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TENSION ENVELOPE CORP

by Arthur Scholes

FOURTEEN MEN
The Story of the Australian Expedition
to Heard Island

(*Official U.S. Navy photograph*)

A submarine passing through the Antarctic pack-ice

SEVENTH CONTINENT

Saga of Australasian Exploration in Antarctica 1895–1950

ARTHUR SCHOLES

George Allen & Unwin Ltd
RUSKIN HOUSE MUSEUM STREET LONDON

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TO THE EXPLORERS OF ANTARCTICA
WHO CAME FROM AUSTRALIA AND NEW ZEALAND

Antarctic Explorers from Australasia

JOHN HENRY BULL
CARTENS EGEBURG BORCHGREVINCK
LOUIS CHARLES BERNACCHI
TANNAT WILLIAM EDGWORTH DAVID
RAYMOND EDWARD PRIESTLEY
FRANK DEBENHAM
THOMAS GRIFFITH TAYLOR
JOHN KING DAVIS
FRANK HURLEY
FRANK ARTHUR WORSLEY
GEORGE HUBERT WILKINS
DOUGLAS MAWSON
JOHN RIDDOCK RYMILL
STUART CAIRD CAMPBELL

FOREWORD

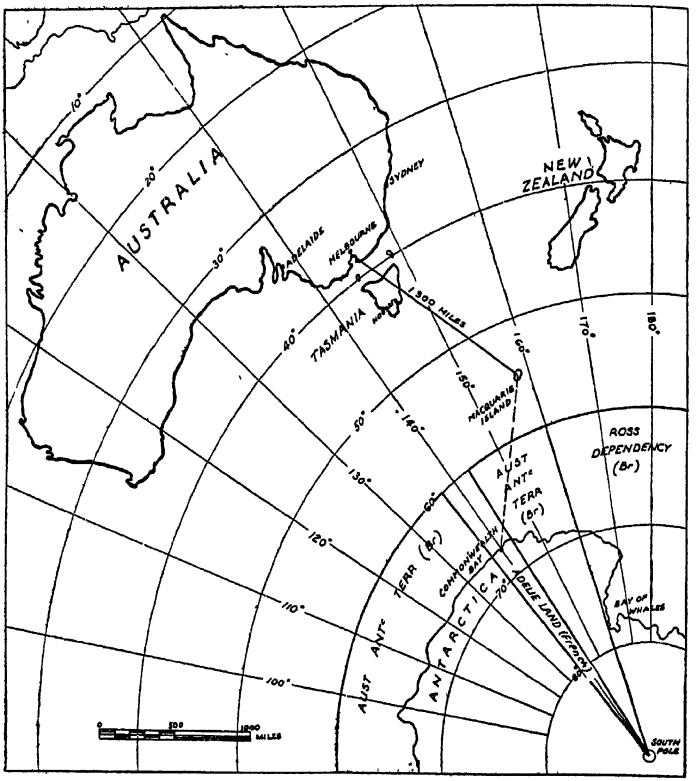
This book is a record of the scientists and explorers from Australasia who forged the path for the ultimate conquest of Antarctica. Some were native born sons; others temporary residents or citizens by adoption; when destiny called them to the seventh continent.

The Antarctic story is an international one in which men of different nations took part. The aim here, for the first time, has been to tell the story objectively from the Australasian angle.

This aim must limit the scope of the work and, therefore, scant mention has been made of the more famous Antarctic expeditions about which many fine books have been written.

I am indebted to the News and Information Bureau, Department of the Interior, Canberra, for the use of official photos taken during the operations of the Australian National Antarctic Research Expedition.

ARTHUR SCHOLES



Key to the General Map of Australia's Antarctic Territories

CONTENTS

ILLUSTRATIONS

MAPS

CHAPTER I

Continent of Mystery

It is little more than a century and a quarter since Antarctica's natural defences were penetrated for the first time. Man sailed through fogs, storms, snows and ice-filled seas to gaze at last on the frozen coastline of whose existence geographers had romanced and speculated for centuries.

Actually, to get back to the original theory of an Antarctic continent you must go right back to the Greeks, for it was they who first postulated the idea of a spherical globe, at a time when the western world was confined to the Mediterranean regions. Legend says a Polynesian native was the first man to sight the Antarctic ice, for shortly after the advent of the Christian era the Central Pacific natives had reached the islands of the South Seas. It seems inconceivable to us to-day that the brown-skinned navigators could reach New Zealand, which they knew as the 'Long White Cloud'. Even with radar, echo-sounders, radio time signals and chronometers, navigation in Antarctic waters is still a hazardous business. Possibly it was their knowledge of the stars or the prevailing winds which helped the venturesome Polynesians on the southward journey.

But how far south did they sail? Did these men in their hundred-feet-long canoes actually glimpse the glittering white flat-topped monarchs of the Antarctic? Did they penetrate to the fringe of the pack-ice, and then turn homewards? Certainly, they could not have seen ice until they reached the southernmost part of New Zealand.

Meanwhile, in Europe, maps were drawn that showed an open sea surrounding a circular continent. Some cartographers even stretched the Antarctic regions as far north as the Equator! Others declared you could sail right down to the South Pole itself, and this theory was only abandoned as late as 1840!

For hundreds of years a mixture of fact and fancy persisted about the Antarctic. Man knew much more about the Arctic.

You could approach the Arctic by land or sea, while leagues of wind-whipped ice-filled seas separated civilisation and the mysterious continent to the south. There was an ocean at the bottom of the world, girdling the continent, which made the Antarctic an inviolate land. Nine thousand miles of ocean, and there are few who have sailed those seas who will not readily admit their respect for its moods; its hurricanes of hundred miles an hour, its screwing, growling pack; its bergs, forty or even fifty miles long, drifting ghostily through fog or mist, ever northward to inevitable destruction in the waiting embrace of warmer waters.

Only by acts of great seamanship was nature's veil torn aside, the ships battering their way through to reach the southern land. Until the middle of the eighteenth century the southern hemisphere appeared on all maps as part of a great continent awaiting discovery. The motive for Antarctic exploration has varied from age to age, according to how the problem has resolved itself with the growth of man's knowledge and the development of thought. It was mainly a philosophical problem, but then it became a struggle between the world powers for commercial and political supremacy, resulting in the foundation of our own Commonwealth of Australia and the Dominion of New Zealand.

To-day once again the nations of the world have a rivalry, the race for scientific knowledge, and, of course, national prestige, and the search for uranium, petroleum and other strategic minerals, are involved. These factors account for the great post-war interest in the world's last-to-be-explored continent, an interest which will write the last chapter to the story of man's fight in the South.

A series of great pioneer voyages culminated in Captain Cook's circumnavigation of the Southern Ocean in 1772–6. This voyage reduced the shape of the legendary Terra Australis Incognita, and narrowed the field of search southward of latitude 60.

Cook, perhaps the greatest explorer in the world's history, showed that if there was any considerable mass of Antarctic land it must lie within the Antarctic Circle and such land would

be unlikely to have any human population because of the harsh climatic conditions.

Cook also reported the presence of many seals at South Georgia. This discovery was the spark which lighted the hopes of the merchant adventurers, the sealers and the whalers, who went to seek their fortunes in the cold blue-green waters of the South.

Australasian exploration of the Antarctic regions began at the start of the last century when the sealers worked southwards from the Australian and New Zealand ports. From isolated beaches round the southern Australian coastline and Tasmania, the sealers and whalers gradually worked their way southward to Auckland, Campbell and Macquarie Island, west to Heard and Kerguelen Islands, and finally beyond the ice-pack which girdles the seventh continent, like an enormous moat thrown round Nature's last stronghold. At one time there were as many as five hundred sealing and whaling vessels of all nationalities operating from Kerguelen.

The story of what transpired on these desolate sub-Antarctic islands has yet to be told. Some of it may be gleaned from the logs of the old sealing skippers, and from the archives of the whaling companies, but some of it will never be told. It lies buried with the bones of the unfortunates who perished under mysterious circumstances in these outposts. Some of these graves were found by Campbell's expedition to Heard Island in 1948. The headstones were crude wooden boards, protruding from the black volcanic sand of Corinthian Bay. A mound of stones covered the unfortunates. The graves surrounded an abandoned tin hut. Flying sand and wind had abrazed the wooden beams until they shone like polished panels. In the hut the pioneer sealers had lived during the summer months. They dragged rocks up from the beach and built a stone barricade to shield their dugout from the penetrating wind. Frowning cloud-topped glaciers surround the bay, and behind the hut is a desolate flat plain, an old glacier bed, a dismal setting for the isolation of the island's first human visitors.

CHAPTER II

Voyages that made History

We know to-day that the Antarctic continent is covered by the largest mass of continental ice in the world, forming an almost unbroken ice-dome larger in size than the whole of Europe. This immense ice-sheet, maintained by snow accretion, is moving outward in all directions. The chief movement is in the form of enormous glaciers down the sloping valleys between the mountains fringing the polar plateau. The snow accretion gradually turns to hard ice by the pressure of its own weight, passing through the intermediate stage of neve ice.

The whole of the coast of Antarctica is girdled with ice, except possibly during the late summer months, December, January and February, but in a normal year the ice-girdle remains for a greater part of the summer months too. It consists chiefly of land-ice afloat, in the form of shelf-ice or ice-tongues, where the glaciers meet the sea.

The great ice-fields that flow over extensive stretches of flat or gently undulating land, fed by glaciers and the general inland ice and also by renewed snowfall, are pushed seaward in great flat-topped masses which float as soon as sufficient depth of water is reached. Ross found the greatest barrier of shelf-ice but he did not know it stretched for 400 miles from Ross Island to King Edward VII Land. The Ross barrier extends 500 miles back from its seaward edge, giving it a total area of 150,000 square miles. The barrier is about 1,400 feet thick and is assumed to be one of the main sources of the great tabular bergs, the Monarchs of the Antarctic, the largest being reported as long as 90 miles.

The surprising and characteristic features of the Antarctic coastline are the long pontoon-like, floating ice-tongues, extending seawards from the glaciers. The Ninnis glacier-tongue in the Australian Antarctic Territory extends from Cape Spencer,

marking its south-eastern junction with the coast, for 45 miles in a north-easterly direction and then for about the same distance in a north-westerly direction.

Scientists have found abundant evidence that the ice-cover over the Antarctic continent was not at a very remote time much greater than it is to-day.

Geographically speaking, the extent of Antarctica is most conveniently considered as the area lying southward of the Antarctic convergence, the line along which the cold northward-moving surface water sinks beneath the warmer waters of the sub-Antarctic regions. On that basis the Falkland Islands Dependencies are all Antarctic, though the Falkland Islands themselves are sub-Antarctic. Farther eastward Bouvet Island, Heard and McDonald Islands are Antarctic and Kerguelen lies just on the convergence.

The majority of the islands which lie in the southern ocean near the Antarctic convergence are well north of the ice-edge in winter. Their milder winters, higher temperature ranges, greater amount of ice-free surfaces, abundant precipitation and the presence of a meagre plant life, all distinguish them from the most northerly part of the continent.

Our knowledge of the interior of Antarctica is based on the observations made during a small number of sledge journeys and air flights. Antarctica has a greater average elevation than any other continent, probably about 6,000 feet. The central polar plateau, an immense expanse of snow and ice, is about 10,000 feet high. Extensive mountain ranges with peaks rising to over 13,000 feet are situated in various parts of the continent. Most of the coastline of the Australian Antarctic Territory and of Adelie Land consists of ice-cliffs where the inland ice reaches sea level. Rock outcrops are comparatively rare in this part. The Ingrid Christensen coast of Princess Elizabeth Land appears to be exceptional, with large areas of low-lying ice-free land. Within more recent years, in Dronning Maud Land, ice-free 'oases' have been discovered in Prins Harald Land and as far inland in Princess Ragnild Land. There is a possibility of smaller ice-free 'oases' in Princess Astrid Land, but otherwise the whole coast of Dronning Maud Land appears to consist of floating or shelf-ice. The relative accessibility of different parts of the coast

is dependent upon the distribution and nature of the pack-ice. Owing to the variations of ice conditions it is impossible to forecast with any certainty the dates at which various places in the Antarctic will be free of pack-ice.

This lack of knowledge of the ice movement has been a continuous handicap to the advance of expeditions and remains so even to-day. The ships bound for the continent must smash, cut and wrestle with the pack, which is sometimes reinforced by thick hard ice, broken off from the coastal rim. The latter floats north, becoming integrated with softer, rotten, and sea ice, forming solid steel-hard ribs several miles wide across the path of vessels.

Discoveries of land in the Antarctic regions have been made at different times, sometimes by comparatively well-equipped expeditions, sometimes by sealing or whaling vessels, but even to-day only one-tenth of the vast continent of six million square miles has been accurately surveyed.

In many cases explorers have been unable to land and have remained uncertain about the truth of their discoveries. Land has often been confidently reported and later demonstrated as non-existent. On the other hand, land has sometimes been proved to exist where it had been cautiously entered on charts as 'only an appearance of land'.

To understand the present political impulse to stake out claims on the Antarctic continent and to realise the scientific attraction of innumerable and fascinating unsolved problems, it is necessary to relate briefly the voyages which pioneered the way to what we now call the Australian Antarctic Territory, an area of land nearly the size of Australia itself.

Though, at the time of writing, no English translation of the Russian voyages to the Antarctic in 1819 has yet appeared, we know that the Russian government fitted out two small naval vessels, the *Vostok* and the *Mirni*, under the command of Admiral Fabian von Bellinghausen. The crews and officers numbered one hundred and ninety. It was a well-planned and carefully equipped expedition. With Cook's charts to guide and help him, Bellinghausen, with proper food and clothing for the climate, crossed the Antarctic Circle at a number of points and

discovered the first certain land in these regions—Peter I Island and Alexander I Land. Bellinghausen called at Macquarie Island in 1821 and stayed there for two days, collecting animal and bird specimens. In other attempts to get through to the continent, Bellinghausen was thwarted by the pack-ice. However, he did succeed in reaching 69 degs 25 mins S., a point beyond Cook's farthest.

Next comes the cruise of one of the daring sealers. John Balleny, in the schooner *Eliza Scott*, accompanied by the cutter, *Sabrina*, in service for Enderby's, the great British whaling firm, for the first time found land within the Antarctic Circle south of New Zealand. In 1838 Balleny stopped at New Zealand, and, after crew difficulties, proceeded to Campbell Island, that wind-and-rain-buffeted spot where men keep sheep and to-day maintain a weather station. By chance Balleny met John Biscoe, who had earlier sighted Enderby Land on a sealing expedition for the same company. From Campbell Island Balleny headed south and on longitude 172 degs E. penetrated as far as 69 degs, a route successfully followed by many expeditions in later years. On February 9, Balleny, having been forced to the west by the heavy pack, was not far north of what we now know as Victoria Land. Here at 164 degs 30 mins E. he discovered five islands: Young Island was over 10,000 feet high, and above the snow-covered peaks hovered huge clouds of smoke, testifying to a volcanic origin.

Balleny again sighted land to the west, which he called Sabrina Land; it was undoubtedly part of the main continent. A few days later, in a terrific storm, the cutter *Sabrina* was lost, but the sealers had proved that there was land in these desolate frozen waters.

The sealing period, initiated and sustained by commercial interests, gave way to the rising world of science, and the formation of the principal geographical societies of western Europe. Then followed the despatch of three major expeditions, those of D'Urville, Wilkes and Ross.

Ross won this race which started in 1840 with a great burst of scientific enthusiasm. His voyage ended in the discovery of the great sea and ice barrier which to-day bears his name.

Admiral Jules Dumont D'Urville, in command of two French

corvettes, the *Astrolabe* and the *Zelee*, steered south from Hobart on January 1, 1840. Without encountering much difficulty from the floating pack, he came within sight of the Antarctic coast and, in his wife's honour, gave the name Adelie Land to the precipitous ice-sheathed cliffs of the coastline. This French expedition did not land on the mainland, but set foot on an adjacent islet where they remained for a few days until one of those sudden Antarctic gales, which spring up with scarcely half an hour's warning, forced them to move off and fight their way through scattered pack and large bergs.

The American sealers had been showing great interest in the southern regions and they were naturally followed by their scientists and geographers. Lieutenant Charles Wilkes proceeded south from Sydney at the close of the year 1839 to circumnavigate the world, after having carried out extensive work among the Pacific islands. His vessels were the *Vincennes* and *Peacock*, both sloops, the *Porpoise*, a smaller brig, and the *Flying Fish*, a small tender. These ships spent only forty-two days in Antarctic waters, during which they were separated mostly by gales, while the men suffered great hardships and exhibited great seamanship in navigating their poorly equipped vessels. Wilkes reported sighting rocks in Adelie Land where D'Urville had anticipated him by a week. Wilkes did not set foot upon the Antarctic continent but it seems reasonable to believe—despite all controversies—that he cruised along 1,500 miles of coastline and actually proved the existence of the continuous continent.

A year later Ross crashed through the pack-ice to reach the sea that bears his name. Ross cuts a dashing figure in Antarctic history and was reported to be the most handsome officer in the Royal Navy in his day. Previously he had reached the North Magnetic Pole and planted the British flag there; he hoped to do the same in the south, though the main scientific object of his expedition was the study of terrestrial magnetism.

Ross used two heavily built wooden ships, the *Erebus*, 370 tons, and the *Terror*, 340 tons. These ships reached Hobart on August 16, 1840, the State Governor at that time being Sir John Franklin. The coincidence of this meeting between Ross and Franklin is one of the quirks of destiny. It is of no historical

importance, but Ross was to receive fame and Franklin was to meet disaster in the same ships in an affair which was to become the Arctic's unsolved mystery.

At Hobart, Ross had news of the voyages of D'Urville and Wilkes and it was this information which he used to success. Ross chose a route more easterly than those of his rivals because, as he wrote, he did not wish to interfere with their discoveries. He picked the 175th meridian and within a few degrees that course has been followed by many succeeding expeditions. This was the route of Scott, Shackleton, Amundsen and Byrd, not to speak of the whaling fleets of modern times.

As Ross's bluff-bowed wooden ships plunged to the roll of the ocean south of Campbell Island, the men aboard saw the huge albatrosses, soaring effortlessly behind the ships, scarcely tilting their great wings. They thought the presence of these birds was a portent of land ahead, but now we know they were wrong, for the albatrosses, those giant air kings of the storm-tossed southern ocean, disappear before the pack-ice is sighted. When the first penguins were seen swimming in schools, jumping straight from the water to the ice-floes as though playing a game of follow-the-leader, the men became certain that land was ahead.

On the last day of the year 1840, ice lay ahead right across the horizon as far as the eye could see. On the beautiful calm summer day that is the rarity and splendour of the Antarctic Ross lay waiting for the wind, with two hundred miles of thick, barrier ahead. The ice did not worry Ross, for his ships had been built for this job. He was blown north and south and then north and south again, but ten days later green open water lay everywhere to the south. At once Ross knew he was much farther south than anyone else had ever been in that part of the Antarctic. Could he sail right on to the South Magnetic Pole? He might even be able to sail right to the South Pole itself? Who knew better in those days? Hopes were high in every heart aboard the *Erebus* and *Terror*.

1841 was the year of triumph for Ross, memorable for his discovery of Victoria Land. He encountered the pack in 67 degs S., 174½ degs E. He set course for the Magnetic Pole and on January 11, at two in the morning, land was sighted. A range of mountains lifted above the horizon, the highest point of which

he called Mt. Sabine. Cape Adare, which was to become so famous later on, was also sighted. Ross named the ridge of mountains the Admiralty Range, the individual peaks being named after the Lords of the Admiralty. Ross and his men landed on a small island where a colony of belligerent penguins squawked defiance at their invasion. He named it Possession Island.

A strong wind and heavy seas forced Ross away from the island. There was a constant danger of his ships hitting uncharted reefs or stranded bergs. When the weather finally cleared, the ships beat south along the coast, running into fog. In a clearing they just avoided Coulman Island, named after the father of Ross's fiancée, and on January 22, 1841, the ships had reached 74 degs 20 mins S., farther south than James Weddell, another British captain, on the opposite side of the continent in 1823. The occasion called for a special issue of grog all round. Ross then discovered Franklin Island, which he named after Sir John Franklin.

Over the horizon Ross's men viewed one of the wonders of the world, a mountain summit from which the snow seemed to be drifting. The snow was found to be smoke!—from a live volcano, its crater more than 12,000 feet above the cold blue-green waters. They named the mountain Erebus, after the ship.

Ross now knew it was no longer possible to sail to the Magnetic Pole. It was not long before he found that the sea route to the geographic Pole was also blocked. To the east of the fuming volcano, the explorers saw an apparently endless white line rising out of the sea, extending to the limit of their vision. When the ships approached the white line they found it was a wall of blue-veined ice, in places more than 150 feet high. Here the dip of the magnetic needle showed the ships were south of the Magnetic Pole, so Ross turned eastward along the barrier in the hope of finding a way around it and proceeding south where there might be open ocean.

Soundings showed that most of the great ice barrier was afloat and it is interesting to note that since that day the face of the barrier has receded more than thirty miles. But though Ross sailed constantly eastward he did not reach the end of the barrier. It was late in February and, much as he loathed the idea,

the approach of winter forced a retreat. Ross had spent 143 days in the Antarctic and had found the gateway to the continent.

After a short while in Sydney and a call at the Bay of Islands, New Zealand, Ross put to sea again in November 1841. This time his luck was out, his ships being caught in the pack. He drifted for weeks and after many adventures, in which both ships were nearly lost, failed to get as far south as on his previous voyage. His ships eventually made the Falkland Islands in safety.

After Ross there was a long lull during which discovery was left to a few whalers, until we come to the beginning of modern exploration of the great continental region lying southward of Australia, which by its geographical position alone is a natural springboard of interest for our scientists. This land mass is closer to the Commonwealth than our east coast is to our west. For the last fifty-five years Australians have played an increasing role in the exploration of this and other Antarctic areas.

The chief interest of our scientists lies in the area which we call the Australian Antarctic Territory, an area of 2,472,000 square miles, and it is there they hope for eventual occupation and economic development.

CHAPTER III

Modern Pioneer

ABOUT 1890 serious efforts were being made by the scientific organisations of Australia and New Zealand to raise funds for sending a research expedition to the Antarctic. Negotiations were opened with the famous Swedish explorer, Baron Nordenskjold, who was asked to accept the leadership of the expedition. Substantial sums were promised and the total nearly reached the £15,000 required; but in the end the plan fell through.

In Melbourne, working in one of the mercantile houses at this time, was Mr. Henrick Johan Bull, of Norwegian descent, though resident in Australia for some time. Bull had for many years cherished the idea of leading an Antarctic expedition. Having heard so much of early whaling round the Australian coasts and considering the comparatively small distance from Australia to the Antarctic, he thought an expedition on commercial lines would find support among the local business men.

Bull has now passed into the hall of forgotten fame, for his name is seldom heard to-day in geographical circles. Yet, at the age of fifty years, this business man with a thirst for adventure and discovery, overcoming many difficulties, organised an expedition, unique in many ways but important for the fact that it penetrated further south than any previous expedition except those of Ross and Weddell. Bull succeeded in reaching the mainland of the great continent, never before trodden by human foot. His expedition discovered vegetation in Antarctica, hitherto believed non-existent, and incidentally provided a future base for the more famous expeditions that followed in his footsteps.

Bull, who in his early days in Norway had been interested in sealing and whaling, was a great believer in the whaling industry in Australia, and to-day we are beginning to reap the benefit of his struggle. The price of whalebone in Bull's time was higher than it had ever been, and he hoped thereby to

make his expedition a financial success. At that time Australia was in the grip of financial depression, and Bull considered that the opening of a whaling and sealing industry would 'form a convenient outlet for numbers of unemployed labourers willing to work, of whom Australia has in these latter days had plenty, and to spare'. He appealed for help in the Melbourne newspapers, but beyond a few personal replies, he received no worthwhile answer. He sadly records hunting all over Collins Street, Melbourne, for a man who expressed interest in the venture, but no one of his name or description was ever found. The financial crisis killed all Bull's chances of raising capital in Melbourne. 'It goes against the grain to give up an idea which has occupied one's thoughts by night and day for years, but there was nothing for it,' he records. 'With the downfall of firm after firm, my heart and hopes grew fainter and fainter and with the closing of the doors of the eighteenth bank, it was only too easy to realise that every chance in Melbourne had vanished.' Indeed, such lack of encouragement would have been enough to make even the hardest heart abandon the project. But not Bull; disappointed, he left Melbourne in February 1893 and returned to Norway. Here he visited Commander Svend Foyn, who at that time was eighty-four years old and the doyen of Norwegian whaling activities. Foyn promised to back Bull and presented him with a steam-sealer, retired from active service.

The ship, 226 registered tons, was re-named *Antarctic*. Its single engine, capable of developing a nominal forty-five horsepower and giving the vessel a speed of six knots in calm weather, was thoroughly overhauled. The immense advantage of having this auxiliary engine was fully appreciated when the ship was pounding through the pack-ice or navigating around the bergs. The ship's wooden bows were specially protected and strengthened outside by iron bands half an inch thick. She was rigged as a barque, royals being added: in half a gale in the Roaring Forties she would spin along at nearly ten knots.

The ship carried a crew of thirty-one but unfortunately relations between Bull, as manager of the venture, and the captain, L. Christensen, were not good and this was to affect the whole venture. On the voyage from Norway to Melbourne, the *Antarctic* called at Tristan da Cunha for whaling news, and

thence laid course for Prince Edward's Island, but no useful whales were sighted and the ship ran before a favourable gale to Kerguelen. Two icebergs were passed *en route*, one being as far north as latitude 40 S.

The ship nosed cautiously into Greenland Harbour, Kerguelen Island, and all aboard the ship, except the cook and engineer, went ashore to kill the sea-elephants. Rather slothful and obscene, these creatures are completely harmless: some have been found that are twenty feet long, twelve feet in girth and weighing all of five tons. At first sight they fill one with revulsion and surprise that such an extraordinary creature can exist. But so great were the depredations of the sealers of early days that on some sub-Antarctic Islands the breed was wiped out. Three hundred and fifty elephants were shot during the first two days the *Antarctic* was in Greenland Harbour. Many of them were enormous and yielded three to four casks of blubber each.

But Bull had no qualms about the sealing. The elephant seal had to die that he and his men might live. Tired arms and aching backs were of no import, and Bull's men worked as long as they could stand, for none knew when the seals might slide off into the ocean. No regular meals were taken, and when a day's gale interrupted the work, it came rather as a relief than otherwise. Sportsmen could find nothing attractive in the seals Bull encountered. Sea-elephants have no sense of fear, and like the majority of Antarctic seals generally look on with mild curiosity and interest at the preparations for their own execution, whether by rifle bullet or pickaxe.

Bull's expedition nearly met an untimely end during the afternoon of December 22, 1893. The ship was not prepared for the suddenness of the Kerguelen gales, which had lifted one of Ross's men bodily off his feet and blown him into the water during a squall; others had been forced to lie prone to avoid being carried away by the strength of the wind. A sudden squall forced the *Antarctic* to drift before her anchor in spite of the engine going full ahead. The crew, with their heavy boots and thick clothing, had great difficulty in reaching the ship from the shore, where they had been busy sealing. One party was unable to stem the wind and sea and spent an uncomfortable

night ashore with only the raw Kerguelen cabbage for nourishment. This green tufted vegetation has small leaves and tastes like a mixture of sprouts and spinach, in fact quite pleasant.

All hands on board ship struggled desperately to extricate the second anchor from its too snug berth and when at last it could be let go, they had only a few more fathoms to drift. The two anchors held and the danger was over, when the storm luckily moderated towards daybreak.

The *Antarctic* continued sealing round Kerguelen, killing nearly two thousand. The cargo of blubber and salted skins was estimated in those days to be worth £3,000, and as the snow-capped peaks of Kerguelen disappeared astern, Bull could not help but feel a certain attachment to the rugged, desolate land and gratitude towards Providence for bountifully rewarding his first effort. A month later the *Antarctic* anchored off Williamstown.

In Melbourne the first serious commercial attempt to explore and exploit the Antarctic waters was welcomed with great enthusiasm. The scientific bodies of Australia were anxious to assist, and special receptions were held in honour of the expedition, but Bull found his sea-elephant skins were hard to sell in the local market. He had estimated their value at several pounds each; but he was severely disappointed. The first offers he rejected, but as time went on the inferior quality of the hides was distressingly apparent. Ultimately the skins were consigned to London where they realised a paltry £200, the greater part of which disappeared in expenses and freight.

Bull had little luck or profit from his sealing ventures during the winter of 1894, when his ship visited Campbell Island and went aground on a reef. The repairs and the damage to the rigging swallowed up the profits from the earlier part of the voyage. 'During my last months in Australia great enthusiasm for our enterprise and anxiety to assist in every way was evinced from all quarters,' he recalls. The Victorian military authorities suggested the loan of a machine gun with which to pepper the Antarctic whales: the Geographical Society assisted with loans of charts and books, and at one time contemplated sending one or two young scientists. The memory of the kindness shown

towards the expedition and himself by Melbourne folk was something Bull never forgot.

Two prominent explorers, Mr. Eivind Astrup, who was Lt. Peary's companion on his Greenland journeys, and Mr. William S. Bruce, a Scottish naturalist, were to have accompanied the ship but could not reach Melbourne in time for the early start of the *Antarctic's* voyage. Bull had resigned himself to a solitary life on board when one day he received a call from Cartens Egeburg Borchgrevinck. Introducing himself as a former student of Oslo University, working as a school-teacher in Australia, Borchgrevinck was very anxious to join the expedition. At first Captain Christensen would not hear of carrying 'passengers' on a trading ship, but ultimately he gave in to Bull and allowed Borchgrevinck to sign on as a useful hand with a berth in the forecastle. During the first two months on board Borchgrevinck worked as required and then he seems to have settled down to an enjoyable life of painting and sketching, taxidermising birds and studying Bull's books on Antarctic exploration.

On September 26, 1894, the last stores were loaded and the hawser connecting them with the friendly Australian shore was let go. The *Antarctic* steamed away from the Melbourne wharf to the cries of a cheering public. It was the beginning of modern scientific interest in the Antarctic territory to the south of Australia.

CHAPTER IV

First Ashore on the Continent

PACING the deck with the cheery second mate, Bull was filled with hope and elation. 'What awaits us at and beyond the barrier of pack-ice which I have already forced so often in imaginary and always successful voyages? Shall we encounter the belt of ice 800 miles in width through which Sir James Ross had to gain his second entry to the Great Bay?' These were the thoughts that ran through his mind.

The original Norwegian crew was now in a minority, others on board were Danes, Poles and last-minute recruits from the Melbourne waterfront, a cosmopolitan crowd who entered thoroughly into the spirit of the venture.

After hailing the lighthouse keeper on Wilson's Promontory to know if any whales had been seen and receiving a negative reply, the *Antarctic* sailed for Hobart, where they spent a day ashore before continuing south. It was deemed early in the season to attack the ice, so the plans had been made to include a week's sperm-whaling round Tasmania.

Fresh gales off Macquarie Island put an end to any hope that the expedition might get ashore. After standing by for three days, the ship sought shelter from the strong north-westerly under the lee of the island, where sometimes fairly calm water is met. The forbidding aspect of the land, with its barren cliffs descending perpendicularly into the sea, was not the most encouraging sight. The only glimpse they had of the grim island was through a fog, so they steered for Campbell Island. The two Norwegian-Australians, Bull and Borchgrevinck, were good companions during the first weeks on board, and laid great plans for their future.

At Campbell Island, the ship dropped anchor in North Harbour during a strong westerly breeze. Although a degree nearer to the Pole than Kerguelen, vegetation covers Campbell Island from top to bottom; beautiful clinging shrubs and groves

of small trees are twisted and crippled by frequent gales which lash this misty outpost where lonely men to-day carry out their scientific duties.

The *Antarctic* steamed round to Perseverance Harbour, falling in with a small New Zealand sealing schooner, whose master told them they had only four days to catch seals before the legal season closed on November 1.

The sealing venture was not particularly successful. Borchgrevinck managed to get ashore to carry out an exploration of the island and returned with a satchel full of plants and eggs. Bull spent a whole day writing farewell letters to family and friends, posting them with the master of the sealer. Already at Campbell Island the indiscriminate slaughter by the sealers had almost destroyed the rookeries: the few remaining seals were hunted from beneath stones and caverns where nature gave them a precarious shelter.

Giant fulmars soared across the masthead as the ship steered southwards. Petrels screamed over their wake and they left behind the trailing albatross as the days grew colder. Schools of penguins passed them travelling in an easterly direction, leaping across the waves in their peculiar fashion, like flying fish. They were nearing the ice.

The first iceberg was sighted in 57 degs S., 162 degs E. It was six miles long and about 150 feet above the water, perfectly flat-topped, alabaster white, and doubtless a drifter from the huge undiscovered glacier tongues to the south. From alabaster to bluish white, changing to an azure blue where the sea has hollowed out a magnificent cave, the indescribable transparency and delicate colouring of the Antarctic bergs is fascinating to those who behold them for the first time.

More and more ice came into sight as the day wore on. Most of the bergs showed the regular stratification noticed by all explorers in these latitudes. On November 6 they sighted what they took to be a long, low, flat-topped island. Was it Emerald Island, that mythical dot on the older charts, the existence of which is now generally discredited? The great length of the island, estimated at nearly fifty miles, puzzled those aboard the *Antarctic*. As the ship drew nearer, the captain persuaded himself that they had discovered new land. The crew was called together

to greet this with three hearty cheers. Amid great rejoicing the captain christened the land the Svend Foyn Island after their sponsor. The discovery was celebrated with a glass of brandy and much congenial back-slapping. Imagine the chagrin of those on board a few minutes later when they saw the immense tract was nothing but an iceberg of unprecedented size!

On trying to approach it, the ship met with a choppy sea and eddies of such violence that it had to beat a hasty retreat. Similar eddies are experienced close to most extensive bergs. The berg was in 58 degs S. Sir James Ross observed his first ice in 63 degs S.

At night the *Antarctic* proceeded with the greatest caution. During darkness they would either heave-to or proceed under shortened sail. On November 7 there was great excitement aboard. In the afternoon the engine was ordered ahead, when to the consternation of all it began to race violently and then stopped short. Then the engineer came hurriedly up from below and reported that the propeller had broken off or was loose on the shaft! The ship was totally disabled and without even the assistance of a breeze. Although Bull reports the captain was in a mind to try the pack-ice, propeller or no propeller, he himself thought it would have been an act of sheer folly. It was 700 miles to Port Chalmers, New Zealand, the nearest harbour where repairs could be carried out; but there was no real alternative. So northwards they turned again and with every stitch of canvas to a light growing breeze the *Antarctic* passed out of the ice and away from the huge berg which they had hailed as new land.

Bull had almost overcome his chagrin at the delay when, one night in a quiet chat on the deck, the engineer said he had feared all along the propeller might come off after the bumping the ship had received at Campbell Island months before! Yet apparently he had never thought to say anything at that time. At Port Chalmers the work was soon in hand, but the delay cost Bull two or three weeks of sealing or whaling beyond the pack-ice and just about ruined his last chance of making a financial success of the venture. On the other hand, he was lucky in another respect: if the mishap had occurred right inside the pack, then the ship might have been trapped there

for the winter, if not permanently, with little possibility of our being able to read the story to-day.

In Port Chalmers several of the crew jumped ship; others asked to be signed off and were allowed to go. When the *Antarctic* was under way again, they were nine hands short; but Bull persuaded the master to call at Stewart Island, where four additional men were obtained.

Sailing through large masses of scattered ice-floes and streams of pack-ice, the first seals were brought on board on December 7 —a common seal and a sea-leopard, the latter being the natural foe of the penguin. Three days later a south-west gale was raging and, though Bull was wearing a pea jacket, three guernseys and a heavy shirt, the cold was penetrating, even if the temperature was barely freezing. Bull saw none of the black whales reported by Ross. Two blue whales were harpooned from the ship's side, the line breaking each time. Borchgrevinck filled in his spare moments by painting scenes of the surrounding ice on the panels of the cabin door.

The bird life continued to be a source of continual entertainment. White petrels hovered above the ship or gyrated about her for twenty-four hours a day, apparently without rest or sleep; Cape pigeons fluttered their checkerboard wings like Antarctic moths; penguins, short and black-headed—the Adelies —squawked defiance from the ice-floes and were seen in large numbers.

By the second week of December the *Antarctic* was again in the pack. At an age when most men are content with caring for a suburban allotment, Bull found the continual bumping and the violent shocks very trying as the vessel ground its way through the heavy pack. The hull trembled from stem to stern as the bows collided with the ice, bending the masts aloft and flinging the unwary forward off their feet. The ship forged ahead under sail and steam, the heavy column of smoke rising in magnificent contrast to the blinding whiteness of the pack.

On December 15 at midnight the ship was off the Balleny Islands. A heavy atmosphere prevented a fair view of the group, but a snow-clad peak, very high, was observed above the cloud banks. During the night the ship hove-to, the men hoping to get under the land in the daytime and there find seals, but

the ice closed round, imprisoning the ship for two days. An attempt to press eastward was ineffectual and the ship was made fast with the strongest hawser to a great floe, which would serve as a buffer. A week later the ship was still only twenty-five miles from the Balleny Islands, the dipping sun lighting up the cone of the mountain, reported at different times to be an active volcano. On December 23 there was endless ice ahead. The sun no longer sank below the horizon. At night, with the engine stilled, with the endless whiteness, the purity of the colouring and the all-pervading silence, Bull felt as though he was gliding through fairyland, until a bump, or the hoarse cry of a sea-bird, awakened him to stern reality. A small whale was harpooned the same evening and brought alongside. Its value was very small except for the practice it gave the men and the excellent steaks it added to the larder. The meat was tied up in chunks under the boats and everyone was at liberty to help himself till satisfied.

On Christmas Eve the ship was at 66 degs 32 mins S. and 170 degs 25 mins E., forging ahead under steam and sail as fast as possible. The occasion was celebrated with 'cream porridge', made with butter, and different forms of whale meat. Borchgrevinck kept himself busy preparing bird skins and taxidermising other specimens. The weather continued fine but once again the ship ran into the endless white desert of the pack and Bull had the melancholy idea that they might not pass through at all. In 1839–40 Ross had crashed through the ice-belt in five days with two sailing ships! The *Antarctic* had been there eighteen days and hardly advanced an inch! The ship was caged firmly in the pack and slowly drifting northward. The ice was wedged round her as far as eyes could reach, the floes heaped up high but not a foot of water anywhere between them. The silent engine and the general sense of desolation in the surroundings caused the spirits of all aboard to fall to zero. There was gloom from the cabin forecastle to the engine-room. Only the first engineer, lying on his bunk with a broken right leg, felt happy. The quiet ship gripped in the desert of ice enabled him to rest his throbbing limb.

The chiming of the ship's bell and the discharge of a gun signalled the departure of the old year. Everyone came on

deck and the flag was run up under the gaff. The midnight sun flooded the ship in a rich red and yellow hue. The scene was gay and festive and the men retired to their narrow cribs, hoping the magnificent birth of the New Year would be a good omen.

As the ship drifted in the ice, occasionally the pack opened up and the ship could head into the green ponds and canals, chiefly eastwarding. To the south, the ice was as firm and solid as ever. During these days Bull records some impressions of his companions. The men were affected by the close confinement of shipboard life, the worse bugbear of an expedition.

On January 6 everything had changed. The peace and stillness of surrounding ice was still wonderful and soothing; whales spouted in different directions, the cries of the ever-circling petrels formed the only interruptions to tranquillity but the ship was sailing through large ponds widening between the floes. From the masthead the way south appeared open to the horizon; the fences of ice that separated the pools of open water were scattered with ease by the heavy ship. A new variety of ice-floe was seen, larger in area and of considerable thickness, the height above the waterline being twenty or thirty feet. Bull assumed that the new formation was true land-ice, its thickness of two hundred and three hundred feet indicating that many winters must have passed before it broke its connection with the shore and drifted out to sea.

But further disappointment awaited the adventurers. The ice repeatedly relaxed its grip and then tightened again and the question of abandoning the venture was canvassed round the deck. Should they keep on waiting for better conditions or turn back and try to retrieve their fortunes by sealing to the west of the Balleny Islands? The captain threw the problem on Bull's shoulders and, though Bull was no master mariner, he decided that the expedition could risk waiting till the end of January. So the battle with the pack continued.

If Bull had been less determined and less conscious of his duty to his financial backer, the result to Antarctic exploration might have been very different. Despite the lack of whaling or sealing opportunities in the pack, Bull insisted upon pushing on. Moored at night to large floes, the *Antarctic* drifted with wind

and current. The vanishing coal stocks were the most pressing anxiety. If they were not out of the ice soon, there would be no fuel left for whaling or even a return through the relentless pack.

January 13 lived up to its worst reputation. A large whale was sighted within striking distance but anchors left carelessly on the foredeck prevented the harpoon-gun from being fired. During the late afternoon rolling was observed in the ice, making them think they were approaching the edge of the pack. Ahead the men saw the peculiar cloud or dark mist of the 'water-sky'. It was bearing dead South. Then a thrill ran through the whole ship when from the crow's nest the look-out bellowed 'Open Water Ahead!'

At night there were ponds ahead, ponds that became wider and wider, though the long struggle and frequent disappointments made the men slow to believe they were on the verge of success. Finally the entire horizon ahead showed the characteristic water-sky and the ocean to the south was clear as far as the eye could see.

The victory was not a minute too soon, for the captain that morning had finally made up his mind to retreat unless that day brought open water. The effect of the success on the crew and officers was magical. The spirit which Bull had admired on leaving Melbourne was again in evidence. Unpleasant incidents were forgotten.

In 1841 Sir James Ross had entered the main pack on January 5 in 66 degs 50 mins S., 174 degs 34 mins E., clearing the last barrier on January 9 in 68 degs 45 mins S., 176 degs 15 mins E., in five days, the total width of pack about 170 miles. On his next voyage he had begun his attack on the ice-belt on December 18, 1841, in 60 degs 50 mins S., 147 degs 23 mins W., emerging into clear water on February 1, 1842, in 67 degs 18 mins S., 158 degs 12 mins W., after battling fifty-six days to break through a width of pack upwards of 800 miles.

On January 17, 1895, the first sight of mysterious Antarctica was obtained, Mt. Sabine showing its summit above the bold and lofty peaks of the 10,000-foot Admiralty range. Ross named this mountain after the foreign secretary of the Royal Society,

who was the proposer of his expedition. Those on board the *Antarctic* forty-five years later saw the numerous peaks and pinnacles buried under a snow-shroud of incomparable whiteness. Here and there along the coast strong winds had bared the dark rock.

Course was set towards the most prominent of the partly-bared patches of land: Cape Adare, the north-eastern extremity of Victoria Land. With its dark sides and snow-streaked top, 4,000 feet up, this landmark was to become famous and familiar to subsequent expeditions.

Between Cape Adare and the land to the north-west, a small bend, Robertson's Bay, was observed as a good ice-free harbour; a heavy barrier of heaped-up floes, with stranded bergs, barricaded the inlet, delaying a landing at this point.

Two days later the Possession Islands were sighted. A party made up of the captain, second mate, carpenter, Borchgrevinck and others rowed ashore to pay a visit to the natives, the thousands of penguins which from the deck were seen to cover the whole of one of the islands. Coffee and food were kept ready for the shore men and a general gossiping party proceeded when they returned. Samples of lichen found by Borchgrevinck in sheltered nooks on the island constituted the most interesting results of the landing, as it upset the previous theories of botanists that the rigour of the Antarctic winter was fatal to all vegetable life.

At 11.30 p.m. the sun was still high above the horizon. The ship steamed and sailed along the face of mountains that towered range upon range in majestic grandeur under a coverlet of matchless white, the glittering gold and silver of the sunlight being broken or reflected through the crystals of ice and snow. When the sun is at its lowest in the Antarctic regions, the sky is of the deepest blue and the deepest gold. What impresses visitors is the utter desolation, the awesome, unearthly silence pervading the whole landscape. Turning from the mountains to the sea, the change is very great; the floating bergs and floes, and the rippling, breaking waters lend an air of motion or unrest to the scene—a sharp contrast to the deathlike calm and immobility of the land, where the mountains reach to 14,000 feet. Stranded icebergs look enormous beside the small ships,

but a comparison with the Victoria Land Alps is ridiculous. Only the spouting whales, paddling seals, squawking penguins and wheeling petrels and gulls bring life into this world of alabaster and blue.

At midnight on January 24 the *Antarctic* was once more off Cape Adare, the weather favourable for a landing. An hour later the master, second mate, Borchgrevinck and Bull left the ship, landing on a pebbly beach of easy access, after rowing for an hour through loose ice. Jelly-fish scudded away from the prow of the ship's boat.

'The sensation of being the first men who had set foot on the real Antarctic mainland was both strange and pleasurable,' Bull wrote. 'Our surroundings and our hosts were as strange and unique as our feelings. Myriads of penguins fairly covered the flat promontory many acres in extent jutting out between Cape Adare and a more westerly headland. They further lined all accessible projections of the rocks to an altitude of 800 or 900 feet. The youngsters were now almost full-grown. In their thick, woolly gray down they exhibited a most remarkable and comical appearance. Our presence was not much appreciated considering the millions of years which must have elasped since the last visit by prehistoric man or monkey—before the glacial period. Our seaboots were bravely attacked as we passed along their ranks.'

During the exploration at Cape Adare, Bull got the impression that the bay enclosed by the low promonotory would provide many advantages as a landing place and station for a new expedition. The promontory was about a mile in length and about a quarter of a mile wide, ideal for moving about. Rocks nearby would provide shelter for huts.

Borchgrevinck, too, must have been impressed by Cape Adare, for five years later he was to return there with the first expedition to winter ashore on the Antarctic continent.

The ship had an easier route back through the pack-ice, but the sealing and whaling activities were not successful. To the joy and relief of all aboard the south-east coast of Tasmania was sighted on March 4. All hands fancied they could smell the land air twenty miles away, laden with the fragrance of apples and freshly dug potatoes. Last efforts were made to

catch some sperm whales off the Tasmanian coast, but the expedition was thoroughly down on its luck. A wind sprang up and soon a gale was blowing. Squalls made the bridge duty an unpleasant task, but thanks to the uncommon qualities of the good ship, little damage was done. One boat was nearly carried off but was saved by the crew, who lashed it to the main rigging, while the decks were awash.

'Every soul on board was sick of the expedition and to a great extent of each other and the vessel was therefore kept going towards good old Melbourne,' concludes Bull. The pilot came on board on March 11, as the *Antarctic* steamed and sailed at a spanking rate towards Port Phillip Heads.

