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PRESIDENTIAL ADDRESS:

THE UNVEILING OF ANTARCTICA.

By Douglas Mawson, Kt., D.Sc., F.R.S.

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The Subject for Review.

The presidential address delivered by His Excellency Sir Hubert Murray at the last meeting of this Association dealt with the administration of the equatorial territory of the Commonwealth. On this occasion, I propose to divert your attention to the other extreme, to the stark solitude that sentinel the Pole, for thus far extends the jurisdiction of the Commonwealth of Australia and the Dominion of New Zealand.

One cannot yet discourse upon the administration of this vast polar land, after the manner of treatment accorded to Pagon by your late president, and for the political mind in regard to it, like the great country itself, is still frozen. Doubtless the glow of light shed, in ever increasing intensity, by science over South Polar lands and seas will, eventually, thaw out the cold scheme for wise and progressive development. The subject-matter of my address will be in the nature of a survey of the salient facts relating to Antarctica, followed by an indication of the future of those frozen fastnesses in the economy of mankind.

To begin with, I shall briefly outline and apprise the successive advance in exploration, which have led up to the almost complete unveiling of the great South Polar Land—Antarctica—the Seventh Continent. If Australia is accepted, as it is due, the sixth place. The principal recent historical works dealing with the earlier phases of Antarctic Exploration are those of Mill (1857) and Piccardi (1905), while biographies are the conclusion of this account. I have drawn consciously upon both these works. The map scheme employed by Mill to illustrate successive advances in Antarctic exploration is here adopted with certain modifications and expansions.

The historical summary to follow in this address is designed as the briefest possible statement capable of outlining the motives and the main progress in the evolution of geographic knowledge concerning the far south, with special reference to the continent itself. For greater detail, the works quoted may be consulted. Some new data and much comment are here published for the first time.

Outline of the Record of Discovery.

Speculation.

The theoretical and deductive speculation of the Greek philosophers postulated the existence of an extensive land mass terminating the earth to the south of the then-known world. This erroneous conclusion, as well as the good of Greek learning, was kept alive by the Arabs in the Middle Ages. Their legacy to Christendom on the awakening of intellectual expansion in the fifteenth century was, as far as our present purpose is concerned, the perpetuation of the fallacy of a great South Land in the maps of three centuries of notable geographic achievement. Even after the globular form of the earth was demonstrated and geographic knowledge vastly enriched by the remarkable activity of the fifteenth and sixteenth centuries, the belief in a great Southern Continent extending in places northward even into the tropics still persisted.

Thus it was that the great navigators of that awakening period, after the invention of the compass and great improvements effected in the art of navigation, all fared forth fully imbued with this mistaken conception and ready to hail any land discoveries in that quarter of the globe, however trifling, as fragments of the coastline of the great hypothetical Southern Continent.

The current ideas of those ages are well illustrated in the maps of Oronteus Finaeus (1531) and of Ortelius (1571). Through several centuries of active maritime expansion, the limits assigned to this Terra Australis incognita, as Ortelius charted it, were somewhat modified, but it remained for Captain James Cook to produce overwhelming evidence to the contrary; then only was the fallacy finally and irreversibly quashed.

Exploration.

In its earliest conception, principally based on the views of Ptolemy, this “great South Land” was conceived as stretching from Africa to the Indies, enclosing the Indian Ocean. It was the persevering efforts of Prince Henry of Portugal (died 1460), sustained over forty years of his life, to promote maritime exploration that first began to set limits to the hypothetical South Land. Speculation began to give way to exploration. The Navigator, as Prince Henry was called, sent forth a succession of well-found and manned ships which succeeded in outlining the west coast of Africa and led on to the subsequent voyage of Vasco da Gama (1497), which, by rounding Africa and initiating the sea route to India, clearly demonstrated the non-attachment of Africa with the fabulous South Land.

The Early Circumnavigators.

In the meantime the New World had been discovered, and Magellan (1520), sailing south along the west coast of South America, had discovered a passage, subsequently to bear his name, leading through to the Pacific Ocean. The land which he charted to the south of the Straits, and to which the name Tierra del Fuego has been attached, Magellan believed to be a portion of the coast of the great South Land. It fell to the lot of Sir Francis Drake first to demonstrate the insularity of Tierra del Fuego, and to disassociate it from any land that may have existed still further to the south. At that time (1578) Drake had just completed a passage to the Pacific Ocean through Magellan Straits when a great storm drove his ship to 57 degrees south latitude, the farthest
south recorded to that date. Working north again, they then fell in with the southern extremity of Tierra del Fuego, around which they reported "the Atlantic and the South Seas, meet in a most large and free scope."

The Lore of the Mythical South Land.

The conception of a great South Land which figured in one form or another in the charts of the sixteenth and seventeenth centuries proved to be a great stimulus to exploration. Many expeditions fared forth in search of it, and such land discoveries as they were fortunate enough to make in those south seas were hailed as portions of the great "South Land."

Juan Fernandez (1593), fell in with the island bearing his name and perhaps other islands as well. Mendana touched on the Solomon Islands in 1597; Quiros (1605) thought he had arrived at the long-sought coast when he touched on the island of Espiritu Santo, one of the New Hebrides group. These, and observations by sundry other navigators, were strung together by cartographers in an arbitrary fashion, and a great coast line appeared across the chart of the south Pacific, extending from south of Cape Horn to New Guinea.

