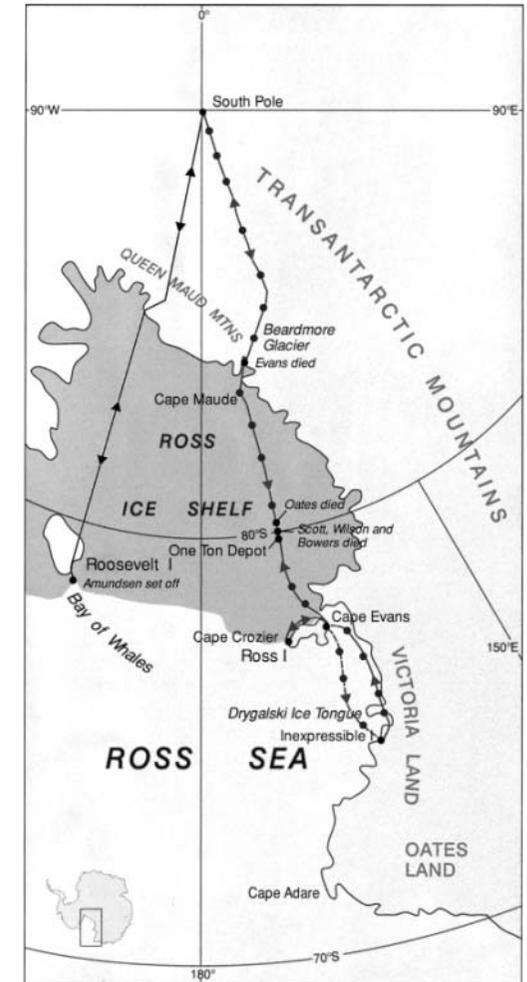
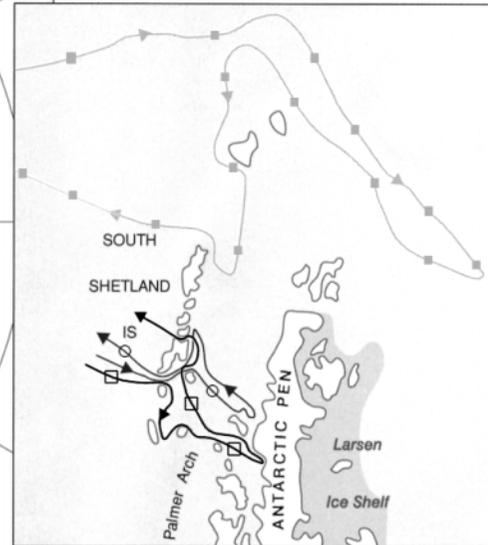
1820–21

Palmer (United States)
 Hero

1820–21
Davis (United States)
 Cecilia

1822–24
Weddell (Britain)
 Jane and Beaufoy

1830–32
Biscoe (Britain)
 Tula and Lively



South Pole expeditions 1910–13

1910–12
Amundsen (Norway)

1910–13
Scott (Britain)

sledge
 ship



Major voyages to Antarctica during the 19th century

Resource D3

Voyage leader	Date	Nationality	Ships	Most southerly latitude reached	Achievements
Bellingshausen	1819–21	Russian	<i>Vostok</i> and <i>Mirnyi</i>	69°53'S	Circumnavigated Antarctica. Discovered Peter Iøya and Alexander Island. Charted the coast round South Georgia, the South Shetland Islands and the South Sandwich Islands. Made the earliest sighting of the Antarctic continent.
Dumont d'Urville	1837–40	French	<i>Astrolabe</i> and <i>Zeelée</i>	66°S	Discovered Terre Adélie in 1840. The expedition made extensive natural history collections.
Wilkes	1838–42	United States	<i>Vincennes</i> and 6 other vessels		Followed the edge of the East Antarctic pack ice for 2400 km, confirming the existence of the Antarctic continent.
Ross	1839–43	British	<i>Erebus</i> and <i>Terror</i>	78°17'S	Discovered the Transantarctic Mountains, Ross Ice Shelf, Ross Island and the volcanoes Erebus and Terror. The expedition made comprehensive magnetic measurements and natural history collections.
De Gerlache	1897–99	Belgian	<i>Belgica</i>		First ship to winter south of the Antarctic Circle, when it was trapped in pack ice in the Bellingshausen Sea.
Borchgrevink	1898–1900	British	<i>Southern Cross</i>		First expedition to winter on the Antarctic mainland. Sledged to 78°50'S. First expedition to use dog teams in the Antarctic. Also, the first expedition to overwinter on land at Cape Adare on Ross Island.