In Melbourne Bull and Borchgrevinck were welcomed by the officers of the Royal Geographical Society and the Antarctic Exploration Committee, but Bull also received the sad news of the death of his backer, Commander Svend Foyn, in Norway.

In Sydney, Bull and Borchgrevinck gave lectures and the New South Wales Premier, Mr. Reid, held out hopes of public support should another expedition be started from Australia. Many people took a lively interest in Bull's voyage but still no substantial monetary support could be obtained in Australia for a new venture.

To cap this unfortunate state of affairs, personal differences developed between Bull and Borchgrevinck. It is not the province of this writer to investigate the merits or demerits of the dispute, but one can feel easily that Bull must have considered this the final disappointment to all his plans, especially when he found credit for the expedition's achievements going to another person when he himself had worked hard to promote the idea.

Bull retained his sense of humour and he needed it too. Some time later it seems he received a copy of Captain Christensen's chart, illustrating the track of the *Antarctic*; in it all the names which had been given to the expedition's discoveries had been changed. Bull found among the additions one called 'Bull's rocks'; the leader of the expedition describes this as 'a kind of log-rolling or self-immortalization particularly distasteful to me'.

The expedition had its value. It had given a fresh and strong

impulse to Antarctic exploration. It paved the way for better equipped expeditions, by proving that a landing on the continent was not as difficult as had been imagined. Now it was known that a party had every chance of passing the winter at Cape Adare safely and pleasantly, with a fair chance of penetrating to the vicinity of the constantly shifting Magnetic Pole.

CHAPTER V

Winter at Cape Adare

THE first men to invade the Antarctic continent were the members of the *Southern Cross* expedition, which landed under the command of Borchgrevinck at Cape Adare in 1899, completely equipped for exploration on land and at sea. Borchgrevinck was the first to leap ashore and place foot on the southern continent.

After his return from Bull's expedition in 1895, Borchgrevinck lectured in Sydney and Melbourne. He hoped that his observations and experiences within the Antarctic Circle might stimulate Australian interest in that part of the world. In the first month, he found himself 'surrounded by the greatest thinkers of Australasia', but his hopes were soon dashed. Later he said, 'Great and noble thinkers in the Australian colonies rarely can afford to accompany their thoughts on far journeys, nor despatch others, less worthy perhaps, in pursuit of their philosophy.' He received all possible moral support from the Australian people, but the funds did not come.

A year later, in England, he met Sir George Newnes, the wealthy publisher, and two years after that meeting Newnes provided the necessary funds for an Antarctic expedition. For the expedition, the designer and builder of Nansen's *Fram*, Colin Archer, designed the *Southern Cross*, a ship of 521 gross tons, barque-rigged and built in Norway, where the engine was also made.

From Tasmania came Louis Charles Bernacchi, then aged twenty-two, to join the expedition which left London in August 1898. Educated at Hutchings School, Hobart, and also privately, Bernacchi entered Melbourne Observatory in 1895 where he spent three years studying magnetism and meteorology. In 1897 Bernacchi had been appointed to the Belgian Antarctic Expedition and was to have joined the ship in Melbourne. But the *Belgica* was caught in the pack-ice off Cape Horn and was not

able to call at Australia. Bernacchi therefore tried pot luck, journeying to London on the off-chance of being able to join Borchgrevinck.

Other members of the party of ten who planned to spend the first winter at Cape Adare, were Sub-Lt. William Colbeck, R.N.R., magnetic observer and cartographer, and Hugh Blackwall Evans, who also had an Australian background. Evans had spent four years in the north-west of Canada and from Melbourne he had joined a sealing expedition to Kerguelen Island. He joined Borchgrevinck as assistant zoologist. Four Norwegians and two Finns made up the rest of the party.

The dogs gave both trouble and pleasure on the way from England to Australia. There were ninety of them from Greenland and Siberia on the deck of the *Southern Cross*, and beside the dogs and their kennels, and miscellaneous equipment, thirty-one men had to move about. The baying of the dogs, whether in sentimental song to the tropic moon or in quarrel with each other, tried the tempers of the expedition. But it was remarkable to see how early in the voyage dogs took to certain men, some of whom, in their leisure hours, selecting a quiet corner beneath a boat or on a barrel, quietly petted and chatted to their favourites.

Fair weather prevailed nearly throughout this voyage to Tasmania, where the ship arrived after ninety-eight days. The *Southern Cross* dropped anchor at a spot named Cooktown on the chart; a boat was launched to search for some habitation where fresh vegetables and food could be bought, but in those days Cooktown was no more than a typical Tasmanian bush hut. Bernacchi was among the six in the party who rapped on the door of the hut, just up from the beach. Inside was a young girl about twenty and rather pretty, and it was a long time before she was willing to open the door to so many strangers. But the ship's party were out of luck, as the young girl and her absent husband were about to leave the locality and had sold up all their fowls. After a fruitless search for ringtails in the surrounding bush, which the young woman's small son swore abounded in the she-oaks, Bernacchi and his companions grew tired of stumbling over logs and falling into water-holes in the dark and they returned to the ship.

Their welcome in Hobart was just the reverse. The Tasmanian capital has a traditional open heart for the explorer. Sir John Franklin—the great Arctic explorer, governor of Tasmania in 1837—was in office when the French warships *Zele* and *Astrolabe* called with the news of their discoveries in the Antarctic regions, and the English expedition to the same regions started from and returned to Hobart in the ships *Erebus* and *Terror* under Captain Ross and Captain Crozier. Bernacchi's father, moreover, was well known as the owner of Maria Island off Tasmania.

During their stay in port the two Finns dressed in their native kilts and remarkable Lapland boots with straw sticking out at the tops, had rather too much of a good time for Borchgrevinck's peace of mind. 'They were rather handsome fellows and great favourites with the fair sex. In fact, during our stay in London before our departure for the South I lived in constant anxiety for the welfare of these children of nature. I expected any day to see them involved in some breach of promise case or other complication,' the Commander wrote.

The sun was setting behind the bold eminence of Tasman's Head, firing the dark rocks, as the men on the deck of the *Southern Cross* feasted their eyes on the Tasmanian shore, the last of civilized land they were to see for many months. It was December 19, 1898. A supply of carrier pigeons had been taken on board and were now released with Christmas greetings for Hobart.

The *Southern Cross* steamed on. Bright calm weather prevailed. The days passed pleasantly, each member busy at his own job. Nicolai Hanson, the zoologist, whenever opportunity occurred, collected specimens of the fauna. Short-tailed albatrosses and mutton-birds followed the ship's track, now swinging over the stern, and drifting lazily back on the wind.

As she sailed on, petrels and prions gave warning that early drift ice, the scouts of the Antarctic pack, was not far off. Quite suddenly, and with little warning, the *Southern Cross* was in the ice-fields in latitude 51 degs 66 mins S. and longitude 158 degs 55 mins E. No icebergs had been seen; only a dense mist on the horizon that had been visible some hours, and a slight fall

in the temperature of the sea presaged what lay ahead. Four more pigeons were released with messages. Two of these came back after three days' absence fruitlessly flying over the ocean; the fourth and strongest returned after a week but it was so weak that it had to be killed.

Great was the enthusiasm of those on board who saw the Antarctic pack for the first time. From the crow's nest Borchgrevinck watched the vessel as she rose and fell on the swelling ocean, dashing in among the grinding ice-blocks. Some were of the most fantastic shapes imaginable; grotesque palaces, pinnacles, towers, bridges and arches, all forming something like a great city of ice. The colouring in the cracks and cavities was magnificent, the light green tints contrasting with the alabaster white of the floes. Bernacchi, the physicist, noticed that in some places the ice was stained yellow; this had been observed also by Captain Ross, who took some of the stained matter home with him. Under the microscope it was found to consist of an entirely new and minute form of organic life, the diatoms. This microscopic marine life abounds in the cold waters of the south. Other minute life feeds on the diatoms, and in turn provides food for seals, birds and whales.

The first iceberg was spotted that afternoon, it was seventy feet high, tabular in form with great yawning caves in its iridescent sides, into which the seas roared ominously. Captain Jenson, the Master, and Borchgrevinck took charge of the ice navigation, as the ship's steel-covered sides noisily rammed the ice. Great green blocks reared on end, overturning and plunging against the hull, while the entire crew watched the magnificent spectacle from the forecastle. The ship shivered and the shock was felt right up to the crow's nest. The roar and noise in the forecastle was deafening, making it difficult for the men to sleep.

Ten cold successive hours in the crow's nest made Borchgrevinck feel the strain. From his perch he could see the pack as it closed and opened far out towards the horizon, where sky and ice seemed to meet. On his sole responsibility and judgment rested the safety of the ship, as he found the path through the ice. At places between the canals, the ice-floes are sometimes blocked by broad or narrow isthmuses of ice through which a

vessel cannot always work her way. The ship must then be reversed into the open space which has just been cleared. Then from the crow's nest comes the order 'Full speed ahead' and the ship charges straight at the ice-block, ramming, smashing and wrestling.

With eleven feet of solid oak at the bows, the *Southern Cross* needed all her weight and engine power when ramming the hard ice. Often she was momentarily stopped and her bows, which sloped off at an appropriate angle, rose out of the ocean and thus gradually equalised the strain which the impact brought upon her.

Borchgrevinck again observed the characteristic ice-blink, the reflection in the air of the large ice-fields ahead and the dark vapour clouds which always indicate open water. Beautiful white petrels appeared; the black-backed and sooty albatross had vanished at the edge of the ice, but the checkerboard Cape pigeons still followed the ship's wake.

The end of the year 1898 was celebrated by the ringing of bells, the blowing of fog-horns, the tooting of the steam whistle, the clattering of tin cans, the howling of the dogs and salutes from the guns, a pandemonium which sounded weird in that quiet world of ice. At one in the morning the sun rose in glorious splendour over the white flats, crimson light shooting across glittering floes, changing their pure whiteness to a blood-red hue. Seals were shot and the dogs enjoyed a royal banquet. While the ship was temporarily halted by the canals closing up, the dogs were let loose upon the floes where they scampered madly, rolling in the snow.

During these halts all the men took to the ice on skis, and it was one of these excursions which nearly cost Borchgrevinck his life. Crossing chasms in the ice-floes is difficult and often dangerous, and on one occasion, Borchgrevinck missed the farther edge of the floe and fell into the sea. The long ski, tightly fastened to his boots, prevented his feet from sinking so that his head went down instead. Fortunately Anton Fougner, the expedition's scientific assistant, was close behind and able to extricate the leader from his inelegant position.

On January 14, 1899, Borchgrevinck climbed to the crow's nest and discovered high snowland to the south. It was the

Balleny Islands, but relief was not near, the ship making little progress from pool to pool. The Balleny Islands, discovered in 1839 by John Balleny in the *Eliza Scott*, and afterwards seen by Ross in 1841, are five in number.

A dark cloud of smoke was perceived rising from the eastern end of the land, undoubtedly the smoke of a volcano in eruption. On drawing nearer, a vast mantle of snow was seen to descend to within 700 feet of the sea, where it ended abruptly. From the appearance of its edge, the snowcap was thought to be some hundreds of feet thick. At the western end was a high headland and a peak some 10,000 feet high, with a large and apparently inactive crater at the summit. At the other end, at a greater distance, the land was comparatively low and dark clouds of smoke issued at intervals. Other snowclad peaks were sighted low on the eastern horizon.

The ship approached to within forty miles of the land before progress was completely stopped by huge blocks of ice, which had only quite recently rolled down from the peaks. The ship moored to a floe. Borchgrevinck decided to wait until the ice opened again before attempting to approach the shore. During the night the barometer fell rapidly and at noon the next day it was blowing a gale. Fog hung over the waters, completely blotting out the land, compelling the ship to steer northwards to more open water. It was dangerous to remain near the heavy ice. There being no likelihood of the weather clearing, it was decided to abandon the idea of approaching the land and to make instead for Cape Adare.

For forty-eight days the ship was imprisoned in the ice, making those on board think they might have fared better if they had gone farther east. This experience, subsequently confirmed by other explorers, has shown that the pack on the Australian side of the Antarctic Circle is not nearly so dense to the east as it is to the west. Ships that have entered the pack at about longitude 170 E. have penetrated it in a few days whilst those entering at between 150 and 165 E. have taken more than a month. The reason for this seems to be the strong current setting out in a north-westerly direction from the Ross Sea and driving the ice up northwards between Heard Island

and Australia. The prevailing south-east winds round Cape Adare are also a factor in driving the ice in that direction. The sea-ice, which constitutes the bulk of the pack, is formed by the freezing of the sea in winter along the coastline of the continent, to a minimum depth of four or five feet and extending into the ocean for more than fifty miles. This ice begins to break up early in November and to move northwards; by the middle of January some of the coast is almost free. But the sea-ice is frequently driven back by northerly winds, so that open sea is met within the Antarctic regions almost regularly when the principal zone of pack-ice has been pierced.

On January 24 the *Southern Cross* was fast wedged in the ice, and during a gale from east-south-east, severe pressure set in. On the port side the blocks piled up to a height of nearly fifteen feet, the ship being lifted four feet out of the water. Though preparations were made to land on the ice in case the ship should be lost, at no time were those aboard really anxious, for the pack, very susceptible to gale, drives before it. If there is no resisting force, there is therefore no danger. If a ship winters near the Antarctic coast it must seek a well-sheltered inlet, otherwise when pressure sets in there, the ice blocks will form up to great heights, twenty and sometimes sixty feet high, splintering the strongest ship like matchwood.

The *Southern Cross* ran into open water in latitude 70 S., longitude 174 E. Heading eastwards by steam and sail, no ice within sight, a curious phenomenon occurred. On February 12, an hour before midnight, the ship was shaken as if by an earthquake. Several members of the expedition noticed this simultaneously in different parts of the ship. The tremor lasted two seconds, then stopped for about three seconds and then repeated itself. It was probably a submarine explosion or eruption in the vicinity.

On February 16 land was sighted and the ship entered Robertson Bay, forty miles wide. Ahead lay towering mountains and the great peak of Mt. Sabine could be seen to rise in majesty to 12,000 feet. Borchgrevinck was impressed: 'We could not sight the lowlying peninsula at Cape Adare until we were very close to the shore,' he wrote. 'Only a yellow border at the foot of the rocks of the Cape was visible where I intended to

pitch the pioneer camp. It seemed at a distance so small and inhospitable that some of my staff felt constrained to remark at first sight of the place, that if it was there I proposed to live for a year, they had better send letters of farewell back with the ship. It was a moment which, I believe, will always remain in the memory of my staff and self as we slowly moved towards the low beach whereon man had never ventured to live before and where we were to live or perish, under conditions which were an unopened book to ourselves and the world.'

Next day, for the first time in the world's history, an anchor fell at the unknown Southern continent.

The *Southern Cross* dropped anchor in ten fathoms of water. Before the spray from the rattling chain had settled on the icy surf, an echo from her salute of four guns, mingled with the energetic cheers of thirty-one enthusiastic men, pierced the frosty air, gradually dying away above the lofty snow-clad peaks ashore. Borchgrevinck and Bernacchi, with one of the Finns, landed at once from a boat and the Australian scientist congratulated the leader on the expedition's safe arrival.

Borchgrevinck had already observed that the Cape Adare region was freer of ice and snow than on his previous visit with Bull, five years earlier. Much to Borchgrevinck's surprise, Robertson Bay was free of ice, but it might fill at any moment. The beach was dark and bare; here and there were ice-blocks, but few penguins were left on the peninsula, owing to the lateness of the season.

Preparations to land the cargo were started at once; stores were unloaded into the small whaleboats and pulled to the shore, where the men waded into the breakers up to their armpits, a cold job with the water temperature at 28 degs F. Two huts were built four yards apart, one for living in, the other for provisions and gear. The space between was roofed with wood, seal-skin and canvas. Evans, the taxidermist of the party, was given a small cubicle; other cubicles were arranged as instrument room and a dark room for photography.

Landing operations were interrupted by a severe south-easterly gale on February 23. By midnight a blizzard was raging and, after consultation with Captain Jensen, Borchgrevinck

ordered the rigging to be cut. One by one different seamen went aloft, but owing to the strength of the wind and the hail of pebbles from the shore, work on the ropes proved impossible. The ropes were as smooth as glass in their sheaths of ice; it was difficult enough to walk even on deck. In the engine-room the two stokers worked with feverish haste to raise pressure in the boilers; even below decks, the howl of the tempest could be heard. In danger of drifting, the *Southern Cross* was in mortal peril. Having lost an anchor, the ship was driven by the furious gale towards the rocks and icebergs. It was an anxious time for all hands but finally, as the steam pressure reached a point when the boilers might burst, the engine quickened, making the ship a living and fighting thing. Assisted by two big new anchors, the ship managed to keep its position in the bay. With the dawn, the gale lowered and the ship steamed over to a large rock, to which four sailors in a whaleboat succeeded in fastening two wire hawsers and a cable.

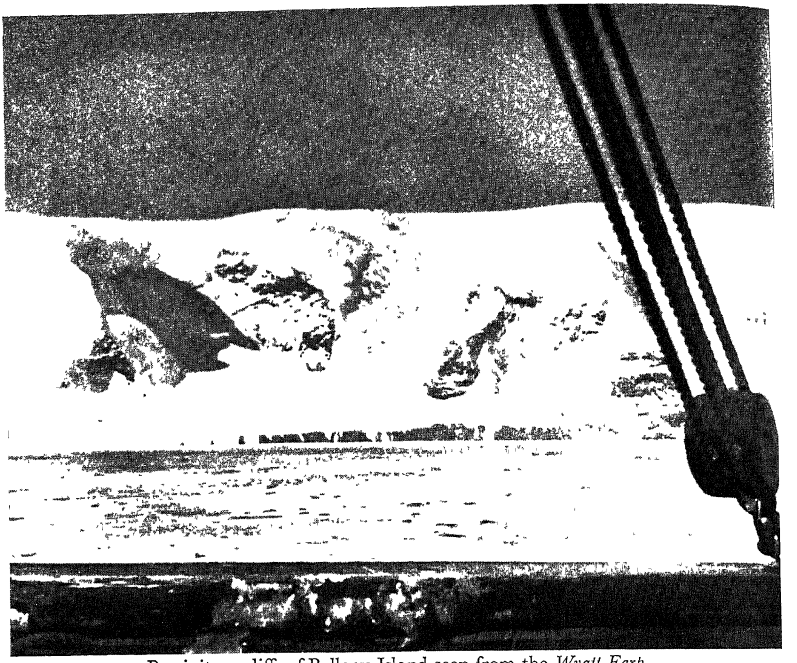
The next few days and nights were most anxious ones for the entire expedition. The two Finns spent a night ashore, gales preventing their return to the ship, which lost two anchors and was in imminent danger of being wrecked on the jagged cliffs. The two hawsers and the cable snapped like thread. Showers of stones from the mountains rained on the decks. By manœuvring carefully, the ship held its position with the minimum consumption of coal. When the gale finally abated, the ship ran into Robertson Bay, at the top of which Borchgrevinck found a broad and magnificent glacier, descending in a fifty-degree slope from a height of 2,000 feet. Yawning crevasses, one above the other, were ready to swallow the unwary. Borchgrevinck named it Sir George Newnes glacier. At the end of Robertson Bay, Hanson, Fougner, Colbeck and a mountaineer from among the crew ascended the mountain ridge, while their shipboard companions watched them toiling over the glaciers and steep rocks. They returned after midnight with a rich collection of rocks and mosses, having reached 3,000 feet.

March 2 was an historic day. The Union Jack was unfurled at Cape Adare. It had been presented to the expedition by the Duke of York. There were cheers from those ashore, and a salute and dipping flag from the ship. Said Borchgrevinck:

A whale-boat party from the *Wyatt Earp* off the Balleny Islands

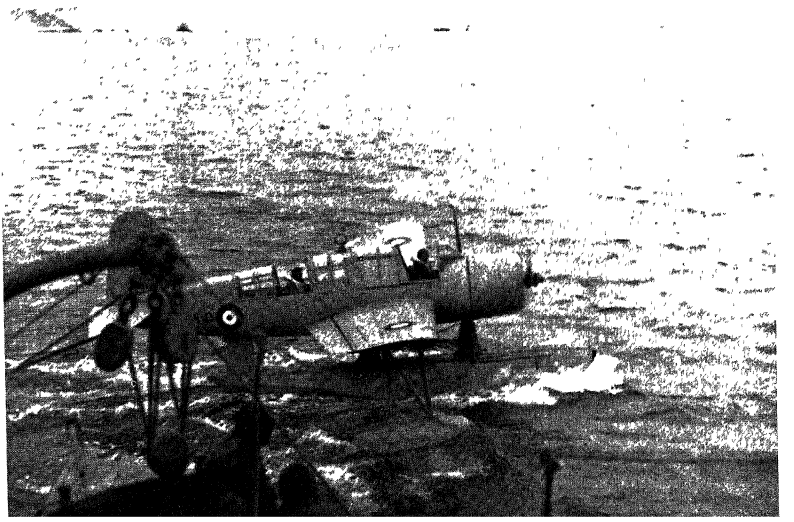
(*Australian News and Information Bureau*)

Scientists from the *Wyatt Earp* recover geological specimens from an ice-floe near the Balleny Islands



Precipitous cliffs of Balleny Island seen from the *Wyatt Earp*
(*Australian News and Information Bureau*)

Reconnaissance flight off Ninnis Glacier Tongue



'Hereby I have the honour of hoisting the first flag on the great Antarctic continent. It is the Union Jack of Great Britain.'

That evening the *Southern Cross* left the pioneers at Cape Adare, the Master had instructions to winter at New Zealand and to return as soon as possible the following year. Borchgrevinck gave strict instructions that on no account should Captain Jensen steer west of longitude 170 on his return voyage to Cape Adare, a course which proved to be almost free from ice hindrance.

But can we imagine the feelings of those ten men, 2,000 miles south of Australia, cut off from the whole world? What would happen to the *Southern Cross* and to the men in the coming year? There was no radio communication or air transport in those days. The pioneers did not even know if it was possible for human beings to exist where they were. As the ship disappeared from view, bearing the wishes and greetings of those left behind, what thoughts passed through the minds of the shore party?

Could they withstand the natural forces they would have to fight? What would happen should the *Southern Cross* be crushed in the ice? How long would they have to stay in Victoria Land? No doubt, these and similar thoughts ran through the ten minds as the departing vessel was swallowed up by the darkness and the men plodded back to their hut.

CHAPTER VI

'Watching Ourselves Grow Old'

It is interesting now to look back at the names of Borchgrevinck's party which spent the first winter ashore on the Antarctic continent, at Camp Ridley, the maiden name of the leader's mother. Three of the party were from Australia. The magnetic observer and navigator was Lt. W. Colbeck, R.N.R., Louis Bernacchi, the other Australian, was the physicist, astronomer and photographer; Hugh Evans, assistant zoologist, had lived in Melbourne. The others were Nicolai Hanson, senior zoologist; Herluf Klovstad, medical officer; Anton Fougner, scientific assistant; Kolbein Ellifsen, assistant, and the two picturesque Finns, Ole Must and Persen Savio, who were in charge of the seventy dogs that had been landed. The average age of the party was twenty-seven years.

On March 12 Bernacchi and Borchgrevinck ascended the 3,670 feet of Cape Adare. On the top they found mounds of pebbles and large boulders stretching westward on undulating ground. They saw, too, vegetation of the kind found on the lower rocks at Cape Adare in 1894. The temperature during the following days began to fall but preparations for magnetic and meteorological observatories went ahead.

In his examination of the terrain round Camp Ridley, Bernacchi was struck by the similarity between the geological formation of Victoria Land and that of the Australian continent. He particularly noticed the numerous pieces of blue-streaked quartz with a remarkable resemblance to the gold-bearing quartz of Australia.

Waving curtains in the sky were the party's first glimpse of the Aurora Australis, and the first of the Cape Adare hurricanes lifted one of the boats bodily from the beach, smashing it against the rocks. At Camp Ridley the wind peaked 87 miles an hour. Blizzards in early April swept down from the peninsula to the camp, burying the dogs completely. The ice in the bay was

ground up and waves of snow, ice and water dashed up to the camp beach, hurling the spray over the hut roofs. The next day the scientists were surprised to find, washed ashore, innumerable specimens of marine life, jelly-fish, star-fish and seaweed. Did then an extensive shallow-water fauna exist within the cold water of the Antarctic circle?

In the middle of the month the penguins had left their rookeries on their annual migration to the warmer water. Only a few brown-backed skuas remained. Many fish were caught in the shallow water near the shore, either off the rocks or from the small collapsible canvas boats which the scientists used for network. Most of the fish were caught by a strong line and without bait.

Towards the end of April, Borchgrevinck started out to explore the Robertson Bay area, travelling over the coastal ice, already about two and a half feet thick. Fougner, Bernacchi and one of the Finns made up the party, complete with provisions for twenty days, twenty sledge dogs and a collapsible boat. Camp was pitched the first night on a small beach at the foot of the perpendicular wall of Victoria Land.

The party had great difficulty in reaching the spot. The slope where the tent was pitched was less than thirty yards wide and only four feet above water. From the sheer wall of Victoria Land a gravel slide had taken place forming a steep slope thirty feet high from the wall of rocks to the beach. The cliff rose to five hundred feet, at places overhanging the little beach, which seemed completely isolated except by way of the bay. Shortly after landing, a southerly wind rose, which continued to increase till it became a violent gale. At seven the ice began to break up, huge breakers washing over the beach; the campers had barely time to save their provisions by carrying them to the top of the gravel slope, where drift snow and ice had formed a gallery, about six feet broad, close to the mountain wall.

As the breakers dashed frozen spray over the beach, the men hauled on the ropes, pulling the travelling gear to safety. Fingers went dead as men and land were covered in a sheet of ice. After immense difficulty they pitched camp in the gallery, all working calmly, although fully realising the awkward position.

On April 23 the bay was completely ice-free and perfectly calm. Fougner and the Finn Savio were sent to Camp Ridley in the collapsible boat with emergency rations for several days. When out of Borchgrevinck's sight the boat party met heavy ice drifting into the bay. Those ashore noticed the floating ice masses returning to the bay and became anxious about their companions. They themselves were without any craft whatever.

For two days they remained in ignorance of the others' fate, until both men appeared over a steep ice slope, descending from the perpendicular wall of Victoria Land. Cutting footholds in the ice, they slowly approached the camp. Both men were in a weak condition, having spent two days and nights in the shelter of the canvas boat, but having discovered what they thought was the only possible place for an ascent to the ridge of Victoria Land, 5,000 feet up.

Four days later the small party of four attempted this ascent, roped together, cutting footholds in the ice and with a good meal of seal-beef inside to sustain their efforts. The sledge dogs howled dismally when they saw the party start their ascent. Three dogs perished, losing their footholds on the icy slope; another was precipitated into an abyss when the climbers were two hundred feet up. The steep pull continued throughout the night, the cold increasing as they climbed. By way of the cliff-top, the party proceeded towards Camp Ridley, where great anxiety had prevailed since the ice broke up, for at base none knew where Borchgrevinck could have camped.

Every clear night the aurora was visible.

Long coloured light beams illuminated the northern sky. Sometimes the colours changed like a spotlight shining on the black roof of space. At other times pink and mauve curtains wavered and unrolled themselves in a brilliant kaleidoscopic display. Numerous seals were seen on the ice-floes as winter approached. One day seventy-one fish were caught, some to be eaten, others to be added to Hanson's collection. Occasionally a brown-backed petrel was observed.

On May 15 the men at Camp Ridley bade farewell to the sun, the refraction appearing as a large red elliptical glow in the north-west. The beauty of the vanishing day left a firm impres-

sion on their minds as the sun sank out of sight in a triumph of colour. It did not return until July 27.

During May and June tremendous gales blew from the south-east, the wind-borne stones rattling against the huts like rifle fire. In the bay, the ice-blocks piled up before the wind.

Meteorological readings were made with great difficulty and on one occasion Evans was lost crossing from the thermometer screen to the house. The Cape Adare blizzards reduced visibility to the end of one's nose, making it an easy matter for a man to be lost when only a yard or two from the huts. Snow lay everywhere, giving Evans no hint as to where he might have strayed. A three-hour search finally found him; with careful treatment he soon recovered.

That winter, meteorological readings were taken every two hours, right through the twenty-four. Magnetic observations were made in a tent by Lt. Colbeck and Bernacchi. Unfortunately the apparatus was placed about 2,000 yards from a volcanic and magnetic range of mountains, which influenced the instruments. Disturbances due to the occurrence of the aurora were another trial for the scientists.

Borchgrevinck describes the strain of the long polar night, the monotony and the difficulty of living so close to one another, the lot of all who venture into the southern regions: 'During the gradual shortening of the days we experienced great depression, as if watching ourselves grow old. We were getting tired of each other's company and began to know every line in each other's faces. Chess, cards and draughts were the most popular recreations.'

On June 3 the thermometer showed −31 degs F., and some men were badly frozen. It was the Duke of York's birthday, and the Union Jack, his present to the expedition, was hoisted, whilst a beautiful aurora waved in mighty kaleidoscopic curtains over the camp. On June 15 another tremendous gale was blowing, lasting until the 17th and making it impossible to collect the meteorological readings. But for the special roof sloping towards the east, it is doubtful whether the hut would have survived. As will be seen from a study of the meteorological

records, a great and sudden rise of temperature indicated an approaching gale.

Days were now very dark, though the horizon towards the north-west glowed slightly crimson. 'The darkness and the silence in this solitude weighs heavily on one's mind,' the leader wrote. 'The silence roars in one's ears. It is centuries of heaped-up solitude.'

During the last of the autumn sledge journeys, depots had been made at several places along the coast in Robertson Bay and on the peninsula in more elevated places than the camp, in case high water should rise above its level.

On July 26 Borchgrevinck started on a fresh sledge journey, with the object of reaching the coast to the west of Robertson Bay. Evans and both Finns went with him, taking provisions for thirty days and twenty-nine dogs. For twelve miles the going was very rough, owing to the large ice-blocks heaped one upon another. Camp was pitched at the foot of an iceberg. As the ice conditions to the south appeared very promising, Evans was sent back to Camp Ridley to tell Colbeck and Fougner to follow with more sledges and provisions, while Borchgrevinck started southward, accompanied by the two Finns. They travelled all night without pitching camp, with a temperature of −25 degs F. During the next two days it was misty. No land was to be seen. Towards evening on the 28th a gale came on with heavy drift, confining the three men to their sleeping-bags. It was bitterly cold. They suffered greatly from frost-bite, while the dogs froze fast to the ice. No land could be sighted anywhere. On July 31, having seen nothing of the party which was to have followed, they continued their journey over comparatively good ice. In the evening, Borchgrevinck discovered an island to the south and reached the western side of it an hour after dark. They were very hungry and worn and the temperature was −40 degs F. when they pitched the tent. This spot was called Midwinter Camp, and the island was named Duke of York Island. Borchgrevinck investigated the coastline, and during the succeeding days made as thorough an investigation of the immediate surroundings as the cold and weather permitted. Getting anxious about the party which was to have assisted, Borchgrevinck took in stores of seal-beef and blubber

as a precaution. They suffered a great deal from cold and frost-bite, although managing to keep up a blubber fire in the tent. Having secured a valuable geological collection, in the middle of August they started back and on this journey experienced the lowest temperature recorded —52 degs F. or 84 degs of frost.

On his return to Camp Ridley, Borchgrevinck decided to continue the explorations already begun in Robertson Bay, partly from the great geological and other interests presented by that locality and partly because he hoped to find there a likely place from which to penetrate further inland.

Parties were despatched during the remainder of August and September with different members in turn and valuable collections and observations were made.

On September 9 the heaviest gale was experienced at Camp Ridley. Showers of stones rattled on the huts all night and the velocity of the wind rose above 100 m.p.h. The mercury barometer dropped to the lowest then observed within the Antarctic Circle—27·9 inches. The highest barometric reading at Cape Adare was 30·1 inches on July 22, so the extreme range between maximum and minimum there is 2·24 inches.

In the vicinity of Robertson Bay, the great elevation of the land, which reaches 12,000 feet, rendered it difficult to find a likely place to start a journey into the interior. Glaciers rising to thousands of feet plunged down to the sea, sometimes at an angle of about 50 degs, and, being split by innumerable deep crevasses, made excursions on the coast both arduous and dangerous. The Finn Savio and Borchgrevinck worked in the vicinity of Mt. Sabine for more than seven weeks, camping in a hut constructed of stones between two projecting rocks. Communication with Camp Ridley was maintained and stores were taken to form a depot at Duke of York Island. On one such journey, Bernacchi and Ellifsen had the frightful experience of being overtaken on the ice-pack by a furious gale.

Land to the south-west of Duke of York Island forming part of the Admiralty range was visited, which, as it is a land of intense geological interest, was named Geikie Land. Moraine studies were made there. Duke of York Island was found to be cut through from east to west by broad, deep reefs of quartz.

'Minerals of value occur in this vicinity, justifying the belief that in time to come exploration will receive much support from commerce,' remarked the leader. 'Geikie Land, which we visited on several occasions, is likewise rich in minerals.' A good deal of vegetation was found there, but great difficulty was experienced in penetrating further inland. Sledges with provisions were taken up ridges, across glaciers and down precipices: when the men could bring them no further they loaded themselves and with ropes and axes climbed the steep slopes. Exhausted and frozen, the men were forced back to the stone hut after numberless attacks on the inaccessible ranges.

A report from camp told that Hanson, the zoologist, was in a low condition and under medical treatment, having lost feeling in his legs and being able to walk only with difficulty. Borchgrevinck began to suffer severely from rheumatism and Colbeck suffered from neuralgia. On October 4 the party started back for Camp Ridley and on arrival found Hanson's condition very low indeed. In spite of all the doctor's care and attention, he daily grew worse.

The next entry in the leader's narrative makes touching reading: 'At two in the morning of October 14 the doctor called me and officially informed me that Hanson had not long to live. He had told Hanson of his condition, at which he expressed a wish to say good-bye to us all, I went in and found him quiet and without pain. Calmly he bade me his last farewell and confided to me his last wishes. He himself chose the spot where he wished to be buried—at the foot of a big boulder 1,000 feet up on Cape Adare.'

One by one the men entered the little room to say good-bye. Hanson said he had a feeling that he was about to take a long journey. He asked Borchgrevinck to make his biography as short and modest as possible. Half an hour before he died from occlusion of the intestines, the first penguin came back from its winter migration. The zoologist retained his enthusiasm till the end: he asked to see the penguin, and when it was brought to him was delighted. He was conscious till the end, endeavouring to write to his young wife, but only succeeded in addressing the envelope.

Like the brave and true-hearted vikings of yore, Hanson

passed away. Bernacchi and the Finns prepared the final resting place, dynamiting the solid ice crust, and at the top of a desolate and almost unknown land was buried this first Antarctic pioneer to give his life in the cause of science.

CHAPTER VII

Relief at Last

The short black-headed Adelie penguins now arrived on the peninsula in great numbers and the men looked forward eagerly to the time when they would get fresh eggs. Before the end of October the ice-pack began to slacken. Watertight oaken casks were placed both in the hollows of the icebergs and on the floes, enclosing a communication, giving the results of the expedition and requesting the finder to forward it to the Royal Geographical Society, with details of the locality and circumstances under which it was found.

On November 3 the first penguin eggs were devoured with eagerness. Eggs were collected and put down in salt in case the *Southern Cross* should not return. During the winter, both away from and in the main camp, they had lived chiefly on seal-beef; now penguin flesh and eggs formed a great resource. Fougner did valuable work for the marine biological department, numberless specimens of starfish and jelly-fish, as well as algæ, being added to the collection. The peninsula was now literally covered with Adelie penguins and still a constant stream of new arrivals could be seen far out on the ice, like a long endless black snake winding in between the ice-floes. As no open water was to be seen anywhere, not even a vapour-cloud indicating the near neighbourhood of any, these welcome travellers must have had a long walk.

With short interruptions the party had continually experienced heavy gales, some of which exceeded 90 miles an hour. These gales naturally considerably checked the progress of sledge expeditions. Nearly all the provisions had to be taken, since little bird-life was seen except on the coastline and the frequent gales always necessitated a great percentage of idle camping days, when much of the provisions for the inland journey would be eaten with no corresponding advance.

According to meteorological observations, Borchgrevinck concluded that no one should start a sledge journey in the Cape Adare region without taking into consideration the probability of at least 20 per cent. of checking gales. In the Antarctic there are none of the northern resources, such as bears, foxes, musk-oxen, reindeer and other Arctic fauna. Life in the Antarctic depends entirely upon a careful selection of the necessary provisions.

These facts, besides the great elevation of Victoria Land and its difficult glaciers, make travelling within the Antarctic Circle quite different from that in Arctic regions. In the vicinity of Cape Adare, a position which corresponds to that of Northern Norway, the ice and meteorological conditions cause much greater danger to the traveller than in those higher latitudes in the north which are ruled by similar average temperatures.

It seemed to Borchgrevinck that an early break-up of the ice in the bay eastwards of the land stretching from Cape Adare down to the active volcanoes, Erebus and Terror, took place every year; thus travelling at sea in the pack, as well as in Robertson Bay and in the vast Ross Bay to the east, would always, in his opinion, be a perilous undertaking. Yet future expeditions disregarded this experience. Successful exploration within the Antarctic Circle, he rightly thought, must always be confined to one locality, for if too large a field for operations were chosen, the natural conditions and the variable Antarctic climate would make failure probable. This warning, however, was also unheeded by future expeditions in the same region, at a cost which we know only too well to-day.

Up to the middle of November at Cape Adare, very little change was to be seen in the general ice-pack, although some open canals were met with on a sledge journey to the east. The canals closed again and not until the end of November did noticeable changes take place. Although the penguin colony seemed to fill the very ground of the peninsula, new arrivals continued even after the first-comers had been sitting on their eggs for a fortnight. The skuas, too, had returned. The boldness of these birds was such that on several occasions they were seen to attack the dogs. The giant petrel also arrived, and their

movements were watched with great interest to discover the places where they intended to nest.

During expeditions in the Sir John Murray glacier area, one of the Finns had an experience which was unlikely to occur twice in a lifetime. The Finn was walking quite alone over the glacier not far from the camp where Bernacchi and Colbeck were, when all at once, without a moment's warning, what looked to be the firmly frozen surface collapsed. Down went the Finn into the sinister and unknown world of a deep crevasse. Too late to save himself, he shot down into the abyss. As he fell he turned over and went head first. When he recovered his senses, he did not at first know where he was, but finally found he was sandwiched between two ice-walls. Far above him a thin streak of light was visible. An intense head pain made him realise that he was somewhere down in the bowels of the glacier. Mad with terror, he shrieked for help. He kept this up for an hour until his voice left him and he could no longer whisper. Somewhere above he heard a man cutting up the frozen carcass of a seal for the dogs. At this stage he accidentally felt his pocket. And then, as his fingers closed round his clasp-knife, it flashed through his mind that he might do something for himself. Placing his back against one wall of the crevasse he began to cut small steps for his toes in the opposite wall. After an hour's work he attained the surface, reaching camp half-frozen and in a state of collapse.

After the middle of November dark vapour-clouds were continually to be seen towards the eastern horizon and on one occasion the temperature rose to +18 degs F. A large sheet of water, in which a strong current was running at five knots, appeared at the Cape. The ice was evidently wearing rapidly, the current increasing perceptibly in strength from day to day; but as the bulk of the immense pack still remained with very few breaks, the men seriously contemplated the possibility that the ice conditions of the previous season had been exceptionally favourable and that the *Southern Cross* might be unable to reach them. Strict precautions were taken against using more food than necessary. To their store of provisions they added seal-beef, penguins and eggs in case they had to face another

winter's siege. Clear, calm, comparatively warm days became frequent.

Bernacchi and Lt. Colbeck made arrangements for observations of the total eclipse on December 3, but expectations were doomed to disappointment, the day proving overcast. The ice now began to break up in earnest, making it clear that all the pack-ice took a westerly course under the influence of the prevailing wind and northerly under that of the current.

On December 10 Borchgrevinck started on a last sledge journey into Robertson Bay, principally for the purpose of securing the eggs of different birds. On this journey a remarkable discovery was made by the doctor, who had been sent on a short journey into the Admiralty range for the purpose of collecting specimens of the vegetation on Geikie Land. When he came back he proudly displayed several insects of three distinct types, which he had found in the mosses. The existence of insects made Borchgrevinck think that the temperatures about Geikie Land would not fall much below those experienced at Camp Ridley, otherwise insect life would not be possible. From Crescent Bay, on Duke of York Island, Borchgrevinck entered a bay to the south-east—an arm of Robertson Bay—at the end of which was found a very low and easily accessible land, the beach rising from the water to about thirty feet. The land was formed partly by the glacier and partly by stone-shoots from the mountain side to the north-east. As a dividing line between this work of the glacier and that of the mountain ravines, a stream came rippling down among the boulders and rocks from two small lakes, formed by the melting of a great glacier which was named the Murray Glacier. Before returning to Camp Ridley, he explored this neighbourhood to the height of 1,700 feet, at which altitude vegetation was found.

With the eye of a geologist, Borchgrevinck noted how the nature of Victoria Land told its own history. The moraines, the empty glacier beds and the worn rocks convinced him that these lands must have changed much during comparatively recent periods.

The report from the cliff-top above Camp Ridley was that no ice was to be seen to the north, even through the telescope. But north-west and west much ice was in view. Along the

beaches of the peninsula the ice was getting unsafe for travelling. Several young penguins were out of their shells. Evans, who had taken over Hanson's department, collected specimens of the young ones from day to day in order to record the stages of their growth. Fougner secured a magnificent ninety-pound jelly-fish. In the surface waters of the Antarctic there is an abundance of diatoms, microscopic marine life, and the small crustaceans which are the chief food of the whales, seals and penguins.

New Year's Day, the turn of the century, broke bright and clear, with the Union Jack flying merrily at the flagstaff, the first fine day for three weeks. The men lay on the hut roof basking like seals in the genial rays of the sun. Although there was open water everywhere, many huge icebergs were now seen to drift northwards past the Cape; a few seemed to be influenced by a strong under-current, which brought them into Robertson Bay, where the larger ones ran aground. It was interesting to see the bergs sail into the bay in the teeth of a heavy gale and the upper current.

Day after day one of the men would climb to the summit of Cape Adare armed with a telescope and gaze eagerly across the ocean for a sight of the returning ship. It was always the same report. 'No ship in sight', nothing but the waste of waters and drifting masses of ice. The men morosely thought they were doomed to remain there another year, perhaps two, but that was a nightmare too dreadful to contemplate! With rigid economy, provisions might have lasted out a year but the coal stocks would have vanished after another six months. The spirits of the men sank below zero and rarely rose above it.

But the long incarceration came to an end, suddenly and unexpectedly. On January 28, when all were asleep in their bunks, a voice in the tiny hut calling out 'post' broke their slumbers. It was Captain Jensen, Master of the *Southern Cross*, with a bagful of mail over his shoulder. With hysterical joy the nine men tumbled out of their bunks to welcome him. Gradually they heard all the news, both private and public. They learnt for the first time about the war in South Africa and of the invention of radio communication, that factor which has broken down the feeling of isolation and strain imposed on men who venture into the lonely corners of the world.

CHAPTER VIII

On the Barrier

THIS world of ours is a magnet, and like all other magnets has two poles. The North and South Magnetic Poles are approximately a thousand miles from the geographic Poles, which are the axis of the rotating globe. At the Magnetic Poles, a compass, if suspended freely, will stand vertically. Halfway between the two Poles the compass assumes a horizontal position. Elsewhere on the earth it will point toward both Magnetic Poles, but will every time dip towards the nearest. The compass is not true north and south, but differs from it by an angle which is called the declination, and the degree of declination is peculiar to any particular spot on the earth's surface.

For navigation mariners want to know the angle between true north–south direction—the meridian—and the direction in which the compass needle points; they know it as the variation of the compass. If a compass is moved in a closed circular path round the Pole, the needle will travel through 360 degrees. At the Pole itself there is no preferential direction, the horizontal component of the magnetic field of the earth vanishes, and the lines of force are vertical, so a dip-needle must stand vertical. Only at the North and South Magnetic Poles does the horizontal intensity reach zero and the dip become 90 degs.

The first effort to fix the position of the South Magnetic Pole was made by Duperrey in 1825, when he sailed the globe in the ship *Coquille*. The approximate position of the Pole was given as 76 degs S., 137½ deg E., and was estimated at the point to which directions of the compass needle at several points converged. A like method was used by D'Urville in 1840 and he obtained the position 72 degs S., 136¾ degs E., as the probable location of the South Magnetic Pole. The first reliable position of the constantly shifting Pole was made by Sabine with Ross's

expedition in 1841 from magnetic observations. He gave the position as 75 degs S., 153¾ degs E., and no further determination was made until Borchgrevinck's expedition on the *Southern Cross*.

Being in cold regions, both North and South Magnetic Poles are difficult of access, and their positions, even to-day, have not often been determined and certainly not with the accuracy that is desirable.

With the return of the *Southern Cross*, no time was wasted at Adare. At once such stores as were wanted for a southward push were taken on board from Camp Ridley, including the dogs, sledges and scientific instruments. After paying final respects to Hanson's grave, all embarked, leaving the huts, coal, a considerable quantity of provisions, and a small note from Borchgrevinck to the commander of the next expedition that might visit the locality. On February 2, 1900, the *Southern Cross* steamed away from Cape Adare, and once again the united expedition of thirty souls was under Borchgrevinck's command.