Meanwhile, in the first half of the seventeenth century the Dutch had been busy operating from Java. Their vessels rapidly outlined the north and west coasts of what is now known as Australia, but which at that time, in accordance with current views, was regarded as part of the great South Land. It fell to the lot of the greatest navigator of the seventeenth century, the Hollander, Abel Tasman (1642) to completely isolate from the hypothetical continent what was charted as Nieuw Holland. His track on that famous voyage passed south of Australia. He touched on Tasmania and then discovered the west coast of New Zealand which he named Staten Land. He then bore away to the north-east without attempting to circumnavigate his Staten Land, assuming it to be part of the coast of the great "South Land."

The seventeenth century closed without effecting much more of real importance as bearing upon the Antarctic problem, though a fuller knowledge of the known southern regions was acquired. The Falkland Islands and South Georgia were definitely located on the map, though, according to some vague reports, they had been sighted in the sixteenth century.

In 1721 a Dutch expedition under Roggeveen, whilst rounding the Horn to enter the Pacific Ocean, met with tempestuous weather which drove them far to the south. One of the vessels reported thus having reached a record south latitude, 64° 55', without sighting land.

An event of great interest was the dispatch in 1738 of two ships equipped by the French Compagnie des Indes for the avowed object of exploring and charting the great Terra Australis of the cartographers. Having this definite object in view, the enterprise has been recorded as the first real Antarctic expedition. An able French navigator, a captain in the service of the East India Company, M. J.B.C. Bouvet de Lozier, was the organizer and commander of the expedition. A principal object of the enterprise, which set forth in two ships, the Aigle and Marie, was to establish a port of call and trading base on the prospective coast, somewhere south of Africa, for the use of their vessels plying to India. In foggy weather, the expedition fell in with a corner of the coast of what is now known as Bouvet Island (the location of the centre of the island is 54° 36' S., long. 4° 20' E.), but which they regarded as a cape (Cap de la Circumcision) on the coast of the South Land. Bouvet was disappointed in his further search for land, which carried him through about
48 degrees of longitude in the approximate latitude of 65° S. In its failure to achieve useful commercial results, the expedition was no doubt unsatisfactory to the French East India Company, but it did useful work in demonstrating that no land exists over a large part of the South Atlantic north of 65° S. latitude.

In the middle of the eighteenth century, both in France and in England, there was a revival of speculative interest in the existence of the great South Land, which eventually culminated in the despatch of Captain James Cook with a special commission to investigate the fascinating problem.

In the meantime, interest in the subject ran high amongst French savants and resulted in the despatch of two French expeditions of note in relation to Subantarctic geographical history. The first, which went forth in 1772 under command of M. Marion du Fresne, when bound for the Pacific Ocean via the Cape of Good Hope, had the good fortune to fall in with two small islands in the South Indian Ocean. These are known respectively as Marion Island and the Crozet Islands. The other expedition, under command of Chevalier Yves Joseph de Kerguelen-Trémarec, aimed at locating the coast of Terra Australis to the south of the mid-Indian Ocean. Up to a point the expedition was successful, for in February, 1773, they came upon what is now known as the Kerguelen Archipelago. This discovery was heralded by Kerguelen as forming part of the sought-for "Antarctic Continent," but on his return to France he found his compatriots sceptical. He was eventually thoroughly disillusioned when, on a second voyage the following year, he ascertained his "South France" to be merely an isolated archipelago of small islands.

About this time the British Admiralty instructed the captains of several of its vessels proceeding on voyages across the Pacific Ocean to look for land "which there was reason to believe might be found"—meaning the coast of the speculative Terra Australis. Thus instructed were Captains Byron, Wallis, and Carteret, respectively voyaging across the Southern Pacific. So also was Lieutenant James Cook when despatched in 1768 to circumnavigate the world in command of a scientific expedition with Otaheite, in the mid-South Pacific Ocean, as chief objective.

The Layings of the Spell.

Every citizen of these shores knows the story of that famous voyage of the Endeavour; how, after rounding South America, they proceeded across the South Pacific to Otaheite, where an astronomical programme was executed. Then the Endeavour sailed south on a voyage of discovery in the almost unknown region to the south and west, including a circumnavigation of New Zealand, and delineation of the east coast of New Holland.

Even in the matter of the Antarctic problem, Cook accomplished much on that, his first voyage of discovery, for he had shown New Zealand to be unconnected with the fabulous South Land and had shown only ocean to exist over a large area formerly appearing on charts as hypothetical land. Cook himself, in his log, under date of March, 1770, during the latter stages of his first voyage, writes as follows (3): "Thus far our navigation has certainly been unfavorable to the notion of a Southern Continent, for it has swept away at least three-fourths of the positions upon which it has been founded." He then elaborates "reasons for thinking that there is no continent; to the northward of 40° S. of what can be farther to the southward than 40° S. I can give no opinion."

* Already New Holland had been eliminated from the South Land by Tasman.
On his return to England, Cook was soon in the throes of preparation for a second and larger expedition with the special object of further investigating the extent of the fabled "Southern Continent," the existence of which was still insisted upon in some quarters. The expedition sailed in 1772 in two staunch vessels, the Adventure and the Resolution, chosen by Captain Cook as suitable for the big work ahead.

The task was to circumnavigate the globe in the farthest south latitude practicable. The execution of the work occupied three years. It resolved itself into a series of insurances into high latitudes, alternately with visits to the temperate and tropical regions as reliefs from the stress and hardship endured in the stormy frozen seas of the fifties and sixties. The undertaking was executed in a masterly fashion and set a highwater mark to exploratory achievement up to that time, in fact inaugurating a new era of exploration.