The attainment of the South Pole

In 1910 the South Pole had still not been reached despite two attempts. Captain Robert Scott and two companions had got to 82°16'S on 30 December 1903 and Ernest Shackleton with three companions had reached 88°23'S on 9 January 1909. Scott decided to make a further attempt and set out on his second Antarctic expedition – the British Antarctic Expedition – in 1910. This had the attainment of the South Pole as a major and public objective.

At the same time the Norwegian explorer Roald Amundsen was planning an expedition to the North Pole. When others claimed to have reached the North Pole in 1908 and 1909, he covertly changed his goal to the South Pole. In 1910, his ship *Fram* sailed from Norway under his command and reached the Ross Ice



Roald Amundsen

Shelf at about the same time as Scott's expedition arrived at Ross Island. During the voyage south Amundsen sent Scott a telegram announcing the change of plans.

Amundsen's camp on the Ross Ice Shelf at the Bay of Whales was about 100 km closer to the South Pole than Scott's base at Cape Evans on Ross Island. Amundsen's method of transport was dog sledge and, with loads becoming lighter as supplies were consumed, the spare dogs became food for others. Amundsen made an early start for the South Pole but had to retreat when very severe weather struck. His second attempt crossed the Ross Ice Shelf before ascending the difficult Axel Heiberg Glacier. From here there was a 400 km traverse to the South Pole over the polar plateau at an average altitude of 200 m. Amundsen and four companions (Bjaaland, Hanssen,

Hassel, and Wisting) reached the South Pole on 14 December 1911. At the pole Amundsen left two letters, one for King Haakon of Norway and the other for Scott; this provided an insurance of his attainment should he fail to return. Amundsen left supply depots and markers along his route adequate to mark the return journey, but his mapping was inadequate for his actual route to be determined to this day. He returned to camp with 11 dogs having started with over 50. *Fram* arrived back at the Bay of Whales shortly after Amundsen's return. The expedition reached Tasmania on 7 March 1912 from where the news of his triumph was released to the outside world.

Scott's expedition, aboard *Terra Nova*, was different in several respects to Amundsen's. It was primarily a scientific expedition which had the attainment of the South Pole as one of several objectives. Transport was provided by dogs, ponies, motorised sledges and man-hauling. Supply depots along the way were laid by preparatory parties, and the South Pole party set out using a relay system to lay other depots increasingly further south. The route across the ice shelf was shorter than Amundsen's after which the polar plateau was reached by climbing the crevassed Beardmore Glacier. Dogs, ponies, and motorised sledges proved inadequate and so the party continued by man-hauling the sledges. From the top of the glacier the traverse to the South Pole was about 540 km. Scott and four companions (Wilson, Bowers, Oates, and Evans) arrived at the South Pole on 17 January 1912, 33 days after Amundsen's party. They calculated their position and thus confirmed the Norwegian results; there was no question that the South Pole had been attained. Maps, sketches, biological and geological collections were all made during the polar trek so that Scott's expedition travelled more slowly than Amundsen's. The accurate records made by Scott formed the basis of many later maps.

The return from the pole became increasingly difficult for Scott's party. The disappointment of not 'having the



Captain Robert Scott

reward of priority' as Scott wrote, must have devastated their morale. An accident later caused the death of Evans. Then Oates, so frost-bitten that he was seriously delaying his companions, sacrificed himself by walking out into a blizzard in the hope it would improve the others' chances. The last three had crossed most of the Ross Ice Shelf before a blizzard confined them to their tent. They had only a small amount of food and fuel remaining and were frozen to death, on or about 29 April 1912, before the blizzard finished. This occurred just 18 km from a large depot which might have saved them. A search party found the bodies the next spring when light was available for travelling again. Maps, geological specimens, photographs, diaries, the letter to the King of Norway, and other items were retrieved from the last camp. There were several causes of the tragedy: insufficient food and fuel, incipient scurvy, and unexpectedly severe weather were among them. After a second winter in Antarctica the expedition reached New Zealand on 10 February 1913 from where the news of the tragedy was released.



The rise and fall of the South Georgia whaling industry — Resource D5

In 1902, the Norwegian C.A. Larsen discovered an ideal site for a whaling station at Grytviken, South Georgia. He returned in November 1904 and, backed by Argentine capital, established the first Antarctic whaling station. It was to become the centre of a multi-million pound industry. The Governor of the Falkland Islands Dependencies responded quickly to this and in 1906 issued an ordinance to regulate the whale fishery, in effect the first legal conservation measure.