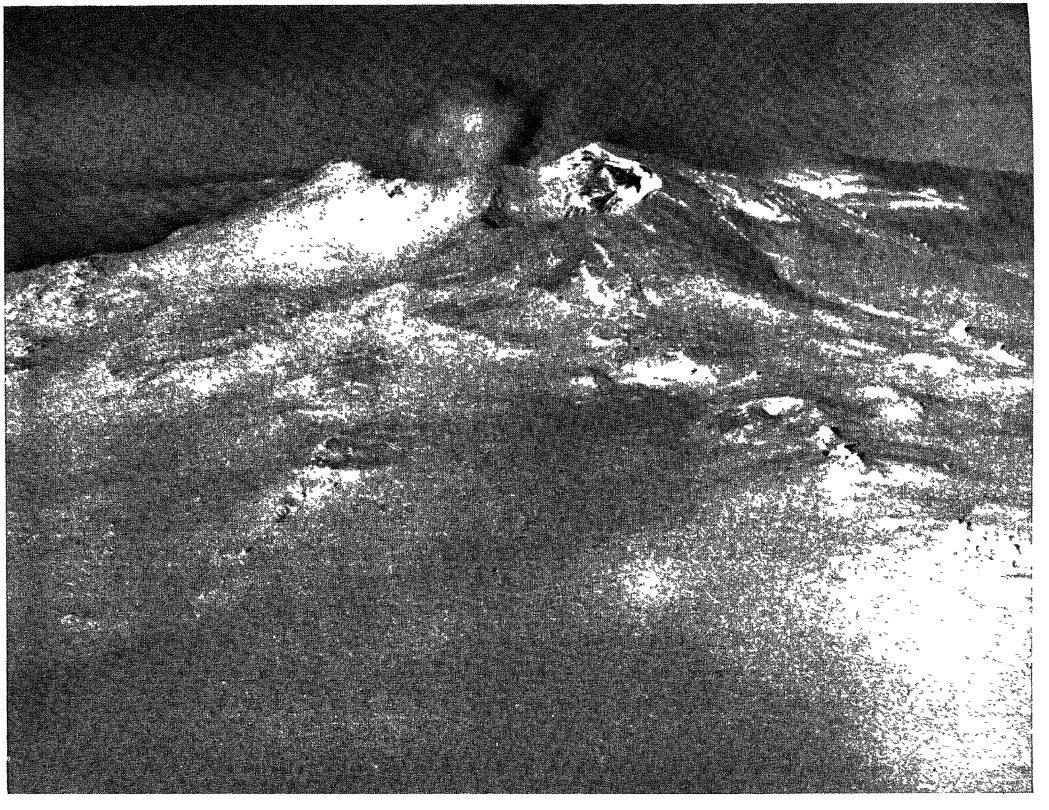
Taking repeated bearings on Victoria Land for mapping purposes, the ship arrived next day at Possession Island. Instruments and cameras were put into a boat and a successful landing was effected. On Possession Island they found the post with the iron box left there by Bull's expedition of 1895. Borchgrevinck left a letter in the box with the names of those who had landed and, after collecting specimens of rocks and vegetation and securing as many photos as possible, returned to the vessel without mishap. In fine clear weather, with each undulation and white peak of Victoria Land clearly defined against the blue sky, a landing was made at Coulman Island, principally for magnetic observations. Then the course of the *Southern Cross* was laid westwards.

Since leaving Cape Adare the temperature of the water had risen from 28 deg to 30 deg. The land now appeared considerably lower than the ranges near Cape Adare, but it still afforded no opportunity for a sledge party to penetrate far.

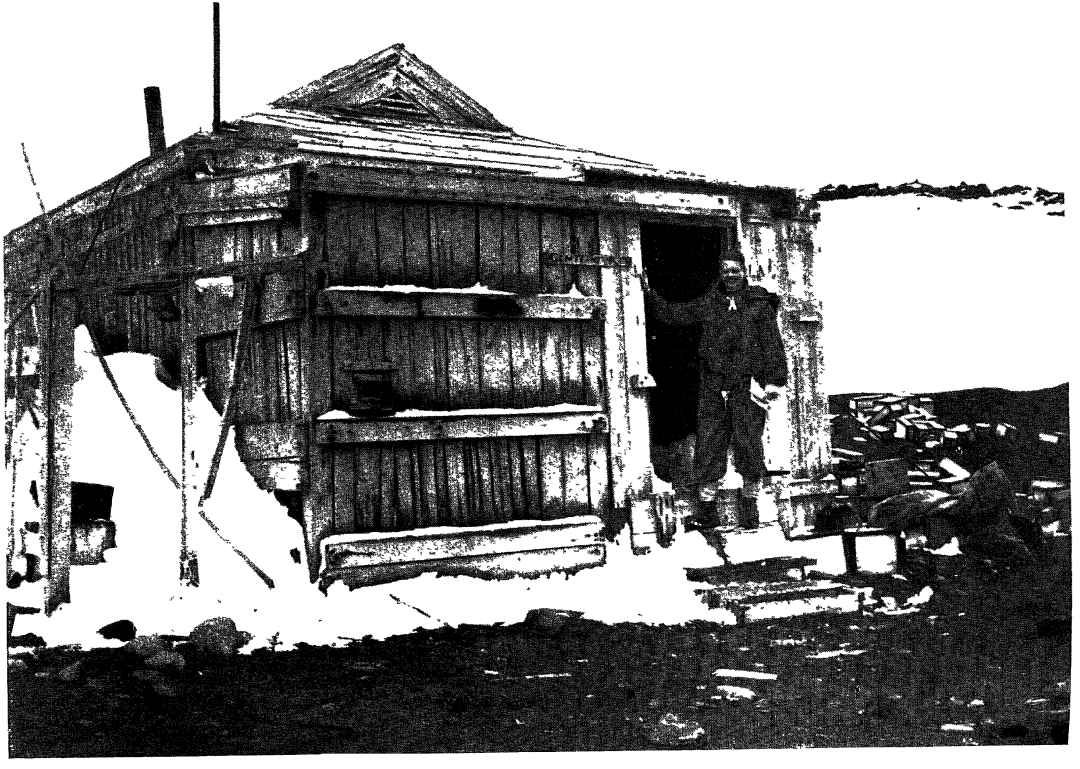
Having travelled as far as possible towards the land to the west of Coulman Island and to the south of a conspicuous cape, which Borchgrevinck named Cape Constance, after his wife,

An aerial view of Mt. Erebus, the 12,000-ft. Antarctic volcano

(*U S Navy photograph*)



Shackleton's Camp at
McMurdo Sound
(U S. Navy photograph)



they found a bay in the seaward edge of the ice-sheet, descending from Victoria Land. It proved to be an admirable place for magnetic observations, made on the ice by Bernacchi and Lt. Colbeck and these were of the greatest value in locating the position of the South Magnetic Pole.

The ship steamed southwards and a great deal of pack-ice was seen towards the west, making mapping difficult. Borchgrevinck decided to risk an investigation of a fiord to the north of a range which terminates in Cape Washington. Proceeding westwards for about twenty miles from the cape, they discovered a promontory almost clear of ice and snow, with a beach of about a hundred acres. There the whole party landed with Captain Jensen and two sailors. The promontory running north-westwards left a cove, apparently a splendid winter harbour, to the south, where Mt. Melbourne rose to a height of about 12,000 feet. Its conical volcanic top was distinctly reflected into the clear cove, while the midnight sun surpassed itself in splendour. To the south-east the peninsula or promontory was undulating and rose in wonderfully worn shapes to the height of about 700 feet, affording wild and magnificent scenery. Large pieces of brimstone and lava covered the ground. Vegetation of two different kinds was found here, very many skuas, plenty of seals and a small penguin rookery.

On February 7 Cape Washington was left behind, the coastline towards the south-west gradually appearing lower with, here and there, dark conspicuous rocks protruding from enormous glaciers.

Mt. Melbourne could still be distinguished to the north-west through the misty air, while Franklin Island rapidly grew more distinct. A landing was made on its western side, on a pebbly beach very like the peninsula at Cape Adare. There were very many penguins on the peninsula, many more than were left at Cape Adare. The most interesting discovery, however, was made in the marine zoological department, Fougner securing a rich collection of the shallow-water fauna.

Soon afterwards, Mt. Erebus and Mt. Terror, with misty clouds clinging to their summits, loomed up in the south. The coastline was ice-bound; only at intervals was it broken by a projecting rocky promontory. Cape Crozier was comparatively

free from ice and snow. They landed at the foot of Mt. Terror. The beach was formed by debris from an overhanging rock about 500 feet above and did not exceed ten feet in width.

Shortly after landing, Lt. Colbeck, at Borchgrevinck's request, went back with two sailors in the boat to fetch a camera, while Captain Jensen and the leader busied themselves collecting. Suddenly there was a tremendous roar overhead. Their first thought was that the overhanging rock was about to engulf them, but in fact the glacier immediately to the west of the little beach was giving birth to an iceberg. With a deafening roar a huge body of ice plunged into the sea and a white cloud of water and snow hid everything from view. A raging, rushing wave rose like a wall before this million-ton berg. It seemed to grow rapidly as it raced towards the low ledge. Instinctively both men rushed to the highest part of the beach and stood close to the perpendicular mountain wall. The wave, which must have reached a height of from fifteen to twenty feet, struck Borchgrevinck first; lumps of ice dashed against his back but he clung to the rock until he felt the blood drain from beneath his nails. He had barely time to call out to Captain Jensen to cling to the rock, when the icy water closed over his head. When it had passed, both men were still together. The following waves were several feet lower and only reached their armpits, but the drag of the water in its return was almost beyond their strength to resist. Had it not been for a projecting ice-slope, which seemed to break the wave in its advance, the men would undoubtedly have been smashed against the rock.

Far out at sea the boat was returning with Lt. Colbeck and the two sailors; they saw all that had happened to greater advantage. Lt. Colbeck saved his boat from being swamped only by the exercise of considerable presence of mind. As it was, both Captain Jensen and Borchgrevinck escaped with a good deal of bruising, chilled by the icy bath; a splendid collection of rocks and vegetation soon made them forget the incident.

Borchgrevinck now decided to steam southwards. To the south-east the slope of Mt. Terror meets the ocean rather

gently and this part, curiously enough, was free from ice and snow, though the cone was covered in a mail of ice. The eastern quarter of the coastline of Mt. Terror was not ice-bound, but from the south-east cape a high continuous ice barrier stretched east-south-east, apparently about sixty feet high. From the crater of Mt. Erebus a smoke-cloud was from time to time shot up into the frosty air. With a biting breeze from the south and the thermometer several degrees below zero, the deck, rigging and sides of the vessel were all covered with ice.

The ship crossed the 180th meridian, the international date-line, and proceeded along the barrier, slowly gaining some southing. On February 13 a strong gale, with heavy seas and thick snowdrift, commenced. The *Southern Cross* had now several feet of ice on her decks, bulwarks and sides, and those aboard suffered severely from the cold. In the intervals between the thick snow squalls tremendous icebergs hove in sight. On the 16th they were still making southwards, with plenty of pancake ice around. On February 17, while in 78 degs 34 mins S., and 164 degs 45 mins W., a break in the barrier was seen with low ice towards the east. At this place Borchgrevinck landed with sledges, dogs, provisions and instruments; then, leaving the vessel with the rest of the expedition in charge of Captain Jensen, and accompanied by Lt. Colbeck, Bernacchi, and others, he proceeded southwards, reaching 78 degs 50 mins, the furthest south yet reached by man.

The return to civilisation now began. On March 30 the *Southern Cross* dropped her anchor at Stewart Island, New Zealand, where fresh food was brought on board, and the leader sent this communication to Sir George Newnes: 'Object of expedition carried out. South Magnetic Pole located. Furthest south with sledge, record, 78 degs 50 mins. Zoologist Hanson dead. All well on board.—BORCHGREVINCK.'

As a small pioneering party the *Southern Cross* expedition stands unchallenged. Its record stands up well against any of the major expeditions which received greater financial support and publicity. Borchgrevinck's men were the pioneers of Antarctic meteorology and their work shows the advantages to be gained from compact expeditions with definite and limited

objectives. They proved, moreover, for the first time that an expedition could survive the Antarctic continent in winter.

The results were of the greatest importance. The first complete series of magnetic and meteorological observations were scientifically taken. These observations proved how disturbed were magnetic forces in Antarctica and gave the truest position at that time of the South Magnetic Pole: 73 degs 20 mins S., 146 degs E. The nature of the Antarctic winter on shore was shown for the first time and important data collected regarding atmospheric circulation. Until then no one had heard of the fierce Antarctic cyclones that blow over the great continent. Cape Adare was found to be nearly in the centre of the world's lowest barometric area. Many biological specimens entirely new to science had been discovered and geological specimens collected of the unknown continental rocks. The habits of penguins and seals were studied and the first photographs of Antarctic lands, ice formations and fauna were taken, which even to-day compare favourably with those of modern expeditions. Unfortunately, and notwithstanding the splendid sledging gear and over seventy suitable dogs, the grim and lofty Admiralty Range made the interior inaccessible from the pebbly beach at the foot of Cape Adare.

The expedition discovered new species in Antarctic biology, including insects and shallow-water fauna, and added new features to the knowledge of the geology of Victoria Land. Robertson Bay had been investigated and mapped and new islands discovered. The coastline from Cape Adare to Mt. Terror had been surveyed and mapped. First time landings were made at Coulman and Franklin Islands, Wood Bay and Mt. Terror, while one of the most important geographical discoveries was that of Southern Cross Inlet, later to become known as the Bay of Whales, and the finding of an excellent camping ground on Newnes Land at the foot of Mt. Melbourne.

The *Southern Cross* navigated farther than any vessel had been brought before, and lastly, Borchgrevinck and his companions proved the possibility of scaling the great ice barrier.

Possibly with his Australian experience in mind, Borchgrevinck wrote at the conclusion of his expedition: 'I believe further in the history of culture of nations in the Southern

hemisphere the awakened interest in Antarctic research in the year 1900 must needs, in time to come, be recognised as a conspicuous and bright intellectual land-mark.'

But it was Fate's decree that Borchgrevinck's expedition should never receive the credit that was its due. It was well equipped as regards food, dogs, sledges, polar gear and scientific instruments. Borchgrevinck had worked alone in organising his expedition but his plans cut into those already being formed by Sir Clements Markham, then President of the Royal Geographical Society. Markham was not at all pleased with Borchgrevinck and it was not until thirty years later that recognition came to the man who had pioneered Cape Adare. Shortly before his death in Oslo, Borchgrevinck received the Patron's Gold Medal from the Royal Geographical Society.

CHAPTER IX

Bernacchi Returns

One of the important aspects of scientific exploration in Antarctica since the days of Ross has been the geophysical problem; such problems as those of terrestrial magnetism, atmospheric electricity and the aurora can best be studied in the polar regions and all of them are more or less related to the sun.

Each expedition to Antarctica, even from the earliest days, has assigned a scientist to this work. Their records throw light on the magnetic state of the earth.

We all know from our newspapers how magnetic storms occur which sometimes put our telegraph lines and the international beam radio links out of action. These storms are thought to be caused by streams of electrical particles from the sun. These cosmic rays, or rather the study of their action, is of the utmost importance and is now being undertaken by scientists in every country. Research into these mysterious and invisible rays is a probe into the study of matter itself.

Visible tokens of these electrical storms, attracted polewards by the earth's magnetic field, are the auroræ, most beautiful of nature's light effects. As these storms ionise the upper air, the auroræ occur about forty or fifty miles above the earth, sometimes reaching 500 miles into space. Different theories exist as to the cause of the auroræ and Antarctic expeditions have noted how their occurrence causes radio blackouts. The auroræ occur in the Antarctic regions on the circumference of a circle, twenty-three degrees from the geomagnetic, or magnetic axis pole. Many observations have been taken in high latitudes where auroræ are frequently seen but a great number of problems still remain to be solved.

The immediate and practical application of magnetic observations made by different expeditions is the correction of navigation charts, making the sea safe for ships. Mariners want to

know all the changes and variations in magnetic forces taking place from year to year and there is no better place to find this out than in the polar regions. Best results have been obtained by simultaneous observations made at different places over the whole polar region. This applies to the meteorological, magnetic and auroral phenomena. To a small extent simultaneous observations were made by the nations in the year 1882–3, and again in 1932–3, both periods being fixed as international polar years.

Bernacchi had been back less than a year from the *Southern Cross* expedition when he was invited by Captain Robert Falcon Scott, R.N., to become physicist with the National Antarctic expedition in the *Discovery*. Bernacchi was then working in London for the Royal Society, reducing the magnetic and other physical observations taken at Cape Adare. Bernacchi found himself placed in charge of a set of the latest magnetic instruments. He visited the Potsdam Observatory near Berlin and received instructions from Professor Eschenhagen, the designer of the instruments. The delicate apparatus had not been seen outside Germany and there was some doubt whether it could be operated under Antarctic conditions. However, that it did work all right, though not without trouble and anxiety, is proved by the two-year continuous photographic record of all the magnetic forces in the Antarctic region. Bernacchi had new types of pendulums to measure the force of gravity and a new type of seismograph to be tested.

Bernacchi returned to Australia under his own steam, taking his precious instruments, and finally joined the *Discovery* at Port Lyttleton, New Zealand.

Scott's *Discovery* was the sixth ship of that name to win fame in the chronicles of exploration. With magnificent support from the British Government, from wealthy citizens and various scientific bodies, Scott's was the most ambitious scientific expedition which had ever sailed from England. The *Discovery* was one of the most powerful ships ever built for the Antarctic, constructed not for resisting pressure like Nansen's ship the *Fram*, but for biting her way through the pack like an old-time whaler. She was 485 tons, and 172 feet long. Her invincible bow

enabled the charging vessel to ride upwards on an ice-flow and then by its downward pressure crack it.

This expedition's purpose was to explore the nature and extent of the Antarctic continent, to penetrate the unknown interior, probing the depth and character of the ice-cap, the underlying rocks and their fossils, to make a magnetic survey to the south of latitude 40, to take meteorological observations every two hours, to observe ocean depths and temperatures, to sound, trawl and dredge, and to take pendulum observations of the force of gravity.

Bernacchi alone among the forty-four souls aboard, had previous Antarctic experience. Among his companions were Ernest H. Shackleton, Dr. Edward A. Wilson and Frank Wild, who were making, with Scott, their maiden voyage to the southern ice. All of them later became famous.

Among the *Discovery* scientists was Hartley T. Ferrar, who spent much of his life in New Zealand, later joining the New Zealand Geological Survey Department and becoming a prominent lecturer at the Philosophical Institute, Wellington. Other members of this expedition hailing from New Zealand were the indispensable ship's steward, Charles R. Ford, and Hare, who acted as wardroom steward for a year only but had a unique experience during his time of service.

In New Zealand the *Discovery* went into dock, for a mysterious leak had developed in the hull during the outward voyage. Dry-docking failed to reveal the defect. On Christmas Eve, 1901, heaped high with coal, supplies and scientific gear, the ship bade farewell to the friendly New Zealand shore. Bernacchi was comfortably installed in a cabin next to Captain Scott. The average age of Bernacchi's companions was only twenty-five and few were married. Scott himself, then a bachelor, was thirty-three, in the full vigour of his youth and mental powers.

Fortune favoured the *Discovery* and in the whole of her three-years' journey she was known as a 'happy ship'. The expedition had one of the easiest and pleasantest voyages to the pack of any expedition. On January 2 the first berg, vanguard of the approaching ice-fields was sighted and next day the Antarctic circle was crossed, earning the sailor's traditional right to drink a toast with both feet on the table. Ice-blink, the white reflection

of the ice-fields, was visible on the southern horizon. This distinct whitening of the sky, herald of the pack, is seen hours before the ice is met.

During the night scattered fragments of honeycombed floes slid against the stalwart hull. By morning ice was all around, and the ship was forcing her way through grinding floes, twisting and turning in the open pools and canals.

Bernacchi was again struck by the magical sight of the pack, the alabaster floes, the exquisite greens of the cavities. Here and there he spotted the yellow patches of plankton, the marine life which drifts with the ocean currents or is carried along with the wind, and whose myriad tiny organisms are manna to biologists.

In the pack the *Discovery* found so much open water only the sails were needed. Animal life abounded. Albatrosses had vanished, but the denizens of the pack—the slatey fulmars, voracious skuas and incredible snow petrels, were on the wing. The squawks of inquisitive penguins filled the air, as they gazed up in wonder at the two-legged creatures leaning over the rails. Sleeping seals awoke on the ice-floes, wide-eyed, not understanding the lurking danger.

A penguin-hunting party left the ship and the penguins too set out to investigate the strange invaders of their habitat. In penguin experience the only danger lay in the sea where the vicious orca or sea-leopard make banquets of unwary birds. When seals were sighted, ship's course was altered for the rifle to do its fatal work. While zoologists skinned seals and penguins for food and scientific research, the decks ran with blood. The sheep aboard were killed too, for the Antarctic ice-box kept the carcases fresh and clean as they festooned the rigging. The long, calm Antarctic nights under the midnight sun were beautiful with blazing skies and all nature was pleasing and restful.

Soon the crew were forced to increase pressure in both boilers to force their way through the pack. The ship broke through the ice from pool to pool; only about thirty miles a day were made, though the ship battered her way strongly forward.

The men were living on seal meat regularly. It was found all right, but the smell or taste of blubber, which was to become

only too familiar later, turned their stomachs. Six days after entering the ice-fields the southern edge of the pack was sighted and the ship slid out into open water. The ice had been heavier than when Ross went through, but not nearly so heavy as some later expeditions found it. The clouds rolled away, the daylong sun came out. The ship was becalmed, so the sails were furled and the engine brought into use.

The mainbrace was spliced and at dinner they drank to the future in champagne. Their happiness was complete when at ten-thirty that night there came the cry of 'Land ho!' The sun was shining over the southern horizon and to the south-west they could see the peaks of Victoria Land, 100 miles away, a scene of fantastic and unimagined beauty. They forced their way through drifting ice-streamers and anchored within Robertson Bay. It was not long before the boats were overside and they made their way to the grounded floe-ice along the shore and to the pebbled beach beyond, where the Adelies met them. Seeing the long-familiar peninsula of Cape Adare was like an exciting home-coming to Bernacchi. A party visited Borchgrevinck's empty hut, which stood exactly as it had been left. There was a note pinned to one of the bunks addressed to the commander of any future expedition and a quantity of provisions in perfect preservation.

At night Bernacchi went with a party to visit the lonely grave of Nicolai Hanson, the *Southern Cross* zoologist, then the only human grave on the Antarctic continent. Beyond were the lofty summits of the ice-sheathed mountains.

Leaving the Cape early next morning, the *Discovery* came near to disaster. Turning south in an attempt to find a path through the pack along the shore, for a time they moved ahead at fair speed. Then the tide changed and heavy pack charged the ship, forcing her back to where the floes were grinding and piling up against grounded bergs. For the first time they realised how helpless a ship can be in the pack. With full steam up the *Discovery* barely moved. Then, in the inexplicable manner of all things in the Antarctic, the tide eased, hours before a turn had been expected, the floes parted and the *Discovery* moved ahead.

After being held by a ninety-mile gale under Coulman

Island for a day and a landing near Cape Wadworth, they continued on down the coast, puzzled by alterations of the compass. The compass is sluggish near the Magnetic Pole and the ship was so far south that the Pole was north of them. As the southern end of the compass pointed to the Magnetic Pole, the ship appeared to be sailing north, according to compass, although, of course, actually moving south. At times the compass was deflected madly by the influence of volcanic rocks on shore and when passing over shallow water.

Wood Bay, which Bernacchi knew and which he hoped would provide their winter quarters, was not yet free of ice. Captain Scott feared to waste valuable time waiting for it to clear and so perhaps was lost an opportunity of reaching the geographic Pole years before it was achieved. Wood Bay leads easily to the polar plateau, reached in later years at a much less accessible spot. At least the South Magnetic Pole could have been reached, for at that time it was only 150 miles from the bay.

Soon they could see the smoky crest of Erebus 120 miles away. The day was so clear they could see Coulman Island to the north, giving them a range of vision of 240 miles, showing how clear the Antarctic can be when the cool dry air blows off the frigid interior.

After running into McMurdo Sound, where they were to winter, they turned east. Mt. Terror, snow covered when Ross first saw it, was found bare, which made them wonder what had caused the change. As they passed Cape Crozier, east of Mt. Terror, the great barrier, the size of France, stretched before them as far as they could see. They had clear fair weather, little fog, no gales or drifting pack. They hugged the barrier face, recording its height and taking soundings every twenty-four hours. At first the barrier appeared no more than 70 feet high, but in a day it had risen to 240 feet.

They stared in fascination, as do all who gaze at the white blue-veined wall of ice. They passed many bergs, but so strong was the current against them they had to fire up the second boiler. On two days they made no headway. Occasionally they ran into small inlets in the fog, not realising their position until they found ice on both sides of them. One of these inlets was

named Discovery Inlet, a deep opening running to the east, high ice on each side.

By January 27, they were east and south of Ross's farthest position, where he had reported an appearance of land to the south-east. Missing the heavy pack that had beset Ross, they were encouraged, while all on deck peered ahead or to the south. Land was reported more than once, which only proved to be cloud. Then the ice-cliff turned east and they saw the shore ice gradually ascending in long slopes to rounded ridges, undoubtedly land.

Pushing east they moved along a series of capes, domed ice-islands linked to the shore. They tried to pass between the islands and the shore but without success.

Fog added to the uncertainty. At dinner-time on January 30 Shackleton from the bridge saw several black patches above the slopes. For the first time they were seeing indisputable proof of land, bare rock. It was named King Edward Land and the rocks are now called the Alexandra Mountains.

Next day the fog lifted. The *Discovery* was among the ice-islands and huge bergs, one at least six miles long. Ahead the lifting fog showed them the solid pack that had defeated Ross. They pushed through a narrow channel between two bergs and followed the open water to the north. On the ice-sheet were hundreds of Emperor penguins, which made them think they had found a rookery.

The next day they saw a cloud low on the horizon east-north-east. It was there the next day. They wondered if it might indicate land. It was probably a cloud above the land discovered there by Byrd nearly thirty years later. Scott was forced to turn back because of the impenetrable ice; there seemed no hope of the pack opening and their coal supply was limited.

For hundreds of miles Scott had coasted along the barrier, which he believed to be afloat, and had then come to indisputable proof of high land. Scott thought that somewhere the floating barrier must end and the land begin. So he looked for an inlet he had seen on the way east and steamed into it, tying up to a wall twenty feet high. He called this place Balloon Bight. Bernacchi noticed how similar it was to the place located by

the *Southern Cross* on February 17, 1900. Observations later showed that the ship lay only a mile south of *Southern Cross's* position.

Bernacchi had been one of the sledging party to trek southward on the barrier to 78 degs 34 mins S., the farthest south at that time. He was lucky to be selected by Captain Scott for another sledging party to make a preliminary barrier journey. Unfortunately the tent was built to accommodate three, but there were six in the party. 'To sleep in such close formation called for more endurance than at least one polar explorer possessed,' related Bernacchi. 'After an hour of more or less silent suffering, I left the over-populated area for the great open spaces of the barrier.' Then, without more ado, being well clothed and with the temperature hovering round zero, he went to sleep, curled up on a snowbank!

Next day they reached 79 degs 3 mins S., twenty miles farther than the sledgers of the *Southern Cross*, before being compelled to return to the ship.

No other expedition has seen Balloon Bight, and it is probable that the ice which formed the bight broke out to make the larger Bay of Whales. Ross had found the barrier forty miles farther north than Borchgrevinck, when the bay might have been just a cup in the barrier. Balloon Bight has gone and it got its name from the fact that Scott, and later Shackleton, ascended there in a balloon to see as far as possible to the south of the barrier edge: both saw that the surface to the south rose in gradual undulations and a bank of cloud had all the appearance of dry land. It has since been found that the highest point south of this position within possible vision is only 1,000 feet high; it is the surface of the barrier, but with land beneath.

Balloon Bight was left behind and the ship headed for McMurdo Sound, where it was to winter. Selecting a harbour where the *Discovery* could lie safe for a year required much thought. A little bay was found south of Cape Armitage in which the ship would be protected from pressure and the shallow water would ward off the bergs. A hut was erected on shore where it was intended to live if a safe anchorage had not been found. The men learned ski-ing on nearby nursery

slopes, tried to master the dog teams and went on explorations afoot. It was on one of these that the expedition had its only disaster.

Twelve men started from the ship on a journey to Cape Crozier, on Ross Island, below Mt. Terror, where the barrier meets the island. After three days they met such deep snow that only those on skis could continue. They had only three pairs of skis, so nine men returned. These men reached Castle Rock, where they decided to climb up and over a ridge that lay between them and the sea. All the men put on their frozen ski boots except two, Vince and young Hare, who found it impossible and continued tramping in slippery fur boots. At the top of the ridge it began to blow, filling the air with drift. The men made for rock shelter, and exhausted and frost-bitten, put up their tents. Without experience of Antarctic conditions, they could not work their cooking apparatus. In their stiff leather boots their feet began to freeze. They feared their tents would blow away. Being only a mile or two from the comfort of the ship and not realising the danger of venturing into unknown territory in a blizzard, they started for the *Discovery*. In ten minutes Hare was missing in the blinding drift. The others spread out in a line, yelling all the time. Evans, stepping on smooth ice, shot out of sight.

Barne, in charge of the party, slid after him, going at a tremendous pace. Next came Quartly. The three men came together and found themselves at the edge of a precipice beyond which was nothing but whirling snow. They did not know it then, but it was an ice-cliff that ended in the sea. As they drew back in dismay, a dog came sliding past and disappeared over the edge. They found a boulder and took shelter.

The higher party, that had been left behind, was gathered together by Wild. Heading towards the ship in single file, Wild suddenly found himself on the edge of the cliff with the sea below. He sprang back, yelling to his companions to stop. All did except poor Vince. He had no heels to dig in. In an instant he shot forward and disappeared while his comrades looked on horror-stricken. How the men returned from the edge of death they never knew. Clutching an occasional bare stone frozen

into the ice and with only the edges of their heels to rely upon, they eventually retraced their way to the rocky ridge top. It was comparatively simple from there to return to the *Discovery*.

A whaleboat under Shackleton was despatched in a hopeless attempt to find Vince, while Bernacchi and others searched for the three still missing. These were finally guided back to camp by Ferrar. For Hare hope was finally abandoned. But two days later, on March 13, a man was seen staggering down the hill towards the ship. It was Hare. On arrival he drank some milk and then went to sleep. He was not even frost-bitten! Outside the temperature had been six below zero. Later he told how he had become lost and had tried to find his way back to the sledges. Unable to find them, he eventually reached a patch of rock where he found shelter. Pulling his arms inside his jacket, and covering the opening in his helmet, he curled up and dropped off to sleep. After thirty-six hours he awoke covered in snow, which probably acted as a blanket.

Vince was never found.

The days were shortening and becoming colder. On April 23 the sun made its final brief appearance. Soon only the smoky vapour of Erebus, floating high above the summit, reminded the men by its mid-day radiance that somewhere the sun still shone. Then the radiance vanished and the winter was night.

CHAPTER X

Epic of the 'Discovery'

In 1902 the isolation of the Antarctic was complete: no radios, no planes. No news of the outside world could reach the party at McMurdo Sound and no assistance, either, should the black shadow of disaster spread its mantle over the white land.

How numerous were the possible evils had been shown by the tragic death of Vince, the disablement of Captain Scott with a severe knee sprain and the broken leg of chief steward, Ford. The winter night which Bernacchi had spent at Cape Adare in a hut fifteen feet square, lashed by cables to the rocky shore, was a shorter one than the experience that awaited him, for now he was farther south.

On the *Discovery* each officer had his own sanctum, thus avoiding some of the boredom and irritation engendered at Cape Adare. In their quarters the men could enjoy their leisure in their own way. Each had his own job to do and was left to do it without interference.

The first step in settling down to winter life was to establish a routine. Certain things had to be done daily, almost every hour. Bernacchi's task was to make the magnetic observations, and as no one else understood the adjustments of the delicate instruments he had no relief. The self-recording instruments had to be visited once or twice a day, and on the 1st and 15th of every month he had to visit the magnetic hut every two hours of the twenty-four to change the photographic records. While the other scientists settled down to their work, Koettlitz, the botanist, used a full set of bacteriological instruments, examining the inner workings of seals, skuas and penguins. Everyone peered eagerly through his microscope at the strange bacteria, but most of the party were unable to appreciate the botanist's enthusiasm. In self-defence the botanist instituted the

'Order of the Ass', and Bernacchi became a member—fourth class!

Each day began for the men with the collection of the water supply. Fresh-air addicts demanded the thorough airing of the wardroom. Breakfast for both officers and men consisted of porridge, bread and butter, marmalade and jam. Soup, seal or tinned meat was the usual dinner, varied on feast days with frozen mutton. All hands fared alike. Bernacchi comments that the cook, shipped at the last moment from New Zealand, to replace a trained cook 'who had become too big for his boots', proved both inefficient and dirty. The cook, apparently, was stronger in talk than cookery, and when he left at the end of a year in the relief ship *Morning*, it was said his thrilling experiences in all parts of the world extended over a lifetime of more than 590 years! Wardroom concerts helped fill in the lonely hours. The *South Polar Times*, the first issue of an Antarctic journal, was a unique effort, with many contributions from the lower deck.

It was towards the end of the first winter that Bernacchi had an experience which might have had fatal consequences. With Skelton, the expedition photographer, to help him, Bernacchi had been taking pendulum observations in the scientific hut. Leaving the ship in fine weather, the two men had not bothered to don windproofs. When they decided to return, a blizzard was raging. It was impossible to see three feet ahead. Following the guide rope, they reached the shore but here they found it buried under the drift. The distance was only about 120 yards, but striking out for the ship across the open shore, the two men were lost in less than ten minutes. Finally they decided to work back to the shore but could not locate the rope.

'We groped along on hands and knees, clinging to the shore by thrusting our hands into the tide crack. From time to time we stood up and shouted with all our might but nothing happened. All around blackness, and biting wind drove snow into our boots and trousers, while drifting snow turned into ice-pads in our eye sockets.'

For two hours they continued the search. They knew that unless they found shelter, they would soon be frozen inside their

light clothing. In a final effort they shouted for help . . . and this time they were heard by a minstrel party rehearsing in the hut! There were twenty would-be artistes inside but they came out to form a living chain to span the beach and rescue the two exhausted men. Retracing his steps next morning, Bernacchi found that during the blizzard he had wandered within touching distance of the ship!

It is tragic even now to read Bernacchi's comments on the expedition's organisation for land travelling. Although in 1902 the man-hauling of sledges was already out-dated and the efficiency of dog travel had long been proved, and although the expedition had been planned for many years, no reliable information had been available regarding dog travel. 'There was in the minds of all English explorers, perhaps, the acknowledged thought that the dog was a pet—yet in Siberia, Alaska and Canada dog teams were in everyday use for travel,' commented the Australian physicist.

Provision had been made for a splendid ship to convey the expedition to the Antarctic, yet little planning had been done as to how the men would cope with land travel. The autumn sledging of the *Discovery* expedition was a failure. Once in Antarctica, with inadequate equipment, nothing could be done, except to make the best of it. Sledge loads were altered and made compact, ship-shape and well-balanced. The haphazard collection of provisions gave place to canvas bags, but there was still great inexperience. The men did not know how to put up a tent in a blizzard or even secure it when it was up. They did not know how to manage the cookers or put on sledging clothes properly.

Much was unknown then regarding Antarctic conditions, but even in crevassed areas the comparatively light weight of dogs and their speed over snow-bridges were strong arguments in their favour. Only twenty-three dogs were taken on the *Discovery* and then of the wrong type. West Siberian dogs were taken instead of Canadian huskies. Allowing for accidents and the elimination of less suitable animals, only one efficient team was available. The little *Southern Cross* expedition had landed seventy-five, bringing most of them back. A few years later

Amundsen took 114 dogs and with teams of twelve dogs drawing lightly-loaded sledges—about 700 lb. as compared with 2,100 lb. on the *Discovery's* sledge expeditions—to make his spectacular dash to the South Pole, keeping his animals so fit that in one day sixty-two miles were covered.

The *Discovery's* dogs were handicapped by loads beyond their power, even had they been well fed. The dogs therefore suffered from two disabilities. The average distance covered each day by man-hauled sledging parties from the *Discovery* was only five miles, yet Amundsen, husbanding his resources on the way to the Pole, limited the daily effort of his dogs at between seventeen and twenty-five miles. The best day's run on the *Discovery* expedition was eleven miles.

To add to the tale of woe, which later had such fatal consequences, Bernacchi criticises the inadequacy of the dogs' rations. It was impossible to carry enough food to feed both men and animals. One or the other had to suffer. Slow transport meant inadequate transport and the latter chased the former in a vicious circle. The importance of food was not fully realised in those days, vitamins had hardly been heard of. With a view to reducing sledge loads, food supplies were reduced to a minimum, chosen for ease of handling, not for nutritive value.

'The starvation diet on which the English Antarctic sledgers work can only be described as fantastic,' commented Bernacchi. A maximum of seven and a half ounces of pemmican was allowed each man daily! On Scott's southern trip this fell to as low as one and a half ounces daily. Strange concoctions were hopefully thrown into the cooker; ship's biscuits, sometimes a quarter of a biscuit only, was supposed to make a meal. Even in those dreadful conditions splendid work was done. But one cannot help wondering what might have been accomplished by these superb men if they had been well fed and better organised.

Unwashed, unshaven, hungry, wet, cold, exhausted from the back-breaking coolie labour, no energy remained for imaginative thinking. Days of hungry straining misery, nights of shivering pain-wracked weariness were the lot of the heroic *Discovery* sledgers.

When the *Discovery* left New Zealand for the south, the idea

of a relief expedition had not been considered. The ship could have stayed in the ice for two or three years. In fact, when summer dawned in 1903, the men, gaining knowledge about food through bitter experience, were fitter than they had been the previous year. In England, for some reason, anxiety prevailed and funds were raised to safeguard the expedition. Subscriptions came from all quarters, including the New Zealand Government, and a small stout barque-rigged Norwegian whaler was purchased and named *The Morning* and the command given to Lt. William Colbeck, Bernacchi's companion in Borchgrevinck's expedition. Another officer who joined the ship was Gerald Stokely Doorly, a sub-lieutenant in the Royal Naval Reserve. Doorly subsequently joined the Union Steamship Company and the Melbourne Pilot Service in 1925.

Another officer, Lt. E. R. G. R. Evans, later became famous for his exploits on Scott's second and ill-fated Antarctic journey. They were a happy group on the *Morning*.

On its first relief journey, the *Morning*, with little ability to force her way through heavy pack, went ashore on a hidden reef on Christmas Day, when just on the rim of the Antarctic Circle. The reef was part of the outlying rocks of a mountain peak jutting above the ocean surface with a thousand fathoms of water around it. They called it Scott Island. Owing to ill-health Shackleton had to retire from the poleward sledging party and he travelled back on the *Morning*.

For some reason a kind of panic assailed the expedition authorities and officials in England. A dispute and wrangle followed between Government heads, scientific bodies and citizens who had supported the expedition. The result was that the relief of the expedition was handed over to the Admiralty, and the finest Dundee whaler afloat—the *Terra Nova*—was purchased, fitted and commissioned. At Hobart, Tasmania, the *Terra Nova* was joined by the *Morning*, and Captain Colbeck took command of both.

Two winters were to pass before the *Discovery* could leave her icy berth and during the two summer seasons the men accomplished a tremendous amount of work.

Scott followed where Borchgrevinck had left off, blazing the

trail across the Antarctic snows. What lay behind the icy ramparts, the lofty mountains, less known to man then than the nearest surface of the moon? During the first summer Scott sledged south across the barrier to 82 degs 16 mins S., discovering the mountains that fringe the western edge of the barrier and the tremendous glaciers that come tumbling down between them. The next year he scaled the domed plateau to the west travelling along the 78th parallel to 156 degs 33 mins E., at an altitude of 9,000 feet above sea level. Furthermore, Barne went south to an inlet that bears his name and Royds went far out on the barrier surface to the south-east. When the second summer was ended, the expedition knew much about this new world. The men were rich with the treasure of knowledge, of geography and other scientific matters.

In the previous summer, while Scott with two companions was struggling south over the barrier, Lt. A. B. Armitage, second-in-command of the expedition, who had previously spent four years in the Arctic, took the western trail with another party in an attempt to pierce the impregnable mountain ramparts. At an altitude of 6,000 feet they found a pass leading to a big glacier, now named after Ferrar, the geologist. Plodding up the frozen river of ice to a height of 9,000 feet, they reached the polar plateau, establishing for the first time that the Victoria Alps guarded a great ice-swathed territory. This party discovered the polar plateau and from a geological viewpoint their findings were most valuable. Specimens collected showed strong possibilities of the existence of sedimentary deposits, the yardstick by which the scientists can measure the geological history of the southern continent.

Of the many journeys made by the *Discovery* expedition were the four trips of Lt. Royds to Cape Crozier to fix the position for the relief ships and to visit the Emperor penguin rookery on the sea-ice off the cape. Here the first eggs of the Emperor, the four-foot tall aristocrat of the South, were collected. These journeys stand at the peak of Antarctic winter sledging, for temperatures of —60 degs F. were experienced.

Bernacchi found that third winter and fifth summer in the Antarctic rather monotonous and long. The health of everyone was better. The early scurvy sufferers had recovered, since

tinned meat had been discarded in favour of seal meat and skua gulls. During the winter Bernacchi had requested permission from Scott to undertake an extensive sledge journey across the surface of the barrier for the purpose of examining the ice-sheet and running out a line of magnetic observations.

Scott approved of the plan, but as naval officers were there for that purpose, Scott had to send one of them, Lt. Royds, in charge. Bernacchi was given a free hand to do the work he wanted. It was arranged that a start be made in November on a thirty-five days' journey.

In a letter to his parents in Tasmania, written during his barrier journey, Bernacchi describes his experiences. 'We left the ship on November 10 and continued on a due south-east course for 155 geographical miles, or 178 statute miles, reaching lat: 79 degs 32 mins south and long: 175 degs 55 mins east. The total number of miles out and back was 356 which we did in 31 days, an average of little over ten miles a day, the best average done here without dogs. We had 180 lb. each to drag. The dragging was very heavy on account of the bad surface and as the temperature was generally below zero, with a strong wind and drifting snow from the south-west, the trip was not altogether enjoyable. Unfortunately our food supply was most inadequate and we suffered badly from hunger. I have never before suffered from real want of food. We, of course, saw no new land, nothing but the barren, level surface of the barrier, with few undulations to break the monotony.'

The *Discovery* was still frozen in her dock, with twenty miles of ice between her and the open water. Scott determined to saw a channel to the sea. Despite the hearty co-operation of the men, the sawing was soon given up as useless. So Scott and Wilson went on a picnic to a penguin rookery, lay in the sun watching the amusing antics of the penguins and decided that life in the Antarctic was quite pleasant even though they must prepare for another winter. There was plenty of food. One morning as they sat in the tent door dreamily looking out to sea, a ship hove in sight, quite unexpectedly. And then there appeared another ship! They thought the first ship was their relief ship, the *Morning*, but what could the second be? They soon learnt.

When the *Morning* had returned to civilisation the year before, the Admiralty had formed the idea that Scott's ship would never be released, so the *Morning* and the *Terra Nova* were sent back with orders for Scott to abandon the *Discovery* if she were not freed from the ice and return home.

It was the thought of leaving the *Discovery* that brought gloom to the expedition. If the ice did not break up in six weeks, they were to abandon the ship that had been their home for more than two years, enough to make any sailor miserable. The relief ships appeared on January 5, 1904, but it was a long time before there was any change in the ice. Then came a swell that broke the ice to within a few miles of the *Discovery* and the ship heaved groaningly up and down in its icy casing. The swell died. The men tried cracking the ice with explosives but without much effect.

It was not until February 14 that the ice began to break up fast. It all went out in a few hours as the two relief ships battered and cracked the floes, aiding the unseen current in the rapid disintegration. Finally all three ships were close together, but the *Discovery* was still held in its little bay. The ice here was sixteen feet thick. Two huge charges were put ahead and astern of the vessel and fired. The ice cracked with a roar, the water gurgled through and on February 16 the *Discovery* lay riding freely at anchor, ready to sail.

Drama dogged the *Discovery* till the end. The ship swung easily at her anchorage. Steam was raised and the anchor, which had been down for two years, was heaved up. From this moment until the vessel reached the Auckland Islands, the amazingly lucky ship was pursued by accident after accident until those aboard thought they might never reach New Zealand.

As the ship was leaving the winter harbour, with steam in one boiler, a strong north wind caught the bows, and the next moment the *Discovery* was ashore off Hut Point. The yards were braced, sails set and the engines kept going ahead but without success. Matters looked serious when the wind increased to gale force, bringing in a heavy swell which bounced the ship heavily on the bottom. Soon the seas were breaking right over the ship, driving her against the perpendicular ice-cliffs which were only

fifty feet away. Those on board saw large pieces of timber, apparently the keel, floating up and drifting away. The *Terra Nova* whalers aboard the *Discovery* expressed the opinion that the ship would break her back. If she had gone to pieces, it would have been the devil's own job to launch a boat. Between the ship and the ice-cliffs was a boiling mass of water and there were heavy seas on the windward side.

Fortunately the wind moderated, and the sea calmed. No sign of the other ships could be seen as they were out in the strait, blanketed by the drift. Later the officer of the watch reported that the ship appeared to be moving astern. The engines were promptly put full astern, all hands aided the effort by running from side to side to roll the ship. Slowly she commenced to slide off the bottom, and in a quarter of an hour lay in deep water. They had been aground eight anxious hours.

The next day the *Discovery* lay alongside a tongue of land-ice, forming a natural quay, taking in coal and provisions from the relief ships. Everyone, scientists, officers and men, took a hand in the grubby business, till their faces were streaked with black. The coaling operation was finished early on February 19 and the little *Morning*, with just enough coal for her own needs, started for Port Ross in the Auckland Islands, where all three ships would rendezvous before proceeding to New Zealand.

There was always trouble with the pumps on the *Discovery*. They refused to work soon after they started north. The water gained so fast that it was soon over the stokehold plates, threatening to put the fires out, so they were drawn. Finally it was found that the bilge suction, which had been a mass of ice, had thawed out and was clogged with ashes. When this was put right, the pumps worked perfectly but for a time the situation was serious.

Later the rudder-head was found to be shattered, so there was a big lag when the ship manœuvred from side to side. They put into Robertson Bay and installed their spare rudder, only about half the size of the original. It was just sufficient to steer them through the heaviest pack they had seen, big hummocky stuff, deck-high. The whole sea south of the Balleny Islands was covered with this ice.

Shortly afterwards, the *Discovery* was in the position where

Wilkes had plotted peaks and capes. Finding them non-existent, Scott decided there could be no land eastward of Adelie Land and abandoned the search. We know differently to-day. There is a lot of land there, though it is not where Wilkes said it was.

Boisterous weather was encountered on the run north. Having very little ballast the ship plunged in the rollers, yawing over in fifty-degree rolls. Ross Harbour, Auckland Island, was reached on March 15, but there was no sign of the *Terra Nova* or the *Morning*. The *Discovery* men had expected both ships to be there long before them but they had had some advantage in going west. In the waiting time they cleaned up the old tub, took in fresh water and went ashore to shoot rabbits, pigs and ducks. Before the end of six days both ships turned up, after a rough passage. One of the boats on the *Morning* had been washed out of the davits and the bridge nearly carried away. Her engines had broken down and the position had been touch and go.