The 17th January, 1773, was a notable date in geographical history, for on that day, in about long. 39° E., the Antarctic Circle was first crossed by human beings. On that occasion they pushed on to 67° 15' S., before being held up by impenetrable pack-ice, which prevented their discovery of the Antarctic Continent which we now know by only 70 nautical miles ahead. During the two ensuing years the Circle was crossed on several occasions, the farthest south of the cruise and of the century being 71° 10' S. reached in 103° 54' W., achieved on 30th January, 1775. Finally in the southward extension of the Atlantic Ocean, just prior to turning north towards home, Cook fell in with and charted the island since known as South Georgia. He was not, however, the discoverer, for the vague records of early navigators suggest that it may have been sighted long before; and in any case the discovery and the naming of it as San Pedro by a Spanish trading vessel, the Leon, in 1755, is well authenticated. Cook then discovered the southern islands of the South Sandwich Group, which, however, he did not circumnavigate on account of impenetrable pack-ice then enveloping the land. He thought that the more southerly of the peaks he then sighted within the pack-ice might possibly be the northern limit of land which extended south beneath Antarctic ice and snow. He then proved Bouvet's discovery could be no more than a small island, though he failed to actually locate it.

Cook returned with a vast amount of data relating to the regions visited, and he had demonstrated the existence of continuous sea over a large part of the globe, certainly to the 60th degree of south latitude, where formerly land was conjectured.

During this voyage Cook became convinced, and rightly so, that the amazing number of icebergs met with in high southern latitudes was an indication of the existence of extensive land within the Antarctic Circle. Whilst finally heading towards home on that voyage, Cook writes as follows: "I had now made the circuit of the Southern Ocean in a high latitude, and traversed it in such a manner as to leave not the least room for the possibility of there being a continent, unless near the pole, and out of reach of navigation." He considered as one result of his labours "a final and put to the searching after a southern continent, which has, at times, engrossed the attention of some of the maritime powers, for near two centuries past, and been a favourite theory amongst the geographers of all ages."

* Cook and several succeeding navigators searched for but failed to locate Bouvet's island. This is explained by the fact that Bouvet gave the position as 6 deg. 13 min. too far to the east (see The Antarctic Pilot, Admiralty publication.)
Cook Concludes that a Large Land Mass Exists Within the Polar Ice.

A very important conclusion reached by Captain Cook and recorded in his published work is stated (4) as follows:—"There may be a continent or large tract of land near the pole, I will not deny. On the contrary, I am of opinion that there is; and it is probable that we have seen part of it. The excessive cold of the upper latitudes, the many floating islets of ice, all tend to prove that there must be land to the south; and for any persuasion that this southern land must lie, or extend, farther to the north than is opposite to the Southern Atlantic and Southern Oceans, I have already assigned some reasons, to which I may add the greater degree of cold experienced by us in these seas than the Southern Pacific Ocean, where the same parallels of latitude are met with.

Thus Cook’s contribution to the Antarctic problem, so far as concerns the distribution of land and sea, included firstly, the elimination of the great mythical South Land from the charts and the substitution of a vast ice ocean extending at least 60° S. latitude; secondly, a general indication of the northern limit of the Antarctic pack-ice; thirdly, a picture of such Antarctic lands as may exist from analogy with features of South Georgia and the South Sandwich Islands as reported by him; fourthly, his conclusion based upon the extent and distribution of isobars and pack-ice that a considerable land mass, if not a continent, must exist within the impenetrable ice-bound region; and finally, he produced evidence which led him to forecast that the mass of such Antarctic land would be found to the south of the Indian and Atlantic Oceans rather than in the Pacific sector. In all these conclusions subsequent exploration has proved Cook to be right.

This last of the great pioneer circumnavigators had thus placed on a precise basis knowledge concerning the vast southern region through which for so many years his ship’s bow had broken through the ice. Cook not only accurately deduced the broader nature of the inaccessible frigid region still further south. Cook’s work in the South Seas had been so thorough, and his description of the Antarctic land he had sighted so unattractive, that such exploratory efforts as the political situation in Europe would allow were, for several succeeding generations, devoted to the investigation of the little-known lands in the habitable areas of the globe.

The Early Sealers—American and British.

With the passing of Cook, the myth of a great habitable South Land with facilities for trade was gone, and a fresh incentive was required to draw men to the far southern seas. But a new lure soon arose, largely originating from Cook’s own reports of abundant seal life on the shores of the island of South Georgia, and of southern New Zealand. Thus it was not long before great activity was developed in the southern sealing grounds. The valuable Fur Seal was first virtually extinguished; then the seal-bearing creatures such as Sea-elephants and the Southern Right Whale were decimated. Consequently new localities were constantly being sought. In the American region the slaughter commenced around the coasts of Tierra del Fuego and the Falkland Islands, then spread to South Georgia, and finally, on their subsequent discovery, to the Antarctic island groups usually indicated on charts as the South Shetlands and the South Orkneys.

Concurrently operations of a similar nature were progressing in the Australian region. The close of the eighteenth and beginning of the nineteenth century was a period of great activity on the coasts of Australia, southern New Zealand, and in the Subantarctic islands to the south. Much of the industry in the young days of Sydney and Hobart was comprised in sealing and whaling enterprises (4). All the Subantarctic islands south of New Zealand were located after Cook’s time. The last to be charted were Macquarie Island and Campbell Island, discovered in 1821 by Lieutenant W. D. P. Hamilton, master of sealing brig "Austral." The sealing industry, operating from Sydney, New South Wales, ships went out from these ports coming the southern seas to the edge of the pack-ice. The rich harvest of fur-seals skins from these islands soon attracted the American sealers also to the Antarctic region.

As the years went by, the whalers and sealers directed their attention more and more to the remote islands of the South Indian Ocean, Marion Island, the Crozet Islands, and, chiefly of all, Kerguelen. So great was the competition in this commercial field that the sealers were forever on the lookout for new sealing grounds and, as a consequence, knowledge of the Antarctic regions benefited.