The early industry was very wasteful. Only the blubber oil was extracted and the remains of the carcass were discarded. This led the government to require whaling companies to make full use of the carcass if they wished to obtain a licence. It also required that whale catches should be recorded by the companies and charts of whale distribution prepared. The government later required that part of the whale receipts should be used to pay for scientific investigations of whale stocks. This funded the Discovery Investigations which yielded important data on marine biology in the Southern Ocean. They began in 1925 and continued until 1939.



The tail fluke of a humpback whale



Flensing whales at Grytviken, South Georgia

As the whaling industry rapidly increased, it began to deplete the whale stocks and systematically moved from one species to another as numbers were exhausted. Eventually the stocks were so reduced that Grytviken closed in 1965 when the industry in South Georgia finished. Although the rise of the environmental movement in the 1970s contributed to tougher international controls on whaling, the whaling industry in the Southern Ocean collapsed because of the almost total exhaustion of the whale stocks. Whaling was an exploitative primary industry that drove itself into extinction through greed and inadequate political control.

The closed whaling station at Grytviken still survives today, and is an excellent example of how the complex whaling industry worked.

At South Georgia, whale-catchers brought their catches into Cumberland Bay from where whales were hauled ashore at Grytviken by winch. Once ashore they were flensed with large knives which separated the blubber. This was then stripped from the carcass by smaller winches. The blubber was minced before being pressure-cooked in the Cookery. This caused oil to separate. The oil

was then sent to the Separator House where it was refined further using a centrifugal process. The remaining liquid, or 'graks', was also sent for separation. The oil was eventually pumped into tanks. About 25 fin whales could be processed in 24 hours yielding on average 160 tonnes of oil.



Grytviken whaling station as it is today

After 'flensing', the meat, tongue and guts of the whale were also cut up and dropped into rotating cookers in the Meat Loft. The head and spine were dragged to the Bone Loft and also cooked. The remains of meat and bone, after oil extraction, were dried and powdered, to be sold as fertiliser or animal feed. The powder was known as 'guano'. The liquid from the meat-meal plant was taken to the Meat Extract Plant where it was treated to precipitate proteins. This was concentrated into a thick, flavoursome black extract used in canned and dried soups.

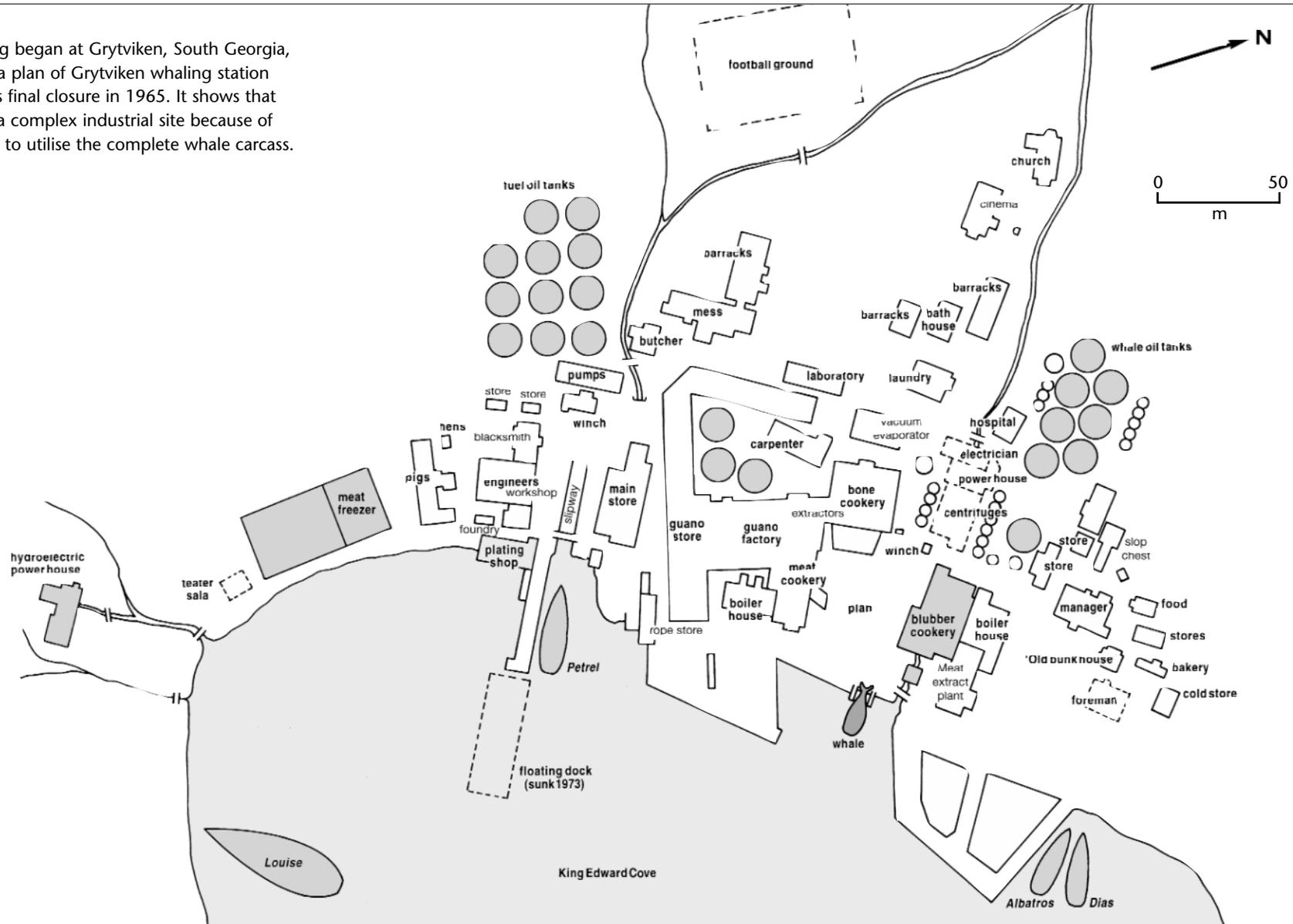
In all, Grytviken processed over 54,000 whales from 1904 to 1965 yielding 458,000 tonnes of oil worth some £25 million. Additionally, 200,000 tonnes of meat and bone meal were produced. Whilst the station operated it was a highly profitable business.