When the New Zealand Government steamer, *Hinemoa*, put into the harbour a week later, the men heard of the outbreak of war between Japan and Russia. Next month, the *Discovery* reached Lyttleton to receive a great ovation from the inhabitants.

Scott's first expedition was a tremendous scientific success. He opened up fields of exploration which promised grand things in the years to come, showing the world the way to the Pole itself. As for Bernacchi, the end of the expedition found little recognition for the scientists and no job for an Australian physicist in England. Bernacchi went on private exploration trips, penetrating the forests of tropical Peru to the Upper Amazon, in German South-West Africa, in Malaya and Indonesia. He served with distinction in the Royal Navy in World War I, being awarded the military O.B.E. and the United States Navy Cross. He became a member of the Council of the Royal Geographical Society, and on his death in 1942 was the only surviving member of the *Discovery* expedition in England.

CHAPTER XI

Erebus and the Magnetic Pole

It was inevitable that men should be drawn to attempt the Pole itself when the story of Scott's expedition became known. However strong the pull of exploration for the sake of science, the simple call of the unknown is the strongest of all. It has drawn the adventurous to the most distant corners of the globe. Any part of the world, undiscovered or unclimbed, will always be a natural magnet for certain men.

The years 1908 to 1914 were filled with great achievement in Antarctic history. The story is familiar and only needs brief mention here. The men who took part in this onslaught were Shackleton, Scott, Amundsen and Mawson, the latter being the only survivor to-day and in many ways perhaps the most successful of them. Each of the other three died in dramatic circumstances and one wonders whether there will ever again be such mighty men in the field of exploration. Shackleton, that restless soul who gained the devotion of his followers through unselfish leadership, took several men from Australia and New Zealand when he made his first poleward effort.

Shackleton's own expedition caught the enthusiasm and popular imagination of Australians and New Zealanders. The Commonwealth Government donated £5,000 and the New Zealand Government gave £1,000 and also agreed to pay half the cost of towing the *Nimrod* to the pack-ice. Indeed, the leader himself said 'the kindness and generosity of Australasians will remain one of the happiest memories of the British Antarctic Expedition, 1907'.

Among the scientific staff on this expedition were Professor T. W. Edgworth David of Sydney University, and Dr. Douglas Mawson of Adelaide, both of whom were to win knighthoods for Antarctic exploration. It was with Shackleton that Mawson had his first chance to establish himself as an Antarctic explorer. In his four journeys to the southern continent he has

achieved a reputation which is equalled by few others in this world.

Douglas Mawson was born in 1882 at Frizinghall, near Bradford, England, and came to Australia as a boy and made it his home. He took his degree in mining engineering and had his first experience of exploration when he went to the New Hebrides in 1903. He returned to Sydney a year later, took his B.Sc., and then became a doctor of science.

In 1920 Mawson was appointed Professor of Geology and Mineralogy at Adelaide University, a post he has occupied ever since. To-day this tall, broad-shouldered man, with a fine head, has lost none of the lion-hearted courage which enabled him to win through when others might have lost heart. His jaw is still as firm as ever and his knowledge of the Antarctic without equal. Apart from the geographic importance of his discoveries, Mawson has brought back many interesting specimens from his southern journeys, particularly in the field of deep sea research. He recovered specimens from a depth of 2,600 fathoms. His account of the vast slaughter of whales going on in the Antarctic regions caused considerable indignation in many countries, for it threatened the total extermination of the monsters. Mawson has not confined himself to Antarctica. In January 1934 he led an expedition to Central Australia to investigate a number of meteorite craters, some of which were found to be the largest in the world.

Originally Edgworth David had sailed with the idea of returning on the *Nimrod* after winter quarters were set up, but Shackleton persuaded the fifty-two-year-old Professor to remain. Raymond Edward Priestley, another geologist from Sydney University, was in this expedition and played a pioneer part in the scientific examination of the terrain. He was Vice-Chancellor of Melbourne University from 1935 to 1938 and was later knighted. Others with Australian background were Bertram Armytage, from the western district of N.S.W., in charge of ponies, and John King Davis, First Officer of the *Nimrod*, who later became Commonwealth Director of Navigation but not before he had made five more journeys to the southern ice. Leo Cotton, now Professor at Sydney University, joined the *Nimrod*

for the trip. In those days Cotton was a demonstrator at the University.

Shackleton left New Zealand in the *Nimrod* on January 1, 1908. It was Regatta Day at Lyttleton and great crowds were there to bid farewell to the forty-year-old sealing vessel, small but strongly built, which was fortunate, for few ships have had such a battering as the *Nimrod* received from the howling southern ocean. Three ships of the Australian Navy, *Pegasus*, *Powerful* and *Pioneer*, their cheering crews lining the decks, bade the expedition godspeed on the way to the ice-infested waters. Shackleton was the first to have his ship towed to the pack to save fuel, an example followed successfully by Byrd on his first expedition. Shackleton's towing ship was the Union Steamship Company's *Koonya*, a powerful steel vessel of about 1,100 tons, under Captain F. P. Evans.

Shackleton took ponies, dogs and a motor-car to assist in sledge hauling. The Manchurian ponies were shipped down from Shanghai direct to Australia and trans-shipped in Sydney to a New Zealand bound vessel.

Scarcely was the *Nimrod* at sea when it blew a tempest. Loaded to the gunwales with stores, provisions, scientific equipment and animals, her head held down by the towing cable, the *Nimrod* was sluggish, wet and anything but comfortable for those aboard. Before the first night had turned to day heavy seas were breaking over her decks. Life-lines were rigged to save the men being swept overboard by the pounding combers. What a first night for an expedition! Sailors call this region the Roaring Forties. But further south it is worse, the stormiest ocean in the world, and Stuart Campbell's expedition to Heard and Macquarie Islands in 1947 underlined all that occurred to the *Nimrod*. It is in the Furious Fifties and the Shrieking Sixties that you begin to wonder why you ever left home!

The ponies, which were found to be largely impracticable, had a dreadful journey, their stables on the foredeck being constantly awash, until the poor animals were unable to stay on their feet.

The *Nimrod* had a speciality—fifty-degree rolls to port and starboard, enough to put the toughest sailor off his food! The wind would drop for a while and in the lull the men would

endeavour to restore order out of the chaos. But the calm always preceded a worse storm and the towing *Koonya* was signalled to pour oil on the water. During one lurch a pony was knocked over. It was too weak to get up and had to be shot. Five days out of port hurricane winds struck the *Nimrod.* Even the *Koonya* made bad weather, at times disappearing completely out of sight, as terrific mountains of water rolled past the ships.

The *Nimrod's* seams opened and she began to take in three feet of water an hour. Steam pumps could not cope with the inflow, so the men were rostered in two-hour shifts to man the pumps, a perilous time for all. Shackleton said the waves were forty-two feet high; and they must have looked like the grim grey walls of an unlimited ocean prison.

On January 8 the *Nimrod* heaved to. Everything that could break loose had been lost overboard and now an enormous wave rose up higher than the others. The men on board thought it would swallow the ship but somehow she staggered through the overwhelming mass of water. Starboard bulwarks were smashed in, a deck-house crushed, and ports broken, allowing the water to sweep in through the decks to the galley, extinguishing the fire.

Succeeding days were the same: a whaleboat was lifted from its chocks and hurled midships; fodder and oil drums rolled across the deck in a mad helter-skelter. As they neared the pack, a gentle wind and sun brought a respite. Out struggled the sorry-looking expeditioners to dry their clothes and belongings on the deck.

The *Koonya*, first steel ship to penetrate the Antarctic Circle, left them to return to New Zealand after towing 1,510 miles through unimaginable weather. Shackleton had planned to make his base in the east region of the Ross Sea, near Borchgrevinck's Southern Cross inlet and later used by Scott for his trial balloon flight.

Shackleton found the bight had disappeared. Ice-cliffs were high and menacing, the old barrier front had broken away. Eight miles to the south he saw rising slopes, some peaks beyond, and a long valley running east and west at the end of the bay. Because the place was a playground for the spouting monsters, their dorsal fins clearly seen above the water, Shackleton named

it the Bay of Whales. Seeing the treacherous nature of the barrier, Shackleton decided to sail west and put his camp on solid rock on the western shore of Ross Island. Strange are the happenings in the Antarctic, for where Shackleton thought it unwise to camp, Amundsen wintered before his record dash to the Pole. More recently Byrd has had four winter camps there. Now we know the barrier there is protected by land to the south and the ice-tongue on the east side is therefore motionless.

The story of Shackleton's poleward trek is well known. Discovering the Beardmore Glacier, one of the world's largest, he attained the plateau and reached 88 degs 33 mins S., 90 miles from his goal. If he had gone on, he would never have come back; wisely he turned before it was too late.

In the meantime two important sorties were made by other parties from the camp on McMurdo Sound. Australians played prominent parts in both these attacks, which culminated in the conquest of Mt. Erebus and the attainment of the South Magnetic Pole.

Mt. Erebus was a natural challenge to the scientists camped on Ross Island. Apart from the achievement of scaling the ramparts of the 13,000-feet-high crater, the scientists were interested in observations of wind and temperature at the summit. They might find out something that had an important bearing on the movements of the upper air, a meteorological problem still being debated to-day. From a geological point of view the mountain might also reveal interesting facts. David, Mawson and Mackay, a surgeon, were the men chosen and they were supported by a three-man party in the rear. In the final stages the supporting party went the whole way and shared the honours of the enterprise.

A mass of planning details had to be undertaken for the venture. Most of the men were inexperienced in the hardships of mountain climbing, to say nothing of the low temperatures of high altitude and the blizzard winds which bring in zero visibility, blotting out all sense of direction.

The party found the crater was three times the size of Vesuvius. Volcanic bombs picked up four miles distant from the crater showed the scientists that Erebus had recently been pro-

jecting lava to great heights. They found that the height of the mountain was a thousand feet higher than when calculated by Ross, which is quite likely, for the volcano could well have grown by that amount during the sixty-seven intervening years.

The geologists revelled in their examination of remarkable crystals, rare lavas and the unique ice-topped smoke-holes, for to them the mountain was like a giant tide-gauge, recording the flood level of the greatest glaciation of Antarctica when the whole of Ross Island was a lonely nunatak in a gigantic field of ice.

At points in the climb the men had difficulty keeping on their feet, but nearing the summit they found the crater emitting great volumes of smoke. What surprised the travellers most was the extraordinary structures that rose above the surface of the snowfield, mounds and pinnacles of fantastic shape, like bee-hives, turrets and various animals. At first the origin of these remarkable structures was a mystery, but later in the day the Professor had time for a closer examination, directing his attention to one which bore a striking resemblance to a waiting lion. In normal climates a volcano's smoke-holes may be detected by a thin cloud of steam above and you can feel the warmth by passing your hand into the vapour column, but in the cold of the Antarctic the vapour turns into ice as soon as it reaches the surface of the snow plain. These ice-mounds, similar to the shapes formed by the geysers in New Zealand, are built up round the smoke-holes.

On the way up the climbers found yellow ice due to sulphur. Towards the summit progress was painfully slow, altitude and cold making breathing difficult, but on March 10, five days after leaving base, the lip of the active crater was reached, the first men to conquer perhaps the most remarkable summit in the world. They stood on the verge of a vast abyss, unable to see across because of the mass of steam rising 1,000 feet in the air. They heard a loud hissing noise and dull booms from inside the crater, then upwards rushed masses of steam to swell the snow-white cloud ever swaying above the cone.

Then a northerly breeze fanned away the steam cloud, enabling Mawson to use instruments to measure the crater, and enabling them to see three large openings in the bottom of the cauldron.

On the return the party glissaded down 5,000 feet in two hours, but the cooking pots and pans in their packs were much battered when they reached the rocks below.

Priestley, Armytage and Brocklehurst formed the western sledging party. They penetrated the region of the Ferrar Glacier, examining the rocks and searching for fossils. It was towards the end of this journey, when they camped on the sea-ice off Butter Point, that they had an amazing escape.

They had examined the tide-crack. There was no sign of ordinary movement and they assumed the place was safe. Next morning Priestley was first up and out of the tent. A few minutes later he came running back to tell his companions that the ice they were on had broken away and was drifting north to the open sea. The two others turned out promptly and found two miles of open water between the floe and the shore. They were moving steadily out to sea. Most of the food was at Butter Point and the position was extremely serious. There was nothing much they could do, so they returned to camp and had breakfast.

They held a conference and agreed to stay where they were. It was then that packs of the dreaded orcas began spouting in the channel off their floe. These killer-whales grow up to thirty feet long and have powerful vicious teeth, which interlock when their jaws are closed. They hunt in packs, preying on the warm-blooded marine animals. Their mouths are large enough to swallow a whole seal. They must have seen the stranded men, for they swam round the floe and began to bump it, as if to crack it and hurl the scientists into the water.

That night fortune was with the marooned men, for the floe drifted back towards the shore. They were waiting their chance and when the floe touched the shore-ice—only six feet of it—they leaped across with their gear. They had only just got off the floe when it moved away again, out to the open sea. The only place at which it touched the fast ice was the point to which Priestley had gone in the morning. If he had gone to any other spot, they would not have escaped.

Mawson, of magnificent physique, David and Mackay, the team that had conquered burning Erebus, were chosen by

Shackleton for a greater and more perilous mission—to carry out a scientific investigation of the coast of Victoria Land and then drive inland through the precipitous ranges and tumbling glaciers to fix the South Magnetic Pole. Shackleton instructed them to work at the geology of the Western mountains, prospecting for minerals of economic value, and claim the whole of the territory for the British Commonwealth. Shackleton warned them that the relief ship *Nimrod* was due back on January 15, 1909.

With the help of the motor-sledge, stores and equipment were conveyed to forward depots and after an early breakfast on October 5, 1908, they hit the trail. Unfortunately, visibility was dreadful, due to thick snow, and their friends who had offered to accompany them on the start of the journey had to return to camp after two miles. So Mawson, David and Mackay started man-hauling. Relaying the two sledges on the sea-ice was hard physical work and they were lucky to average five miles a day for a start.

On October 15 they were awakened by the chatter of Emperor penguins, who had marched to their tent out of curiosity. David said the chatter reminded him of a mixture of a goose cackle and a kookaburra chortle. Peeping out of the tent, the Professor saw four of the birds by the sledges. 'They seemed much interested at the sight of me and the conversation between them became lively,' reported the Professor. 'They evidently took us for penguins of an inferior type and the tent for our nest.'

With a fresh following wind the men travelled faster, the makeshift sledge-sails being a great help. The journey totalled 1,260 miles, but over more than half this distance the sledges had to be relayed. Their track was from Ross Island, across McMurdo Bay, then over solid fast ice, to the western mainland, up the valleys to the high plateau and to the Magnetic Pole. They returned to the coast near the Drygalski ice barrier, after a journey of 122 days, for five of which they were blizzard-bound in their tent. They ate seals and penguins and an ingenious utensil helped guard their precious supply of cooking fuel.

It is interesting to note how useful were the observations made by Bernacchi with the *Discovery* expedition. His readings showed

that the amplitude of the daily swing of the magnet was considerable. The compass, at a distance from the Pole, points in a slightly varying direction at different times of the day, indicating that the polar centre executes a daily wander round its mean position. So it was not surprising if Mawson announced on January 15 that by waiting for twenty-four hours at the same spot, taking constant observations, the Pole during that time should come vertically beneath them. However, they decided to go on to the approximate mean position of the Magnetic Pole. The next day they were at the spot, calculated by Mawson at 72 degs 25 mins S., and 155 degs 16 mins E. They fixed up a flagpole and hoisted the Union Jack with the temperature at exactly 0 degs F.

'It was an intense satisfaction to all of us, after so many days of hardship, toil and danger. We were too utterly weary to be capable of any amount of exultation,' wrote the Professor in his diary.

It was a fatiguing tramp back over the hard and high sastrugi and they were thankful when they picked out the small dark cone of the tent, rising above the distant snow ridges. Here they had a little cocoa, a biscuit and a small lump of chocolate. They turned into their sleeping-sacks that night, faint and weary, but happy in the comforting glow of a job well done. They slept like logs after twenty-four miles of travel.

They started the descent from the 7,500-feet plateau to the Drygalski depot. It was a race to get back by February 1. It was a journey of 249 miles and they actually did not get there until February 3. The three men were excellent comrades and each had their share of dangers and privations on the run home. Twice on the journey Mawson pitched into the fearsome crevasses, being held by the sledge rope attached to his harness. Even while dangling over an abyss, Mawson remained cool and unruffled, throwing handfuls of ice crystals at the anxious faces above.

The final adventure is worth recalling. It happened on February 4, with the three men camped in a tent on the cliff-top, waiting for the arrival of the *Nimrod*. Suddenly the silence was split with a roar from the ship's gun. Mawson dived for the flap.

So did the others. They jammed together in the opening. David was knocked over in the rush, but they saw the ship not quarter of a mile away. At the sight of the three men running frantically to meet the ship, ringing cheers burst from all on board.

A sudden shout came from Mackay. Mawson had fallen down another crevasse! David pulled up just in time. The two men yelled down to their mate. Mawson was twenty feet below, unhurt, so Mackay ran to the ship for help, shouting: 'Mawson's down a crevasse and we got to the South Magnetic Pole!'

In less than no time officers and men swarmed over the bows of the *Nimrod* and dropped on to the barrier. Davis, first officer, arrived on the scene, bridged the crevasses with a stout piece of timber and had himself lowered down. Mawson was on a small ledge, two feet above the sea water. With a strong pull and a heave he was soon hauled to the top, none the worse for his adventure.

Then the three conquerors of Erebus and the Magnetic Pole had a chance to greet their old friends, not the least of whom was Captain Evans of the *Koonya*, who had now come down in charge of the relief ship. On board they read letters from Australia and had their first real wash in four months.

Sir Tannat William Edgworth David died in 1934, aged seventy-six, and was given a State funeral in Sydney. He was the son of a Welsh clergyman and came to be known as the greatest living geologist. During World War I he conducted mining operations leading up to the explosion of big craters on the Messines Ridge on the western front. He was later appointed geologist to the British armies. In 1928, in rocks on the Mount Lofty and Flinders Ranges, South Australia, David discovered perfectly preserved remains of animal life millions of years older than any so far classified. In 1922 he went on a tour of exploration in Central Australia and he continued his scientific investigations till shortly before his death.

CHAPTER XII

Mawson in Blizzard Land

MAWSON himself says that it was while sledging across from the Ross Sea to the Magnetic Pole that he felt the urge to go on to discover the limit of the land to the west, an untrodden area whose features were entirely unknown.

On his return from Shackleton's expedition the young Australian scientist discussed the matter with Scott and Shackleton. His idea was to investigate thoroughly the coastline between Cape Adare and Kaiser Wilhelm II Land, a distance of more than 2,000 miles. In January 1911 there was a meeting in Sydney of the Australian Association for the Advancement of Science. Mawson attended and left the meeting assured of the utmost co-operation from that body. Generous help was provided by State and Commonwealth Governments. Private citizens also dug into their pockets, and financial support came from Britain too.

Mawson set the pace for modern explorers by choosing young and energetic men from the universities of Australia and New Zealand. He chose scientists to lead a scientific expedition in his magnificent team, and he mixed experts from England and Europe. Frank Wild, the tough warrior who had been a member of both the Scott and Shackleton expeditions, was an invaluable addition to the team.

Mawson intended to investigate the Antarctic Continent to the southward of Australia, a region where the continent was supposed to extend far to the north, but concerning which only minute information existed. Most expeditions hitherto had the South Pole as their objective; their fields had much overlapped and the area of the unknown had not diminished commensurably with the magnitude of those undertakings. But since the year 1840, no one had been within the limits of the Antarctic Circle in the region selected by Mawson as a field for operations.

In 1839 Balleny reported the appearance of land at a spot near the Antarctic Circle in longitude 120 degs E., Sabrina Land, which Mawson proved to be non-existent. D'Urville came in sight of about 150 miles of an Antarctic coastline within the Circle, situated between longitude 136 degs 30 mins E. and 142 degs E. To this he gave the name of Adelie Land, but its existence Mawson was not then able to confirm. Wilkes reported sighting land at frequent intervals during a long voyage from east to west, close to the Antarctic Circle. Many of these reports of landfalls were considered erroneous. Wilkes outlined the northern edge of the pack as it existed in 1840, and supplied several shallow soundings, convincing evidence of the proximity of land. Geographers have been arguing about Wilkes for one hundred years!

Kaiser Wilhelm II Land, at the western limit of the region to be investigated by Mawson, discovered by Professor Drygalski's German Expedition of 1901, and Oates Land, to the east of the sphere of the Australasian Antarctic Expedition, sighted by the *Terra Nova* in charge of Lt. Pennell of Scott's second Antarctic Expedition, were more relevant to the Australians.

Mawson wanted to land wintering parties at widely separated points between longitude 90 degs E. and 158 degs E., each to make continuous scientific records at the base-station, and to investigate the surrounding region by sledge journeys. On the southward voyage, a party was left at Macquarie Island, in that day a little-known possession of the Commonwealth. Radio was used for the first time in polar exploration, the Macquarie Island station transmitting Antarctic news to Hobart.

The vessel selected for the work was the *Aurora*, with a carrying capacity of about 600 tons. Built in Dundee the ship was engaged in sealing and whaling in the Arctic. The Master was Captain J. K. Davis, veteran of Shackleton's *Nimrod* and Second-in-Command of the Mawson Expedition. She sailed from Hobart on December 2, 1911. A violent gale was weathered off the Tasmanian coast without any more serious consequence than the loss of half the bridge and slight damage to the motor-launch. Deeply laden as the vessel was, the decks lumbered with cargo, the *Aurora* soon showed her sterling sea-going qualities.

Twenty miles long and 3½ miles at its widest point Macquarie Island was sighted on December 11. The island is ringed by many rocky reefs and islets. Rocks appear for many miles to the north and south, rising from a submarine ridge, the continuation of the island itself. Ashore, the chief vegetation is tussock grass and Kerguelen cabbage, but Mawson found the island rich in a truly wonderful population of birds and animals. Once it had been a favourite haunt of the valuable fur seal, but for fifty years or more before Mawson's visit only odd specimens had been seen. Ruthless slaughter by early sealers was responsible for the complete extermination. Sea-elephants, however, are numerous to-day, the bulls being up to twenty feet in length and weighing five tons.

Little information was known about the island and the only map was a sketch made by a sealer. Rumours of the existence of wingless parrots and other continental forms of life indicated that Macquarie Island was the last remaining summit of a vast sunken southern land. Other evidence suggested that probably at one time Australia and the Antarctic Continent were united.

A preliminary survey was made before settling the site for a permanent station on a low neck of land at the north end. There a hut, coal store and instruments for a year's occupation were landed, in which work the motor-launch proved most valuable. Next the masts, stays, engines, apparatus and materials for constructing a radio station and an engine house were landed at an adjoining spot below a precipitous hill. Eventually the radio was erected 350 feet above sea-level. To transport all the gear from the sea-shore up the cliffs to the summit was a difficult piece of work. Under Wild's able guidance, however, it was accomplished, use being made of a 'flying fox' stretched from the summit to the strand. Even the landing of materials was no mean work, for there are no harbours at Macquarie Island and, situated as it is in the track of the Roaring Forties, the roadsteads were not serviceable, as Campbell's expedition discovered in 1948.

A small steamer, the *Toroa*, chartered to carry coal as far as Macquarie Island, arrived and replenished the *Aurora's* bunkers before the latter continued her southward voyage. The two ships were anchored a quarter of a mile apart and the coal was

transported in whaleboats and the motor-launch. On Christmas Eve, leave was taken of the Macquarie Island party, who were destined to remain there for two whole years.

The *Aurora* met the first ice in latitude 64 degs and, ninety miles further south the pack became impenetrable. The vessel was headed west and repeated attempts were made to ram southwards through the pack. Early on January 3, when skirting an ice-field travelling before a fresh breeze in thick weather, a continuous ice-wall ranging from forty to one-hundred feet in height was dimly discerned on the port side through the falling snow. The position was 65 degs 40 mins S., 144 degs E. When the weather cleared it was seen to extend for a great distance, as if it were part of some land mass. On the return of the *Aurora* the following summer, it was discovered to be a floating iceberg of stupendous proportions, at least forty miles long. In the interval of a year, it had shifted fifty miles to the north-west.

During the afternoon of January 6, an ice-cliff loomed ahead, extending to the horizon in both directions, an immense barrier —afterwards named the Mertz Glacier—pushing sixty miles out to sea from a great ice-capped land. This land had never before been seen. Its continuity with Adelie Land was later proved. Land rose up everywhere from the sea to form a plateau. Only rarely did portions of the rocky platform break the ice-sheet. Numerous rocky islets fringing the coastline were breeding grounds for the denizens of the pack. Flocks of seabirds in great variety flew round the *Aurora*, welcoming them to the unbroken solitudes.

At a point some miles from the nearest portion of D'Urville's Adelie Land a suitable spot was discovered for a base. This rocky outcrop, a mile long, was named Cape Denison. Rocks projected from under the ice-sheet in a sweeping curve of the coastline which was named Commonwealth Bay.

To find a passage and an anchorage for the ship, a preliminary examination of the in-shore waters was made by a whaleboat party. Late that evening a gale blew up off the land. The motor-launch was ashore and by the time it returned to the ship a high sea was running. In order to save the launch the

Aurora had to steam into the wind until close under the lofty ice-cliffs, where calmer water was found. Anxious moments followed for all aboard, for the bottom was shallow, rocky and uneven. Fortunately, calmer water was reached without accident and the anchor dropped. But the launch's troubles were not yet over. As the craft was ready to be hoisted aboard, it broke away. Away it went before the wind with Bickerton, engineer, Hunter, biologist, and Whetter the doctor, on board. The rudder had been unshipped and in the running sea, Whetter found it impossible to manœuvre. After many futile attempts a temporary fastening was made. Worse still, though Hunter got full duty out of the hand pump, the water breaking over the sides affected the stricken motor and caused starting trouble. Helplessly they drifted half a mile, heading straight to destruction on a rocky group of islets. Providence guided the launch that day and the anxious watchers crowding the *Aurora's* rail breathed sighs of relief when they saw the launch start under her own power. Seconds later and it would have been too late.

A succession of off-land gales veering between south and south-east hindered landing operations. An excellent boat harbour at Cape Denison enabled the launch to ply between shore and ship. Tentative arrangements had been made for the landing of three separate parties at intervals along Antarctic shores, should opportunities arise. Discovering the wind-swept and desolate nature of the newly discovered land forced Mawson to attempt only two bases, amalgamating the smallest base with the main base; a wise decision, for the climate and exploration of Adelie Land proved to be the toughest task on any land yet known.

By January 19 all stores and gear for the main base were ashore. From his tent Mawson watched the good ship steaming over the western horizon into the great unknown.

The *Aurora* steamed west along the coast until the limit of open water was reached. This was named the D'Urville Sea. Later it was discovered that the absence of pack-ice is due to the persistent gales setting off the land in that locality. Adelie Land could be traced in a westerly direction, but on account of

heavy pack the vessel could not follow along the coast, being forced to follow the heavy ice to the north and west. At this point Davis expected to sight the high land reported by Wilkes as lying to the west and south-west, but none was seen.

In longitude 132 degs 30 mins E. they were able to stand south again and shortly afterwards passed over the charted position of D'Urville's Cote Clarie. 'The water here was clear of pack ice but studded with bergs of immense size. The great barrier which had been followed for 60 miles by the French ships in 1840 had vanished—nothing remained to mark its former position except a collection of huge bergs,' reported the *Aurora's* skipper. They sailed over the charted position of land east of Wilkes's Cape Carr, but no trace of land was seen.

A few hours afterwards, still steaming south, new land was sighted—icy slopes rising from the sea, similar to those of Adelie Land but of greater elevation. Fast floe-ice extended far out to sea from the land, though the nearest approach the ship could make was twelve miles distant. This land was named Wilkes Land, to commemorate the name of a navigator whose daring was never in question.

A week later the ship was pushing south amongst heavy pack-ice in the vicinity of longitude 120 degs E. A portion of Balleny's Sabrina Land was sailed over and there was no indication of land in the vicinity. Finally a point was reached seven miles from a portion of Wilkes's Totten's Land, reported to be high land. A sounding gave 340 fathoms. The pack was too heavy for the ship to penetrate further to the south, so a course was set to the west.

Some days later the vicinity of Knox Land, of Wilkes's charts, was reached. It was, therefore, very disappointing when heavy pack-ice barred the way, at a point still north of Wilkes's furthest south in that locality. Three attempts to force a passage were made, but they were without avail; in the third the vessel was extricated only with great difficulty. No land had been sighted, but soundings indicated that land would in all probability be met with to the south. Repulsed from his attack upon the pack-ice in that vicinity, Captain Davis decided to go still further west.

Early on the morning of February 8, in foggy weather, a wall

of ice about eighty feet high appeared across the bows, extending in a north-westerly direction. Following this along, the weather cleared and it was seen to be the face of an extensive flat-topped mass of floating barrier. Rounding a cape to the west and passing through loose ice, open water was reached to the south. Fifty miles in that direction the sea was found to shallow rapidly and a maze of large grounded bergs was entered.

After several days' delay owing to blizzard, they pushed south again on February 11. Two days later the last of the obstructing ice was negotiated and the ship steamed into a broad sheet of water still stretching to the south. This open sea inside the ice-belt was found later to be a permanent feature of that vicinity and it was named the Davis Sea.

One hundred miles further south in latitude 66 degs S. and longitude 94 degs 23 mins E., the icy slopes of new land were seen extending east and west as far as the eye could reach. The sphere of operations of the German Expedition of 1901 was now near at hand, for their vessel, the *Gauss*, had wintered frozen in the pack about 125 miles to the west. The land to the south, which the Germans visited by sledge journey over the pack-ice, was eventually proved by an Australian sledge party to be continuous with the new land sighted by the *Aurora*. The 'high land' seen by the Germans during a balloon ascent was found to be a high ice-sheathed island about nine miles across. It was named Drygalski Island. A barrier trending 180 miles to the north from the newly discovered land was very similar to the Ross Barrier. This was called the Shackleton Ice Shelf. Its height was remarkably uniform, ranging between sixty to one hundred feet. In area it occupied many thousands of square miles.

The Shackleton barrier ice comes from the glacier-flow over the great plateau-interior. Every year an additional layer of consolidated snow is added to its surface by the frequent blizzards. These annual additions are clearly marked in layers on the dazzling white face of the ice-cliff. The whole mass moves constantly and slowly north under the irresistible pressure of the land-ice behind.

As they were steaming along within 300 yards of the cliff face, suddenly with a loud roar and a splash a mass weighing perhaps a million tons broke away, at once sinking into the sea. Then followed an interval of a few minutes during which the new berg rose and sank in majestic fashion accompanied by a rapid splitting up. After five minutes only small bergs and brash ice remained, as though the new ship launched from nature's slipway had been unseaworthy, foundering on her maiden voyage.

It had now become urgent to land the Western Party. After a conference Davis and Wild decided the landing should be attempted on one of the floating shelf-ice formations, as nothing better presented itself. An ice-tongue near at hand suggested itself as suitable. Fortunately a reconnaissance was made before a landing, for it was discovered to be nothing more than a huge iceberg about twenty-four miles in length. Eventually a location was chosen on the Shackleton Ice Shelf. The spot selected was seventeen miles from the land itself—the nearest approach possible by the ship. Wild's camp was the first Antarctic settlement to be established on floating barrier.

Days of hard work followed, getting the hut, stores, coal and instruments to the top of the ice-cliff by use of a 'flying fox'. Twelve tons of coal was the last item sent up.

No time was lost in sailing, for the long battle in the ice had left the ship desperately short of coal and ballast. It was then February 21 and penetration of the pack-strewn sea had become more difficult and dangerous on account of the growing hours of darkness. The climatic conditions had proved worse than had been expected. Foggy weather or falling snow was the rule, gales were prevalent and, worst of all, even within a few weeks of the height of summer, darkness enshrouded the midnight hours, making ice navigation a perilous business. However, the 2,300 miles to Hobart were accomplished without accident, the vessel arriving on March 12 with only nine tons of coal in the bunkers.

The vessel was refitted in Sydney and deep-sea dredging gear taken aboard for securing samples of the bottom-life in the deep ocean. On May 20, 1912, a voyage south was commenced to

investigate the ocean floor between Australia and Antarctica. A call was made at Macquarie Island and several weeks were spent at the Auckland Islands. There Waite, the biologist, succeeded in capturing six of the very rare flightless ducks indigenous to the Auckland Islands. On July 11 the *Aurora* reached Lyttleton, New Zealand.

After outfitting in Melbourne, a second cruise was made between November 15 and December 15, 1912. A large part of the work of both these voyages was the delineation of the ocean floor. Till then, excepting those in the coastal waters of Australia, Tasmania and New Zealand, very few depths had been determined in that great stretch of ocean southward to the Antarctic Continent. The contour of that ocean floor has a bearing on the theory of a lost southern continent. Thus the soundings were of unusual interest.

The most important results of the 1912 winter cruises were the discovery of a submerged island-like plateau southward of and about the size of Tasmania; and a trough-depression was found to separate Macquarie Island from the Auckland Islands and others which stand upon the same submarine platform as New Zealand.

Meanwhile, at Mawson's main base in Adelie Land, a hut was quickly erected and self-recording instruments housed and set running without delay. Preparations were made for autumn sledging and a journey commenced on March 1, 1912. The weather had been bad enough before but it soon became worse and the party returned, leaving the loaded sledge on the plateau. After that date there was no slackening of the wind, excepting for an odd hour or two, until far on in the spring. It was not until six months later that this sledge was recovered. During that interval the winter quarters were swallowed in a sea of drifting snow which poured over the landscape. The average wind velocity in Adelie Land was far beyond anything known hitherto. The charts of the self-recording instruments showed the average for the whole year to be 50 miles per hour. Average hourly velocities of 100 miles and more were common and twenty-four-hourly averages of over 90 miles were recorded. How the men learnt to 'lean on the wind' was shown in the

amazing photos taken by Hurley. Frequently the air travelled forward in a series of cyclonic 'willie-willies' in the centre of which velocities reached much higher than the averages mentioned. Mawson speaks of these reaching 200 m.p.h.! Rocks were lifted and structures, not buried in the névé, were whirled away. Fortunately, the hut was soon drifted over to such an extent that only a portion of the roof remained above ground. In fine weather entrance to the interior was by a trap-door in the roof, at other times through tunnels in the névé.

For months the drifting snow never ceased and intervals of many days together passed when it was impossible for a man to see his hand held at arm's length. The drift-snow became charged with electricity and in the blackness of the winter night all pointed objects and the men's clothes, noses and finger-tips glowed with the pale blue light of St. Elmo's fire. The indescribable roar of the hurricane, the sting of the driven particles of ice and the piercing cold give some idea of conditions under which the routine of outdoor observations was maintained. This weather lasted almost nine months of the year. Even in midsummer, blizzard followed blizzard in rapid succession.

Three Mawson reconnaissance parties in September 1912 had their tents torn to ribbons and were fortunate in reaching the sanctuary of the hut without serious accident. One of these parties, led by Madigan, meteorologist, assisted by Whetter and Close, assistant-naturalist, returned badly frost-bitten after a splendid effort. To save the tents two underground rooms were excavated in the glacier ice on the highway to the plateau at distances of $5\frac{1}{2}$ miles and $11\frac{3}{4}$ miles respectively from the hut. In these ice caverns quantities of stores were accumulated during the spring ready for an extensive summer sledging campaign.

The constant hurricane along the Adelie Land coast broke up the sea-ice as quickly as it formed and pushed it away to the north. Mawson had to abandon any idea of sledging over the frozen sea. It was not until November 7 that there was sufficient moderation in the weather for a real start. Five diverging parties worked simultaneously, so that a maximum of new ground was covered during the comparatively short sledging season.

Stillwell, the geologist, assisted by Close and Laseron, the naturalist, mapped the coastline to the east as far as the Mertz Glacier. A number of rocky islets, fringing the mainland, were seen to be havens for the silver petrels, Antarctic petrels, Wilson petrels, snow petrels and Cape pigeons, all nesting in large colonies.

Further east Madigan, assisted by McLean, chief medical officer, and Correll, mechanic, continued the work, reaching latitude 67 degs 14 mins S. and longitude 150 degs 21 mins E. Eastward of the Mertz Glacier they found the sea frozen and travelled over it for the remainder of the journey, crossing the fifteen-miles-wide tongue of the Ninnis Glacier and visiting several headlands. In the vicinity of the Horn Bluff, in a sweep of coastline bounded by rocky cliffs, 1,000 feet high, they discovered coal and carbonaceous shales. Madigan made frequent determinations of magnetic dip and azimuth. The new land east of the Mertz Glacier was named King George V Land.

CHAPTER XIII

Fight for Life!

It was here, in the desolate vastness of King George V Land, that tragedy met Ninnis and Mertz, the dog team leaders, and Mawson, who were undertaking the longest of six sorties, planned as part of the spring and summer mapping operations from the snow-cased hut on Commonwealth Bay. Mawson's objective was to push out rapidly across the highlands, travelling south of Madigan's man-hauling coastal party. Mawson wanted to map to the eastward limit of Adelie Land. His party had all the dogs, but found the going much tougher than they had imagined. Many times they had to toil up to 3,000 feet and descend again to sea-level. Glaciers were heavily crevassed; many serious accidents were narrowly averted. It was when they believed that all these dangers were behind them that catastrophe struck.

On December 14, 1912, 311 miles from base, Ninnis, with his dog team and sledge, broke through the roof of a névé-covered crevasse, plunging into the unfathomable depth. Peering over the crevasse lip, all the two survivors could see was an injured moaning dog 150 feet down on an ice shelf, surrounded by fragments of sledge. The moans of the dog soon ceased, no answer came back to the frantic calls of the peering men. All the dog food and nearly all the rations, besides the tent, pick shovel and other necessities, had been aboard Ninnis's sledge. After hours of calling, hope was abandoned.

The six remaining dogs were the poorest of the pack. Fortunately there was a spare tent cover. With a pair of skis and the theodolite legs, a frame was improvised for a tent. Later a broken spade was picked up at an old camp.

Nine hours later Mawson read the burial service. They had come to know Ninnis as a man of fine spirit and courage. His death was a grievous blow and with heavy hearts they set their faces to the hut. After full consideration they decided that their

best chance for survival lay in a return journey over the plateau.

Owing to delays by bad weather, the ration had to be reduced further than anticipated. The dogs gave out daily, so that soon there were none left. Dog flesh seemed to contain a minimum of nutriment and was difficult to digest.

By the first week in January they were a hundred miles from the hut. Mertz was ill from the short and unsuitable ration. Mawson was affected to a less extent. Weak from want of food and with nothing but dense falling and drifting snow day after day, the men truly felt the cold eating through their bones. Daily journeys grew shorter.

On January 3 Mertz was worse. He turned against the dogs' flesh. Even under those circumstances he remained cheerful and undaunted. The slippery surface caused the staggering men to fall down frequently, painfully jarring their emaciated frames. Mertz could not proceed on foot. After some demur he agreed to try riding on the sledge, but even with the help of the sail progress was slow. Much toil resulted in 2½ miles only being covered. It was possible to steer only a very rough course in the flying drift. On January 7, 1913, Mertz's condition was much worse and at midnight he passed away, being delirious and unconscious.

Contrary to the usual procedure on the outward run, the travellers had left no food depots. It had been their bad luck to meet such impossible country that already before the tragedy they had decided to come back a different way.

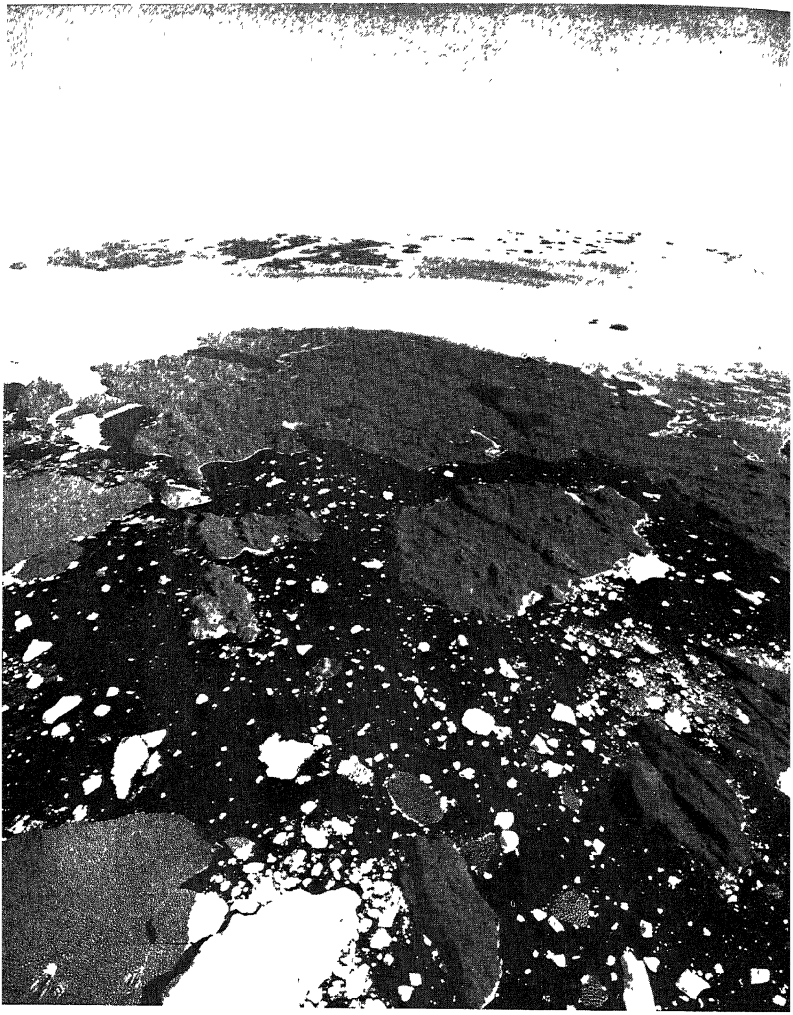
Mawson, now alone, still a hundred miles from the small hut, buried his companion amid the snow blocks on the eastern slope of a glacier that to-day bears his name.

With two comrades gone and very little hope in his heart, Mawson set out to win through. He cooked the last of the dog meat and struggled on. Dragging half his sledge behind him, he fought on day after day, a few miles at the most. Some days he was kept in his patchwork tent by the howling wind and hurtling drift. When the soles of his feet came away in whole pieces, he bound them back again with strips of clothing and staggered on.

Ten long days followed, but the worst was to come, for on January 17 Mawson trod on a soft snow-bridge and plunged

(U S. Navy Official photograph)

Scott's treacherous route to the Pole was through this blue-ice Amazon



(*U S Navy photogra*

A warm spot in the ice of Antarctica. An aerial photograph

into an abyss. Only his own words can convey the horror of that moment.

'Having seen my comrades perish in diverse ways and having lost hope of ever reaching the hut, I had already many times speculated on what the end would be like. So it happened that as I fell through into the crevasse, the thought "So this is the end!" blazed up in my mind, for it was to be expected that the next moment the sledge would follow through, crash on my head, and all go to the unseen bottom. But the unexpected happened, the sledge held, the deep snow acting as a brake.'

Fourteen feet above Mawson, at the end of the rope, daylight glittered through the hole in the roof of the crevasse. Exhausted and chilled, he spun round and round between the ice-walls, which led to the unseen depths below. They afforded neither hand nor foothold. In his weakened condition it seemed hopeless to Mawson to try to reach the surface, but at least, he decided, he would make the effort. Slowly grasping knot above knot, he managed to draw himself on to the overhanging snow-roof. Then, as all appeared to be well but before he could get on solid ground, a further section of the lid collapsed, precipitating him once more to the full length of the rope.

'I felt I had done my utmost and failed, that I had no more strength to try again and that all was over except the passing,' were the words Mawson used to describe his feeling of utter hopelessness.

Then came the severest test of all. A miserable slow end awaited him, but the thought flashed through his mind that he could easily slip from the sledge harness. He wrestled with the idea, but thinking of how Providence had miraculously brought him so far, he felt that nothing was impossible and so he determined to make a final effort.

Inch by inch he edged his way up. Progress was so slow he thought he would never reach the roof. With the last ounce of his strength he reached the surface, feet first, and pushed himself safely to the solid ground at the side. Swift reaction surged upon him. Lying alongside the sledge his mind went blank. Two hours later he came to, numbed by fresh-fallen snow. It took him three hours to put up his tent, resting for breath and strength between every movement.

After this experience Mawson decided to make a rope ladder, for he knew he would never manage to climb out of another crevasse. While passing over glaciers he had several similar experiences and was able to extricate himself fairly easily with the ladder.

Twelve more days passed, his sole food being stringy dog meat, a little pemmican and an ounce or two of chocolate. On some days he managed to stagger five miles, sometimes nine and sometimes none. Then came a day when, twenty-three miles from the hut, he had a bare two pounds of food left. It was January 29, forty-eight days since the loss of Ninnis and twenty-two days since he had lost Mertz.

Through light drift, a mound of ice, with a black object on the top, loomed up ahead. When he staggered there, Mawson found that, of all things it was a bag of food, left by chance that very morning by a search party from the hut. It was a chance in a million that led Mawson's steps to that spot and that night the two camps had been only two miles apart! Even a thorough search might never have found the food dump in a land where visibility is often a blinding glare or more restricted than in a London fog. Mawson never thought he had a donkey's chance of pulling through when he started that terrible nightmare journey. Even now his struggles were not over, but he went on with renewed hope.

Without crampons, it was almost impossible to stand on the hard blue ice of the glacier. Mawson had thrown them away weeks before to save weight. With the extra food, he covered fourteen miles the next day, blown along most of the time by a following wind. At times he was blown aside or straight to the ground. When he camped, he made himself a pair of crampons from the theodolite case which he had kept. Finally he reached the food depot at the ice cavern which they called Aladdin's Cave on February 1, 5½ miles from the hut. Then a strong blizzard, reaching a velocity of 80 miles per hour, caused further delay. The wind eased on February 8. Descending the ice slopes to the hut, Mawson saw the relief ship *Aurora* on the horizon, outward bound heading for the open sea.