In those early sealing and whaling days, the New England States, America, sent forth annually to the southern seas a fleet manned by virile sailors who ramseaked the world for seal skins and blubber oils. Their chief hunting ground in the earlier period was the region south of America. It is vaguely reported (6) that these American sealers possibly knew of the South Shetland Islands before they were sighted by William Smith, who, in the brig "Waltham," in 1810, on a trading voyage between Montevideo and Valparaiso, sighted land of that archipelago. In the same year he returned, and making a landing on the north-eastern extremity of King George Island, he raised the Union Jack. Later Edward Bransfield, R.N., was despatched to follow up this discovery and to chart the region. In 1819, Bransfield, with the assistance of Admiral Phillip Brown, strengthened the British title. Bransfield named the South Shetlands on 16th January, 1820, and continued surveying operations thereabouts until 21st March. During that time he explored and named South Shetland Island, the Deception Island, the Elephant Island, and "Dee" Island. Bransfield’s chart, though unpublished, is still extant, and clearly demonstrates priority in sighting the large island designated Graham Land on the Admiralty charts. On some of the old charts the name Dirk Gerritz Archipelago is attached to the South Shetland Islands. The claim is based on a report and quite inadequately-authenticated report relating to one Dirk Gerritz, captain of a Dutch vessel, one of a squadron of five ships which had cleared Magellan Straits going west in the year 1590. Reports states that the warm and favourable climate in the south of the South Shetlands did not persuade the adventurers to remain there, as they had intended.
portion of the large island recorded as Graham Land on the Admiralty charts. This landfall has appeared on the charts as Palmer Land. On some charts this name has been applied to the whole island mass, which, however, was first sighted the preceding year by Bransfield, as already detailed. Fanning records (8) that Palmer proceeded south in a stout vessel the following season (1821-22) until he met fast ice firmly attached to the shore of "Palmer's Land," and then traced the coast eastward. "In this way he coasted along this continent upwards of fifteen degrees, viz., from 64° and odd, down below the 49th of west longitude." On investigation, it transpires that what Palmer probably did follow was, in the main, the pack edge extending from "Palmer's Land," the land lying south of the South Shetlands, out into the Weddel Sea to the 49th degree west longitude. Fanning's use of the term "continent" in this connection illustrates the little significance that can be attached to the use of the term in accounts of some of the earlier explorations.

Captain George Powell, in the sloop Dora, discovered and charted the South Orkney Islands in 1821. In some of the earlier charts they appear as "The Powell Islands."

Von Bellinghausen's Fine Achievement.

In the midst of this period of sealing enterprise there enters the field of South Polar exploration a very important Russian expedition of two ships under the command of Captain Fabian Gottlieb von Bellinghausen. The expedition was despatched in the vessels Vostock and Mirny in 1819 by Emperor Alexander I., to make a circumnavigation in high southern latitudes. A period of three years was occupied in the task, which was executed with highly successful results. On their outward voyage, after reaching South Georgia, the expedition sailed east about the South Polar regions. The South Sandwich landfall of Cook was mapped and shown to be merely a chain of small islands, to which von Bellinghausen added three new ones at the northern end of the group.

Von Bellinghausen's voyage continued in high southern latitudes, closely in touch with the pack-ice around the entire Antarctic regions. At two points the Russians actually came very close to sighting the ice coast of the Continent, having penetrated to within about 15 miles of the approximate coastline of Princess Martha Land and 30 miles of the approximate coast of Princess Ragnhild Land as recently laid down by the Norwegians. He discovered Peter I. Island and Alexander I. Land, both islands lying within the Antarctic Circle to the south of the eastern Pacific. In 1821 the Russians dramatically appeared amongst the American sealers in the South Shetlands, which had been discovered and charted subsequent to von Bellinghausen's departure south, and whose existence therefore was unknown to him until his own ships arrived on the spot.

Von Bellinghausen's effort was, like Cook's, a great achievement. He circumnavigated the Antarctic in a considerably higher average latitude than had his predecessor. In this, however, he had the advantage of greatly-improved technique both in the preservation of food and in shipcraft; also, at that date mariners operating in the far south must have benefited greatly in knowledge of that region from the experience of the sealers during the 40 years since Cook laid a foundation for the successful prosecution of long voyages under such difficult circumstances.

The Russians justly deserve the highest commendation for the complete success of their undertaking; our only regret is that the intimate and complete account of their adventures has appeared only in Russian, and is thus inaccessible to most historians. In the progress of von Bellinghausen's voyage, the Antarctic Circle had been crossed and recessed.
no less than six times, and the vessels had navigated through no less than 243 meridians of longitude beyond 60° S. latitude, 46 being within the Antarctic Circle. Though his furthest south record fell 17 nautical miles short of Cook’s, yet Bellinghausen was the first to discover land within the Antarctic Circle. As a result of von Bellinghausen’s voyage and the operation of sealers in the interval post-dating Cook’s effort, the unknown in the Southern Hemisphere was considerably reduced by the year 1821.

Triumphs of the Later British Sealer—First Sighting of the Continent.

About the time of von Bellinghausen’s return, James Weddell, who in connexion with sealing and exploratory operations had already visited the newly-discovered South Shetlands, again set out from the Thames bound for the southern seas. The intention was again to combine sealing with exploration. Departing from the South Orkney Islands on 23rd January 1822, his two small vessels made a course to the south-east, and eventually on 29th February, reached 74° 15’ S. latitude, 36° 17’ W. longitude. Though there was open sea around them at the time, he decided to retire north on account of the condition of the crew and the lateness of the season. Weddell, in ordinary sealing vessels, had thus penetrated to 30°, beyond Cook’s furthest south, securing a record which in that sector of the Antarctic remained unbroken until comparatively recent times.