Grytviken whaling station

Resource D6

Antarctic whaling began at Grytviken, South Georgia, in 1904. This is a plan of Grytviken whaling station at the time of its final closure in 1965. It shows that the station was a complex industrial site because of the requirement to utilise the complete whale carcass.





It was the geographers of ancient Greece who first suggested that there was a large landmass around the South Pole. They believed that such a continent was needed to balance the known land in the northern hemisphere. They named it *Anti-Arkitos* meaning the opposite of the Arctic. In the centuries that followed the continent took on an almost mythical status and was often described on world maps as *Terra Australis Nondum Cognita* or the 'unknown south land'. This worksheet describes the discovery of Antarctica, its early exploitation by sealers and whalers and the establishment of the British Antarctic Survey.

Task 1 Look at Resource D1 which shows a map drawn in 1570. Study the map and comment on the size of Antarctica as depicted in comparison to the known size today. Why do you think it was drawn in this way?

The early voyages (1770–1830)

The first recorded voyages south of the Antarctic Circle were undertaken by Captain James Cook between 1772 and 1775. He reached as far south as 71°10'S without sighting the continent and was pessimistic about the chances of exploring further south. However, he discovered a wealth of marine life, particularly seals and whales, that aroused the interest of sealers and whalers. These commercial hunters discovered, exploited and exhausted seal and whale stocks, so were in constant search of new populations. Much of the exploration until the 1850s was undertaken by the masters of sealing vessels who made significant contributions to the knowledge of Antarctica, although many discoveries were probably not reported because of commercial secrecy. By 1830, the whalebone from a single large whale fetched £2500 which was more than enough to pay for a vessel to go from the UK to Antarctica and back.



Captain James Cook's vessel HMS *Resolution*

Task 2 Study the map shown in Resource D2 of voyages between 1770–1830 and identify the voyages that came closest to the Antarctic continent. Comment on the nationalities of the expeditions.

Later voyages (1831–94)

During the later part of the 19th century a series of government supported voyages took place. These were motivated by a combination of national interests in claiming new territory, scientific research and commercial profit. The British Antarctic Expedition (1840–43) led by Captain James Clark Ross, for example, explored the Ross Sea, discovering the Ross Ice Shelf, Ross Island and Victoria Land and carried out a detailed magnetic survey.

The 'heroic age' (1895–1915)

In 1895, the 'heroic age' of Antarctic discovery was launched by the International Geographical Congress in London with the resolution that 'the exploration of the Antarctic region is the greatest piece of geographical exploration still to be undertaken'. The enormous international interest that followed in the next twenty years led to a remarkable increase in geographical discovery and scientific knowledge.

A feature of many of these expeditions was their international membership. For example, the first expedition to winter in the sea ice south of the Antarctic Circle was that of the Belgian Adrien de Gerlache in the vessel *Belgica* in 1898. Among the ship's complement were the Norwegian Amundsen and the Pole Arctowski, who were both later to become famous polar explorers. The first expedition to winter on land was the British Antarctic Expedition in 1899 at Cape Adare in Victoria Land. This expedition was led by the Norwegian Borchgrevink.