Of the other summer sledging parties from main base during

Mawson's journey with Ninnis and Mertz, Bage went south, inland over the plateau, and Bickerton west over the highlands. Bage's companions were Webb, chief magnetician, and Hurley, the photographer. Murphy, Hunter and Laseron formed a supporting party for sixty-seven miles. The wind seldom ceased and drifting snow was the rule. The constant flow of air, they found, had cut deep sastrugi, of unprecedented dimensions, in the plateau surface. Over those dreadful ridges they dragged their sledges in the face of the wind for 300 miles out from the hut, to within the region of the Magnetic Pole. They reached an altitude of 6,500 feet. On one occasion, a march of forty miles was made. The magnetic information from this journey was valuable, for Webb took full sets of observations for dip and azimuth at regular intervals. The difficulties with which he had to contend in carrying out such delicate observations in the biting wind were tremendous.

On the return journey, after waiting several days at a food depot 67½ miles from the hut, this magnetic work was abandoned. Drifting snow obscured everything. With but two days' supply of food left they pushed on to reach the coast, trudging onwards hour after hour in clouds of flying white nothingness. Fortunately, before it was too late, Aladdin's Cave, the food depot 5½ miles from the hut, was reached.

Hodgeman, Whetter and Bickerton formed the western party, using an air-tractor sledge. Unfortunately, after reaching an altitude of 2,000 feet, ten miles south of the hut, several pistons broke. The vehicle was abandoned. The western journey was conducted for the most part at an elevation of about 4,000 feet and proved very dreary. The average wind velocity for the whole period of the journey was 34 miles per hour. They passed over the highlands of the Adelie Land seen by D'Urville, coming close to the coast in latitude 66 degs 33 mins S., longitude 138 degs E., where they saw frozen sea to the west.

The men found a piece of rock a pound or two in weight lying on the inland ice-sheet far from any nunataks. They thought it was a stone meteorite.

A party of six, Madigan in charge, Bage, magnetician,

McLean, Bickerton, Hodgeman, cartographer, and Jeffryes, the radio operator, had remained at base to carry out the scientific observations for another year and search for Mawson and his two companions.

The party at the hut, assisted by the ship's crew, had re-erected the radio aerial blown down the previous year. The ship was fitted with a receiver but no transmitter. When Mawson arrived back on the evening of February 8 he sent a message from the hut recalling the ship. As the ship came into sight again, the wind rose. There was no knowing how long it would continue to blow, for this was Adelie Land, the land of blizzards.

Great anxiety had been felt by Captain Davis about the safety of Wild's western party camped on the Shackleton barrier. In the absence of information on how that party was faring, the possible difficulties in effecting relief being dependent on the weather conditions in their locality, and the special features of the pack-ice, and finally, from lack of information about the condition of the *Aurora* and her coal supply, Mawson could only leave it to Captain Davis to decide whether he should delay any longer at the main base. So Mawson sent another message to Davis hoping the position would allow the *Aurora* to stay a day or two longer in the hope of the weather calming. The actual decision had to be left to Captain Davis himself. Those ashore saw no more of the vessel, which sailed on to the relief of Wild's party.

Captain Davis had sailed from Hobart to the relief of the two bases on December 26, 1912. Heavy weather was met going south, but nevertheless a number of soundings were secured. Commonwealth Bay was reached on January 12. At that date some of the parties had not arrived but all with the exception of the leader's appeared during the following days.

When the date prescribed for their return had been exceeded by a week, Davis decided to leave a search party for another year. McLean, Hodgeman and Hurley sledged on to the plateau and laid several depots on the highlands southward. The ship's party searched the eastern coastline, arriving back at Commonwealth Bay on January 31. The wind was blowing

too strong to communicate with the shore party. A heavy gale continued until the morning of February 8, when a lull set in.

The vessel had been steaming into heavy seas, keeping the coast in sight. The ship's plight was told laconically when Captain Davis logged: 'All hands were exhausted and the vessel covered with ice and our likelihood of being able to reach the second base this year looks doubtful.'

Accordingly no time was lost at Commonwealth Bay in taking on board all except the six men who were to remain and off went the *Aurora* on the 1,500-mile voyage to relieve Wild's western base. That evening, when fifty miles at sea, Hannam, at the receiver, heard news of Mawson's return to the hut. The wind again sprang up and prevented the relief of the seven now at the main base. So the *Aurora* pushed through the pack at the north of the D'Urville Sea to relieve Wild's eight-man party and shaped a course to the west. A three-day easterly gale, thick with flying snow, followed.

It was an anxious trip and the captain wrote: 'As daylight came each morning we could feel thankful that another night, which lasts five hours, had passed without disaster.' North of the Shackleton shelf-ice conditions were different than the previous year. Great difficulties were encountered in pushing through the growling pack. Eventually the western base was reached on February 23.

The ice-sheet upon which the hut of the western base was erected was uneven and much crevassed for 200 to 300 yards from the edge. During the construction of the living-hut, Harrison, standing upon the roof framework, sighted a large island rising out of the ice-sheet to the east. An igloo was built as a magnetic observatory. Upon completion of the hut, a regular meteorological and magnetic programme was instituted and autumn sledging started. Wild with Dovers, surveyor, Harrison, biologist, Hoadley, geologist, Jones, the doctor, and Moyes, meteorologist, set out on March 13, 1912, with the idea of reconnoitring the coastal slopes of the mainland. A point 2,000 feet above sea-level and thirty-five miles in a direct line from the hut was reached. Protracted blizzards, accompanied by an unusually heavy snowfall, rendering the surface at this

point difficult to travel over and forced them back to the hut after caching a large supply of food.

The drift completely buried their hut and store-houses were made by driving tunnels and chambers out in all directions into the hard snow. The floe-ice had all broken up at the end of summer and until the next summer no seals or penguins were obtainable. Short sledging journeys foraging for fresh meat supplies were conducted in April. The winter was marked by frequent blizzards and heavy snowfall.

On August 20, Wild, Harrison, Jones, Moyes, Dovers and Watson, geologist, assisted by the three remaining dogs, set out on a depot-laying journey to the east. Food was cached on the Shackleton ice-sheet eighty-four miles out. Temperatures as low as —47 degs F. were experienced. Small nunataks and large islands were seen rising from the ice-sheet.

On the return journey they camped under a sheer face of rock 400 feet high, crowned by a 200-feet cliff of ice. The inland ice-sheet, pressing forward, kept overthrusting great avalanches of ice, from one of which they had a narrow escape.

For the eastern summer sledge journey Wild picked Watson and Kennedy. Harrison was to accompany them to the depot, eighty-four miles out, then return alone. At the depot, though the food was found, the sledge that had been left to mark the spot was not recovered. The wind had carried it away. Wild decided to take Harrison on with them, as they could not afford to give him a sledge for his return journey: 120 miles east of their hut they met a mighty glacier, the Denman Glacier, descending into an embayment of the coast and then pushing out through the Shackleton Ice Shelf. An attempt was made to cross this chaos of ice but was found impossible. A second attempt was made some distance to the north with no better fortune. A large island 900 feet high, upon which were many rock exposures, was examined and mapped.

They arrived back at the hut on January 6. Moyes, who had lived alone at the winter quarters for two months, keeping up the routine observations, was overjoyed to find Harrison alive, for he had long since given him up as dead. On Harrison's non-appearance, he had packed a sledge and gone out by himself on a six days' journey in search of his comrade.

Jones, Hoadley and Dovers set out on November 7 over the ice-slopes to the west. Progress was slow on account of the numerous crevasses. Travelling was done at elevations of between 1,000 feet and 4,000 feet. At a small rock island 420 feet in height, lying several miles off the coast, they located an immense Emperor penguin rookery. It contained 7,000 young birds, which, on account of the heavy mortality amongst the young, meant something like 20,000 adults. They discovered eggs of the rare petrels.

After a journey of 215 miles by track, not counting relays, they reached Gaussberg and returned to the hut again on January 21. After picking up Wild's party, the *Aurora* returned to Hobart on March 15, 1913.

The seven men remaining in Adelie Land for a second year had a very miserable prospect ahead. However, there was plenty of work in the routine scientific observations to keep the mind from dwelling unduly upon the raging elements without. Bage carried on the magnetic work in place of Webb. The care of about twenty sledge dogs presented to the expedition by Amundsen, and brought down by the *Aurora* that summer, fell to Madigan.

Radio communication was established with Macquarie Island about the middle of February and Mawson was able to tell the world of the dramatic happenings before even the *Aurora* had reached Hobart. The radio proved a success and a boon throughout the year, though temporary stoppages occurred, owing to unusual difficulties from the constant hurricane. It was found difficult to keep the aerial up; difficult to hear the messages on account of the muffled roar of the wind; and often impossible to work the transmitter on account of the heavy electrical discharge from the atmosphere. The weather the second year proved even worse than the first.

In November Madigan, Hodgeman and Mawson set out with the dogs on a short sledging journey to the Madigan nunatak and Mt. Murchison to recover instruments cached the previous year. The winter snows had deeply buried the surface of the previous year and nothing could be seen. Returning to

winter quarters, they descended the plateau slopes as the *Aurora* entered Commonwealth Bay.

When Mawson found that his section of six men was to remain at Adelie Land for a second year he radioed the party on Macquarie Island that it was desirable that they should remain on another year in order to keep contact with Commonwealth Bay. As regards their activities, Blake, the surveyor, made a thorough map of the island by triangulation and produced evidence that not long ago, geologically speaking, the whole island had been overridden by an ice-sheet travelling from west to east. Hamilton, the naturalist, found in the bird and seal life a wonderfully interesting field. Hamilton and Blake constantly visited parts of the island remote from the hut, making use of several dilapidated shelters left along the east coast by sealers of past times.

On account of shortage of funds the *Aurora* was laid up during the winter of 1913. It was arranged that a small sealer should take stores to the island party. July proved an unusually stormy month, however, and the vessel, after being long overdue, eventually reached New Zealand in a damaged condition, and did not reach the island at all. By that time the men were living almost exclusively on sea-elephant meat. Fortunately the New Zealand Government promptly sent a steamer, the *Tutanekai*, to their aid.

On December 2 the *Aurora* arrived at Macquarie Island, picking up Ainsworth, Blake, cartographer, Sandell, radio operator, and Hamilton, the biologist, *en route*, to relieve the Adelie Land party. With the *Aurora* there came three new men to carry on the meteorological and wireless station for the Commonwealth Government which was to maintain the station from then onwards.

On December 12 the *Aurora* was at Commonwealth Bay and old comrades were united in a joyous celebration. After a survey cruise to the Shackleton Ice-Shelf, the *Aurora* returned to Adelaide on February 26, 1914.

CHAPTER XIV

Priestley, Debenham and Taylor

MEN go out into the wild parts of the world for many reasons, for love of adventure, or because they have an insatiable thirst for scientific knowledge or because they are caught by the mysterious fascination of the unknown. Time and time again the call of the Antarctic lured men to return and as we examine the expedition records, we see the same names cropping up again and again. Those who have once seen some part of Antarctica have an unquenchable desire to see more of the vast continent that lies amid eternal snows and glaciers; its fascination grips their hearts. Even to-day this sinister and beautiful land, lying in frozen slumber, continues to draw men to its shores, but fewer than a thousand human beings have wintered there. To-day the great continent is a challenge to the unsettled adventure-hungry post-war world. There will always be men to wrestle the malevolent elements that guard the secrets of the South.

In considering the progress of Antarctic exploration, increasing emphasis is seen to have been placed on the scientific element of each expedition. While Mawson was in Adelie Land, Scott's *Terra Nova* expedition was operating in the Ross Sea area and the continental land east of Mawson's zone of activities.

Raymond E. Priestley, already a veteran of the *Nimrod* expedition, returned to the Antarctic with Scott's Second Expedition, 1910–13. For the main sledging season of 1911–12, in addition to the ill-fated Polar party, western and northern parties were organised for scientific and, particularly, geological exploration.

Scott sailed in the *Terra Nova* from Port Chalmers, New Zealand, on November 26, 1910. After a struggle through the pack the party eventually landed on the Antarctic Continent

with a strength of thirty-three men, comprising seven officers, twelve scientific staff and fourteen men, nearly all Royal Naval personnel.

The chief of the scientific section was Dr. Edward Wilson, who perished with the leader. There were at least two Australians in the scientific section, Griffith Taylor and Frank Debenham. When he joined the expedition Taylor was a physiographer with the Commonwealth Weather Service; he was the expedition's senior geologist and afterwards became lecturer at Melbourne and Sydney Universities before taking up the prominent position in American and Canadian Universities which he has occupied in recent years. Debenham also returned from the expedition with high honours. He was the founder of the Scott Polar Research Institute and was Director there from 1925 to 1946. He was Professor of Geography at Cambridge University from 1930 to 1949, but even at the age of sixty-five, the fever of exploration still ran through his veins. In 1949 he led a party of students to Central Africa to study water supply problems and explore the sanctuary of the curious 'web-footed' natives of Lake Bangweulu, Northern Rhodesia.

Scott went into McMurdo Sound, site of his former camp, but this time he chose a spot about half-way between his old hut and Shackleton's hut at Cape Royds. Unloading for the winter, the *Terra Nova* returned to New Zealand. The expedition's plan was to get to the Pole the next season, but Scott was much surprised and upset when he heard that Amundsen, the Norwegian, was at the Bay of Whales all set for a rapid dash to the Pole.

The tragedy and heroic achievement of Scott's party has been told many times. It loses nothing with the passing of the years, but here we are concerned with the activities of the smaller elements of this great expedition, about whom less has been heard.

Scott's northern party was in the charge of Lt. V. L. A. Campbell; with Priestley as geologist and G. M. Levick, R.N., as surgeon; there were three seamen, Abbott, Browning and Dickason. Still aiming at establishing a base in King Edward Land, Scott instructed his northern party to get ashore there,

but if unsuccessful they were to go back to Cape Adare, where the *Southern Cross* party had wintered, 400 miles north of McMurdo Sound.

The *Terra Nova* under Captain Pennell was to transfer the northern party to its base, wherever it was, move them to a new position in the following spring and to return to retrieve the party before the winter of 1912.

It was this northern party that found Amundsen's *Fram* anchored in the Bay of Whales, much to their astonishment. No time was lost in acquainting Scott with the news and the ship's prow was turned towards McMurdo Sound. The *Terra Nova* departed for Robertson Bay but ran into a ferocious gale. The ship had to heave-to and she drifted a hundred miles beyond Cape Adare. On returning they found no suitable place for a base, so they proceeded to occupy the hut which Borchgrevinck's party had used. In addition they set up their own hut, twenty feet square, and secured it to the ground with wire hawsers over the roof.

An old hand like Priestley soon realised that conditions at Cape Adare were worse than anticipated. It was Priestley's job to visit the meteorological screens and read the instruments several times each day. During the hurricanes in May he was repeatedly thrown down and carried many feet, clinging for his life to the guide rope which ran a hundred yards from the hut to the instruments. At the end of the winter, sledge journeys were made round Robertson Bay and the temperature dived to −48 degs F. The party suffered greatly from their lack of knowledge of ski-ing and sledging technique. Faces and fingers were badly frost-bitten.

On January 3, 1912, the *Terra Nova* returned to Cape Adare and all equipment and personnel were embarked. Ten months had been spent by the little party on one of the stormiest parts of the continent. Little did they know it, but they were on the threshold of more terrifying experiences.

Now Shackleton's *Nimrod* in 1909 had experienced no difficulty in reaching the bay north of the Drygalski Ice Tongue, on the coast about two-thirds of the way between Cape Adare and Scott's new headquarters at Cape Evans. The northern party chose this bay, later named Terra Nova Bay, for summer

sledging before the ship should pick them up and return to Cape Evans.

The northern party landed at Evans Cove on January 8. It was necessary to sledge all the equipment and supplies needed for the short summer operations, across half a mile of shore-ice. The *Terra Nova* was expected back in six weeks, but if the ship did not return by March 15, the party must be ready to winter in the region. Soon after the landing, sledge parties began to explore the glaciers to the north. The mountains of the coast north of Terra Nova Bay culminate in Mt. Melbourne, 8,500 feet, and Mt. Dickason, 7,000 feet. Here Priestley found fossil trees in the sedimentary rock, which proved that once the Antarctic region possessed a climate milder than that of the United Kingdom to-day.

By March 1, with the non-appearance of the *Terra Nova*, the party awaited the onset of the winter. They were completely unprepared in every respect and their only shelter was a cave dug in a hard snowdrift, like an igloo. The only suitable drift was the lee side of what they called Inexpressible Island. Priestley, who was assigned the task of obtaining and dividing the food, decided to reserve half their pemmican and other supplies for the 200-mile sledge journey in the coming spring to the expedition base at Cape Evans.

Seals and penguins were already leaving the region of Terra Nova Bay, but the men laid in what fresh meat they could catch. There followed a dreadful winter during which the men experienced frightful privation, hunger and cold; everything failed except their will to survive. Their summer windproofs flew in tatters in the blizzard winds, their ice cave was filthy from the blubber stoves and meal preparations; at times they suffered food poisoning. Day after day they were snowed in by the hurricanes and narrowly escaped suffocation. Priestley said that if their boots had not frozen, they would have fallen to pieces. Truly their winter was the worst ever experienced by men in the Antarctic regions.

With the returning sun the men's spirits rose; they could get more seal meat too. How they finally struggled to Cape Evans along the coast, passing through terrible country with short rations and hopelessly ill-equipped, is a saga itself. Then when

they finally reached the small expedition hut, it was deserted. There was a note there to say that those who had been there had gone to look for the bodies of the lost Polar party. Actually it was thought at Cape Evans base that the northern party had perished too.

After two weeks' rest and recovery Priestley, the insatiable scientist, led a party of three to the summit of Mt. Erebus.

The two journeys made by Griffith Taylor and Debenham with the Second Scott Expedition brought in more discoveries than any other branch of the expedition. A detailed geological examination was made of a hundred miles of the coast of South Victoria Land north from McMurdo Sound to Granite Harbour. Taylor and Debenham went inland and broke fresh ground, discovering and charting many new mountains and tributary glaciers. They found Ferrar Glacier was actually two glaciers instead of one. Debenham discovered coal on the Gondola Mountain thirty miles inland from Granite Harbour, opening up miles of new land and bringing back fresh knowledge of this region.

The end came on October 27, when the ship was shattered beyond hope. Shackleton had already set in motion all preparations for abandoning it and moving to a camp on a great ice-floe some distance away. Even as they settled down ashore, Shackleton noticed a sudden crack appear in the floe between the tents. The leader blew a whistle and they shifted to a safer area, the whole party, dogs, stores and equipment. It is worth noting that while trapped in the ice, the *Endurance* drifted 1,186 miles. Shackleton calculated the nearest island was 346 miles away, as the skua flies. Here there might be food and shelter.

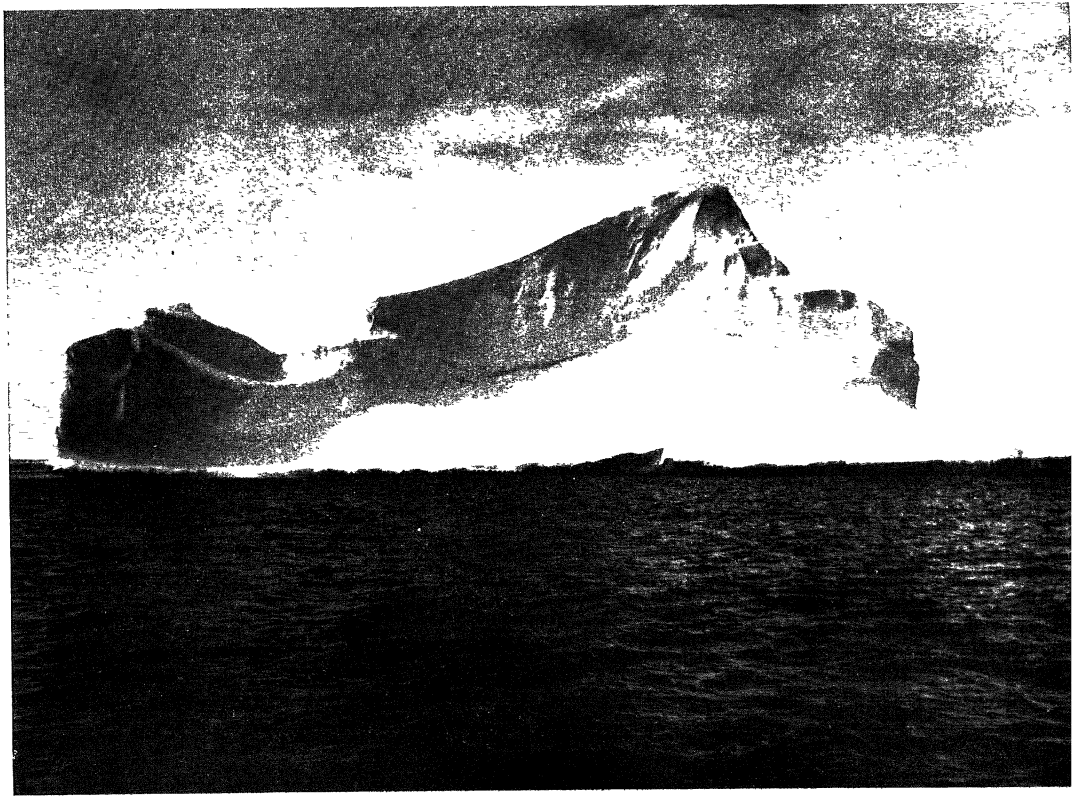
Shackleton and his twenty-eight men camped on the ice-floes in several locations during the following months. At all times they were on their toes to shift camp should the ice under their feet threaten to crack. In April they took to the three lifeboats which they had landed from the *Endurance*, and after thrilling experiences all the men safely reached Elephant Island in the South Shetland Group. After six terrible days at sea many of them were delirious and frost-bitten, but the imperturbable leader and his officers had the situation under control. No others had landed on this desolate beach, which at least provided the men with temporary shelter and solid ground beneath their feet. Their nearest place for assistance was the whaling station at South Georgia, 800 miles away.

After a fortnight's recuperation, Shackleton, with Worsley and four others, climbed into one of the twenty-foot boats, bade their companions good-bye and shoved off on their sixteen days' sail to the whaling outpost.

That long and perilous passage is now as much part of history as Captain Bligh's open boat journey, one of the great feats of man's fight against the sea. Meanwhile, Hurley and the marooned party prepared to spend their second Antarctic winter on the narrow strip of blizzard-swept beach. For five months they sheltered here behind the overturned boats and small stone barricades, surviving on a diet of seal and penguin meat. Finally, Shackleton was able to secure the services of a small steamer from the Chilean Government and in due course rescued the twenty-two men.

Meanwhile, it will be recalled that the second half of the

Grounded glacial type iceberg off the Shackleton Ice Shelf
(U.S. Navy photograph)



(*U S Navy photograph*)

Unloading the U.S.S. *Yancey* in the Bay of Whales in 1947

expedition, under Captain Aeneas Mackintosh, another *Nimrod* veteran, was operating in the Ross Sea region. They had set up winter quarters at McMurdo Sound and laid a trail of depots as far as the Beardmore Glacier. This was to ensure the safe return of Shackleton and his party tramping across the continent from their base in the Weddell Sea. Wintering at the ice-cliffs, where she was securely moored, the *Aurora*, too, was caught in the pack, being blown out to sea with the ice. From May 1915 until April 1916 she was held prisoner and drifted helplessly 1,200 miles before she was caught by a rescue tug and towed to Port Chalmers, New Zealand. The *Aurora's* drift gave valuable information about the ocean currents. She averaged four miles a day, in a south-easterly to north-westerly direction, breaking out of the pack in 62 degs S., 157 degs E.

On the return of the *Aurora* to New Zealand it was known that ten men of the Shackleton expedition had been left in the Antarctic in May 1915. Of these four were at the winter station at Cape Evans and six under the leadership of Captain Mackintosh had not returned from their expedition southward on the barrier; but it was hoped that they were safe at Hut Point. Shackleton's fate with the Weddell Sea party was unknown and immediate steps had to be taken if the Ross Sea party were to be rescued. The British, Australian and New Zealand Governments undertook the organisation of a relief expedition. The British Government contributed half the cost, the other half being met by the Australian and New Zealand Governments in proportion to their respective populations. The *Aurora*, seriously damaged as she had been in her long drift in the ice, was the only ship available for the rescue. On survey she was found to be badly forced up amidships, the stem and stern were seriously strained and a large amount of her sheathing needed renewal. An Australian committee was formed in Melbourne, consisting of scientists and old Antarctic hands. They worked in conjunction with Mr. J. J. Kinsey of Christchurch, New Zealand, whose experience with the final equipment of the earlier Antarctic expeditions gave him unique advantages in superintending the fitting out. Kinsey gave his whole time to the task and the *Aurora*, after being put through repairs at Port Chalmers, was ready for sea early in December 1916. The

command of the relief expedition was offered to Captain J. King Davis.

Shackleton was fortunate in being able to join the *Aurora* in New Zealand, travelling by way of Panama, after rescuing the *Endurance* party on Elephant Island. He was to be responsible for any land operations that might be necessary. It was thought that Captain Mackintosh had gone south in the expectation of meeting Shackleton on his way from the South Pole; if so he could not return to the base before March. In that case it would have been necessary to send a search party, involving the risk of another wintering.

The *Aurora*, provisioned for two years, left Port Chalmers on December 20, 1916, and made a remarkably rapid voyage, reaching Cape Evans on January 10. Here seven of the ten members of the expedition who had been left behind in 1915 were found and rescued. Unhappily Captain Mackintosh and V. G. Hayward had lost their lives in a blizzard which broke up the sea-ice while they were on the way from Hut Point to Cape Evans in May 1916, and the Rev. A. P. Spencer Smith had died of scurvy on the barrier. The remaining members of the party were taken on board and the *Aurora*, leaving McMurdo Sound on January 19, arrived in New Zealand three weeks later.

In the Ross Sea party, Cope, Jack and Hayward, forming one of the southern parties, got back to Hut Point on March 14, 1915, three days after the *Aurora* had gone to seek winter quarters, and on March 22, Mackintosh, Wild and Joyce arrived. They had laid two depots on the barrier, one at 79 degs S., the other at 80 degs S. Of the sixteen dogs of the first party two survived, but all those of Mackintosh's party had died. It was June 1 before the six men were able to reach Cape Evans over the sea-ice, and by that time the *Aurora* had been blown away. The winter passed without incident and on September 1 sledge journeys with stores for Hut Point were commenced. The work was very heavy as only four dogs remained. On October 9, 1915, three parties of three men each started sledging stores southward from Hut Point to the Bluff depot in 79 degs S., and after making four journeys between these points the whole party started south to lay out the remoter depots on which

Shackleton's expected party would depend for their existence. Three men, Jack, George and Cope, were sent back from 80 degs S. as their stove was worn out; they reached Hut Point on January 15, 1916. Mackintosh proceeded southward with the others, and on January 22, at 83 degs S., Spencer Smith broke down with scurvy and was left in the tent with provisions while the others pushed on to Mt. Hope (near 84 degs S.) and laid the last depot there at the foot of the Beardmore Glacier on January 26.

The return journey was a ghastly experience. Scurvy attacked one member after another and Spencer Smith had to be hauled on a sledge from the beginning; while on February 17, when within thirty miles of the point where Scott had perished, the whole party were blizzard-bound for six days until their food was exhausted. Notwithstanding the weather, they made a start in the faint hope of reaching a depot eleven miles away; but Mackintosh fell exhausted and was left with Spencer Smith, and Wild to look after them, while the others struggled to the depot and returned with food and fuel.

They started again on February 29, with Smith and Mackintosh lashed to a sledge; the next day, Hayward also had to be added to the load dragged by the others. Progress was hopelessly slow, so to save the others Mackintosh insisted on being left behind in a tent while the others pushed on. Spencer Smith died on March 9 after forty-seven days' illness, cheerful to the end. Two days later the survivors reached Hut Point, and returning for Mackintosh brought him in on March 18, 1916. They had fulfilled their mission, laid all the depots and travelled 1,500 miles over the barrier.

The invalids speedily recovered with fresh food and on May 8 Mackintosh and Hayward started to cross the young sea-ice to Cape Evans but were never heard of again. Two days later the rest of the party found that the tracks of the two pioneers ended abruptly in open water. Every search was made and eight months later Shackleton landed at several points and searched the coast for relics, but found none. Mackintosh had perished like Scott, his work well done; but happily most of his party survived.

The Trans-continental journey had completely failed, because

no landing-place on the Weddell Sea was reached. There were consequently no results as regards the geography of the unknown portion of the Antarctic Continent across which Shackleton had hoped to make his way.

Geographers had long urged that an exploring survey of the whole of the accessible coast of Antarctica from the sea was a necessary preliminary to any inland exploration from new coast bases. This could be done by a cruise in the highest latitude from Queen Mary Land westward to and if possible beyond Coats Land; and another from the neighbourhood of Alexander I Land westward to King Edward Land. While it was a failure in respect of its main purpose, Shackleton's attempt had not failed to produce important results. The observations on the *Endurance* in her push to the south, and on the *Endurance* and *Aurora* in their drifts, produced new facts regarding the ice-movements outward from the Antarctic Circle. The Weddell Sea had been traversed along a new line with important bearings on the interpretations of earlier voyages; and the meteorological observations made on both sides of the continent added materially to a branch of knowledge the practical importance of which was becoming plainer every year to the people of the Southern Hemisphere.

The greatest interest was the renewed proof that failure due to physical causes served only to throw into relief once more the magnificent courage, tenacity and comradeship of the explorers. Mackintosh's devotion to his disabled companions and his choice of the place of greatest danger for himself is a worthy companion-picture to Shackleton's heroic struggle with winter and frozen seas in rescuing his men on Elephant Island.

CHAPTER XVI

The Voyage of the 'Quest'

With the approval of the chief scientific bodies, Shackleton, after the first world war, planned a cruise round the Antarctic islands.

The proposed route was from St. Paul Rocks on the Equator, South Trinidad Island, Tristan da Cunha, Inaccessible Island, Nightingale and Middle Islands, Diego Alvarez or Gough Island and thence to Cape Town. Cape Town was to be the base for operations in the ice and a depot of stores for that part of the journey was formed there. The route then led to Marion, Crozet and Heard Islands and then into the ice where the track to be followed was of course problematical but would lead westwards to emerge again at South Georgia. From South Georgia it led to Bouvet Island and back to Cape Town to refit. The second journey from Cape Town included New Zealand, Raratonga, Tuanaki (the 'lost island'), Dougherty Island, the Birdwood Bank and back via the Atlantic.

The scientific work comprised meteorological observations, including air and sea temperatures, kite and balloon work, magnetic observations, hydrographical and oceanographic work, with an extensive series of soundings and the mapping and careful charting of little-known islands. Search was to be made for lands marked doubtful. A collection of natural history specimens would be made and a geological survey and examination carried out in all places visited.

Shackleton decided to carry an aeroplane as the 'eyes' of the expedition in the South. There were obvious difficulties in the way of extreme cold and lack of adequate accommodation, but it was thought that they could be overcome.

The ship purchased was a small wooden vessel of 125 tons. She was built in Norway, fitted with compound auxiliary steam engines of 120 h.p. She was designed originally for sealing in Arctic waters. Frank Wild was the deputy-commander and

Worsley went along as hydrographer and sailing master. Another Australian, G. H. Wilkins (or 'Wilkie' as he was known), went as naturalist, while the pilot was Roddy Carr from New Zealand. Altogether there were twenty in the party, including a boy, J. W. S. Marr, who twenty-one years later led the secret British services expedition to the Falkland Islands.

The *Quest* entered Rio de Janeiro harbour on November 21, 1921. The report of consulting engineers showed that much work was necessary. They condemned the survey which had let her put out on a lengthy voyage. While here the forward end of the deck-house was enlarged for use as a mess room.

A month was consumed in this way. It was now impossible to carry out the original programme of visiting the Tristan da Cunha group and making Cape Town the base; Shackleton realised that, in order to be able to enter the ice during the open season, it would be necessary to proceed direct to South Georgia. The aeroplane, all winter equipment and stores were waiting at Cape Town, but they were compelled to go without them.

They left Rio on December 18 and set course for South Georgia. During this time they had bad weather with some violent gales which tested the seagoing qualities of the *Quest*. Hull and rigging were sound and the vessel showed herself capable of standing anything in the way of seas, but developments occurred below decks. A crack appeared in the furnace from which the water poured out in a thin stream, and the forward water-tank developed a leak and emptied itself. The first was serious, the latter less so, for there was enough water for drinking from the exhaust tank which collected steam after it had passed through the cylinders. It tasted oily but was sufficient to maintain health.

These developments, following in quick succession upon the countless difficulties since the inception of the expedition, might have broken a lesser man than Shackleton. How fully Shackleton realised the difficulties of the situation is shown by his last log entry: 'Anxiety has been probing deeply into me, for until the very end of the year things have gone awry. Engines unreliable; furnace cracked; water short; heavy gales; all that physically can go wrong; but the spirit of all on board is sound and good.'

He spoke during the few days before they reached South Georgia of modifications to his original scheme but reserved any definite decision until a complete examination of the boiler could be made. They arrived at Grytviken, South Georgia, on January 4. Sir Ernest wrote before turning in for the night, 'Now we must speed all we can but the prospect is not too bright, for labour is scarce.' At 2.50 the next morning he died suddenly from heart failure.

This is no place to speak of his work and record, but Wild, who served with all the British Antarctic explorers of repute since the *Discovery*, said that for qualities of leadership, ability to organise, courage in the face of danger and resource in overcoming difficulties, Shackleton must be ranked as the first explorer of his age.

His body was sent to Montevideo, but the wish of Lady Shackleton was that he should be buried in South Georgia, the 'Gateway of the Antarctic', in the little cemetery on the hillside of Grytviken.

The leadership of the expedition fell to Wild, who determined to carry on. The *Quest* left South Georgia on January 17. Whilst preparations were in progress, scientific work and observations were being actively carried on. Douglas, the geologist, and Wilkins had preceded from Rio in an oil transport and they continued throughout to make examinations and collections in geology and natural history respectively.

On leaving South Georgia the *Quest* entered a sea filled with innumerable bergs, which passed slowly in a north-easterly direction. Many of them were the usual flat-topped Antarctic bergs, others were old structures of beautiful shape, all moving to meet their fate in the warmer northern waters.

They reached Zavodovski Island on January 20. Numerous bergs with distinct tide-marks and much worn at sea-level had gone aground upon it. They were thickly covered with ringed penguins. Some of these bergs were steep-sided and there was a heavy wash of water against them. Those on the ship were struck by the patience and tenacity of the penguins, as they failed time after time to effect a landing, only to try and try till they succeeded. On the south-eastern and eastern sides of the island were caves from which sulphurous fumes issued in a

thin reddish cloud. Wild's party could feel their effects in a smarting sensation of the eyes, nose and throat. The penguins gave these caves a wide berth and kept to windward of them.

They had bad weather nearly all the time in the ice region, and life on board was uncomfortable. On this stage of the trip numerous sea-birds tailed their wake in hundreds, every known species from the large and stately wandering albatross to the dainty ubiquitous Mother Carey's chickens.

On January 30, a fine day, though a long broad swell continued to run from the westward, Wild decided to take his chance and swing out the port lifeboat both in order to have her more ready to lower away and to give space on the bridge deck. The boat contained a quantity of emergency stores and was very heavy. The *Quest* rolled considerably and during the operation a guy parted and the boat, swinging forward, pinned Worsley against the after bulkhead of the bridge-house, almost crushing him to death. For two or three days the surgeons had doubts of the captain's recovery but once over the shock he rapidly regained his health.

In latitude 65 degs S., longitude 15 degs E., the floes were much heavier and at times it was all the *Quest* could do to push ahead. Crab-eater seals were present in considerable numbers and in the large open leads they saw killers. They took occasional seals, for use as food and also as blubber fuel to eke out the coal supply. It is a messy form of fuel and burns with a fierce hot flame. Crab-eater meat is excellent to eat and is capable of maintaining health for long periods; it is a much cleaner animal than the Weddell seal, which is much parasite-infested and has usually an unpleasant smell. The Weddell hugs the land and lives largely on fish, which are a prolific source of intestinal parasite; the Crab-eater lives largely on the small crustacea of these regions. The best meat comes from the back and the undercut. The brain is considered by some a great delicacy.

At South Georgia the ship was refitted; repairs were completed and mails for Tristan da Cunha taken aboard. Here Douglas and Wilkins actively carried on their scientific work in their respective fields. Worsley and others surveyed the island and verified the position of the more salient points. Wilkins, a

great collector, discovered the nest and egg of the brown molly-mauk. Numerous collections were made for presentation to the museums.

After calling at several other sub-Antarctic islands, the *Quest* returned to England on September 16, 1922.

CHAPTER XVII

Wings over Graham Land

In the year 1888, at Mt. Bryan East, South Australia, was born George Hubert Wilkins. He had an unspectacular youth, but whatever may have been lacking, it certainly was not the spirit of adventure. At the age of twenty-four Wilkins was a camera correspondent with the Turkish troops in the Balkans War. We next hear of him as second in command to the famous 'Stefansson of the North', in the Canadian Arctic from 1913 to 1917. He joined the Australian Flying Corps in World War I, became commissioned and decorated. It was in the Middle East that he met Frank Hurley in the same group of flying men. This contact was probably the spark that set Wilkins off on his Antarctic wanderings, for Hurley had been down in the south with Mawson and Shackleton.

During the first of his Antarctic expeditions Wilkins pointed out that the importance of the Antarctic Continent lay in the fact that it played a very large part in controlling the weather of the Southern Hemisphere. His ultimate aim was to place twelve meteorological stations in suitable places within the Antarctic Circle and to keep three ships in these waters to study the sea and air currents with a view to forecasting the effects on the weather of the great ice masses. Twenty years later it seemed as though this plan might materialise. The importance of the South Polar weather had been recognised and a small degree of international co-operation developed.

Wilkins's method was not to establish an elaborate land base but to make short expeditions during the summer months and with a small party to fly over as much of the coastline as possible before weather conditions forced his base ship northwards.

His first experience of Antarctic exploration was in the year 1920, when he became associated with the British Imperial Antarctic Expedition under the leadership of J. L. Cope, who planned to take twelve old R.A.F. surplus bombers to King

Edward VII Land, and from there make a daring flight to the South Pole. Cope's idea was to use the planes in relays, abandoning them on the way according to the distance they covered. Unfortunately the organisers were unable to obtain support for the project, and the planes were returned to the R.A.F.

Eventually, early in 1921 a party of four men with a 28-foot lifeboat, seven dogs, two special sled boats and enough food and equipment for two years were landed by Norwegian whalers on a small island in Andvord Bay on the western shore of Graham Land, on the opposite side of the continent to Mawson's sphere of operations. Owing to their confinement on the island, this small expedition could not achieve much. They made short journeys in the whaleboat round surrounding ice-sheathed inlets and made excursions to the nearby prominent features of their lonely outpost.

Wilkins returned to New York and secured the use of two Junker monoplanes, intending to accompany Norwegian whalers to Port Lockroy, near Antwerp Island and from there make flights, using the machines as seaplanes. Sir Ernest Shackleton, however, persuaded him to postpone this plan and join him on the *Quest* during the summer of 1921–2. After the voyage in the *Quest* Wilkins returned convinced that aeroplanes could be used successfully throughout an Antarctic summer.

Wilkins did not again visit Antarctica until 1928, when he led the Wilkins-Hearst Expedition to Graham Land. Accompanied by four companions he took two Lockheed Vega monoplanes, which could be used with wheels, skis or floats. They sailed from Montevideo in the 15,000-ton whaling vessel *Hektoria*. After calling at the Falkland Islands, Deception Island was reached on November 4, 1928. Unfortunately the season was very bad. Where the land was flat there was practically no snow. The ice in the bay was thin and shortly after the machines had been landed rain caused the snow to disappear. The machines were then fitted with wheels and a runway cleared on the hillside.

The first plane flight in Antarctica was made by Wilkins on November 16. Ten days later both machines flew for several hours in opposite directions, looking for a better landing ground. An examination was made of the islands to the north, including

Low, Snow and Livingston Islands, but Wilkins failed to locate a better starting point.

The Australian tried to use one machine as a seaplane, but as it could not take off with a full load it became necessary to use the machines as land planes. This made it quite impossible to fly from Graham Land to the Ross Barrier, as originally planned. Wilkins had intended to fly to a more southerly base in the Weddell Sea, whence one machine would proceed to the Ross Sea and the other would return to Deception Island. To do this, however, meant that both machines would have to be fitted with skis.

On December 20, Lt. C. B. Eielson and Wilkins took off. They laid a course for Trinity Island, passing it on the west. They then turned south-westward, passing Brialmont Bay. A few miles further south, at Salvesen Bay, they turned and crossed the Graham Land Plateau, which at this point was 8,000 feet above sea-level. Two hours later they were above the plateau, flying due south on longitude 61 degs W. To the east could be seen the Seal Nunataks and Robertson Island; to the west were long ice-filled fjords, which appeared almost to cut Graham Land in two. Opposite Jason Island the flyers saw a deep indentation in Graham Land which was apparently Nordenskjold's Richthofen Valley.

Wilkins then passed between C. A. Larsen's Foyn Land and the coast and saw two conspicuous black mountains which were named Mt. Napier Birks. Just to the south and near the latitude of the Antarctic Circle they saw what they believed to be a circuitous channel dividing Graham Land.

A mighty mass of mountains stretched far to the south-west, while opposite was an island they named Robinson Island. The most easterly point to the south was named Cape Northrop. To the south of this point a large bay extended to the west. At the southern end of the bay, they were opposite high, steep mountains. Beyond these, in latitude 69 degs 30 mins S. appeared to be a channel between high mountains. This was named Casey Channel. To the south they saw an island which they named Scripps Island, lying approximately between latitude 69 degs 30 mins S., and latitude 70 degs 15 mins S. Near this island and north of latitude 71 degs S. lay a group of six islands or moun-

tains. Immediately to the south was a strait which appeared to be about forty to fifty miles wide. Beyond it an unbroken slope stretched southward as far as the eye could see.

They flew across the strait and the return journey was commenced from latitude 71 degs 20 mins S., longitude 64 degs 15 mins W., following the route of the outward journey, and they reached Deception Island after a flight of ten hours, covering 1,200 miles.

On January 10, 1929, a second long flight was made. Pontoons were used and they flew about 250 miles along their previous course in an endeavour to find a more southerly base accessible by boat. Clouds, however, obscured the land below 4,000 feet.

After storing the two machines at Deception Island, the party left for the Falkland Islands. Like Edgworth David and Mawson, Wilkins received a knighthood for his explorations. This same honour has since been bestowed on Raymond Priestley.

Next, Sir Hubert approached the United Kingdom Government, who agreed to make the whale-catcher *William Scoresby* available and to provide £10,000. Sir Hubert took with him four companions, a caterpillar tractor, an outboard motor-boat and a small car. They sailed in the Norwegian whaler *Melville*, intending to carry out the plan of the previous year, but on arrival at Deception Island conditions were found to be unsuitable for long flights and the planes were embarked on the *William Scoresby*.

Although the ship cruised as far south as 67 degs 30 mins, no suitable pack-ice could be found to enable a flight to be made with the ski-planes.

Wilkins decided to use pontoons, but found it necessary to return north to Neumayer Channel before sheltered water could be found.

On December 19 the first flight was made. The west coast of Graham Land was followed as far south as Leroux Bay and the mountains were then crossed in an attempt to estimate the width of Graham Land. It was discovered to be about twenty-five miles wide between Leroux Bay and Richthofen Valley. To clear the mountains with a sufficient margin of safety, the

plane rose to 10,000 feet. The return flight was made over Beascochea Bay, where the ice appeared to be suitable for a flight to be attempted from its surface. The *William Scoresby* was moved south immediately, but, while the aeroplanes were being made ready, the ice thawed and a second cruise to the south-west in search of suitable ice proved as unsuccessful as the first.

When the *William Scoresby* was in latitude 67 degs S., longitude 75 degs W., a flight from the sea was attempted on December 25 by Sir Hubert, with S. A. Cheeseman as pilot. But a snowstorm made necessary their return when, according to Sir Hubert's calculations, they had almost reached Charcot Land. On the following day, however, Charcot Land was reached on another flight and seen to be an island. They circled it and discovered a small island a few miles to the north. Alexander I Island, as it was then called, could be seen to the east, between latitude 69 degs 30 mins S. and latitude 70 degs 30 mins S. To the south they could see low, sloping, snow-covered land, starting from a dim cliff outline about thirty miles away. This land was visible as far as longitude 80 degs W., and appeared to be the coast of the mainland.

It was now necessary for the ship to return for fuel. On the way Sir Hubert flew from Port Lockroy through the De Gerlache Channel to Deception Island.

The party remained at Deception Island until the *William Scoresby* returned on January 25, 1930. In the hope of finding better weather conditions, the vessel pushed west, past Peter I Island. Two flights were made: one short, and the other, on February 1, due south to latitude 73 degs S. No land was seen. The *William Scoresby* was then turned west towards Charcot Island, but the weather prevented any further flights being made on the return journey.

Sir Hubert made his fourth journey to the Antarctic in 1933. The expedition was planned and financed by Lincoln Ellsworth, son of a Chicago millionaire coal owner, and a World War I flyer. The Australian went as adviser and reporter. It was intended to make a 3,000-mile flight from Little America, in the Bay of Whales, to the head of the Weddell Sea and back, ex-

tending to fifteen days if necessary, in order to make a rough survey of this portion of the continent.

They left New Zealand in the motor-ship *Wyatt Earp*, named in honour of a famous Texas marshal who had been Ellsworth's boyhood hero. The vessel, formerly a Norwegian herring boat of 400 tons, was built to withstand the Arctic ice-pack. Their low-winged Northrop monoplane was named *Polar Star*. The Bay of Whales was reached on January 6, 1934, and five days later a trial flight was made. It was a complete success, but bad weather intervened, and a week later the ice, which was fifteen feet thick, broke up for a distance of five miles from the ship. The skis of the plane, which was standing on the ice, slipped through a crack. It was only after six hours' dogged work by ten of the fifteen men comprising the expedition that the plane was hauled back to safety. The skis were broken and parts of the machine damaged. It was an unfortunate accident, for the plane had to be returned to the American makers for repair. The expedition returned to Dunedin.

As October and November are considered the best months for flying in the Antarctic, Ellsworth decided the following season to fly from Deception Island, which was accessible in those months, to the head of the Weddell Sea, and thence to the Ross Sea, a total distance of 2,800 miles. He would then wait at the Bay of Whales until Sir Hubert Wilkins arrived in the *Wyatt Earp*.