Almost all the more outstanding advances in Antarctic geography effected by the sealing and whaling interests in the first half of the nineteenth century were connected with the firm of Enderby Brothers, a British mercantile firm of high standing which operated throughout the southern hemisphere for a period of well over 65 years. Their ships already plied the Antarctic seas in 1785. The Enderbys, whilst conducting a mercantile business, were prepared to spend much effort and expense in advancing knowledge of the far southern regions, without receiving any encouragement in the way of pecuniary returns. Their ships were usually well found as sealing vessels go, and the officers and crew well chosen. At the date of the foundation of the Royal Geographical Society (1830), the senior member of the firm, Mr. Charles Enderby, became an original Fellow, and continued actively interested in the work of the Society (47 years). Their vessels frequented Australian and New Zealand ports in those early Colonial days, and they held exclusive concessions of the fisheries of the Auckland Islands about the year 1849, when, for a time, Mr. Charles Enderby resided there, and held the title of Lieutenant-Governor.

As early as 1806, two of their vessels earned fame by again sighting Bouvet Island, which had already evaded attempts to locate it since Bouvet’s somewhat indefinite record of 69 years earlier. Again, in 1825, two more of their vessels fell in with the island. On that occasion, Captain Norris, the senior officer, landed, and being the first human being to effect a landing, he raised the Union Jack on the shore.

In the year 1830, Messrs. Enderby equipped for Antarctic exploration two vessels, the schooner Iris (150 tons), and the cutter Lovely (50 tons),

* At the time, they were ignorant of Bouvet’s discovery, and thought they had made a new one. They named it sight of an island which was promptly named Liverpool Island, but had previously driven them off. In a few years, three days later, they again sighted an island which they named Thompson Island. Their description leaves no doubt that it was Bouvet Island upon which they landed, and recent investigation by the Norwegian Expedition has established that there is only one island in that vicinity, and that is Bouvet Island.

*Hesse’s account of a voyage in those seas, including a landing on Bouvet Island in 1823, is, of course, chiefly fiction.
under command of John Biscoe, a retired master of the Royal Navy. The voyage commenced from Gravesend. Leaving the Falkland Islands late in November, a course was set to the South Sandwich Islands, then eastwards as far as 60° S. as the pack-ice would allow.

On the 29th and 30th of January, Biscoe's track as charted is practically right on the coast of the eastern side of Princess Martha Land, as now fairly mapped. Two weeks later, Biscoe's vessels were in about latitude 69° 24' S., longitude 371° E. Biscoe then discovered Princess Ragnhild Land. Six days later, still in longitude 69° 40' E., they were within about 25 miles of the coast of Queen Maud Land. However, there was no indication of land being under-ice. Biscoe observed that the ice was very thick, and the ice-bergs in the coastal zone prevented them pressing farther to the south, and the ice was repeatedly recorded as an area of scattered icebergs. This is, of course, particularly so in the case of the moderately large land.

Eventually, on 29th February, 1831, in latitude 69° 29' S. and longitude 45° 17' E., they observed the appearance of land along the southern horizon. What they described corresponded to ice-covered highland descending gradually to the sea, and terminated by a vertical ice-cliff wall, which reminded them of the chalk cliffs of the North Foreland on the Kentish coast. This description, in general terms, tallies with the ice-covered land recently proved to exist in that longitude, but it would appear that the ice-cliff coast line seen by Biscoe in 1831 was situated very many miles farther north than it is today. Possibly a shelf-ice extension of the land-ice existed at that period.

During the next couple of days, in squally and cloudy weather, with "a most distressing E.S.E. sea," they worked their way further to the east, though driven a little to the north. Eventually at 4 p.m., on 28th February, they sighted the black tops of mountains projecting through the ice, which signified the emergence of land.

This land is now known as Enderby Land. Subsequent exploration has shown that, as it appeared on the charts as Kemp Land, Biscoe was the first ever to catch sight of any portion of the coastline of the Antarctic Continent; and for this reason alone his exploit is a most memorable one. Unfortunately, on account of the lateness of the season, constant gales and an impenetrable belt of pack-ice, Biscoe was unable to proceed further, though he persevered until 14th March. By that time there was much sickness among members of the crew, and any further attempt had to be abandoned. Biscoe then continued for another three weeks, hoping to be able to find the coast in the hope of again meeting with land. On 4th April Biscoe wrote, "The vessel, now a complete mass of ice, only three of the crew who can stand, and being likewise well courting weather, any land to the southward of that latitude would be inaccessible, I find myself from these most imperative considerations obliged, although very reluctantly, to give up any further pursuit this season." He hoped to make New Zealand as a wintering base, but had finally to put into Hobart, for an anchor for several of the men, and only one of the crew was able to stand when the 'Tula' eventually reached Hobart Town.

The cutter 'Lively' had been separated from the 'Tula' during a storm off the coast of Enderby Land. Captain Avesy eventually succeeded in reaching Western Port (Victorian coast, near Port Phillip), after seven of the crew had died of scurvy and privation (9).

Eventually both vessels joined up again on the Derwent (Hobart). After three months' sealing around southern New Zealand, the vessels commenced the homeward journey, including, on the way a far south exploratory cruise across the Pacific. During this voyage Biscoe again fell in with new Antarctic islands in the neighbourhood of longitude 279° W. Then westward to Adelaide Island and the Biscoe Islands. He also set foot and took formal possession of what he believed to be an unknown mainland which appeared in his charts as Graham Land, named after him by the Admiralty. His Graham Land, however, was subsequently accounted part of the island, the northern tip of which had been earlier discovered and charted as Trinny Land by Brunyldie.