Task 3 Resource D3 shows a table summarising some of the key voyages of the 19th century to Antarctica and some of the major discoveries made. Using the information in Resource D3, draw up a table showing the most southerly latitude reached by some of these expeditions. What factors enabled these expeditions to get closer and closer to the South Pole?

Between 1901–15, the scene was dominated by the expeditions of Scott, Charcot, Shackleton and Amundsen. By then the attainment of the South Pole had gripped the popular imagination and national aspirations. Science was also very important and most of the expeditions carried out major research programmes. Other factors that played a part in these heroic expeditions were personal ambition and patriotism.

Discovery of Antarctica

The outcomes of these expeditions were both triumphant and tragic. They culminated in Amundsen reaching the South Pole first on 14 December 1911.

Task 4 Read Resource D4 which describes Scott's and Amundsen's expeditions between 1910–13. Summarise in a set of bullet points the reasons why you believe that Amundsen triumphed while Scott's expedition ended in tragedy.

Task 5 Using the information in Resource D4, the map showing the route of Amundsen's sledging journey (Resource D2) and your imagination, create a board game entitled 'In Amundsen's footsteps'. You will find it useful to look at the other worksheets in the pack such as Living and Working, the Antarctic Climate and the Nature of Antarctica. You will find it easier to work in small groups of five for this exercise.

You are required to:

- draw up a board of the terrain crossed by Amundsen's party that allows counters to progress in steps from the edge of the Ross Ice Shelf to the South Pole.
- provide assets such as stores, dogs or expertise that the party can choose from at the start, but which can be lost en route when hazards are met.
- create a pack of 'success cards' that help the party on its way (e.g. '24 hours uninterrupted sunshine – advance one square' or 'gentle gradient enables increased progress – double your next score').
- create a set of 'hazard cards' (e.g. 'all day blizzard – miss a go' or 'route blocked by crevasse – retreat 4 squares').
- devise a set of rules.

When you have finished, play the game and see how practicable it is to play.

Compare your game with others created by the class.

Antarctic whaling

It was the Norwegian Larsen who first saw the potential in Antarctica for a highly profitable whaling industry. In 1904, he established the first shore-based whaling station at Grytviken on South Georgia. It was the start of a major international multi-million pound industry in the Southern Ocean. Whaling developed very rapidly. At South Georgia alone, whaling grew from one shore station and a single catcher taking 195 whales in 1904 to six shore stations, 21 floating factories and 62 catchers taking 10,670 whales in 1912/13.

Task 6 Resource D5 describes the rise and fall of the whaling industry at South Georgia. Read Resource D5, and with reference to the map of Grytviken shown in Resource D6, create a flow diagram that summarises all the components of the South Georgia whaling industry in 1965.

The spread of whaling to the South Orkney Islands and the South Shetland Islands prompted the British government to include them in a territorial claim to Antarctica, established as the Falkland Island Dependencies in 1908.

Between the wars

There was little exploration of Antarctica between the two world wars, the exceptions being the American Byrd's expeditions in the 1920s, the British-Australian-New Zealand Expedition (1929–31) and the British Graham Land Expedition (1934–37). There were also the Discovery Investigations (1925–39) which carried out marine biology in the Southern Ocean and were financed through a tax on whale oil production at South Georgia (see Worksheet 4 on Science in Antarctica).

The Second World War to the present

In 1943, the British government organised a top-secret naval operation – code named 'Tabarin' – to Antarctica. It had the task of establishing three small bases in the Antarctic Peninsula area. Its aims were to provide meteor-



A whale catcher at Grytviken, South Georgia

ological and reconnaissance information that could be useful in combatting the German Navy, provide a strategic presence to strengthen the British territorial claim of 1908 and carry out a programme of scientific research. In 1945, 'Operation Tabarin' was renamed the Falkland Islands Dependency Survey (FIDS). In 1962, FIDS became the British Antarctic Survey (BAS), which is now one of the world's best Antarctic research institutes.

Discoveries and challenges in the 21st century

There still remains much to be discovered in Antarctica. Modern geophysical and remote sensing systems using satellite technology mean that once inaccessible regions of the Antarctic ice sheet and the Southern Ocean can now be probed. In 1996, Russian and British scientists announced that they had found a huge subglacial lake near the Russian Vostok station using radar and satellite altimetry measurements. The lake is 4 km under the ice sheet, is 200 km long, 500 m deep and covers an area of 10,000 km². The lake may be a unique habitat for ancient microbial life, as it has been isolated from external influences for over 200,000 years. The challenge at Vostok is to devise a way of sampling the lake which will not contaminate it.