During the winter the *Wyatt Earp* remained at Dunedin for repairs to her rudder and engines. By the middle of September 1934, Ellsworth and his companions were back in New Zealand with the *Polar Star*. They reached Deception Island, but, before a flight could be made, a connecting rod snapped and the *Wyatt Earp* had to return to Magellanes, Chile, for a new one. She was back at Deception Island on November 17. But the snow on the runway had melted and it was no longer possible to use skis.

The *Wyatt Earp* left Deception Island and cruised down the west coast of Graham Land to Port Lockroy. The vessel then proceeded to the east coast, where good landing grounds were found on Snow Hill Island, near the cabin built by the Swedish explorer, Nordenskjold, in 1902. Appalling weather followed

and though the expedition remained until mid-January, the sky was continuously clear for only twelve hours.

On January 3, 1935, the *Polar Star* flew to the south along the east coast of Graham Land. But cloud and snow squalls ahead made it necessary to turn back and the plane returned to Snow Hill Island after a flight of several hours.

During the return voyage to South America, Dundee Island was selected for the next attempt, and Ellsworth and Sir Hubert returned there in the *Wyatt Earp* in November 1935, after calling at Deception Island, where the plane was assembled. On November 20, Ellsworth and H. Hollick-Kenyon, a veteran Canadian pilot, started their flight to the Ross Sea in fine weather. Misfortune continued to dog the flyers. The oil-gauge broke and they were obliged to return from latitude 65 degs 30 mins S. Next day they set out again and had flown almost 600 miles and were just entering the unknown region beyond the point to which Sir Hubert Wilkins had flown in 1928 when very heavy clouds made it necessary to return once more. Before they turned they discovered a lofty range of mountains to the south which they named Eternity Range.

On November 23, Ellsworth and Hollick-Kenyon once more took off from Dundee Island into an almost cloudless sky on their remarkable Trans-continental flight. They flew south along the east coast of Graham Land for 500 miles. The Weddell Sea was seen to be open to latitude 69 degs S. Stefansson Strait was found to exist but to be not more than a mile or so wide. Flying at 13,400 feet, the bold rugged mountain peaks of the Eternity Range lay ahead of them, one hundred miles long and rising to 12,000 feet. The flyers looked out upon a vast snow plateau, where few rocky islands or nunataks broke the surface.

Ellsworth gave the name James W. Ellsworth Land to the region between longitude 80 degs W. and longitude 120 degs W.; he was the first man to see this part of the continent. Next day they took the air again, but low visibility forced them to land after thirty minutes. At midnight on November 27 they started again, but once more bad weather reduced the visibility and they landed after an hour's flying. A blizzard hit the grounded men. It blew for days and when it finally cleared, it took them another day to free the plane from its blanket of snow.

On December 4 they came down 160 miles from Little America. On the next day they flew until shortage of fuel compelled them to land at the north end of Roosevelt Island. After six days' marching, Little America was reached, where they settled down to wait the arrival of Wilkins. On January 16, 1936, a rescue party from the research vessel *Discovery II*, which had left Melbourne on December 24, 1935, reached Little America and found both of them safe.

When the *Polar Star* was in latitude 75 degs S. and longitude 79 degs W., on November 23, Ellsworth's transmitter failed and Sir Hubert Wilkins, aboard the *Wyatt Earp*, immediately became anxious about the safety of the flyers. In accordance with previous arrangements Wilkins proceeded to Magellanes, where he took on board a relief plane, flown from the United States. From there the *Wyatt Earp* proceeded to the Ross Sea, arriving at the Bay of Whales on January 20. Ellsworth decided to return to Australia on the *Discovery II*, while Hollick-Kenyon remained to salvage the *Polar Star*. The success of this flight goes down as one of the greatest achievements in Antarctic exploration.

In October 1938 Ellsworth left Cape Town in the *Wyatt Earp*, planning to fly 500 miles inland into Enderby Land on the Indian Ocean coast, across a vast unknown area towards the South Pole. If conditions were favourable, the flight would be continued to the Bay of Whales in the Ross Sea. He was again accompanied by Sir Hubert, who visited Australia on his way to Cape Town. While in Australia, Wilkins visited the Commonwealth Government about the best area of operations and was supplied with the latest information.

The *Wyatt Earp* remained fast in the ice and cruised there for sixty-five days until open water was reached off Princess Elizabeth Coast. The Antarctic ice-cap was seen from the crow's nest when at latitude 68 degs 24 mins S., longitude 73 degs 42 mins E. Next morning a flight was made and from an altitude of 5,000 feet the edge of the barrier from Cape Amery to the Vestfold Mountains was visible. The Rauer Islands were reached that day and were inspected from the air and from a motor-boat for a suitable landing place for the larger Northrop monoplane.

The *Wyatt Earp* lay off the Vestfold Mountains, but the ice

there was not as suitable for a landing field as that near the Rauer Group, to which they returned on January 4, 1939. The *Wyatt Earp* was moored against the edge of the ice between the islands and the mainland.

On January 8 Sir Hubert flew the Australian flag on the northernmost island of the Rauer Group and left a record of his visit. Next morning a large section of the bay ice broke away, so they proceeded to the east. Sir Hubert went ashore at the west end of the Vestfold Mountains, on what appeared to be part of the mainland. Again the *Wyatt Earp* moved eastward and near the east end of the Vestfold Mountains a section of flat ice near where the continuation of the West Barrier meets the Vestfold Mountains appeared to be suitable for the ski-plane.

The flat ice was reached and the machine unloaded and prepared for an inland flight. Ellsworth set out with J. H. Lymburner as pilot and, flying southward, reached latitude 72 degs S., longitude 79 degs E., before returning.

To the south of the islands fronting the continental ice was an area of crevasses extending fifty miles inland. Ellsworth was surprised to find no mountains, for the elevation of the ice surface increased gradually and the plateau became one unbroken surface over which visibility extended for 110 miles. No colour or contour relieved this apparently limitless expanse of ice and snow. The plateau at the most southerly point was 7,500 feet above sea-level.

Meanwhile Sir Hubert proceeded to the eastern end of the snow-free land at the edge of the continental ice-cap, where he flew the Australian flag. After cruising along the barrier to latitude 66 degs 17 mins S., longitude 81 degs 41 mins E., the *Wyatt Earp* emerged from the pack, making port at Hobart on February 4, 1939.

CHAPTER XVIII

Mawson Takes to the Air

THE question of national ownership of certain Antarctic Territory was raised at the British Commonwealth Conference in 1926. The Conference agreed that certain areas could rightly be claimed as British Territory by virtue of discovery. These areas included: Enderby Land, Kemp Land, Queen Mary Land, Wilkes Land west of Adelie Land, discovered by the Australian Antarctic Expedition 1912, King George V Land, Oates Land and part of Coats Land, outside the area known as the Falkland Islands Dependencies.

At the conference the Government representatives studied the information available concerning these areas with special reference to further exploration and scientific research. This discussion led to the formation of Mawson's third expedition, the despatch of the British, Australian and New Zealand Antarctic Research Expedition to Enderby Land in 1929, an important year in the history of Antarctic exploration, marking the general introduction of aviation into the Antarctic. Every expedition operating in the Antarctic in 1929 was equipped with planes with the exception of the oceanographical research vessels, *Discovery II* and the *William Scoresby*. It was in this year that Rear-Admiral R. E. Byrd, the American, made the first flight to the South Pole.

The continuation by Australia of the exploration of what was considered to constitute the Australasian Antarctic region had for some years after World War I been under consideration by a sub-committee of the Australian National Research Council. Eventually the Commonwealth Government decided to provide financial assistance for such operations and Sir Douglas Mawson was invited to take command of the expedition. All arrangements were dealt with by a collaborating committee with a representative of the Commonwealth Government as Chairman. Great assistance was rendered in London

by the interdepartmental Polar Committee. Scott's *Discovery* was made available by the British Government.

The Hydrographer and members of the Discovery Whaling Investigations Staff helped Mawson in providing for the conduct of a programme of oceanographical investigations. As New Zealand stood to benefit by increased knowledge of her Antarctic Dependency, that country also contributed to the finances. Thus the enterprise eventually became the British, Australian, New Zealand Antarctic Research Expedition, or the B.A.N.Z.A.R.E.

Like Bull's expedition, years before, Mawson's third southern venture was launched when a great financial depression was paralysing the country. The organising committee welcomed financial assistance from private individuals and firms, and at one stage, when the future of the whole enterprise was in jeopardy, a patriotic and generous citizen of the Commonwealth, Mr. MacPherson Robertson, popularly known as 'Mac-Robertson', came forward with the sum of £10,000. Later this was greatly increased in order to make possible the continuation of the operations for a second year.

Mawson chose veterans of previous expeditions to accompany him, and Captain J. K. Davis, then Commonwealth Director of Navigation, was ship's Captain and Second-in-Command of the Expedition during one season's operations.

Among the total personnel of 39 men, Mawson took a strong team of scientists, and technicians including biologists, mappers and weather experts. Frank Hurley, the photographer on his third expedition, made up the complement, which included two pilots, Flight-Lt. S. Campbell and Pilot E. Douglas, of the R.A.A.F. A member of the staff was J. W. S. Marr, who had sailed on the *Quest* as a boy, and now an expert in modern hydrological and plankton research.

Captain Davis went to England to take over the *Discovery*, and in August 1929 set sail from London for Cape Town. Members of the scientific staff and the balance of the stores travelled by regular mail steamers to Cape Town, where, with Mawson, they joined the vessel.

Captain Davis had the ship ready for sea on October 19,

Course was set for the Crozet Islands, where a landing was made at American Bay, Possession Island, on November 2. Only two days could be spared for observations ashore, but during that time every moment was occupied to fullest advantage by the scientific staff. The bay and anchorage were mapped, magnetic constants determined, and the naturalists made collections ashore.

Possession Island, which is volcanic, ranges from low areas of moorland to snow-clad peaks reaching to 5,000 feet. Ice-worn valleys cut the lava gullies and beds of tuff which compose the island. The prolific sea-elephants and native bird life fascinated the biologists. The albatross chicks were already in an advanced state of development, soon to begin their wanderings right round the Southern Ocean, the domain of these kings of the air.

Kerguelen Island was reached on November 12. A South African whaling company, which included Kerguelen waters within its sphere of operations, helped the expedition by transporting coal to the derelict whaling base on an arm of Royal Sound, near the south-eastern end of the island.

Contrary to the popular idea regarding Kerguelen, the expedition found the island to be full of extraordinary scientific and scenic interest. Ninety miles long and eighty miles at its widest, it is so greatly indented by arms of the sea that the area is only 2,000 square miles. From boggy peat lowlands, the hills rise up tier on tier to majestic ice-topped highlands, culminating in glacier-furrowed Mt. Ross, an extinct volcano 6,120 feet above sea-level. The whole island is emerging from the ice era; once buried beneath a flood of ice, only a small portion now remains ice-capped. On the south-west coast valley glaciers reach the sea and the ice breaks away to form bergs. Everywhere are deeply eroded valleys, formerly excavated and occupied by glaciers.

Just above the muddy beaches the land is densely clothed in vegetation, including a variety of grasses, herbaceous plants and ferns, but there are no trees. The peculiar plant growth of these latitudes is due not so much to low temperatures as to the incessant winds. The strongly growing grasses develop into large tussocks in the rich swampy areas near sea-level.

The fleshy-leafed plant, known to sailors as the Kerguelen cabbage, noted for its antiscorbutic properties, was found to have been largely eaten out by wild rats and rabbits when the Australian Antarctic Research Expedition called there in 1948.

Kerguelen and its myriad islets are visited by immense numbers of sea-birds whose presence relieves the desolation and loneliness. No preying land animals harass the birds. In the breeding season, all day long, they hurry to and from the sea to their nesting grounds. At night other species, too timid to run the daytime gauntlet of the nefarious skuas, fly ashore in countless numbers, swishing through the darkness direct to their nests, often in burrows beneath the ground. Of land birds there are only two varieties, one being the cheeky Paddy, which lives on the eggs of other birds and marine scraps from the seashore, and the teal duck, very numerous, excellent to eat and easy to shoot.

The Australian scientists found abundant insect life. This is of peculiar interest, for most of the tiny creatures are flightless. Unable to escape by flight for self-protection they feign death on the approach of danger. From whatever vegetation or rock they have been clinging, they suddenly become rigid and fall, apparently lifeless, to the ground, camouflaged by the particles of sand and gravel.

Seal life, formerly so abundant, has now been reduced to infinitesimal numbers as a consequence of more than one hundred years of unabated massacre. Sea-elephants are now rarely met with, except in certain isolated bays, difficult of access to sealing craft. The toll taken of animal life for blubber oils in these seas was not restricted to whales and seals, but also thinned out the penguin ranks until only vestiges of immense rookeries remain.

On November 24 *Discovery*, loaded to capacity with coal and stores, headed for unknown Heard Island. The 9,000 feet ice-covered volcanic peak of Big Ben loomed up two days later. Captain Davis anchored in Corinthian Bay and a party of nine of the scientific staff, with camping equipment, went ashore at Atlas Cove. There they found a small hut erected by sealers and this they occupied for some days. The return to

the ship was delayed longer than they anticipated by the advent of stormy weather, which eventually drove the *Discovery* out to sea.

Heard Island, in latitude 53 degs S., is in one of the stormiest sections of the world, as many as sixty cyclones being experienced there in a year.

It was discovered in the year 1853 by Captain J. J. Heard, of the barque *Oriental*, when on a voyage between Boston and Melbourne. It was proclaimed Australian territory in 1947. Little was known of the island until Campbell's pioneer party landed in December of that year. Such calls as had been made before the *Discovery's* visit were landings of but few hours' duration. Consequently only a rough approximation of the outline of the island appeared on the charts. During Mawson's stay they were able to improve their knowledge of the western end of the island, but stormy weather prevented a survey of the coastline elsewhere. This remained for the later expedition to accomplish.

The island is twenty-five miles long, slanted in a west-north-west by east-south-east direction. Those aboard the *Discovery* caught only brief glimpses of the high mountainous interior, almost perpetually enveloped in clouds. Extensive as these ice formations are to-day, they were once much greater, for almost everywhere the exposed rocks show evidence of former glaciation, and morainic matter is distributed widely over the uncovered lowlands. Lying in a cyclone belt, the island is seldom relieved from the torment of constant wind, which has greatly reduced the variety of vegetation compared with Kerguelen. The vegetation is tussock grass in low sheltered localities and cushions of Azorella moss in more exposed places. So constant is the wind that large areas of exposed ground are bereft of vegetation. Here the rock shingle on the surface is eloquent of the prevailing conditions, for each pebble is faceted by wind erosion.

With difficulty and at some risk, the *Discovery* got away from the island in a gale on December 4. Mawson was greatly disappointed, for it had been his intention, weather permitting, to re-chart the whole coastline of the island. It was necessary to conserve every ounce of coal for operations along Antarctic

shores so the ship was headed south-east to trace the submarine ridge that links Kerguelen and Heard Island.

Previous expeditions had found evidence of the Kerguelen—Heard Island bank to the south-south-east of the latter. A moderate rise of the sea-floor was thought to exist between the bank and Antarctica in the vicinity of Gaussberg, base of the German expedition in 1901–2, in Kaiser Wilhelm II Land. This was indicated by the discovery that the bottom water on the west of that line was slightly warmer than that of the same depth some distance farther to the east. Mawson anticipated that soundings from Heard Island to Antarctica would throw further light upon the matter. The echo-sounding apparatus in the *Discovery* was a great success and they obtained an almost continuous series of soundings at close intervals throughout 20,000 miles traversed in the Southern Ocean during the two summer cruises. The information obtained south from Heard Island exceeded expectations, for the floor of the sea was found to rise to within 350 fathoms of the surface. This shallow region was named the Banzare Rise.

On December 7, in latitude 58 degs 47 mins S. and longitude 77 degs 43 mins E., the *Discovery* entered seas strewn with icebergs. Continuing south during the next few days, she passed a colossal quantity of ice, the heavy type from crushed and hummocky floes. After traversing a belt of pack-strewn sea, 300 miles wide from north to south, the vessel was blocked in impenetrable heavy pack in latitude 65 degs 5 mins S., longitude 81 degs 5 mins E. Fifty-eight years earlier the *Challenger* had sailed south in that neighbourhood and found open water; it was evident that *Discovery* had come south in a bad ice season.

Mawson decided to work west and there followed many days of slow progress through the ice. A gale for a few days helped open up the pack, so that on Christmas Day, when the wind abated, a passage to the south-west was found. In that direction the sea-floor shoaled rapidly and by noon next day further progress was barred by solid, unbroken, hummock floe-ice, extending as far as the eye could reach to the south-south-west.

In the evening the men felt the cold continental air, a regular diurnal feature along the Antarctic land as the sun

sinks south. From the masthead the look-out saw what appeared to be the smooth slopes of land-ice miraged on the south-western horizon. Next day, with the warming of the atmosphere, the mirage vanished, leaving only unbroken floe in that direction. The evidence was sufficient to convince Mawson that high land lay to the south-west.

Mawson was anxious to get airborne but it was too windy for a sea take-off, and a flight, which would have been invaluable at this time, had to be postponed. Later their small plane proved of great value. Unfortunately there was no space available on the ship to provide proper housing and the aircraft had to be carried on skids of limited dimensions above the upper deck. It was in great danger of damage during rough weather and offered much windage, considerably adding to the difficulty of handling the vessel.

On December 29 the sturdy ship was fighting the edge of unbroken, hummocky floe in latitude 66 degs 10 mins S., and longitude 65 degs 10 mins E. Campbell and Douglas took off and from an altitude of 5,000 feet saw a wide sheet of continuous heavy floe-ice extending to the south, then a narrow belt of open water leading to undulating ice-covered land. Away to the south-south-west, embedded in the floe and in the neighbourhood of many grounded bergs, small, black, peaked islets were seen. That evening the *Discovery* steamed west, intending to make a more extended flight the following day. Unfortunately the weather changed and the ice packed more tightly, so that several days were occupied, during bad weather, in detouring north.

During all this time scientific observations were carried out on board. In addition to the daily routine observations throughout the voyage by the meteorologists, hydrologists and biologists, records of a special nature were obtained at frequent intervals. The ship was halted for many hours while the hydrologists secured temperatures and samples of the sea-water at intervals from the surface to the ocean bed, and the biologists made a plankton survey with a series of nettings from the surface to the depth of 1,000 metres. From time to time plankton and nekton, the drifting and swimming organisms, were at still greater depths

sampled with a large two-metre net; trawlings and dredgings were made on the sea-floor itself. An oceanographical survey is the study of the ocean, including the shape and character of its bed, the salinity and temperature at different depths, the strength and direction of currents and a look at the curious creatures and weird plants that haunt the deep.

Stones that came up in these dredgings were carefully studied. They are known as erratics, having been carried out to sea from the neighbouring Antarctic land; they supply valuable indications concerning the nature of the rocks composing the ice-capped and inaccessible portions of the coastline. Weather balloons were sent aloft to 50,000 feet and soundings made of the upper-air currents.

On January 5, 1930, the weather improved, so Campbell and Mawson took off in the seaplane and climbed to 4,000 feet, flying landwards. To the south, at a considerable distance across pack-ice, the land-ice slopes could be seen rising rapidly to a high plateau studded with isolated peaks. To the south-west not far from the coast, several rocky ranges were observed rising from the ice-sheet. Away to the west the land could be seen extending much farther to the north than was the case in the longitude where they had left the ship. They underestimated the distance of the land margin from the ship, a fact which was discovered on revisiting the area the following year.

With a view to mapping the new land more carefully, Mawson intended to make another flight the following day but unfortunately the weather again broke suddenly the same night. A hurricane descended, during which the aircraft's wings were badly damaged, necessitating considerable repairs when the weather abated.

Bad weather prevailed until January 12, when the wind fell and the atmosphere cleared. Stocks of coal were then greatly depleted and Enderby Land, the goal, had not been reached. No more time could be spent investigating the extensive new land area which had been named MacRobertson Land in honour of the expedition's chief patron. The ship reluctantly headed west to investigate the landfalls reported by Biscoe and Kemp one hundred years before.

This coast, which Kemp saw, came into view soon after noon

that day. The land was encased in ice, but a line of peaks, which they named the Nicholas Range, was visible inland. The coast was marked by a line of ice-cliffs from 60 to 120 feet in height.

Early on January 13, the *Discovery* arrived off what proved to be the most northerly tip of Antarctic land in this region, and it was named Cape Batterbee. Nearby were seen a large number of small islets and one of large dimensions. The larger island rose to a height of 800 feet and was entirely composed of dark-coloured rock, the most striking feature of the Enderby Land coast. A cairn was built on the summit. The Union Jack was hoisted, a proclamation read and deposited in a casket at the foot of the flagpole. Thus the territories which they had recently discovered, together with the whole of Enderby Land as shown on Biscoe's chart—namely as far west as longitude 47 degs E.,—were claimed for the British Commonwealth. The newly discovered land, named MacRobertson Land, and the lands seen by Kemp and Enderby were thus found to be all parts of one great salient of Antarctica.

During the few hours ashore the scientists determined the magnetic elements and made geological and biological observations and collections. Squawking Adelie penguins swarmed over the lower slopes of Proclamation Island and on the coast at Cape Batterbee. Antarctic petrels and the pretty snow petrels nested higher up. Furry Weddell seals basked in the sunshine on the ice-foot and in the little coves on the south side of the island. An abundance of marine life floated in the shallow waters.

As the day wore on the ice began to pack in between the islets and the shore party was forced to depart in the motor-launch before retreat was entirely cut off. The voyage was continued westward. Many nunataks came into view on the ice-plateau. From a turn in the coast, named Cape Close, the land turned towards the south. In the early hours of the following morning a 1,500-foot mountain of rock was passed, which corresponded in position with Biscoe's Cape Ann.

Westward from here a dense belt of pack-ice held the *Discovery* far off the coast, but a row of fine high peaks came into view farther to the south. These peaks were named the Tula

Range, to commemorate Biscoe's vessel. Farther south still, near longitude 50 degs E., a long range of rocky mountains opened up, their tips vanishing into the void of the horizon. The pack headed the ship away from these mountains, but enough was seen to prove their existence and they were charted as the Scott Range.

The coastline, trending south towards this range, was lost to sight across the ever-broadening belt of pack. Later in the day, near longitude 48 degs E., ice-covered land was again sighted to the south rising to a distinct knob. It now seemed they had passed a large pack-filled recession in the coastline leading down towards the Scott Mountains. To this Mawson gave the name Amundsen Bay.

As the stalwart vessel, approaching the western limit of the area assigned for investigation, steamed west along the pack edge, the bridge officer sighted another vessel several miles ahead. It was the Norwegian exploring ship *Norvegia*. On her deck she carried two large planes and was deeply laden with coal. After an exchange of greetings, the *Norvegia* lowered a boat and Captain Riiser-Larsen, a veteran of Arctic flying, her skipper went aboard the *Discovery*.

At a conference between the two leaders Riiser-Larsen agreed that it was desirable for scientific expeditions in these unknown regions not to overlap but to operate each within selected regions. He said he would radio for instructions with a view to concentrating his resources on the unknown region lying farther west. Mawson suggested that the highest point of the Tula Range, about 6,100 feet, should be named Mount Riiser-Larsen and that the last indication of land they saw that day, a high ice-covered dome, should be named after Consul Lars Christensen, promoter of the *Norvegia* expedition.

Next day the *Discovery's* head was turned about, and the Australian explorer decided to concentrate on an aerial survey of Amundsen Bay and the Scott Mountains. At the pack edge, within sight of the mountains no suitable shelter for a plane take-off could be found. Next day a strong wind sprang up, which in time worked up to a gale. Captain Davis managed to hold the ship in the lee of the pack, but as the hours went by the wind came in more from the east, breaking up ice and

driving the *Discovery* before it at high speed. Anxious hours followed for those on board and the ship was carried before the wind 150 miles west-south-west, where she was hove-to in a big sea. Turbulent ice-filled seas battered the ship, and this nerve-cracking gale continued until January 22, when ice-capped land was sighted far to the south. This south-westerly extension of Enderby Land was centred at longitude 46 degs E.

Once more a return was made to the pack edge north of the Scott Mountains, but the sea surface, which was heaving under the influence of a swell from the north-west, was too rough for flying. The bunkers were now so far depleted that little coal remained above the minimum for the safe return of the vessel.

On January 24 several short flights were made in the neighbourhood of Proclamation Island. Others were made at a point farther east. Two hundred peaks were observed rising from the ice-plateau of these new lands. In the far interior the land ice appeared to reach a height of 5,000 feet, whilst protruding peaks were judged to attain a height of 7,000 feet. A second proclamation was read claiming the new lands seen as far west as longitude 45 E.

On January 26, in the height of the Antarctic season, when the condition of the pack-ice was improving rapidly, Mawson reluctantly turned north towards Kerguelen, where there were still stocks of coal sufficient to take the vessel back to Australia, the ship making Albany, Western Australia, on March 21, 1930.

CHAPTER XIX

The Old Hut at Cape Denison

DURING the winter of 1930, the *Discovery* was refitted at the Williamstown Dockyards, Melbourne, in preparation for a second Antarctic voyage the following summer.

Captain J. K. Davis was not able to come south on the second cruise, so the former chief officer, K. N. MacKenzie, was promoted captain. The only other changes in the wardroom staff were the inclusion of A. L. Kennedy for special work in connection with physical research and the appointment of Lt. K. Oom, R.A.N., in place of Commander M. H. Moyes, R.A.N., who was also unable to get away for a second trip.

Hobart was the final port of departure for the second voyage, which commenced on November 22, 1930. As the *Discovery* had to go east as far as the Balleny Islands to pick up the coal from the whaler *Sir James Clark Ross*, Mawson decided to call at Macquarie Island on the way.

For several days before reaching Macquarie Island much fog was encountered, due apparently to the fact that cold Antarctic surface waters had approached closer to Tasmania than usual. Icebergs came into view the day before reaching Macquarie Island, which is rare, and a number of bergs were aground in shoal waters skirting the western side of the island; clearly, the expedition must have coincided with a cold spell. The next winter, in fact, an iceberg was seen off Dunedin, New Zealand, an unusual occurrence.

The anchor was dropped in Buckle's Bay, and the scientific staff spent two days ashore under unpleasant conditions, for a westerly gale was blowing fog and misty rain over the island. No one had lived on Macquarie for some years. A sealing licence had been suspended in 1916, as the Tasmanian Government wished to maintain this outpost as a sanctuary for sub-Antarctic bird and seal life. The respite from slaughter enjoyed

by the animals had already borne fruit, for the stentorian roaring of the sea-elephants welcomed the ship half a mile out to sea. The raucous babble of penguins echoed along the shores and in many a secluded valley far inland. Royal penguins were nesting on a stupendous scale.

Farther south from Macquarie Island a submarine ridge was traced by soundings for several hundred miles, lending support to the position of mysterious Emerald Island. The existence of this island, which figures on older charts, had been discredited owing to the failure of several vessels to locate it in the charted position. The latitude assigned to it was reached in foggy weather with a gale blowing from the west. This was unfortunate, for a comparatively shallow sounding, only 800 fathoms, was obtained and, given better weather conditions, a search further to the east could have been made.

Over the radio Mawson learnt that, owing to the scarcity of whales near the Balleny Islands, where he had expected to meet the *Sir James Clark Ross*, the whaler had found it necessary to move east and was located near the 180th meridian, the international date-line. This ultimately cost the expedition ten days and sixty tons of coal. In the early morning watch of December 18, the *Sir James Clark Ross* was sighted and the *Discovery* was soon moored alongside.

Much to their disappointment the ice conditions in the neighbourhood and west of the Balleny Islands were found to be exceptionally adverse, so that a close approach to the land was impossible. On December 29 a 22,000-ton whaler, the *Kosmos*, was sighted and this ship was able to spare the *Discovery* fifty tons of valuable coal. The ship then proceeded south through loose pack towards Adelie Land. A south-easterly gale intervened, which eventually worked up to a hurricane, blowing with full fury for day after day. This caught the veteran ship in a bad position, for they were on the weather edge of a belt of pack-ice. At times the position was most critical, the ship playing hide-and-seek with the jagged ice-edge. Only by the excellent handling of Captain MacKenzie and the ship's officers was the vessel navigated to safety, after disaster had been dodged a score of times.

On January 4, 1931, after six days' battling with the elements, the bow anchor was cast off Cape Denison on the coast of King George V Land, where almost twenty years before the leader had wintered for two seasons. Next day a landing was made. Kennedy, the physicist, redetermined the magnetic elements after this long time. His observations showed that the South Magnetic Pole had, in the interval, shifted one hundred miles to the north-west and was not more than 250 miles from Cape Denison, thus rendering the ship's compass useless.

While other scientific observations were in progress the leader inspected his old living hut which, it was surprising to find, had withstood twenty years of ceaseless violent wind. For the greater part of the year the structure was protected by the packed snow. Only for a short time at midsummer was more than the tip of the roof visible above the snow surface. Remarkable effects of snow-blast erosion were everywhere on the exposed timbers. In many places planks had been reduced in thickness by more than half an inch. Inside the hut great masses of delicate ice crystals hung in festoons, which, at a touch, cascaded to the floor tinkling and glittering like a shower of jewels. Only shattered fragments remained of the radio masts which had told the world the story of the leader's dramatic return, after the deaths of his two companions, Mertz and Ninnis.

The men stood in a ring while the flag was hoisted on a rocky point overlooking the bay. In a casket at the foot of the pole a proclamation was deposited, claiming formal possession of King George V Land, defined as that coastline extending between longitude 142 and 160 degs E.

The *Discovery* steamed westward along the coast of Adelie Land. On January 7, in 138 degs E., Campbell and Douglas took up the plane on a trial spin to examine an ice-jam which obstructed further westward progress. The coastline was found to extend somewhat north of west as far as the eye could reach. It was the coastline seen from the *Aurora* in 1912, when it was charted as Wilkes Land. The pack belt north of Adelie Land, separating the coastal waters, which Mawson had named the D'Urville Sea, was more extensive in the summer of 1930–1 than ever previously recorded. In order to get to the west of the

ice-jam north of Cape Bickerton, the *Discovery*, biting and ramming the green blocks, had to push her way through to the north of this ice-belt, an operation which occupied all one day.

On the morning of January 15, in 64 degs 49 mins S. and 124 degs 58 mins E., the sea was sufficiently smooth for the plane to take off. Campbell and Oom, as navigator, climbed to 8,000 feet searching for a southward passage through the pack. Land was seen bearing south-east, at not less than 95 miles. From that point the coast appeared to run east on the one side and south-west on the other. Practically the whole of the region from the ship to the land was choked with massed pack-ice. She continued west along the margin. Another aerial reconnaissance was made. She was now in latitude 65 degs 5 mins S., longitude 120 degs 36 mins E. Douglas and Oom again reached 8,000 feet, where a continuation of the land previously seen was observed, bearing south by east at a great distance from the ship, estimated to be 110 miles. The coast was still trending to the south of west.

This land, seen on January 15 and 16, joins Wilkes Land on the east and was charted as Banzare Land.

The cruise was continued along an unbroken margin of dense pack-ice. Unfortunately the weather became overcast. They were then in the vicinity of Balleny's supposed landfall in 1839. Mawson proved that land does not exist in that neighbourhood. The following day, in the vicinity of latitude 64 degs 21 mins S. and longitude 117 degs E., Mawson himself went up with Campbell to 3,000 feet, above which level dense clouds obscured the view. At that height the pack extended to the southern horizon. In the south-south-west, however, near the limit of vision, was a definite change in the view, either a great jam of icebergs or low ice-covered land.

Conditions became unsuitable for flying: overcast and foggy weather succeeded by gales. The ship drifted steadily to the west. On January 24 she was close to the charted position of Budd's Land, but observations showed that land does not exist in the position indicated on Wilkes's chart. Next day, in latitude 64 degs 55 mins S. and longitude 112 degs E., a change appeared in the sky conditions in the south and south-east, strongly

suggestive of the proximity of land, but situated at a great distance from the ship.

Mawson was most anxious to make further flights before passing the charted position of Knox Land, and with this in view spent much time in bad weather, keeping the ship up to the east. Both wind and current were all the time carrying her away to the west. So much coal was already expended in waiting for better weather that it became risky to stay longer. On January 27, instead of improving, the weather appeared likely to take a turn for the worse, for the barometer was falling. It was the last chance for observation in the Knox Land vicinity. Mawson decided to make the best of the opportunity, even though the sea was rough.

Flying from alongside the *Discovery* was always a hazardous business. Often the return was the worst. Plunging and rolling with the sea, the plane had to be manœuvred alongside before the flyers could hook on the lifting tackle. Then, when a favourable moment arrived, all hands on deck threw their weight into the effort to lift the plane out of the water. On this occasion the right wing dipped, a sea struck it, and the hand slings were carried away. The machine tilted, and the whole lot, including personnel, fell into the water. Douglas and Mawson, the occupants, managed to hang on, swinging grimly from the struts. Fortunately the plane did not sink, and the two men were none the worse for the mishap.

The plane was seriously damaged, and the flight was not fruitful. The position of the ship when they took off was latitude 65 degs 7 mins S., longitude 107 degs 22 mins E. The tiny plane ascended through several banks of clouds, finally reaching an altitude of 6,000 feet. All visibility below was then obstructed by cloud, except on the far southern horizon, in the direction of Wilkes's Knox Land. There the cloud canopy was absent and the airmen saw the sun shining brightly on what appeared to be undulating land-ice. That evening the voyage west was continued in rapidly freshening east-south-east weather.

On January 28 a long, low, ice-capped island was seen amongst the pack-ice twenty miles west of the vessel. This island was named Bowman Island, in recognition of the assistance

rendered by Dr. Isiah Bowman, of the American Geographical Society. In this region a large area occupied by pack-ice during the period of the 1911–14 expedition was now found to be free, and there was consequently every hope of their making further interesting discoveries in the neighbourhood.

Up to that time the ice conditions met with during the cruise were much worse than anything recorded at the time of Wilkes's visit or during the period of Mawson's 1911–14 expedition. Unfortunately, a fierce gale now intervened and drove the vessel away.

January 29, and more especially the evening hours, was a period of great anxiety, for in very limited vision the ship was flying like a kite before the wind through waters infested with bergs. Captain MacKenzie stood the ship out to the east as far as possible in an effort to escape being driven against the white lurking death of the cliffs of Termination Ice Tongue, which had been charted by the 1911–14 expedition. Next day the weather improved and the ship steamed back to the south-east with a view to reaching the shelter of the tongue. Great was their surprise, however, when they found that no such tongue existed! In its place there remained only a number of grounded bergs. In the absence of this tongue, which had formerly held back the westward-drifting pack-ice, the latter had now surged round the end of the Shackleton Shelf, with the result that the Davis Sea was much more restricted than formerly.

On February 6, near longitude 84 degs E., Campbell and Douglas tested out the repaired plane. It now flew with a distinct droop to the right, but to the aviators she was as sound as a bell. That day the *Discovery* fell in with the whaling vessel *Falk*. The Manager offered to spare twenty tons of coal. This was soon on board, the Norwegians rendering every assistance.

On February 9, though the swell in the open sea was too great for the plane to attempt a take-off, Campbell succeeded in getting up from a pool of water in the lee of a large berg amongst the pack-ice. This was in latitude 66½ degs S., longitude 76 degs E. At 5,200 feet Mawson had a fine view over the pack-ice to the south. Away to the east-south-east was a jumble of large grounded bergs and a faint line of ice-covered land. A

few days later they had confirmation of this landfall, and this new discovery was named Princess Elizabeth Land.

Some fifty miles farther south-west the ice was fairly loose, criss-crossed by occasional irregular lanes. Very little life had been seen in the heavy pack, but here great numbers of sea-leopards were met, basking on the ice rafts, an indication of more open water to the south.

Next morning ice-sheathed land came into view from the deck, rising inland to an undulating plateau. The ship approached where there was a prominent angle in the coast, which was named Cape Darnley, after the Chairman of the Discovery Committee. On arriving at the south side of a bar of pack, there was so much sea running under the influence of a southerly wind that it was at once apparent that a large sheet of open water lay to the south. The *Discovery* steamed at full speed, until the lee of a gigantic grounded berg was reached. Here the water was sufficiently smooth for the plane to take off.

Another perilous flight was made; Campbell and Oom got into the air after narrowly averting a serious disaster with a floating mass of transparent ice, an invisible hazard which nearly ripped the floats off the plane. Damage was done to the under-carriage but this did not prevent them continuing the flight. They followed the coast for some distance and, before descending, Oom made a sketch-map of a great extent of coast, tracing it south in a wide embayment beyond the 69th degree of latitude. It was then seen to turn sharply to the north, and finally sharply east at Cape Amery. The sea of open water in which the ship lay was land-locked on the south and west and limited by pack on the north and east, probably an annually recurring feature during the summer months, and it was named the MacKenzie Sea.

The season was far advanced and coal stocks so low that more time could not be allocated for the further investigation of this belt of open water beyond the pack-ice. So the ship headed north and west, following the coast. This was Mac-Robertson Land, observed dimly at a great distance the previous year, when the sea was quite unnavigable. This season, to the west of the 70th meridian, there was practically no pack

north of latitude 67½ degs S. Now, steaming close along the coast, Mawson could chart the features accurately.

The MacRobertson coast was made up of bold rock headlands and striking ranges of rocky mountains protruding through the continental ice-cap. Inland the ice plateau itself rose 4,000 feet and certain rocky peaks were estimated to reach 6,500 feet above sea-level. On February 13 two rocky ranges which reached the coast in the vicinity of the 67th degree E. were seen.

On one of these, the Scullin Monolith, the flag was raised and a casket deposited. To the west numbers of islets rose from the sea from some miles offshore. The presence of these, together with submerged reefs, called for careful navigation. All went well until the afternoon of February 14, when an easterly gale with driving snow obscured the view. The *Discovery* was now in a tight spot, for islets and grounded bergs studded the surrounding sea. Several anxious days and still more anxious nights followed, dodging ghost-like bergs in thick weather and high seas. Fortunately, in groping forward, a line of grounded bergs was located. This broke the sea and offered shelter.

When the weather improved the ship was again steamed in towards the land in the neighbourhood of the 61st degree E. The charting of numerous land features that appeared within range, islands, headlands, mountains, kept Lt. Oom up to his eyes in work. The map began to bristle with the names of many of those connected with the expedition. The Masson, David, Casey and Henderson Ranges record members of the Expedition Committee. A peak which showed up far inland at 6,500 feet was named after Hugh Robert Mill, the grand old man of Antarctic literature.

On February 18 the ship entered an attractive bay and a large party went ashore in the motor-launch, landing upon a rocky point, henceforth known as Cape Bruce. As is the case in other portions of Antarctica, the existing plant and animal life on the land, apart from abundance of marine birds and seals which visit the shore, was limited and elementary in form; it was, in fact, restricted to mosses and lichens growing on the bare rocks and algæ in fresh-water pools, together with microscopic animal life living upon and associated with this vegetation.

The rock specimens found in the new lands in the western part of the Australian Antarctic Territory proved of great interest to the scientists. Irregular pyritic bands crossing the rock formations augured well for the discovery of minerals. Most outstanding was the great quantity of garnet in the formation, for even the dredges made out at sea exhibited a characteristic pink tinge.

That day, at Cape Bruce, Captain MacKenzie reported they had little more than a hundred tons of coal left, so preparations were made for their return, two reserve top-gallant yards being run up on the foremast. Efforts were made over the radio to secure further coal supplies from whalers within reasonable radius but without success. Very violent weather was experienced on the return journey, but as the gales were always from astern, they served to hasten the passage, and Mawson landed at Hobart on March 19.

His expedition had been particularly successful and he had proved that the Antarctic coastline was continuous from Cape Freshfield in King George V Land for a distance of 2,500 miles westward to Enderby Land. The sequel came when an Order-in-Council of the British Government, dated February 7, 1933, placed under the Australian Commonwealth all the islands and territories, other than Adelie Land, south of latitude 60 degs S. and lying between the 160 degs and 45 degs E. Adelie Land, from 136 degs 30 mins E. to 142 degs 20 mins E. was excluded, because of the French claims to that area on the grounds of its discovery by D'Urville.

New Zealand's Ross Dependency, of 770,000 square miles, adjoins the Australian Antarctic Territory on the east. This area, placed under the jurisdiction of New Zealand by an Order-in-Council dated July 30, 1923, includes the islands and territories between 160 degs E. 150 degs W.

CHAPTER XX

Rymill Maps Graham Land

OFTEN the general needs of a small expedition, such as unloading the cargo, building huts, cooking meals and ordinary maintenance, make scientific work impossible; this was quite unavoidable at times with the personnel of Rymill's British Graham Land Expedition 1934–7. Even when on watch at sea the expedition scientists could sometimes combine science with seamanship by observing the distribution and habits of ocean birds, or trying to interpret the rock and ice formations on the islands as the *Penola* threaded her way among them.

The exploration of south Graham Land had been considered by many explorers, including the famous Gino Watkins after his return from Greenland in 1931. Watkins tried to raise the necessary funds, but was forced to abandon the project. He returned to Greenland, accompanied by Riley, Chapman and Rymill, a young South Australian of magnificent physique. After Watkins' accidental death by drowning, it fell to the lot of his followers to carry on the work in the south. On returning to England at the conclusion of the Greenland expedition, John Riddock Rymill, son of a well-known grazier, immediately set about organizing another one to Graham Land. Four of his old companions from the Watkins expeditions agreed to join him: W. E. Hampton, second-in-command and chief pilot; Surgeon Lt.-Commander E. W. Bingham, R.N., doctor and in charge of dogs; A. Stephenson, chief surveyor and meteorologist; and Q. Riley, whose jobs ranged from stock-keeper and meteorologist to the running of the motor-boat. The expedition numbered sixteen, a shore party and a ship's party.

The four mentioned above were members of the shore party; the others were the Rev. W. L. S. Fleming, chaplain and geologist; Lt. I. F. Meiklejohn, Royal Corps of Signals, radio officer; J. I. Moore, engineer and surveyor; and B. B. Roberts,

ornithologist. Among the ship's party were Lt. R. E. D. Ryder, R.N., captain; Lt.-Commander H. Millett, chief engineer; J. H. Martin, first mate; Captain L. C. D. Ryder, British Army, second mate and a brother of the skipper, and G. C. L. Bertram, biologist.

While the part of the Antarctic coast which lies to the south of Australia and South Africa had been explored, western Antarctica had been left practically untouched, mainly because of the difficulty in reaching the coast through heavy pack-ice. The area in which Rymill proposed to work is British territory and is called the Falkland Islands Dependency.

Apart from the exploration of northern Graham Land no one except the German explorer Filchner, in 1912, had succeeded in landing anywhere on what was thought to be the Antarctic Continent or its bordering shelf-ice in the Dependency. Filchner landed in the south-east corner of the Weddell Sea but was unable to carry out any exploration on land. So many ships, including Shackleton's *Endurance*, had failed to penetrate to the southern limit of the Weddell Sea, that it was obvious to Rymill that to try to push south on this side of Graham Land was impracticable.

On the west coast of Graham Land, north of latitude 65 degs S., the coast is easily accessible and had been known to whalers and explorers for many years. Only two ships had succeeded in penetrating inside the Biscoe Islands: Charcot's *Pourquoi Pas?* in 1908 and the *Discovery II* in 1931. Whalers working from Port Lockroy might have sailed inside the Biscoes, but their reports were too unreliable.

When planes became practicable for Polar travel, Sir Hubert Wilkins, making the first Antarctic flight in 1928, in a magnificent effort flew from Deception Island 600 miles south, and so penetrated the vast unknown region of southern Graham Land. Again in 1929, while using the *William Scoresby* as a base, he flew round Charcot Island.

It is unpractical to navigate in the Weddell Sea, but Wilkins's report of Casey Channel, Lurabee Channel and Stefansson Strait opened up prospects for an expedition to work as far as possible down the west side of Graham Land, establish a base somewhere in Marguerite Bay and then travel by dog sledge

through one of the channels, and so explore the Antarctic coast behind the Weddell Sea. Another party from the same base could explore to the west behind Alexander I Island and Charcot Island. This is what Rymill planned.

In spite of generous support from the Colonial Office, the Royal Geographical Society and private donors, Rymill's funds for an Antarctic expedition were very limited. Working on a shoe-string, he bought a small sailing ship fitted with auxiliary power and ran it entirely with amateurs—except for the captain and chief engineer, who were naval officers. He planned a three years' voyage and he met with a great deal of disapproval and criticism from conservative seafaring men, but he really had no alternative. It was either an amateur crew or no Antarctic expedition. So Rymill went ahead and his idea proved an enormous success.

During the voyage of two years and eleven months, this amateur crew, besides carrying out the maintenance work, always heavy on an old wooden ship, covered a distance of 26,896 miles: 15,696 under sail alone, 3,040 with engines, and the remainder under a mixture of the two.

Transport consisted of a small single-engined wooden Fox Moth plane, a motor tractor and sledge-dogs, a combination which worked with extreme efficiency under Rymill's experts.

Early in September 1934, an old Britanny fishing schooner, rechristened the *Penola* after Rymill's home in South Australia, sailed from London: a three-masted topsail schooner of 130 tons, she was fitted with two fifty-h.p. auxiliary Diesels. The amateur crew learnt to handle the ship safely and, after calling at Madeira and Montevideo, arrived at the Falkland Islands, taking seventy-nine days on the passage.

From the Falkland Islands, Hampton, chief pilot, and Bingham, the dog master, left with the dogs and a large part of the stores, including the aeroplane, on board the *Discovery II* which had been lent to help them move their equipment to north Graham Land.

The *Penola* was not ready to leave the Falkland Islands until December 31, and on the first night at sea there was a serious misfortune which was to alter the whole course of the expedition When clear of the islands in stormy weather, with a heavy sea,

Chief Engineer Millett discovered that the engines were running out of line. At once the ship put back to harbour under sail and it was found that the engine beds, made of unseasoned wood, had warped on the long, hot voyage through the tropics. The fastenings had come loose, allowing the engines a considerable amount of movement. Rymill decided to disconnect them and carry on under sail alone, hoping to reconnect the engines again in the sheltered waters of north Graham Land and effect repairs during the first winter.

The voyage of 900 miles across the southern ocean was uneventful, and on January 20, 1935, they reached Port Lockroy, a harbour discovered by Charcot in 1904. Here Hampton and Bingham were waiting.