The return voyage from the Southern Ocean undertook sealing operations. Whilst the 'Tula' was very badly damaged, but she was eventually repaired and the voyage home via the Falkland Islands commenced. While at the Falkland Islands the 'Lively' was wrecked. Thus only the 'Tula' finally reached the Thames.

Biscoe's effort, considering the vessels and equipment at his disposal, is one of the finest in the annals of Antarctic exploration; for not only did he meet with the Antarctic land in two different seasons and establish the record of first sighting some portion of the Antarctic Continent, but he sailed through 100 degrees of longitude south of 60° S. and through almost 50 degrees within the Antarctic Circle.

Another of Enderby's vessels, the two-masted square-rigged vessel 'Magnet' (147 tons), under command of Captain Peter Kemp, made a notable voyage in the year 1833. The manuscript account of this voyage has been lost, but a contemporary chart with Kemp's track and sundry remarks is still extant among records at the Admiralty. Kemp's track is shown proceeding nearly due south from Royal Sound, Kerguelen Island, and McDonald Islands were undiscussed, but Kemp appears to have sighted one or other of them, almost certainly Heard Island on account of its great elevation, for in the approximate latitude of Heard Island the remark "saw land" is written across the track. Further south the track trends to the south-west and Antarctic land is shown as sighted from the 'Magnet' when in about 60° S. latitude. This discovery has apparently been lost in the present series of charts, and, located on the meridian of 55° E., Kemp was able to only two chronometers, each equally unreliable and varying considerably at the time of his landfall, the correct longitude might be indicated by either or by neither of them. For plotting his track in the chart referred to above, the longitude by one of the chronometers has been adopted, whereas our subsequent exploration in that locality suggests that reliance should have been placed on his other chronometer which gives a position somewhat further to the west.

Kemp was apparently unable to land upon the shore owing to an intervening belt of pack-ice. He did not, but proceeded on a course towards Cape Town. Kemp's voyage is notable in that it was the second to sight and discover a section of the Antarctic Continent.

At this time, in the region south of New Zealand, sealers from Sydney and Hobart were active searching for new sealing grounds. It is recorded (10) that Samuel Harvey, master of the barque Venus, 230 tons, sailed from Hobart on 6th January, 1831. After sailing at Macquarie Island he proceeded as far as 72 degrees south latitude (evidently the entrance to the Ross Sea) before turning back. Then after securing a cargo of skins and whale oil at Campbell Island and southern New Zealand the Venus arrived back in Sydney on 21 December, 1831.

Still another of Enderby's captains earned fame in Antarctic seas. This was John Balleny, who in 1835 was dispatched to investigate a particular sector of the circumpolar region, most of which sector had not, at that
time, been traversed in high southern latitudes. The region selected was that south of Australia between the 100th and 108th degree of east longitude. Two small vessels, the schooners Eliza Scott and the cutter Eliza, were selected. Balleny sailed from southern New Zealand on 7th January, 1839, and proceeded south via the Campbell Islands. The Antarctic Circle was reached in longitude 170° E., from whence a passage west was commenced. On 9th February they fell in with what has since been charted as the Balleny Islands, a landing in breaking surf, on a submerged pebble-strewn beach below ice cliffs was effected by Captain Freeman of the Sebrine, and a few pebbles of volcanic rock were collected.

The voyage was continued west maintaining a latitude as far south as the pack-ice would allow. On 2nd and 3rd March they thought they saw land beyond the pack-ice. They were then in latitude 65° 10' S. and 117° E. longitude. Their report has been vaguely recorded on the chart as Sabrine Land. Three weeks later, whilst making a long slant west and north from the ice towards Cape Town, the Sebrine was lost with all hands during a gale.

The spectacular voyages of Wilkes, d'Urville and Ross in this same area, commencing in the year following Balleny's voyage, tend to detract from the credit that is due to one who was undoubtedly a fine navigator and who located the pack-ice edge, as defined in the summer of 1838-39, through 65° of longitude, thus in some degree forestalling the big expeditions immediately following.

The Early Scientific Explorations of Modern Times.

Balleny's achievement was the last of the notable voyages of the early sealers. The stimulus that the exploitation of seal pelts and blubber oils had given to Antarctic exploration had run its course. Where the earlier seal navigators had passed, the Antarctic Circle in the neighbourhood of the Southern Alps of the speculative cartographers of the middle ages, the hardy sailors of the southern seal fisheries had continued the good work, pressing southward, amongst the pack-ice within sight of ice-land, and since proved to be part of a real Antarctic Continent. Knowledge of that inhospitable region might have ended there, but for a new force rapidly developing in the civilized world between the years 1829 and 1840. The rising tide of science had resulted in the foundation during this period of the principal geographical societies of western Europe, as well as other associations and bodies such as the British Association for the Advancement of Science (1831). In those now far-off days of 100 years ago, the virile growth of the youthful tree of knowledge was already unduly curbed for want of data from the vast South Polar field. The need for observations in high southern latitudes was felt most acutely in the deplorable state of terrestial magnetism, the study of which had at that time reached a peculiarly important phase.

In 1837 proposals were advanced for a British expedition, specially equipped for magnetic observations, to visit the Antarctic Regions in the locality where theory indicated the South Magnetic Pole should lie. At the meeting of the British Association in 1838 the proposals were crystallized and the enterprise launched.

James Clarke Ross (afterwards Sir James), already famous for his explorations in the Arctic, and his achievement of the North Magnetic Pole, was chosen to command the expedition.Whilst Ross's ships, the Erebus and Terror, were being equipped for the work ahead, two great expeditions of other nations were already in the field. These were, respectively, a French undertaking in two cutters, the Arctiques and the Coquille, com-manded by Admiral Dumont d'Urville, and a squadron of five vessels despatched by the Government of the United States under Lieutenant Charles Wilkes as Commodore. Both these important expeditions were designed for large-scale scientific explorations to be effected principally in the Antarctic regions south of America, and in the case of Wilke's expedition a cruise to the north of the South Pole was also made.