As *Penola's* engines were in no condition to work in pack-ice or a heavy sea, Rymill looked for an open site on the mainland near the north end of the Biscoe Islands. At Port Lockroy a reconnoitring flight revealed there was no practical place on the mainland for a base, for the coast was fringed with a narrow belt of glaciers lying at the foot of the mountains, ending in ice-cliffs 60 to 120 feet high. For mile after mile the ice-wall was unbroken except at some headland where the rocky cliffs of a mountain spur plunged straight down into the sea. But a good place was found on the Argentine Islands forty miles south of Port Lockroy, and within 300 yards was a sheltered cove making an excellent wintering harbour for *Penola.*

The house and hangar, all one structure, was a two-storeyed building. The downstairs served as a workshop, kitchen and dining-room, with one corner partitioned off to form a radio office. There was no ordinary heating stove but an Aga cooker, which though insulated gave ample warmth except in the coldest weather, when two petrol heaters were also used. A ladder resting against an open hatch in the ceiling led to the living-room and sleeping-quarters above.

The house had double walls, insulated with asbestos-reinforced aluminium foil, a highly reflecting metallic material, which kept the hut snug and warm. Besides lining the walls and roof with the material the ceiling of the downstairs room was covered, making it bright and shiny like the magazine advertisements for modern kitchens.

On February 28, 1935, Hampton and Rymill flew along the coast to Matha Strait, scouting for a possible sledge route across to the east side of Graham Land. Everywhere the central plateau was guarded by a ring of great rock-cliffs, making a crossing impossible except perhaps for a short climbing expedition. There was little they could do, then, except local surveying from the motor-boat and biological work, until the ice in Grandidier Channel, which cuts the Biscoe Islands from the mainland, froze solid.

The waiting period was a long trying one, but all hands were fully occupied. The ship's party were busy with the repairs, the shore party with the scientific work, looking after the motor-boat or handling the plane, which made many short flights, and helping the scientists with their work. Both parties combined in sealing operations, ninety seals being killed and stored in an ice-cave.

Bingham, in charge of the dogs, spent his time on the Argentine Islands, supervising breeding operations and training puppies, increasing the original forty-five which landed in Graham Land to ninety-eight; in fact, half the dogs in the second sledging season were bred and trained on the expedition.

By mid-July the new sea-ice between Argentine Islands and the mainland was strong enough for sledging but was far from solid and might easily be broken up by strong wind. A flight of some fifty miles down the coast showed that the ice in Grandidier Channel was bearing well. Rymill's plan was a combined movement of sledge and air parties. One party would sledge to the north end of Adelaide Island, 140 miles south of base, and establish a landing-strip there for the plane. Then Hampton would fly in 2,000 lb. of sledging provisions. This would involve about five flights, and after the second one the sledging party, which had established the landing-ground, would carry the stores on another seventy miles further south to Jenny Island. Then another party would leave the base and, after joining with the advance one, push on to explore the unknown country south of Marguerite Bay. The whole expedition would be able to move farther down the coast when the ice broke up and establish a new base as far south as possible, and

farther south than anyone had sledged on the west of Graham Land.

On August 18 Bingham, Moore, the surveyor, and Martin, first mate on the *Penola*, left to establish this advanced landing-strip. Ryder, the skipper, and Rymill left at the same time to accompany them for the first fifty miles and leave a depot intended for the return sledge journey and also to mark out an emergency landing-ground. On August 22, after reaching their objective, Rymill returned with Martin and Moore, the latter suffering from slightly frost-bitten feet. It was found that the advance party could travel more efficiently in cold weather with only two men in a tent instead of three.

They arrived at the base on August 24, and two days later Hampton and Rymill flew south. They picked up the sledge tracks at the depot and followed them south to Pendleton Strait, seventy miles from the base. Here was rotten ice and completely open water and, reading the sledging tracks from the air they could see how the sledgers had wandered this way and that searching for a way through the maze of islands. It was impossible to sledge beyond this point and, after looking for their camp on the islands, Bingham and Ryder were spotted on a small island twenty miles south of the depot.

The season was too advanced to give any hope of improvement in ice conditions, so they had to abandon any idea of getting farther south from this point. Bingham and Ryder returned slowly northwards, making an accurate survey of the coast and off-lying islands, while chief-surveyor Stephenson, Padre Fleming and Rymill started south from the base to connect with them.

Working slowly south, Rymill's party was hindered by broken and newly-formed ice, which made travelling difficult. Even in winter it was impossible to land on the mainland except at one or two isolated places, for the promontories were fringed with narrow glaciers terminating in ice-cliffs over 100 feet high. Farther into the bays these narrow glaciers gave place either to broad crevassed ones, yawning death-traps, or to rock-cliffs where mountains reached the water's edge. The backs of the bays terminated in steep valley glaciers which flowed down

from an even larger glacier running parallel to and at the foot of the great plateau scarp. Tremendous ice-falls poured over the 4,000-foot sheer rock walls of the central Graham Land plateau. This was real explorer's country, unknown, rugged and full of pit-falls for the unwary.

The two parties linked on September 11, and returned to base four days later with the coastal survey completed.

During December 1935, Rymill established radio contact with Sir Hubert Wilkins on the *Wyatt Earp*. Wilkins reported that Ellsworth had confirmed the existence of 'Stefansson Strait'.

The wood in the base house was too swollen with the damp and too well put together to take to pieces for re-assembly elsewhere. So when the *Penola* had been freed by cutting and sawing the ice out of the creeks, she left for Deception Island to collect timber from the abandoned whaling station there. Meanwhile, Stephenson, Fleming and Rymill made a short sledge journey into the interior of Graham Land plateau, starting at a point opposite the Argentine Islands. They followed much the same route as Charcot's party had done in 1909 and were stopped by heavily crevassed country in much the same place. The country was so badly crevassed that if they had pushed on they would have been certain to have lost the dogs, and possibly the sledges too, a pointless risk on a minor journey when all transport would be needed the following year.

The *Penola* returned from Deception Island on January 27, 1936, with the wood for building the new house. All hands immediately set to work cutting the main timbers, while the ship's party prepared to voyage south.

Neither Rymill, nor anyone else for that matter, knew anything of the coast south of Adelaide Island except that they might find Casey Channel in latitude 69 degs 40 mins. Leaving the Argentine Islands in mid-February he reckoned on being in Marguerite Bay early in March before the freeze-up. Charcot had reported a possible anchorage for a small ship in a group of islands off the south end of Adelaide Island. These islands, if they proved safe, would make an excellent harbour while the plane scouted farther south.

On February 12 Hampton and Ryder flew south inside the Biscoes. Soon after they started the clouds settled down and although they scouted seventy miles to the south they saw very little. Hampton was forced down until he was flying level with the tops of the largest bergs and only then did he decide it was time to return. Next day they made a successful flight and found that most of the winter ice had left the channels behind the Biscoes, but that the south side of Matha Strait and the fjords running south from it were still blocked. They also found a possible anchorage for the *Penola* about seventy miles south of the Argentine Islands.

Rymill and the others sailed on February 16, leaving Hampton and Stephenson behind to fly down when they received a radio message. The decks of the little ship were high with cargo and on top of everything else there were seventy-five dogs chained in family groups, besides several crates of puppies. It was a beautifully sunny day, with a light following breeze, and they soon reached the anchorage which Hampton and Ryder had spotted. Sailing through Pendleton Strait, they rounded Adelaide Island and were in the north of Marguerite Bay, with very little heavy ice. A few miles south an irregular jagged white line warned them of the proximity of the pack.

Weather reports were sent back to Stephenson, and he and Hampton flew down on February 22, covering the 220 miles in two and a half hours. They came down inside Adelaide Island and found the channel very much narrower than they had expected from their existing map.

Hampton and Rymill prepared to set out on what promised to be their most interesting flight, for they hoped to penetrate well beyond Charcot's farthest south along this coast. The brash ice was thick round the islands, forcing the machine to taxi over a mile before there was enough clear water for take-off. As the tiny plane rose above the majestic bergs, they could see Alexander I Island showing up clearly against the cloudless sky. At 2,000 feet they stopped climbing and steered for the entrance of Charcot's Neny Fjord.

The pack-ice which they had seen from the *Penola* proved to be the previous winter's, still breaking out of Marguerite Bay in the form of small floes, but they could see the ship would

nose through without much difficulty. As they flew on they were surprised to see what appeared to be a great mountain chain connecting Alexander I Island to Graham Land. They could not be at all certain of the discovery for, as so often happens in this region, although the day appeared bright and sunny with a cloudless sky, in the distance there was a thin mist, so thin that it looked only a few shades paler than the clear sky. The mountains appeared a hundred miles away, huge peaks peeping vaguely above the mist, while the lower levels were whited-out. This was the first new land they had seen but Rymill knew they must wait for a clearer view before being certain of the discovery.

Neny Fjord was really a glacier-filled valley, with only a small fjord at its mouth, but there was an island about 2,000 feet high some four miles off the mainland and the channel between was dotted with small ice-free islands and submerged reefs. Finding a possible anchorage for the *Penola*, Rymill flew back the sixty miles to the ship.

This bay was a most attractive place, where the plane could lie safely at anchor while Hampton and Stephenson lived in a tent on shore. The plane carried a small collapsible rubber boat, which made it possible for her to work as a separate and entirely independent unit. Next morning the *Penola* had pushed her way easily through the bay ice and was at the anchorage.

In the morning they cruised round in the motor-boat, looking for the best base site, and eventually found a good raised beach, facing a reasonably sheltered harbour. The motor-boat towed the *Penola* over and she was soon moored in her new berth. Unloading started at once and, in spite of high winds and snowstorms, was finished in four days. While the shore party started building the house, the ship's party prepared for their long 1,200-mile voyage back to the Falkland Islands, finally bidding farewell to their friends on March 12.

No flying was possible until March 31, when a trip was made to the north. To the east of Adelaide Island, Charcot had marked two channels; one had already been flown down, and this time Hampton and Stephenson flew up the one farther to the east. After some thirty miles it came to an end in steep rock

walls and small branching fjords. They turned westwards and soon found a glacier-filled valley running north and south. They flew up this valley at a height of 6,000 feet for twenty-five miles. On either side were magnificent mountains towering up to 7,000 feet, while the glacier beneath them rose to about 4,000 feet. They eventually came out at one of the fjords leading into Matha Strait and saw the Biscoe Islands in the distance. Here they turned, and arrived back at the base in the evening. The sun was just setting and the flying spray froze as it touched the floats and wings.

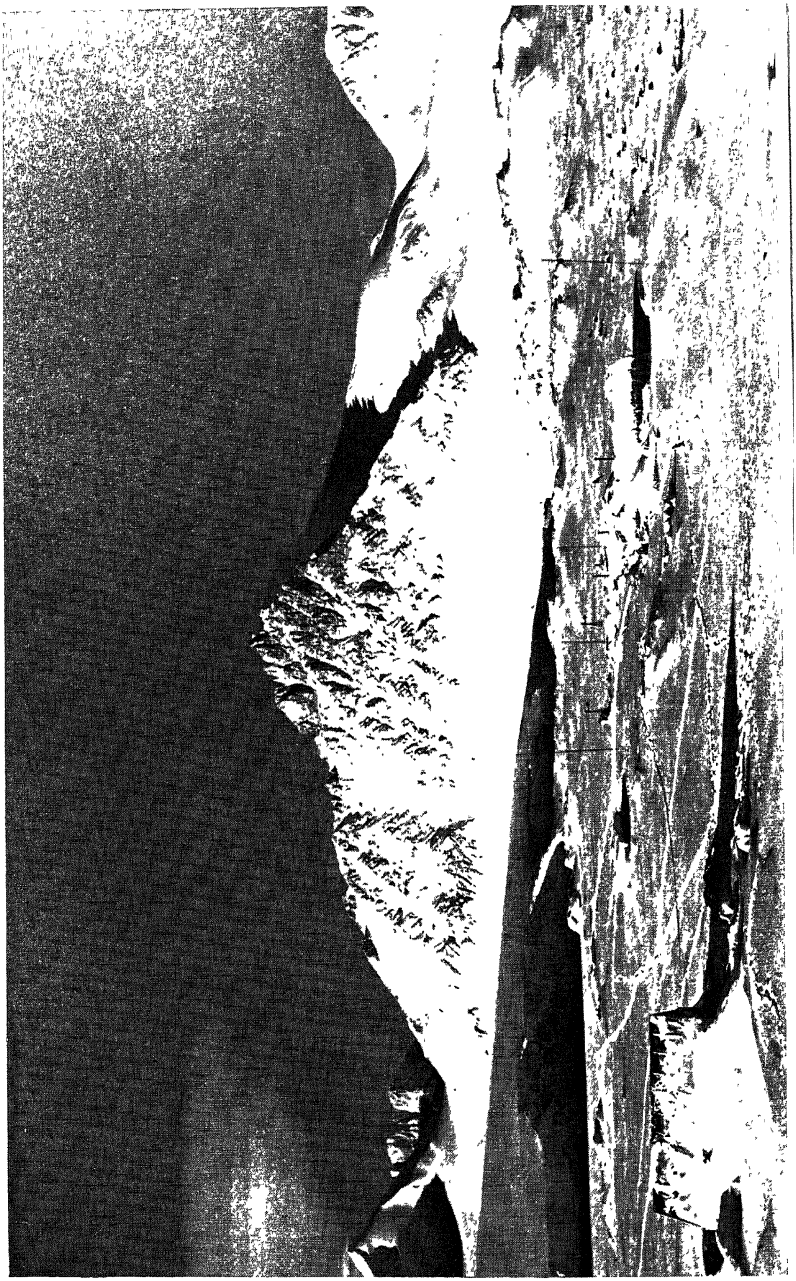
Rymill was now in a position to work out a rough outline of their future plans. Lincoln Ellsworth, in November 1935, had made his epoch-making flight from Dundee Island to the Bay of Whales and should have crossed the country somewhere to the south of the position which Stephenson and Hampton had reached. During the time Ellsworth had been in western Antarctica, Rymill's party was in daily communication with the *Wyatt Earp*. Ellsworth had confirmed 'Stefansson Strait' but said it was only about three miles wide. Stephenson and Hampton had seen large mountain ranges extending far to the south beyond Marguerite Bay, so where 'Stefansson Strait' fitted in was a puzzle to all in Rymill's camp.

The flights had shown there was no chance of crossing Graham Land north of the shelf-ice, at least seventy miles south of the base. The first thing Rymill had to decide was whether to make one long journey east, crossing the mountains of Graham Land and then following the coastline of the Weddell Sea, or to explore the new country to the south and penetrate to the west behind Charcot Island and then make a short journey east to survey some of the east coast of Graham Land without trying to reach the Weddell Sea.

For reasons of man-power interest, and expedition limitations Rymill decided to explore the land to the south. His discoveries there were to be totally different from those of other explorers, and he cleared up many controversial points that had arisen over the reports and claims made by each vessel or plane that had visited the area.

Relief party from the *John Biscoe* coming ashore at Hope Bay

(Falkland Islands Dependencies Survey photograph)



Marguerite Bay at Stonington Island; Falkland Islands Dependencies

CHAPTER XXI

Across the Plateau

As soon as the ice was safe for sledging, Rymill decided to put a depot on the shelf-ice about seventy miles south of the base, to be used for crossing Graham Land, and also for a party consisting of Stephenson, Fleming and Bertram while on a sledge journey round the bay. Bingham and Rymill would make the long journey round the north end of Alexander I Island and then behind Charcot Island to the western limit of the Falkland Islands Dependency

Before this journey a flight round Alexander I Island was essential to examine the state of the sea-ice. Judging from previous experiences, this ice might be too thin and broken for sledging. They had to wait for the long transition period while the sea-ice was forming. This proved unduly long, as frequent gales, sometimes lasting for four or five days, were recorded on their anemometer at over 100 miles per hour. By June 1 the ice was safe for sledging, but they decided to fly out over Marguerite Bay and take a good look.

By this time winter darkness had advanced, leaving only a glimmer of twilight to seep through for two hours at midday. The flight had to be short and in fact it was an amazing effort on Hampton's part to take-off and land on a snow surface in half light. The flight showed Marguerite Bay completely frozen over, with no open water anywhere. The ice looked good and solid, with none of the treacherous grey patches, tell-tale signs of the thin ice. The temperature slumped to −30 degs F. They now thought that the sea-ice, in spite of the strong off-shore winds would be as safe as sea-ice ever is.

They left on the first depot journey on June 12. There was Bingham, Stephenson, Riley, Bertram and Rymill with the dog teams and Hampton with the tractor. All went well at first, owing to a very heavy surface, but the short twilight reduced

progress to a crawl. Five days' travelling found them forty miles from the base. That final night is one that will live long in the memory of the men, for the wind blew an off-shore gale for thirty-six hours and the ice started to crack. To avoid disaster a quick move was necessary to reach the safety of some islands four miles away. The tractor could not be moved from the camp and, together with the greater part of the depot had to be left behind. After nine hours of hard travelling over loose ice-pans and high-pressure ridges the men reached safety and thus the expedition was saved from a ticklish situation. These islands they called Terra Firma.

The experience on this depot journey proved that they could not go south until the ice had withstood at least one really strong gale. Although the ice to the south of the base had broken up so completely, that to the north had shown no signs of going out and while waiting to start the long journey Rymill decided to do the northern survey.

This northern survey would verify their aerial survey and also explore the complicated fjords north-east of Marguerite Bay. It was planned that Bertram and Rymill with two dog teams would travel up Laubeuf Fjord, which lies between Adelaide Island and what we now know to be the mainland, while the other party, consisting of Stephenson, Fleming and Riley, each with a team, would try to cover all the country from base up to the south end of Laubeuf Fjord. Each party hoped to sledge 200 miles in three weeks.

The two parties left on July 20, travelled together for the first fifteen miles and then separated. After being held up by strong winds, Bertram and Rymill arrived at the south end of Laubeuf Fjord on the sixth day from base. They turned north for Matha Strait. They had sledged twenty-two miles and camped just short of where a fjord narrowed down to a few hundred yards wide. Here they expected to find thin ice and the next morning went forward cautiously. They were not disappointed and were soon on the rottenest of ice. Right in the narrowest part they were stopped by completely open water. So thin was the ice when they turned south again that an inquisitive seal, anxious for a good look at the unusual two-legged visitors, pushed his

head up several times through the ice where it had been sliced by the sledge runners

Rymill speaks of 'no trouble' on this journey, but we do not need to be familiar with this type of exploration to let our imaginations fill the gaps in the leader's factual narrative. The hardship of camp life on the trail, the sixty degrees of frost pass unmentioned, and never once does Rymill mention trouble with his dogs.

As they travelled south again, the north wind freshened and by the middle of the afternoon it was blowing a gale. Rymill goes on: 'We were stormbound in our tent for three days with the usual 100-miles-per-hour wind, again on the sea-ice, as there was no chance of making a landing up the ice-cliffs; but this time the ice was solid and we had no trouble.'

The wind died on August 2, leaving a good travelling surface, and the dogs, pleased to be moving again, trod the seventeen miles from the south end of Laubeuf Fjord at a fast rate. A day was spent taking astro sights and then they sledged back to base, trekking the last fifty miles in two days. The other party arrived back two days later, after a most successful three weeks of surveying and geologising.

Back at Marguerite Bay base there were things to be done before they could start the long journeys. A flight must be made round the north end of Alexander I Island, to locate the depot and tractor abandoned on the sea-ice near Terra Firma: and they needed more dog food. Seals had been scarce and the dogs were feeling the lack of fresh meat.

Daylight on August 15 broke clear except for low clouds to the south and south-west. Hampton and Rymill were in the air by 11.30 a.m. The ground temperature stood at —30 degs F. As they gained altitude, owing to temperature inversion, which is quite usual in the Antarctic regions, the thermometer rose at the same time. At 2,000 feet it was twenty degrees warmer, clearing the rime off the windows. They could distinguish the northern part of Alexander I Island about ninety miles away and headed straight for it. Even when they could just see their objective, the flyers kept a careful check on course, using a drift-indicator let into the cabin floor.

Twenty miles off Alexander I Island coast, they were worried to see that the ice beneath was thinner, and looked as if it had recently broken up. A few miles farther on, open cracks and pools lay below while everywhere the ice showed a dull, grey colour broken into pans several hundred yards wide. In many places the pans were separated by open water or patches of ice so thin they were only a little lighter in colour than the dark open pools. Fifteen miles out at sea a low, heavy fog-bank indicated the northern limit of the pack.

They followed the north coast of Alexander I Island eastward, gradually gaining height until at 6,000 feet they sighted what appeared to be Rothschild Island, but they found it was part of the mainland. Along the coast the ice-cap finished in a high cliff with a broken edge, showing many icebergs in the making. Behind the cliff the ice-cap rose steeply in crevassed slopes to a height of 3,500 feet where the black patches of the exposed mountains began. These were in great massive groups, intersected by slightly crevassed glaciers, rising gradually towards the interior.

When they had flown 140 miles they turned for home, all the time photographing the coast. As they passed the last mountain they eagerly looked towards the large fjord. The clouds had now cleared away and they could see what appeared to be a great channel running away to the south to the limit of vision. As its mouth must have been about sixty miles away, they could not make out whether it was filled with sea-ice or low shelf-ice and, unfortunately, they had not enough fuel left to go and look. They took the necessary bearings for fixing its position roughly on the map and then continued home. After landing, the plane was soon in the hangar and Stephenson started plotting the new discovery on the chart. It appeared when plotted to run in a direction slightly east of south and to be fifteen miles wide at its mouth.

This discovery, together with the bad ice off Alexander I Island, upset all Rymill's sledging plans; it completely stopped any idea of sledging to the western end of the Dependencies by this route. But the new channel had opened up new possibilities: it might connect with the Weddell Sea, or it might be the entrance of a strait leading to the west somewhere behind

Alexander I Island. By this time, judging from their own experiences in the air, and from what they had already discovered to be wrong in previous reports, they were very sceptical of information brought back from hurried single flights without any kind of ground control.

As Rymill points out, it was difficult for them to disregard totally discoveries of two airmen of the calibre of Wilkins and Ellsworth.

On August 16 Hampton and Stephenson attempted a flight down the new channel but they flew into low cloud and were forced to return. Bad weather followed for eighteen days. Everything was ready for sledging and they were impatient to start but could not get away until the plane had scouted the trail ahead. It was this combination of plane, dogteam and ground control, working as a team, which led to the first crossing of the Graham Land Plateau, and the success of the expedition.

The plane had a flight endurance of three and a half hours, representing a range of 280 miles. On September 4 they at last got away. As the newly-discovered channel mouth was about 100 miles from the base, they could fly down it for about forty miles.

From the air the channel appeared ten miles wide, in places narrowing to five miles. On the west was a solid wall of mountains 8,000 feet high; to the east it was more open. Once they had passed the main headland at the entrance ice-covered country rose gently to a height of 5,000 feet. There were steep valleys down which much-crevassed glaciers flowed, and here and there bare rock ranges pushed out from the high hinterland as prominent, black-looking capes.

As they entered the channel there were large cracks in the sea-ice; extending close in shore were very large pools of open water, it was obviously impossible to sledge into the channel that way. Immediately south of the headland the sea-ice finished and the shelf-ice took its place.

For the first thirty miles this shelf-ice was badly broken up by glaciers pushing into it and by large bergs breaking off from its free end, but by the time the fliers reached their turning-point the shelf-ice looked absolutely flat and solid. To the south the high western mountains continued but appeared to turn west at

a cape twenty miles farther on. They could see nothing beyond this cape and assumed it was the end of Alexander I Island.

On the east side of Graham Land the coast continued to the south as far as they could see, finally disappearing in the mist. They had reached latitude 70 degs 10 mins S., but there was no indication of any strait coming through from the east side of Graham Land. Casey Channel was marked as being in latitude 69 degs 30 mins, but it certainly was not there. There was always a possibility that there was a channel to the south beyond the last point which they could see, but this would have to wait for the sledge journey.

Rymill formed up two parties: Stephenson, Fleming and Bertram with three dog teams, and Bingham and himself with two teams. They would travel together over the pass and down into the strait. Rymill's party would then turn to the west behind what Hampton and Stephenson thought was the south end of Alexander I Island, while the other party continued south along the Graham Land coast, and if they found Stefansson Strait' would turn east through it.

Past Terra Firma Island to the edge of the shelf-ice south of Cape Berteaux was 'uneventful' travelling to use the leader's own word. Nevertheless, there were bad spells owing to the rough surface which was deceptively levelled off by the winter snowfall, forcing them to relay heavy loads through the worst places. On the seventh day they reached the shelf-ice sixty miles from base. Unable to see land owing to low cloud and mist, they steered on compass. Bad weather kept them camp-bound.

At last, on September 20th, they resumed travel and trekked 10½ miles, fording the worst crevasses. The next day it was snowing and blowing as hard as ever. Zero visibility held up progress, a blessing in disguise, for they did not know the deceitful nature of the country. At any moment they might be confronted by one of the many rifts or crevasses, the haphazard death-traps of the shelf-ice.

So far they had been out seventeen days, on eight of which it had been possible to travel and they had covered only seventy-one miles. This was not good enough for men like Rymill, and his team. Bingham and Rymill decided to reinforce Stephen-

son's party and eventually leave them with food and other gear so that they could carry on with a full eight weeks' rations while the first two returned to the base for fresh supplies. The next few days' travelling brought the party to the crevasses of the land-ice. The crevasses were well bridged and they were able to sledge straight across them. The steepest climb to reach the 3,000-foot pass which had been seen from the plane was the first 700 feet. After this, the trail was easier.

At the south end of the shelf-ice they found a level uncrevassed area, large enough for a landing-ground. Rymill and Bingham left everything except essential gear and a few days' dog food and started back on September 24. With light sledges they travelled fast, covering the ninety miles in five days. As soon as they returned, Hampton prepared to fly the depot south.

After flying some seventy miles into low cloud, bad weather forced the plane to return. It blew hard all that night, but the wind died next morning and Hampton and Rymill took off just after lunch on October 1. Twenty miles from base a strong wind off the mountains blew the plane all over the sky. As far as Cape Berteaux, it was just one bump after another, but south of that point the conditions were better. After dropping a flag to indicate the wind direction and to give a mark to judge their height by, they touched down safely on the shelf-ice. Unloading the supplies, they flew on farther south to see how Stephenson's party was progressing. After a few miles they picked up their sledge tracks in the mountains and followed them for thirty miles until they ran steeply down a crevassed glacier into the channel. Lack of fuel forced a return but not before they saw that Stephenson's party was well on its way south.

By October 10 six depot flights had been completed, which meant there were eight weeks' supplies on the shelf-ice plus emergency rations and fuel. October 19 was a glorious day and Hampton and Rymill were in the air approaching the point they thought marked the southern limit of Alexander I Island. They were surprised on drawing level with this point to see another one a little farther on and the strait continuing to the south. On rounding this point there was yet another. They flew southwards some 120 miles from the mouth of the channel and 220 from home, exhausting the safety allowance of fuel.

They had of course got nowhere near Charcot Island but had made the surprising and interesting discovery that the channel continued on in a southerly direction.

Stephenson's party had travelled down the channel for 200 miles and from this, their turning-point, they could see the last rock exposure on the Graham Land side about ten miles ahead. Thenceforward, the country was completely glaciated, and ran for some fifty miles slightly west of south before disappearing from sight. To the south-west they could see what appeared to be the end of Alexander I Island—a long glaciated point. They were seventy miles south of the southern limit of 'Stefansson Strait', but there was no break in the coast anywhere to the east. On the way back they made two landings on Alexander I Island and were lucky in finding fossil deposits in both places.

As Stephenson's party reported that there was no possible route across Alexander I Island to the west Rymill decided to try to cross Graham Land and see if he could explore anything of its east coast. After eleven days they had covered seventy-three miles from the depot and saw the line of mountains ahead which they thought must be the east coast of Graham Land. Two more days put them right amongst them and they camped at 7,500 feet beside a massive peak rising to 9,500 feet and then climbed a smaller one beside it, thinking to see the shelf-ice of the Weddell Sea.

On reaching the top and looking east, they saw a large terrace-like plateau, with more mountain ranges about twenty or thirty miles beyond it. They travelled due east for twenty-five miles over the plateau before reaching the mountains fringing its eastern edge. From these mountains the land fell away steeply in a series of rocky ridges intersected by crevassed glaciers. At the edge of this second plateau there was low cloud covering what they thought must be shelf-ice farther on; in fact for the thirty days they were in sight of the east coast there was always low cloud out to the east.

They decided to turn south and travel along the shelf-ice, keeping about 3,000 feet up on the mainland. They soon got into serious trouble on crevassed glaciers. After spending a

week trying to get to the south they were forced to return to the plateau. Eventually they reached what should have been the north coast of 'Stefansson Strait'. They pitched camp 6,000 feet up on what the maps indicated as Lurabee Channel but were disappointed to see that all the land to the south-east was covered in cloud, except for the higher mountains. Next day was clear and they saw the land to the south continued first at a lower level, then rose into the highest mountains yet seen in Graham Land, while out to the east the coastline continued to run in a north–south direction.

Not enough provisions remained to attempt to penetrate into this mystery land of distant giant mountains and, after spending two days surveying and collecting geological specimens, they turned north to investigate the eastern end of the supposed Casey Channel. After travelling for forty miles, they reached a position overlooking a valley glacier running down from the main eastern mountain chain to the coast. This glacier was in the same latitude as Wilkins's Casey Channel and formed the east end of a rift about 5,000 feet high running right across the main plateau.

Bad weather held them up on the south side of this glacier for seven consecutive days, but at last it improved and on Christmas Day, 1936, well pleased with the success of their mission, they turned for home. They had been away from the base for sixty days and from the depot on the shelf-ice for forty-three days. In all this time they had sledged 340 miles and had succeeded in mapping 150 miles of the east coast of Graham Land.

The sea-ice in Marguerite Bay was still holding, though much broken up by leads of open water and thaw pools which had rotted large holes. They arrived back at base on January 5, 1937, completing a journey of 540 miles.

At the end of January, although the greater part of Marguerite Bay was still blocked with ice, there was plenty of open water along the shore, and on February 1 Hampton and Stephenson flew across Alexander I Island to try to gain some idea of its western shore. When they reached the east side, near the mouth of the Channel, a strong head wind was against them, and while

flying at 7,000 feet they crawled up magnificent glaciers with mountains towering a thousand feet above them.

The mountains forming the west side of the channel were a narrow ridge behind which lay a plateau about 4,500 feet above sea-level. Beyond this was another plain about 2,500 feet high, and on the far side of this lower plain there was a large mountain mass lying in an east–west direction. After flying 170 miles and reaching the southern end of the upper plain, they had to turn back. What they saw and photographed enabled Rymill to give a more reasonable shape to Alexander I Land, though its western limits were still unknown.

After a rough passage, in dirty weather, the relief ship *Penola* reached the Marguerite Bay base on February 23.

Those who had been on previous Antarctic expeditions knew that Rymill had become a worthy successor to Scott, Shackleton, Mawson, and other pioneers. Rymill's expedition had been of very different type, however, run on more economical lines and with the interesting experiment of an amateur ship crew.

Rymill started a new style of Antarctic exploration, less ambitious than the expeditions of the past, working at shorter range and more exhaustively, and concentrating on certain definite problems. On the map there was still a big area to explore, both in Graham Land itself and westwards south of the Pacific to the Ross Sea, leaving plenty of scope for extending the work which Rymill and his party had pioneered.

Rymill's expedition was the successful combination of the latest methods of exploration; plane, tractor, radio and the old-fashioned but still essential elements of strong, sound men, aided by dogs bred actually on the scene of their labours and guided by men who knew how to drive them.

Rymill eliminated the terrible privations which form such a large part of the early volumes of previous travellers in those regions. Hardships they had, but only of a kind that served as a stimulus to men who met them with a laugh and carried out their work with more efficiency than their predecessors because they were better sheltered, better clothed and, above all, better fed.

In those days some said that aviation was all very well for

the north, but in the south, with the great heights of the Antarctic continent, a South Polar air route was not a practicable proposition. The distance from Hobart to Punta Arenas is little more than 5,000 miles or ten hours' flying time by latest jet plane. With the technical improvements and with perhaps landing-places and refuelling bases made, as the results of such exploration and research as Rymill's show, that aerial route has to-day become a practical proposition.

On his return to Australia Rymill settled down to family life, and served as an Officer in the R.A.N. in World War II.

CHAPTER XXII

Oases Discovered

THE importance of Australia taking an active interest in her Antarctic Dependencies was continually urged by Sir Douglas Mawson for several years before the war. Support by the government of the day was evidenced by the fact that the *Wyatt Earp* was purchased from Lincoln Ellsworth after his return from the Antarctic in 1939, the express intention being to use her for further Antarctic operations. No firm plans, however, were made, and with the gathering war clouds in Europe the idea of another Australian expedition was temporarily deferred.

In the year of the outbreak of World War II, some rather startling discoveries were made by a German expedition. This is worthy of mention here, as although not much was disclosed of its operations at the time, it appears now that its findings may alter the course of international exploration and not a few of the scientific theories woven around the continent of mystery.

The expedition, sponsored by the Nazi Government and led by Captain Paul Ritscher, left Hamburg, Germany, on December 17, 1938, on the *Schwabenland*, a catapult ship of the Lufthansa's fleet. She carried two Dornier Wal ten-ton flying-boats and a staff of scientists, including meteorologists, an oceanographer, a biologist, a geophysicist, a geographer and two photographers.

The *Schwabenland* arrived during January 1939 off the Antarctic Continent in the vicinity of the Greenwich meridian. In the following weeks seven special inland flights and many others were made, during which vast ice-free regions were sighted in Queen Maud Land. These are now known as the 'oases' of the Antarctic and have caused more speculation among scientists than any other geographic discovery in this half-century.

On January 20, bad weather caused the *Schwabenland* considerable difficulty and she moved to the east in the hope that

ice conditions would be better in that direction. At the end of January a change in weather and ice conditions compelled the vessel to move even farther to the east. From latitude 69 degs 05 mins S., longitude 14 degs 45 mins E., a flight was made along the edge of the barrier to longitude 18 degs 30 mins E., whence the barrier could be followed by eye far beyond longitude 20 degs E.

The last flight was made on February 5 and the expedition left for Germany next day, as it was considered that, in view of the deterioration in weather and ice conditions, further activity would be too risky. The most southerly point reached was latitude 74 degs 25 mins S., longitude 0 degs 20 mins W. Air operations totalling 8,000 miles were flown by the flying-boats.

The expedition reported that the territory reconnoitred formed a geologically self-contained section bounded on the east and west by an ice-plain rising fairly sharply in the direction of the Pole and merging into the Polar cap south of latitude 74 degs S., at more than 10,000 feet above sea-level. Between longitudes 2 degs E. and 8 to 10 degs W., the expedition reported that the Polar cap falls away to the north in high steep rock precipices between latitudes 73 degs 30 mins and 74 degs S.

Undoubtedly the German planes were looking for sites for secret weather stations to give information to their aircraft and sea-raiders. They dropped Nazi flags over this land to claim it for Hitler. After the Allied victory the British Admiralty sent a special agent to Germany; he unearthed the files, reports and photographs of the expedition. The report showed the warm area covered 30,000 square miles, larger than Tasmania.

Kerguelen, the French possession, where whalers and sealers reaped a rich harvest in days gone by, is the only island known to have been used by German raiders during the last war. In October 1940 the British warship *Neptune*, under Captain R. C. O'Connor, carried out a search of the Southern Ocean and reported that Marion and Prince Edward Island were deserted, with no signs of boats or stores. A close examination of these two islands was made from the ship, but no landing was made. When the *Neptune* called at the Crozet Islands, they were shrouded in thick fog, and so the group could not be examined,

but intelligence reports showed that this was unlikely to be a suitable base.

At Kerguelen an intense search was made of all bays and harbours, and an aircraft was launched to assist. No presence of enemy activity was reported, but three months later the German raider '33' intercepted the Norwegian whaling fleet in latitude 59 degs S., longitude 2 degs 30 mins W., capturing two factory ships, a supply vessel and eleven catchers. Only three of the catchers escaped. In March 1941 two German raiders operated from Gazelle Basin, Kerguelen. They used this isolated island as a rendezvous with their supply ship, and a third raider is also known to have been there. Before they were destroyed, the raiders sank thousands of tons of United Nations shipping in the South Atlantic and Indian Oceans. During their long cruises the crews were able to rest and go ashore only once at Kerguelen. Prisoners reported that the German High Command had planned to use the islands as a hide-out for prize ships, after it became too risky to attempt running the Allied blockade of Germany.

From other statements from the captured German crews, it is apparent that they did use the Crozet Islands some time during 1941 as an alternate rendezvous for the raiders. H.M.A.S. *Australia* made a further search of the region by sea and air, visiting Kerguelen during the first week of November 1941, and then the Crozet Islands. No definite evidence of further use of these islands by enemy vessels was uncovered. During this cruise the Australian warship laid mines in Kerguelen waters. The next year the Germans planned to set up a secret weather station. In May 1942 German raider '28' transferred a meteorologist and two radio operators with full equipment to the supply ship *Charlotte Schlieman*, which made course for the Indian Ocean and Kerguelen Island. For some reason the German High Command changed their mind, and the project was abandoned. Allied intelligence collected no evidence of similar Japanese activity in the Southern Ocean, but in view of the sinkings south of Australia this possibility cannot be ruled out.

The other side of the Antarctic Continent was also brought under the widening threat of wartime operations. In February 1944 British parties under J. W. S. Marr, the 'boy' of the *Quest*

expedition, were landed on Deception Island and at Port Lockroy. Argentine insignia which had been erected on these stations were removed. In addition, at a time when she was least able to spare the manpower, Britain was forced to send a strong garrison to reinforce her strength in the Falkland Islands against possible threats in that region from fifth-columnists and unsympathetic neutrals. Another British party was landed at Melchior Islands, and an attempt to land at Hope Bay had to be abandoned. The expedition was unable to locate a suitable site for a shore base on Graham Land between Antarctic Sound and Andvord Bay, but the culmination of all this secret activity was the establishment of the Falkland Islands Dependencies Survey, a long-range programme now being carried out by the Colonial Office for the scientific development of this territory.

In 1945 a depot hut was built at Sandefjord Bay in South Orkney Islands, and since then further stations have been established at Cape Geddes on Laurie Island, at Stonington Islands and at Neny Fjord, Marguerite Bay, Rymill's old stamping ground. In the season 1946–7, under the leadership of K. S. Pierce-Butler, new stations were set up at the Argentine Islands and at Admiralty Bay. The principal activities were meteorological, topographical and geological surveys, while botanical and zoological surveys were also carried out.

In 1947 Chile and Argentina sent expeditions to these regions. The Chileans established a 'met' station at Discovery Bay, Greenwich Island, South Shetlands, and one of their expedition ships cruised to Marguerite Bay. The Argentinians built a permanent 'met' station on Gamma Island, Melchior Islands, Palmer Archipelago, and their squadron of six ships called at Deception Island, Port Lockroy, Argentine Islands and also at Marguerite Bay.

The most spectacular event in the post-war Antarctic scene was the visit of Admiral Byrd's U.S. Navy task force in the summer of 1946–7. The writer was fortunate enough to visit some of these fine ships on their return from the South, when they pulled in to Sydney for 'recreational furlough'. The armada was made up of many large ships and several thousand men were engaged. It worked in three sections along the entire circumference of the continent, and on its return claimed to have discovered or

confirmed 5,400 miles of coastline, ten new mountain ranges, including undreamed-of glaciers and peaks from 15,000 to 20,000 feet high. Camera planes photomapped 340,000 miles of territory never before seen. The eastern section, operating off the unmapped portion of the Amundsen Sea, discovered and logged extensive high mountain ranges in longitude 105 degs W., and here they saw a bay 20,000 square miles in extent.

The section operating south of Australia found evidence that the South Magnetic Pole had shifted 150 miles north-west of its previously located position. Camera planes photomapped the coast of Wilkes Land, and reported a spectacular discovery near the Shackleton Ice Barrier in longitude 101 E. The aircrews spotted snow- and ice-free land which they named the Bunger Oasis. At first the discoverers thought this was a series of blue and green fresh-water lakes, possibly of volcanic origin, but when scientists examined the water samples some time later, they said the lakes were only arms of the sea. At different times the region is thought to be ice-free because of the solar heat being re-radiated from the blackened rocks of the vicinity. More ice-free areas were spotted in longitude 70 deg E., including a bay fifty miles wide.

The centre section of ships concentrated on the Ross Sea area, and they found the entrance to the Bay of Whales had shrunk to 800 feet, whereas in 1911 the ice-cliffs had been ten miles apart. To use the Bay as a base, the powerful ice-breaker *Northwind* bit off two square miles of bay ice between five and twenty feet thick. Near Byrd's old camp, Little America, an air strip was laid out on the snow, and six huge transports flew in from the deck of the carrier *Philippine Sea*, 800 miles to the north, beyond the pack. These planes, using jet-assisted take-off tubes, were the largest craft to leave a carrier's deck, and made possible the exploration of 800,000 square miles. Using air-borne magnetometers, scientists found islands entirely hidden beneath the shelf-ice. It was expected to be a long time before the full results of this expedition were known, but there were many who saw it as a demonstration to the world of America's ability to fight a war in the Polar regions, north or south.

In March 1947 three important pioneer flights were made by the Royal Australian Air Force. The flights were designed to

Macquarie Island
—now a reserve
for penguins and seals
(Photograph: Norman Laird)

The Isthmus, Macquarie Island
(Australian Official photograph)

collect meteorological data, to gain a special form of flying experience, to examine and photomap Macquarie Island and to indicate the possibility of aerial liaison with Australian ground parties in Antarctica. The first two flights were made in modified Lincoln bombers, the distances and durations were 2,000 miles in 13 hours and 2,200 miles in 11 hours 40 minutes. On the second trip the farthest point south which the plane reached was latitude 52 degs. The third flight was made in a modified Australian-built Lincoln bomber, which flew 2,800 miles in 14 hours 30 minutes. The plane circled low above hills on Macquarie Island, and more than 250 photographs were taken. This point is the farthest south ever achieved by an aircraft based on Australia. Throughout the trip radio contact was kept with the air base in Victoria, and it was considered afterwards that these flights had been useful, and had given valuable training for future aerial exploration.

At the end of 1947 another American naval expedition was in operation off the Shackleton Ice-Shelf in the vicinity of the Bunger Oasis. This party was entirely ship-based, and transmitted daily radiophoto facsimile weather maps over a record distance of 10,500 miles. Under Commander Gerald L. Ketchum, the expedition consisted of the ice-breakers *Edisto* and *Burton Island.* The expedition endeavoured to get inside the pack and skirt the Antarctic coastline from the region of longitude 110 degs E. right round to the Ross Sea, calling at the Bay of Whales; the ships then continued round the coast to Marguerite Bay, for a private American expedition was camped here. The expedition established a number of temporary ground control stations along the coast to make a better interpretation of the thousands of air photos taken the previous year by flyers of Admiral Byrd's task force. These photo-flyers were forced to pass over hundreds of miles of frozen sea and pack before they saw land, at the same time facing many navigational problems. They left small but vital gaps in an otherwise continuous coverage of the coastline they were attempting to survey.

In 1948 the French sent their first expedition to the Antarctic for many years. Led by André Liotard, the expedition sailed aboard the *Commandant J. B. Charcot.* There were twelve members of the party, which was well equipped with a light aircraft,

weasels and thirty sledge dogs. Unfortunately, owing to a late start and engine delays at Hobart, the *Commandant J. B. Charcot* could not crash her way through the ice to Adelie Land, and was forced to return to Australia.

With the approach of the half-century, new and intensely efficient machines had been forged to span the last unknown parts of the Antarctic Continent. Helicopters, tracked vehicles, radar and television were all playing their part in the international race for geographic, economic and scientific information. In a few hours it was possible to cover country which a few years back would have taken many months. Nations were using the Antarctic regions as testing grounds for men, materials and equipment, just in case the 'cold' war had to be fought in a cold climate. But one salient point seemed to obtrude above all the welter of publicity, and that was something that Rymill had said before the war: you could not map a country from the air alone. You had to follow up with ground parties to confirm topographical details. The uncertain weather and lack of liaison between dog teams on the trail and depot-laying planes are factors likely to hinder surveying, for if there is one thing upon which all old hands agree, it's this: 'You never can tell in the Antarctic!'

Meanwhile, in Australia interest had been aroused once more, again largely due to the efforts of Sir Douglas Mawson. Various committees were formed and plans discussed. Finally in May 1947, Stuart Laird Campbell, a pilot of the British, Australian, New Zealand Antarctic Research Expedition 1929–31, was appointed leader and chief executive officer in organising an expedition. Commander K. E. Oom, R.A.N., surveyor on the B.A.N.Z.A.R. Expedition, was appointed captain of the *Wyatt Earp*. An Antarctic Planning Committee, consisting of Sir Douglas Mawson, Captain J. K. Davis, and representatives of the Navy, Air Force and Council for Scientific and Industrial Research, was appointed and given the task of making recommendations to the Government as to what could most usefully be done.

At a cabinet meeting in August 1947, it was agreed that scientific and meteorological stations should be set up on Heard and

Macquarie Islands during the forthcoming expedition and maintained for a period of at least five years; that a systematic reconnaissance of the coast of the Australian Antarctic Territory should be carried out over a number of years by the *Wyatt Earp*, with a view to establishing a permanent scientific station on the Antarctic Continent itself; and that a ship should be obtained, of much greater capacity than the *Wyatt Earp*, especially adapted for work in Antarctic waters.

CHAPTER XXIII

Campbell Leads ANARE

THE new Australian National Antarctic Research Expedition was another development in the story of Antarctic exploration, as different from the early endeavours of Bull, who gambled money on his enterprise, as the efforts of Mawson and other pioneers, who had struggled to balance the financial accounts on returning from the south. The new expedition was wholly financed and organised by the Commonwealth Government.

By the end of the World War II, exploration had become too big for one-man shows. It was now a national enterprise with the governments or armed forces of different countries taking part.

Funds for private exploration were almost a thing of the past. The formation of the Royal Geographical Society in 1830 marked a great period of British exploration and most of the famous British expeditions received help from the society. But those were the days when travel was cheap and when expeditions, mainly concerned with the opening up and simple mapping of new country, needed no elaborate scientific equipment. In the post-war world exploration continues under more difficult conditions. While there are large tracts of territory unexplored, exploration has become more specialised and the equipment more elaborate. It was announced in November 1947, at Canberra by the Prime Minister of the time, Mr. J. A. Chifley, that three separate research stations would be established at or near Antarctica by the Australian Government and two of them would be manned continuously for at least the next five years. Before the end of this time it was hoped that Australia would establish a permanent weather station on the shores of the Antarctic Continent. It would be the first permanently inhabited location in the Australian Antarctic Territory.