The addition to the military scientific programme of this latter expedition was, nevertheless, due to the fact that at that time the South Magnetic Pole was to be found in approximately latitude 66° S. and longitude 160° E.

The French expedition during the early months of 1838 operated in the Antarctic south of Cape Horn. Their work centered around the South Shetland and adjacent islands. The charts were improved and enriched in detail, and some entirely new features incorporated.

The following year Wilkes arrived at that locality, but too late in the season (March) to accomplish anything of great geographic importance. Some detail was added to the chart in the neighbourhood of Palmer's Hurdland; also two of the squadrion, the Peacock and Flying Fish, made a long run to the southeast towards the spot where Cook had made his farthest south, but they were not able to penetrate so far.

After executing valuable researches amongst the Pacific Islands, both the French and American expeditions appeared in Australian waters in the summer of 1839 and sailed south to the region for the investigation of which Rose's expedition was also being equipped.

The French expedition, on 19th January, 1840, came within sight of great icebergs, but the Antarctic Circle in the neighbourhood of 65° S. and 106° E. On the 21st some of the party landed and raised the tricolor on a rocky islet situated 500 or 600 metres from the shore of the mainland. The island was named to them to be unoccupied. This very important discovery, d'Urville's Terra Adelie, which has since been proved to be part of the Antarctic Continent, was traced by d'Urville through at least 5 degrees of longitude.

Efforts to trace the high ice-covered land farther to the west were successful, and a congregation of pack-ice and bergs which restricted the vessels far to the north out of sight of land. Since what they did do was well done, it is to be regretted that they remained only a fortnight within that area. Immediately on return to Hobart, d'Urville caused it to be inserted in the Hobart Town Courier and Adam's London Gazette (11) an official account of their discovery as an advertisement advising their territorial claims. The new territory is there described as follows:—

La terre Adélie. d'abord appelée ... et qui présente enfin 50 degrés de latitude Sud d'une part ... et 130° au 143° de longitude E. de Flerte.

Four of Wilkes's vessels proceeded south from Sydney late in December, 1839, and entered the pack-ice zone not far from the longitude 160° E., the Balleny Islands, which, though unknown to Wilkes at the time, had been discovered by the sealing captain Balleny during the previous summer. They planned to work their way west as far as the 100th meridian, keeping high a southern latitude as possible. Several of the vessels suffered severely from storm and ice, but two succeeded in executing the full programme. Their craft, propelled by sail alone, could not attempt to carry the large icebergs; consequently their track was that of the northern margin of the pack-ice. Only in one locality was the pack-ice so far absent that one of the vessels could sail right up to land. This was off the Adela Land coast which d'Urville had reached a few days earlier. Much farther to the west, in about longitude 107° E., Wilkes
approached very closely to new ice-covered land which he called Knox Land, also situated in the neighbourhood of the Antarctic Circle. In addition to these two new land discoveries, the record of the voyage includes reports of appearances of land, and the sighting of land at many other points along their route, to the west. That some of these appearances of land were distorted views of distant cloud banks or floating ice formations appears certain. The subject has been the cause of much controversy, even to this day (12). A careful inquiry in the light of present knowledge (13) of that very region traversed by Wilkes, after making every allowance for exceptional conditions of the atmosphere concurrently with abnormally favorable mirage conditions, appears to indicate that it is possible that Wilkes did see land in two other localities, namely, between 110° and 113° degrees of east longitude, which he refers to as 'Budd's Land,' and again about longitude 127° east, a portion of his North's Land. In any case, however, that there is but a slender prospect that Wilkes did actually see land even in those localities. Wilkes seems to have been over-ready to accept appearances of land as definite land, and then upon such acceptances to conjure up a continent.

It is true that Captain Cook, after his long circumnavigation of the south Polar regions, though he failed to find a continent extending beyond the ice, inferred from the nature and distribution of the floating ice that a considerable land mass, perhaps a continent, existed within the pack-ice zone.

In the case of Wilkes, it is to be noted that on the eighth day after reaching the Antarctic pack-ice in the Australian sector, at a time when he had recorded merely several isolated and distant appearances of land, he referred to the "Continent" in view at the time (14). He was then unaware of any other Antarctic land discovery within 2,300 miles, nor had he made a single sounding in the region where no soundings had ever been made.

Again, a few days later, when in longitude 147° 30' E., the pack-ice prevented his reaching what he took to be distant ice-covered land, he writes, "We were again foiled in our endeavour to reach the Antarctic Continent." Wilkes' use of the term in this loose fashion indicates that either he was not aware of what the term Continent connotes, or else his mind was already made up by a pre-conceived notion of the existence of such a continent. Anyway, his use of the term was premature.

Wilkes (ibid p. 329) enumerates arguments supporting the assumption of a large land mass within the ice-bound area. A principal general consideration advanced is practically the same as that which Cook promulgated 65 years earlier. Even at the conclusion of the cruise, Wilkes had advanced but a stage further in support for a continent within the ice.

"An argument that has been advanced to strengthen Wilkes' case for discovery of a continent in the Antarctic relates to soundings. It has been stated (12)—'By a number of soundings he (Wilkes) was able further to prove that a continental shelf lay along its front.' I have researched Wilkes' records for soundings, and can locate that the squadron got bottom only in two localities. Once was in a small pack-ice bound bay, Pomeroy bay, on the coast of Allan's Land. The Victoria found bottom at 30 fathoms. The other case was when the Peacock, on the 23rd and 24th January, 1846, was standing W.N.W. of Cape Hulme, near the meridian of 163° E., they got bottom in three separate shots of the sounding line, respectively at about 600, 900, and 900 fathoms, all within about 13 miles of each other. In his report, Wilkes repeatedly complains of the inadequacy of their sounding equipment.