The decision to establish the meteorological stations was in

accordance with recommendations made at the first post-war conference of the South-West Regional Commission of the International Meteorological Organisation held in Melbourne in January 1947. The conference recommended that, irrespective of any action taken in Antarctica, the different administrations should be urged to provide weather stations at Cocos Islands, St. Paul Island and Kerguelen Island in the Indian Ocean and at Macquarie Island.

The first goal of the Australian expedition was expected to be Commonwealth Bay, Adelie Land, where magnetic observations were to be made. From there it was hoped a reconnaissance would be made of the Cape Freshfield area, before the ship *Wyatt Earp* sailed west to Princess Elizabeth Land and MacRobertson Land. The latter coast had been largely charted by Oom himself in 1930 and 1931. It was anticipated that the *Wyatt Earp* would be in the MacRobertson Land area until March 1948, when it would sail north to Heard Island to pick up Group-Captain Campbell, chief executive officer of the expedition, returning with him to Australia in April 1948.

Personnel on the *Wyatt Earp* included a ship's complement of twenty-seven, including officers and crew, two R.A.A.F. men to fly the Kingfisher aircraft, a scientific staff of three, a meteorologist, a radio physicist and a magnetician to search for the constantly shifting South Magnetic Pole. A photographer was also included.

The 1947 Australian expedition moved in three parts, the first group was aboard the Australian Navy's L.S.T. 3501, under the command of Lt.-Commander George M. Dixon, D.S.C. Fourteen scientists and technicians, under Campbell, constituted the landing party. All had volunteered to spend not less than a year on Heard Island, or until such time as they were relieved.

After landing the party there, it was intended that the L.S.T. should return to Melbourne to pick up the second party and proceed to Macquarie Island.

Campbell had hoped to land a party on the continent itself, but after the planning committee investigated the undertaking,

it was obvious that the scheme was too ambitious. Australia lacked the proper equipment, clothing and experienced manpower. There was no time to secure assistance or materials from overseas.

Campbell's chief difficulty in the establishment of the continental weather station was to find a suitable site. Commonwealth Bay was notorious for its severe and adverse weather. Not very much was known of the other sites along the coastline. In view of these difficulties the establishment of the continental station was postponed. Instead, it had been decided to land scientific parties at Heard and Macquarie Islands. The new plan was a three-pronged drive into the Antarctic regions.

The first party left Melbourne on November 17, 1947, on the tank-landing ship, which had been adapted for Antarctic conditions at a Sydney dockyard. The *Wyatt Earp* left a month later, having refitted at Adelaide. Both ships carried aircraft. After landing the party at Heard Island, the L.S.T. went to the French island of Kerguelen, about 250 miles north-west, where a reserve fuel dump was left ashore. However, due to unforeseen events the expedition plans were re-cast. The *Wyatt Earp*, which should have been sailing along the coast of Adelie Land, returned to port in an unseaworthy condition.

After landing the Macquarie Island party, it was hoped the L.S.T. would be able to proceed along the edge of the pack-ice between 125 and 151 degs E., nosing her way through to the Cape Freshfield–Penguin Point area; thus a large portion of the continental coastline of the Australian sector would have been surveyed. Owing to the severe battering received by this ship at Heard Island, the latter part of the operation became quite impossible.

After much discussion on the scientific side, the expedition organisers agreed that no urgent need existed to undertake much biological work as this was being well catered for by the Discovery Committee. They also thought that geographical work or detailed examination of small areas of the Antarctic Continent, though of great interest, was not of high priority and that the most important and practical scientific work lay in physical rather than biological research. The decision must

have been influenced by the fact that much new equipment and many new exploration techniques had been developed.

After a stormy voyage, the landing-ship party made a careful examination of the eastern coast of the Heard Island. A camp was set up on the shores of Atlas Cove, a shallow semi-circular bay at the north-east end, sheltered by the lofty forbidding cliffs of Cape Laurens. The rest of the island, except its extreme south-east, was an unknown waste of snow and ice, shunned even by penguins and elephant seals. Several beaches were known to exist, but these were mostly backed by rocky precipices and heavily crevassed glaciers. The landing party saw no trees or vegetation except coarse tussock grass on the flat areas, some mosses, lichens and a poor variety of Kerguelen cabbage. The landing operations at Heard Island were far from simple, as all who were with Stuart Campbell's party testified. Fierce squalls swept down from Big Ben, the central mountain, and the wind frequently changed direction 180 degrees in six hours. Lt.-Commander Dixon had been warned of the treacherous nature of the anchorage by Captain Davis, and was prepared for the worst.

During one of the few calm days the Walrus amphibious aircraft made a trial flight, photomapping the island. It was then ascertained that the peak of Big Ben, occupying the centre of the island, approached a height of 10,000 feet rather than 7,000 feet, as previously estimated by H.M.S. *Challenger* in 1874. The air crew reported that the mountain appeared to be an active volcano, for they saw a thin spiral of smoke creeping up from the central cone, a thousand feet higher than the white dome of the mountain. Unfortunately, a few days later a violent storm tore the aircraft from her moorings and wrecked her. In spite of all difficulties the shore party settled in just after Christmas and the L.S.T. left on December 28, 1947. Campbell remained behind to assist and advise in the organisation of the camp, expecting to be picked up in April 1948 by the *Wyatt Earp* on her return from the Antarctic.

Meanwhile, shortages of materials and labour delayed the refit of the *Wyatt Earp* and it was not until December 26, 1947, that she finally left Hobart. Even to sail at that time it was

necessary to dispense with the sea trials normally carried out after a complete refit. Timbers were still dry after six weeks on the slip-way. The hull was leaking badly, but Commander Oom decided to set out in the hope that the planking would take up in due course.

Some improvement did occur and the leaks, though uncomfortable, were not serious, but five days out very heavy weather was encountered south of Tasmania in latitude 52 degs. The engineer reported that the wooden engine bed was settling down and throwing the tailshaft out of line with the stern gland. This was a serious defect and could only be rectified in dry dock, so Commander Oom reluctantly returned to Melbourne. When the *Wyatt Earp* had been re-docked and pronounced seaworthy, the original programme had to be modified.

Meanwhile, Dixon, on board L.S.T. 3501 at Kerguelen, received radio news that the voyage of the *Wyatt Earp* had been delayed and might have to be postponed. The messages implied that the ship might still be able to do some work in the eastern sector, the season being too far advanced to enable her to get as far as Princess Elizabeth Land and Heard Island. Dixon headed the L.S.T. back to Heard Island from Kerguelen, and Campbell decided to return to Australia rather than risk being left on the island for the whole of the year.

It was decided the *Wyatt Earp* should go to Commonwealth Bay in King George V Land and endeavour to reoccupy the magnetic station established by the Australasian Antarctic Expedition in 1911 and then follow the coast as far as longitude 160 degs E. to look for a location suitable for the establishment of a permanent station. On February 8, 1948, she set out once again from Melbourne, this time with Campbell on board, bound for Cape Denison. As the ship was considerably smaller than most Antarctic vessels, the scientific complement was reduced to a minimum. The late departure discouraged anything more than a superficial scientific programme. Besides the leader of the expedition and the naval complement, there were only three scientists: Dr. Fritz Loewe, the meteorologist famous for his work in Greenland, P. G. Law, physicist from Melbourne University, in charge of cosmic ray apparatus, and E. J.

McCarthy, magnetician. Sq.-Ldr. Robin Gray was in charge of the Sikorsky Kingfisher seaplane.

Icebergs, the sentinels of the pack, were sighted on the morning of February 18, and the pack was reached the following day in latitude 65 degs 50 mins S., longitude 144 degs E. It soon became obvious that ice conditions off Commonwealth Bay, if not abnormal, were certainly different from those encountered by Mawson and Davis. This area had always been considered easily accessible at any time, but now the pack was twenty or thirty miles wide, consisting of heavy pressure floes, through which progress could only have been made with great difficulty and delay.

An attempt was made to reach the face, first of the Mertz and then of the Ninnis Glacier tongues, but a continuous screen of heavy pack blocked any approach to the coastline. This was extremely disappointing to Campbell. As there did not seem to be any prospect of reaching the coast at that point, he and Oom decided to move eastwards to longitude 160 degs E., the boundary of the Australian Antarctic Territory, in an endeavour to reach the coast wherever possible. They hoped to visit the Balleny Islands and return to the Commonwealth Bay area in case conditions should have changed in the interval. On February 27, the *Wyatt Earp* passed the Australian boundary into the waters of the Ross Dependency, set course for the Balleny Islands, and arrived the following day. An examination of the topographical features confirmed reports that there were no signs of recent volcanic activity. The party found it hard to credit Balleny's account, probably referring to Young Island, of an active volcano, heavily glaciated, 12,000 feet high, with smoke emerging from its peak. There was merely a plateau rising to between 3,000 feet or 4,000 feet above sea-level.

There were very few beaches upon which a landing could be made and, owing to bad weather and the increasing hours of darkness, there was little opportunity of sending a boat ashore. The only attempt to land was made on the north-east end of Borradaile Island, where Campbell managed to secure some rock specimens, probably the first ever obtained. Unfortunately, owing to a heavy swell, the whaler which put the party ashore showed signs of swamping and the whole operation consisted of

a rapid scramble up the beach and an equally rapid departure. At one stage it was touch or go whether members of the landing party would be able to get back to the ship without being fished out of the freezing water.

From the bridge of the *Wyatt Earp* a running survey was made of Young, Buckle, Borradaile, Sabrina and Row Islands and soundings taken. Sturge Island was found to be surrounded by fifteen miles of pack-ice and was therefore not included. Generally speaking, the coastline consisted of heavily crevassed glacier faces or precipitous cliffs, topped with a snow crust.

On March 6 the Balleny Islands were left astern and a westerly course set for Cape Denison. This vicinity was reached five days later but the pack was still so thick that the nearest approach to land was about thirty miles. Commander Oom repeated his tactics, working eastwards along the edge of the ice towards the Mertz Glacier, but he could make no headway south. The season was drawing to a close, with eight hours of darkness each night, and it was becoming too risky to attempt penetration unless canals opened up, which unfortunately did not occur.

The weather had been against flying operations, but on March 13 the aircraft was launched in calm water, the cloud-base being 1,500 feet. The task was to reconnoitre the position, take photographs and advise the ship of any ice-free lane through which she could forge ahead. After zooming low above the surrounding bergs, Sq.-Ldr. Gray reported an impenetrable mass of bergs and pack for at least forty miles farther south. Next day, Campbell and Oom decided that, in view of the lateness of the season and the uniformly heavy ice conditions, there was little to be gained by remaining there longer. The attempt to reach the coast was abandoned and the ship returned to Australia via Macquarie Island, where L.S.T. 3501 was setting the second scientific party ashore.

The L.S.T., slightly holed at Heard Island, had docked for repairs on her return to Melbourne. By the end of February she was ready again and departed from Hobart on March 3 with the personnel and 400 tons of stores required to set up the Macquarie Island weather station.

Experience at Heard Island had shown the hazards associated with working ordinary landing-craft in these waters, and this time the ship carried two D.U.K.W.s, amphibious vehicles, lent by the Australian Army. If, as frequently happened, the wind suddenly changed or the swell increased, these craft could be worked until the last minute and then sent ashore to remain there until the weather improved. Under Captain L. Stooke, these amphibious vehicles proved ideal for the job and were able to take their three-ton loads ashore through the outlying kelp and rocks, even when a three-feet swell was running.

On the whole, the Macquarie landing proved less difficult than that on Heard Island. Nevertheless, there was only one good landing beach, at Buckles Bay. Rocky and dangerous and subject to violent squalls, the bay is studded with outlying rocks, fringed with thick kelp, which hinders the passage of landing-craft, fouling unprotected propellers. Even the vehicles with propellers recessed into the hull had two hundredweight of kelp hacked away from the drive shaft every time they beached.

On March 20, 1948, the *Wyatt Earp* arrived at Macquarie Island on her way back and Campbell spent a few days ashore discussing camp matters with the officer in charge of the party, Alan R. Martin, senior meteorologist. Two days later the last load of stores went ashore, the whole job being completed in fourteen days, five of which were rendered unsuitable for working by the weather.

Reports on the progress on the scientific work carried out at Heard and Macquarie Islands were available later in the year, as each week's results were radioed back to expedition headquarters in Melbourne. Weather reports, cosmic ray counts and ionospheric reports came in regularly and were recorded and analysed.

In July 1948 the diesel engineer with the Macquarie Island party, Charles A. Scoble, was accidentally drowned and he was replaced by T. F. Keating, who was flown out to the island on August 4 by an R.A.A.F. Catalina.

At Heard Island a first-class weather station was established and daily synoptic reports transmitted. The usual weather observations were supplemented by daily radiosonde flights to the stratosphere, together with pilot balloon flights.

Automatic recording units for cosmic ray reception were installed, using a geiger counter battery and an ionisation chamber and also apparatus for recording extensive showers. In the field a complete survey of the island was made by Bob Dovers, surveyor, whose father had been with Wild's party in the Western Sector of the Australian Dependency. Dovers was assisted by George Compton, assistant surveyor and Jim Lambeth, geologist. These three overcame enormous difficulties to penetrate the unknown region in the island's interior.

At Macquarie Island the meteorology and cosmic ray programme was set in hand. Gersholm Major, a radio physicist, worked with complicated equipment to measure vertical heights in the ionosphere from variable frequency pulse transmissions, recording the atmospheric noise and monitoring standard continuous wave transmissions. This is an important study in the methods of long-distance communication. Jack Ivanac, geologist, accompanied the L.S.T. to Macquarie Island and carried out some detailed geological mapping during the period of the landing. Preliminary work was begun for a detailed study of elephant seals and southern fur seals, which will probably take several years to complete, and the geophysical station established in 1911 was reoccupied and the magnetic elements redetermined.

After the 1947–8 cruise it was decided that the *Wyatt Earp's* small size and extremely low speed made her entirely unsuitable for any long-range reconnaissance, and further exploration work on the Antarctic coast was suspended pending the acquisition of a more suitable vessel.

CHAPTER XXIV

The Nations Quarrel

A TERRITORIAL dispute between Britain, Argentine and Chile over the ownership of lands south of South America assumed international importance in the latter half of 1948. For a time it seemed the dispute might develop into 'an incident', for all three nations sent warships to the contested areas. Britain based her claim on occupation and priority of discovery; Argentina, who has long cast eyes on the Falkland Islands, based her claim on geographical proximity, and this, too, could be the only reason for any Chilean claims. The Chileans claimed that Graham Land was merely an extension of their long continental coastline, and they even formally 'annexed' the territory. The dispute has its amusing side, for Graham Land became known as Palmerland to Americans, who also claimed the discovery; it was called Tierra de O'Higgins by the Chileans, and no doubt the Argentinians, too, had their own name for the peninsula. In some sections each national claim overlapped the other. Officially the United States continued not to make or recognise territorial claims in Antarctica. However, apart from a courteous exchange of diplomatic notes, genial hospitality continued to mark the shipboard scenes when parties of different nationalities met at the isolated weather outposts, and the whole affair was blown into oblivion like the fierce blizzards of the region. Russian whaling ships also operated in the south in this season. Argentina set up post offices at Deception Island and Melchior Island, and new names were put on their maps. But the affair did have the effect of stimulating scientific and popular interest in the southern continent, a safety-valve, perhaps, for an unsettled and restless, adventure-craving post-war world.

In August 1948 the United States made proposal to seven governments claiming Antarctic territory. It was suggested that

conflicting claims to ownership could be settled by the establishment of a limited form of international control. New Zealand and Britain expressed willingness to discuss this control, but most of the governments, including Australia, did not return equally favourable replies.

In January 1949 the British Foreign Office announced an agreement with Argentine and Chile whereby each nation would keep its warships out of Antarctic seas south of latitude 60 degs, apart from routine movements which had become customary there.

Extraordinary progress was made by the British sledge parties in Graham Land. In fact the Colonial Office has a small-scale laboratory and training centre well established. The country there offers ideal field conditions for the development of Polar equipment, and there is no doubt that Britain is well ahead of other nations in this side of Antarctic research. British Polar tents are the finest, being light, strong, and easy to erect, and what is more they stand up to the 120-m.p.h. blizzards of the Antarctic. These tents have been tested on the annual 900-mile treks which have been made recently from Marguerite Bay to the other Graham Land bases. The leader of the American expedition, Commander Finne Ronne, preferred them to the American field equipment, which was considered out-dated.

Generations of explorers have been raised on pemmican, an uninteresting and monotonous sledging ration. To-day these are made in the laboratories from melted fat and powdered lean meat; sometimes there is a flavouring of beef and mutton. Things are being done to-day which would probably make the old hands roll over in their coffins if they knew what was going on!

Finne Ronne's expedition arrived at Marguerite Bay on March 12, 1947, establishing its base at Stonington Island in the shacks erected by the leader when he was there with an American expedition in 1940–1. Meanwhile, an eleven-man group of British surveyors under Major K. S. Pierce-Butler, had landed at Neny Fjord on the same island. The two leaders got together and drew up a plan of joint scientific work, co-

operating on the manning of outlying weather stations and the ground control parties.

In September of that year a British plane crashed in the frozen wastes of the peninsula, and after a widespread nine-day search, three marooned men were rescued by a Ronne expedition plane. A month later Ronne began a series of trimetrogon photomapping flights. This method of interpretation and translation of air photos into maps was developed during the war. It is no different from the triangulation technique of ground surveying but there is a thousand-fold increase in speed. Details are revealed which would not be grasped by the naked eye.

With the aid of ground control parties and stations on the trail ahead, Ronne delineated the whole of the Graham Land peninsula and the adjoining regions between latitudes 65 and 80 degs S., and 40 and 73 degs W. The leader claimed to have mapped an area of 460,000 square miles, including the last remaining unknown coast-line in the region. On the return of the expedition it was claimed that they had evidence that Antarctica was definitely a single continent, and not divided by a depression between the Weddell and Ross Seas. Finne named the new land he discovered after his wife, Edith, who was an energetic and valuable member of the party, and incidentally the first woman to set foot on the Antarctic Continent.

Finne's main work included a sledge journey up King George VI Sound, accompanied by the exploratory flights over Alexander I Land. They flew down the eastern shore of Graham Land and to the ice-shelf of the Weddell Sea, the latter showing the coastline to trend south-west in latitude 76 degs. They followed the shelf-ice almost to its junction with the Luitpold Coast, and the most southerly point reached was 79 degs.

Stuart Campbell, leader of the A.N.A.R.E., who had been seconded to Antarctic operations for twelve months, returned to his high post in the Commonwealth Civil Aviation Department. He was succeeded by Mr. P. G. Law, a Melbourne scientist and skier of note, who had been on the *Wyatt Earp* cruise.

While Australasian operations in Antarctica were limited in the 1949–50 summer to the relief of the scientific parties at

Heard and Macquarie Islands, intense interest in the Southern continent was being displayed by other nations. To make an extensive scientific examination of the ice-free 'oases' of Queen Maud Land to the west of the Australian Antarctic Territory was one of the aims of an international expedition.

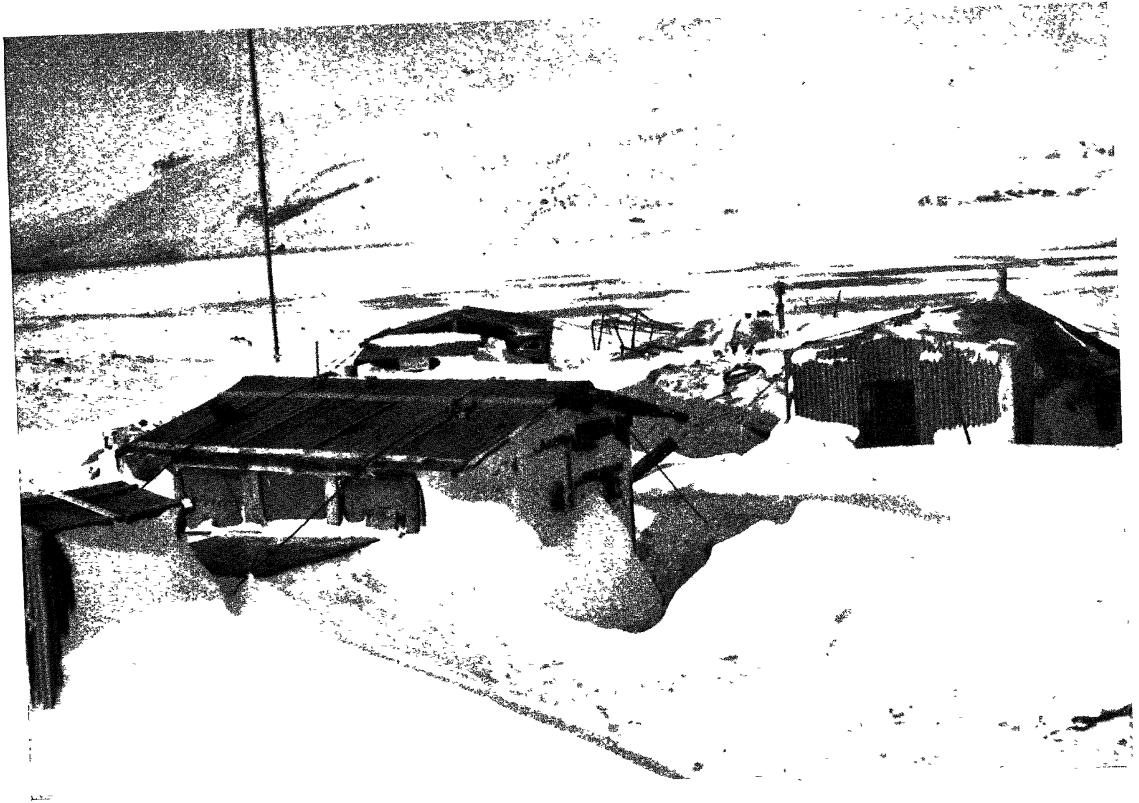
This Norwegian-British-Swedish Expedition of fourteen scientists left London in November 1949, on the 700-ton expedition ship, the Norwegian sealer *Norsel*, completed in record time. They were to spend two years on the Polar ice-cap. The *Norsel* carried two aircraft, tracked snowmobiles and 1,900 cubic feet of other equipment. Sixty dogs, three weasels and much heavy gear were carried south on a whaling factory ship.

The expedition geologists were expected to have exceptional opportunities for attacking the general problems of Antarctic geology. The air photographs taken on the German *Schwabenland* Expedition of 1939 were studied. The geologists expected to find unstratified rocks to the east of the ice-free region and relatively undeformed sediments to the west, possibly related to the beacon Sandstone cliffs of the Queen Maud Range at the head of the Ross Barrier. The unstratified rocks might be a 'shield' area or the core of the continent. The expedition geologists hoped to be the first people to reach overland the huge, warm ice-free oasis, discovered by air photographers, hidden behind the towering snow-covered mountains.

One of the main jobs was to investigate the theory that the Antarctic is getting gradually warmer, causing profound changes in the climate throughout the Southern Hemisphere, including Australia. An Australian scientist with the party was twenty-eight-year-old Gordon De Robin a physicist, who had already done a tour of duty in Graham Land with the Falkland Islands Dependencies' Survey and was a lecturer in physics at Birmingham University. He was in charge of the expedition's £50,000 worth of electrical and radio equipment, including a newly invented device for measuring the speed of wind at high altitudes.

As Britain obtained the information on the German expedition, it was passed to Norway, which owns Queen Maud Land, and the British, Norwegian and Swedish Governments planned a joint expedition to investigate the Antarctic climate, and, if

Heard Island
the camp, 1948
Australian Official photograph)



Heard Island; an aerial view of Big Ben Peak
(Australian Official photograph)

possible, to reach the oasis by land. The expedition planes were to reconnoitre a safe passage for the ship through the pack-ice and survey base-camp sites and the route for the 400-mile sledge journey to the mountains to which no explorer had so far penetrated.

The ice-free land is likely to be void of vegetation, dreary and more like a No-man's Land. So far as Australia is concerned the immediate practical value of the expedition would be from a network of circum-polar weather stations working in co-operation with the Heard and Macquarie Island posts. This would make for safer sea and air communication over part of the Southern Hemisphere, and one natural benefit of improved long-range weather forecasting would be to agriculture and whaling.

Precise astronomical observations were planned at the Queen Maud Land base. The surveys on the summer journeys, supplemented by air photography, would greatly extend knowledge of the topography of Queen Maud Land and its mountains, hitherto seen only from the air. The glaciological programme was comprehensive. If the base-camp could be sighted where the inland ice rests on rock, a deep bore-hole would be driven through a section of the glacier ice and a crystallographic analysis made. Temperatures at varying depths in the ice-hole would be recorded throughout the stay. The ice-movement would be studied by repeated measurements of marker stakes and precise astro observations might reveal a change in the position of the base itself. The depth of the Polar ice-cap would be measured by seismic sounding; secrets of the underlying rock surface from the high Polar plateau to the sea would be gleaned by repeated seismic soundings on summer journeys.

Glacial moraines and other phenomena in the ice-free mountains of the interior were the scientists' chief object of interest, and later there should be a valuable comparison between the photographs now to be taken and those obtained from the air by the German expedition. The glaciological regime at base would be studied in collaboration with the meteorologists and micro-photographs made of solid precipitation and drifting snow. Standard meteorological records were to be maintained at the base and upper air observations made with radiosonde

balloons and Rawin, the radio equipment for following the track of balloons in all weathers.

Despite heavy weather, the sealer *Norsel* reached Cape Town by December 21, 1949. With Mr. J. A. King of the South African Weather Bureau and Mr. P. G. Law, new Chief Scientist of the Australian National Antarctic Expedition on board as official observers, the *Norsel* set sail again on December 28. To save space and to facilitate air operations, one of the two Auster aircraft equipped with skis or floats was uncrated and fully erected on deck before leaving Cape Town. High seas and strong head winds were encountered on the voyage south to meet the whaling factory ship, but all went well. The transfer of five men, forty-four fine dogs and much heavy equipment, including amphibious vehicles, was carried out without mishap, despite a heavy swell, at the ice-edge in the area of the South Sandwich Islands. Two whales were used as fenders between the ships which met on January 13, 1950. The *Norsel* then set course due south for the coast of Crown Princess Martha Land. A week later, in 4 degs 30 mins W., land was seen about 120 miles away, but the ice was thoroughly rotten and so dense that it was decided to work eastwards. By January 26 the *Norsel's* position was 69 degs 4 mins S., 4 degs 20 min E., she was drifting in compact ice at about a half to one and a half knots towards the Greenwich meridian. Away to the south, the ice barrier and the mountains could be seen; but the ice continued to be tightly packed and very still. Soon the movement of the ship became so slow that it was decided to make for open water and make air reconnaissance. On February 1 Sq.-Ldr. Walford, in command of the R.A.F. unit with the expedition, flew 350 miles along the ice-edge from 0 degs 6 mins W. to 12 degs W., where it turned northwards. The *Norsel* then steamed westwards, and further air reconnaissances, which were saving much time and oil, were made in the hope of finding a way through the pack.

A flight on February 2 showed open ice to the south, and the *Norsel* arrived at the barrier near Cape Norvegia the following day. Landing was impossible at this point. The outstanding service done by air reconnaissance was to find a natural quay-

side—the only place in hundreds of miles of ice-cliffs—where the *Norsel* could unload and expect to get the vehicles inland. But after several days of waiting for conditions to improve, another flight discovered a landing place in a bay at about 71 degs 6 mins S., 11 degs W., some forty miles north-east of Cape Norvegia. A glacier, whose ice-cliff was eight feet high, terminated in this bay, rising gently to about 200 feet and more slowly thereafter for many miles to the south, its surface even and with no sign of crevasses.

The report by Sq.-Ldr. Walford says: 'This part of Princess Martha Coast (69 degs S., 11 degs W.) was perhaps typical of the Queen Maud Land sector of the Antarctic. The barrier is afloat but one or two undulations in the otherwise flat surface, such as Cape Norvegia, suggest that at these points the ice may be resting on land.

'Seen from the air, the base lay 2½ miles inland from the small bay where the *Norsel* unloaded. To east and west along the coast could be seen the irregular line of the 100-foot ice-cliffs with the *Norsel* lying alongside the only place where the shelf came to within a few feet of the sea and this it did only for 80 yards.'

The winter camp was set up two miles from the edge of the ice, all stores and equipment being moved up very rapidly on the tracked snow-vehicles. The two larger timber huts were then erected.

On February 16 the whereabouts of the nearest mountains was established. After thirty minutes' flight to the west, Sq.-Ldr. Walford and Sgt. P. D. Weston detected, away to the south-west, a small dark patch on the horizon. They flew towards this outcrop of rugged peaks for an hour and from about five miles distant took photographs while Sgt. Weston prepared a masterly sketch. It was not possible to establish there and then how much of these peaks had been plotted by the Germans from a flight 130 miles away in 1939. A subsequent sortie yielded further details and photographs.

Flying in the low temperatures and poor weather was difficult. Taking off from the water in search of a quay, Flt.-Lt. Tudor was disconcerted to find that the spray immediately froze on the floats. Later, on the ice, the pilots found that the

skis invariably became frozen to the ground and could be released only by rocking the aeroplane. To dare to stop for a minute while taxi-ing was to take root on the spot. The aircraft, pegged down to the ice during several blizzards, had generally to be de-iced with a broom before take-off. Not until the end did the officers discover that the secret of handling nuts and split-pins with bare hands was to smother the hands in grease.

The *Norsel* set sail on February 20, her mission successfully accomplished. The outstanding feature was the success of the air operations, assisted by good luck with the weather. Forty-five hours of flying were completed and the expedition's successful landing and the establishment of the first winter base on this unexplored region of Antarctica was mainly due to the unceasing efforts of the air unit.

Future plans in the Australian sector provide for a systematic reconnaissance to be carried out over a number of years. In 1948 the *Wyatt Earp* was too slow and too small. The expedition organisers have been unsuccessful in procuring an alternative ship. Meanwhile other nations have taken the lead in exploring the unknown areas south of Australia. France and the U.S.A. have both had expeditions operating in the region of our immediate interest.

Cape Freshfield has been suggested by Mawson as a possible site for the main base of our continental expedition. The Antarctic Executive Planning Committee, which includes experts and Antarctic veterans, has a long-range programme of work, extending over several years. Much of the work planned is of a geophysical nature, which if sufficiently extended in duration would be of great practical benefit to Australia and New Zealand. Other sites contemplated to form links in the chain of circum-polar weather stations are at Cape Wild, Cape Bage in King George V Land and at Haswell Island, off Queen Mary Land, about 1,200 miles west of Cape Freshfield. In future years another weather station may be set up at the far western side of the Australian territory in Princess Elizabeth Land or MacRobertson Land. These bases could be used by our expeditions as jump-off points for the exploration of this

vast unknown area of Antarctica. Adjacent to the western regions of the Australian territory there are great mountain ranges that may be expected to extend back into the Australian territory. This area of the vast continent has never been explored. Little is known about these areas geologically and future expeditions may examine their mineral resources.

The year 1950 was notable for the fact that it saw Australia emerging once more as a whaling country. The Australian Government's whaling station at Carnarvon, Western Australia, was to start operating on June 15, the opening of the whaling season. The target set for the first year was 600 whales. Heavy equipment, including five whale digestors, each weighing 29 tons, came from Norway. Whale-catchers were brought from South Georgia, near the Falkland Islands. Experienced Norwegian crews for the catchers were at Carnarvon and would help to build the whaling factory until the season opened.

At Point Cloates by the end of September 1950, 177 humpback whales had been taken. Shortage of labour and materials held up the rehabilitation of the old shore station and facilities were only available for treating three whales a day.

H.M.A.S. *Labuan* left Melbourne for Heard Island with thirteen members of the Australian Antarctic Expedition, the third party for the weather station. Some of the party, led by Harry Thornton, an accomplished skier, hoped to climb Big Ben, the island's unconquered peak. Each succeeding party on the island has tackled the mountain but has been forced back by driving snow and zero visibility at 4,000 feet. Observers in the *Labuan* saw Big Ben's central cone split and emit a fierce glow during the relief landing operations in February 1950. Big Ben is the second known active volcano in the Antarctic.

Ten Australian born huskies made their first trip to the Antarctic with the expedition, the offspring of huskies left in the care of the Melbourne Zoo by the French Expedition to Adelie Land. Two old French dogs, experienced in Antarctic sledge work, are now at Heard Island.

The governments of Australia, New Zealand and Ceylon contributed handsomely towards the cost of recommissioning the *Discovery II*, 1,036 tons, for deep-sea research in the Southern Ocean and the Antarctic. During an eighteen months' cruise

the *Discovery* sailed 40,000 miles. She left London for the Southern Ocean in April 1950, to complete the oceanographic survey begun with her sister ship, the *William Scoresby*, before the war. She studied in the little-known central Indian Ocean, in Australasian waters, and southwards to the edge of the pack-ice. She took soundings and studied currents and sea densities, the habits of whales and marine life from the surface to a depth of 5,000 feet.

I was fortunate enough to be aboard when she probed the region south of Heard Island in 1951, and nosed her way to the edge of the Shackleton ice-shelf in the area of the mysterious oasis, which had been visited a few years earlier by Admiral Byrd's fliers.

The experience of present-day exploration leaves no doubt about many points, the chief being that expeditions must be equipped with all the latest technical aids of modern science, whether it be float-fitted helicopters, pneumatic drills for punching through the ice or simple but durable tin-openers. To-day, in a tracked vehicle, it is possible to travel enormous distances over certain types of Antarctic terrain. The success of using this equipment depends entirely on organisation, at expedition headquarters, at the Antarctic base and with the field party in the wilds.

These pages have told the story of the work done by Australasians in their own expeditions and in service with other expeditions; it is a great achievement for a young country to have produced so many pioneers. Our scientists are ever ready to learn from all who can teach them anything new. There is no room in Antarctic exploration for men with fixed minds and ideas. Such men might and have brought well-nigh disastrous consequences. Exploration is essentially an unpredictable and hazardous business, calling for quick minds, adaptability and improvisation, qualities inherent in most Australians. An expedition, like any service manœuvre, never runs to plan; the best-laid plans can only go so far and after that it is the men, improvisation and a host of little things that count.

Now comes the inevitable question: 'What is the use of this great ice-covered continent?' The answer is rather disappoint-

ing. Except for scientific research and its value to weather stations, there is nothing to be gained in Antarctica which cannot be more easily acquired in other parts of the world. True, vast coal deposits have been found there. Griffith Taylor himself estimated that the continent contains the greatest coal deposits in the world. Mawson has found traces of common minerals, but as long as there are 2,000 miles of storm-tossed ice-strewn seas between Antarctica and Australia, of what use can any mineral or economic wealth be?

So long as there is any part of the continent still undiscovered, there will be men who want to go there. Antarctica, sinister and beautiful, has little natural wealth, and that wealth is in the sea, in the huge long whales. The continent is the field for the adventurer and sportsmen. Its real secret lies hidden in the wind and rocks, for the more we can learn of its strange geological history, the more we will know of the history of the globe in which we live. The search in Antarctica will go on as long as man is on the earth, until every glacier, every mountain and every valley has been mapped and plotted.

Some speculate and say there is great wealth under the ice-cap; they say the world is running short of oil, uranium, and many of its natural resources. So be it. Anyone's guess is as good as the next man's in this respect, but we must not forget that man is very adept at substitutes; margarine for butter; artificial rubber for the natural product; atebrin for quinine; whenever the stress of circumstances is sufficiently strong, a substitute has been found. Possibly one day this great land might be used as a store-house for surplus crops, sanatoria might be built in the germ-free air to ease the lot of chest-ill sufferers, and the wealthier might like to go there for their winter sports.

These are speculations of the future, and all those associated with the exploration of Antarctica hope it will be a peaceful one. But already the dark shadow of international rivalry is thrown across the sleeping continent. The very strategic control of the area south of South America is the focus point. The Russians have shown interest in a large section directly below Cape Horn. Any nation established there would be able to control the passage round the Cape if the Panama Canal was

damaged; this link between the Pacific and Atlantic oceans would be vital to the United States, and indirectly to Australia.

It is more than fifty years since Bull blazed this southern trail. In closing with the final paragraph from his narrative I can reciprocate the sentiments which it expresses: 'I do not know whether it will ever be my lot to revisit Antarctica, but the years spent in realising my dream of an Antarctic expedition will ever remain among the most pleasant, certainly the most interesting part of my life, disappointments and tribulations notwithstanding.'

APPENDIX A

Antarctic Chronology

1487	Diaz rounded South Africa
1502	Portuguese expedition probably saw South Georgia
1520	Magellan rounded Cape Horn
1615	Schouten and Lemaire rounded Terra del Fuego
1675	British expedition under Antonio de la Roche probably saw South Georgia
1721	Jacob Roggeveen of Dutch East India Company reported at 64 degs 58 mins S.
1739	Bouvet discovered Bouvet Island
1756	Spanish expedition sailed round South Georgia
1771	Kerguelen discovered South France, now Kerguelen Island
	Marion-Dufresne discovered Prince Edward and Crozet Islands
1772–4	Cook crossed the Antarctic Circle and circumnavigated the world in high southern latitudes, discovering South Georgia and South Sandwich Islands
1810	British sealer Frederick Hasselbourgh discovered Macquarie Island
1819	Smith discovered the South Shetlands
1819–21	Bellingshausen circumnavigated the world in latitudes generally higher than those reached by Cook. Discovered Peter I Island and Alexander I Land
1820	Bransfield surveyed South Shetlands and N.W. Graham Land
	Palmer discovered Palmer Archipelago
1821–2	Powell discovered South Orkney Islands
1823	Weddell discovered Weddell Sea and reached 74 degs 15 mins S.
1830–2	Biscoe discovered Enderby Land, Biscoe Islands and Graham Land
1833	Kemp discovered Kemp Land
1838–40	D'Urville discovered Adelie Land
1838–9	Wilkes sighted Adelie Land and other coasts between Adelie Land and Enderby Land
1839	Balleny discovered Balleny Islands, 1,000 miles south of New Zealand
1839–43	Ross discovered Ross Sea, Ross Ice Barrier and South Victoria Land and reached 78 degs 10 mins S.
1850	Tapsell sailed from Balleny Islands east to 143 degs E. at a high latitude
1853	Captain J. J. Heard discovered Heard Island
1872–4	Nares sailed from 78 degs 30 mins E. to south of Australia at a high latitude
1892	Larsen landed south of 65 degs S.
1893–4	Larsen sighted Alexander Land

1894–5	Bull landed on mainland of Antarctic Continent in Ross Sea area, first to land on continent
1897	Gerlache reached 71 degs 30 mins S. near Graham Land
1898–9	Borchgrevink spent winter in South Victoria Land
1901–2	Drygalski discovered Kaiser Wilhelm II Land
1901–4	Scott reached 82 degs 17 mins S. in Ross Sea area
1902–4	Nordenskjold at Antarctic Circle in Weddell Sea area
	Bruce discovered Coats Land
1904	Charcot reached 67 degs S. near Graham Land
1907–9	Shackleton reached 88 degs 23 mins S. in Ross Sea area
	David reached South Magnetic Pole
1908–10	Charcot explored Graham Land–Alexander Land area
1910–12	Amundsen reached South Pole on December 15, 1911, first to attain that goal
1910–13	Scott reached South Pole on January 18, 1912, and perished on return journey
1910–12	Lieutenant Shirase, of Japan, visited Ross Sea area
1911–12	Filchner expedition to Weddell Sea, discovering Luitpold Land
1911–14	Mawson's expedition to Adelie Land; discovered King George V Land and Queen Mary Land
1914–17	Shackleton's unsuccessful Trans-Antarctic Expedition with parties at Weddell Sea and Ross Sea. Caird Coast discovered
1920–2	Cope's expedition to Graham Land
1921–2	Shackleton's expedition to the Weddell Sea during which he died
1928–30	Wilkins' flights over Graham Land. Discovered Hearst Land
	Byrd's expedition to Ross Sea area, including flight to the South Pole and discovery of Marie Byrd Land
1929–30 1930–1	Mawson's summer cruises between King George V Land and Enderby Land discovering MacRobertson Land
1933–4	Ellsworth's first Antarctic visit in Ross Sea area
1933–5	Byrd explored Marie Byrd Land
	Ellsworth visited Weddell Sea
1934–7	Rymill maps Graham Land for first time
1935–6	Ellsworth's third Antarctic expedition—flight from Weddell Sea to the Ross Sea area. Discovered James W. Ellsworth Land
1938–9	Ellsworth's fourth Antarctic expedition. Discovered 'American Highland'
1939	Ritscher claimed for Germany an area in the South African quadrant. Discovered ice-free region inland
1939–41	Byrd's third Antarctic expedition
1943–6	Marr's secret British All-Services Expedition to Graham Land
1946–7	Byrd's naval task force visits Antarctica
1946–8	Finne Ronne's expedition to Graham Land
	Pierce-Butler's expedition to Graham Land
1947	Garcia's Argentine Navy Expedition to Graham Land

1947	Campbell's Australian expedition to Heard Island
1948	Campbell visits Macquarie Island, Balleny Islands and coast of Adelie Land
1947–8	U.S. Navy expedition to Wilkes Land
1948	Chilean and Argentine naval visits to Graham Land area
1949	French expedition to Adelie Land
1950	Joint British-Norwegian-Swedish expedition to Queen Maud Land

APPENDIX B

Farthest South

			Latitude		*Longitude*	
Jan.	1773	COOK	67° 15′	S.	39° 35′	E.
Dec.	1773	COOK	67° 31′	S.	142° 54′	W.
Jan.	1774	COOK	71° 10′	S.	106° 54′	W.
Jan.	1820	BELLINGSHAUSEN	69° 25′	S.	1° 11′	W.
Jan.	1821	BELLINGSHAUSEN	69° 53′	S.	92° 19′	W.
Feb.	1823	WEDDELL	74° 15′	S.	34° 16′ 45″	W.
Jan.	1831	BISCOE	69° 03′	S.	10° 43′	E.
Feb.	1831	BISCOE	68° 24′	S.	31° 30′	E.
Dec.	1833	KEMP	66°	S.	60°	E.
Jan.	1839	BALLENY	69°	S.	172° 11′	E.
Jan.	1840	WILKES	67° 04′ 30″	S.	147° 20′	E.
Feb.	1842	ROSS	78° 9′ 30″	S.	161° 27′	W.
Feb.	1874	NARES	66° 40′	S.	78° 22′	E.
Dec.	1893	LARSEN	68° 10′	S.	59° 40′ (approx.)	W.
April	1898	DE GERLACHE	71° 36′	S.	87° 33′ 30″	W.
Feb.	1900	BORCHGREVINCK	78° 50′	S.	164° 45′	W.
	1902–3	DRYGALSKI (Winter Quarters of Gauss)	66° 02′	S.	89° 38′	E.
Nov.	1903	ROYDS	79° 32′	S.	176°	E.
Nov.	1903	SCOTT	77° 59′	S.	146° 33′	E.
Jan.	1909	SHACKLETON	88° 23′	S.	162°	E.
Jan.	1909	DAVID	72° 25′	S.	155° 16′	E.
Nov.	1911	PRESTRUD	80°	S.	158°	W.
Dec.	1911	AMUNDSEN	90°	S.		
Jan.	1912	SCOTT	90°	S.		
Jan.	1912	SHIRASE	80° 05′	S.	156° 37′	W.
Dec.	1912	BAGE	70° 36′ 30″	S.	148° 13′	E.
Nov.	1915	SHACKLETON (*Endurance* crushed)	69°	S.	51° 40′	W.
Feb.	1922	WILD	69° 17′	S.	17° 09′	E.
Dec.	1928	WILKINS (plane)	71° 20′	S.	64° 15′	W.
Nov.	1929	BYRD (plane)	90°	S.		
Feb.	1930	WILKINS	73°	S.	101°	W.
Jan.	1934	PETERSEN and JUNE (plane)	72° 30′	S.	116° 35′	W.
Jan.	1939	ELLSWORTH (plane)	72°	S.	79°	W.
Feb.	1947	BYRD (plane)	90°	S.		

APPENDIX C

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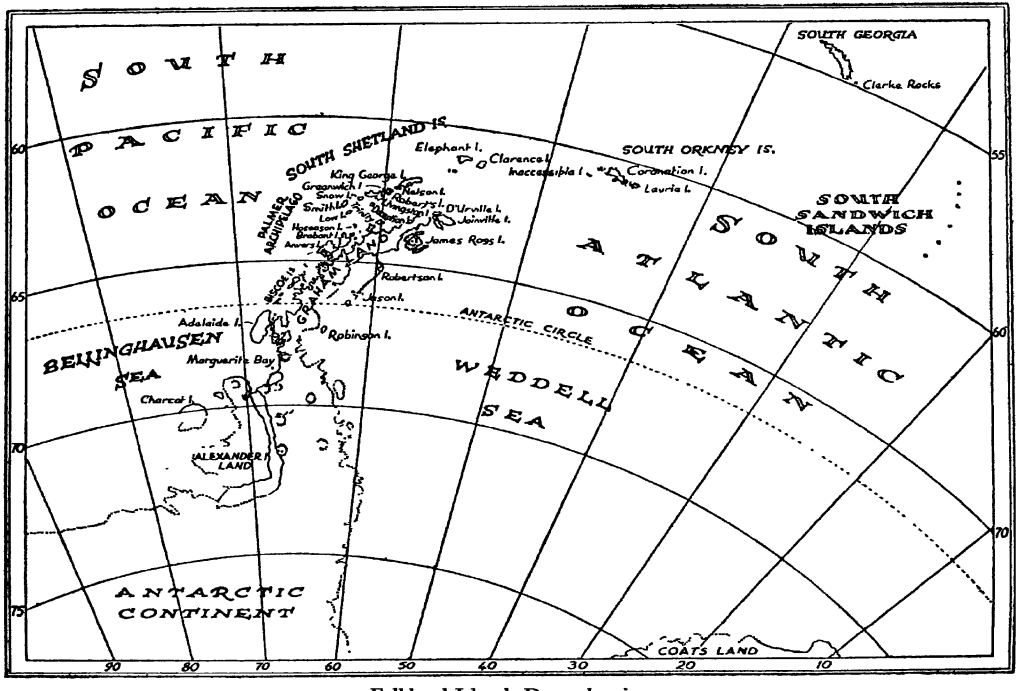

Falkland Islands Dependencies

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