Another argument advanced in support of Wilkes' assumption of the existence of a continent is that the numerous rock fragments they collected from islands were found to be predominantly continental in character. This is so, but such were sighted and collected only in one limited locality, off Knox Land, at the extreme western end of their cruise, and weeks after the term 'continent' had been adopted in the report of the cruise.
In addition to his land discoveries, Wilkes was successful in defining the edge of the solid pack-ice, as it appeared in January, 1840, through 65° S. latitude in the neighbourhood of the Antarctic circle; also additional light was shed upon the climatic and other conditions existing in that at the time, little known sector.

Ross, on reaching Hobart on route south, learnt of the exploits of D'Urville and Wilkes. Thus forestalled in the locality to which he had then been heading, Ross decided to direct his efforts to new ground by sailing with somewhat farther to the east. There he succeeded in breaking through the pack-ice to open waters farther south—what is now known as the Ross Sea. They returned with an account of a wonderful mountainous sheet of ice in a land of ice, and with considerable information regarding the life of the very far south. A landing had been made upon Ross's Island, off the coast of the new mainland.

The following summer, after wintering in Australia and New Zealand, Ross again proceeded to the Ross Sea, and completed the outline of some 300 nautical miles of new coastline, and some 300 nautical miles of the face of the Ross Barrier in that region. The second winter was spent at the Macquarie Island, and a third summer campaign was conducted along Antarctic shores, south of the South Shetlands, and amongst the pack-ice of the Weddell Sea. In this region they made additions to the knowledge of the Trinity Land neighbourhood, and farther east in the neighbourhood of latitude 61° 30' S., longitude 15° W., they penetrated to within 50 miles of Cape Norweigia in the lately discovered coast of Princess Martha Land.

The expedition returned eminently successful in its mission. In the Ross Sea region alone, not only had they quite definitely outlined the coast of Antarctic land, and of the land-ice of the Ross Barrier through 60° of longitude, but they had enriched the chart by securing many soundings. They had succeeded in determining with great accuracy the position of the South Magnetic Pole, though, as it was situated far inland, they had not been able to visit it. Also they had attained a farthest south record, having sailed to 78° 10' S. in longitude 161° 27' W. Ross had returned with the magnetic data of high southern latitudes around the South Pole regions, safe in the sector south of the Indian Ocean. The Admiralty therefore resolved to despatch a small vessel with naval crew to complete the job. Thus Lieutenant T. E. L. Moore, in command of the Siren, proceeded south from Cape Town in 1846, and voyaged east in high southern latitudes, eventually arriving at King George's Sound, in Western Australia. This voyage, though conducted in the far southern seas, did not break new ground excepting perhaps for a mile or two at their farthest south, when they reached 87° 30' S. in about longitude 154° E., having just crossed Biscoe's track. Their track as charted shows that they approached within about 30 nautical miles of the coast of Queen Maud Land.

The Period of Averted Interest.

With a foundation so well laid it was unfortunate that the good work was not quickly followed up. Instead, there new intervened a period of 20 years without further really important contributions to the geography of Antarctica. This halt in the march of events has been referred to by Dr. Mill as the "period of averted interest."

During this time, war and other activities served to turn the current of public interest away from the South. Nevertheless, there were those who, from time to time, pressed the claims of Antarctica. Of these in the earlier years of the period there were two outstanding personalities. The first was Captain Matthew Fontaine Maury, Superintendent of the
United States Hydrographic Department, famous for his Physical Geography of the Sea, who pressed for international co-operation in the expedition of Antarctica. The other chief advocate was Dr. von Neumayer, who later in life held the post of director of the Deutschemeerwarte at Hamburg. It was Dr. von Neumayer's enthusiasm for anything that bore on Antarctic research that led him to secure, for the study of terrestrial magnetism, the establishment of the old Antarctic observatory here in Melbourne. Whilst residing in Melbourne in charge of the observatory, Dr. von Neumayer exerted a considerable influence in fostering interest in the frozen regions. Such advocacy was then timely, for the association of Australia and New Zealand with the far south during the boom period in sealing and southern whaling had ceased with the waning of the industry, which allowed upon the discovery and exploitation of the petroleum oil fields of America, and the virtual extermination of the Southern Fur Seals and Right Whales.

During the period of averted interest there were garnered, nevertheless, some minor discoveries and scientific records. Of such may be mentioned the sighting of Heard Island in 1853 by Captain Heard, master of an American merchant vessel. About that time also a British vessel sighted another Subantarctic island near Heard Island, now known as McDonald Island. Later, in 1874, the great Challenger Expedition, despatched from England to carry out an oceanographical programme throughout the seas of the world, reached latitude 69° 40′ S. in longitude 175° 22′ E., a new area, and thus brought the first thrill of steam power within the Antarctic Circle. That same year a German steam whaling vessel, under Captain Dallmann, revisited and effected some improvements in the charting of the haunts of the early sealers to the south of Cape Horn.

At the meeting of the British Association for the Advancement of Science held at Aberdeen in 1886, a strong committee was formed “for the purpose of drawing attention to the desirability of further research in the Antarctic regions.”

About this time the people of Melbourne were thoroughly awake to the importance of forwarding the cause of Antarctic exploration. The Victorian Branch of the Royal Geographical Society of Australia and the Royal Society of Victoria took up the cause, appointing a joint Committee in 1887. After deliberation extending over ten months, the Committee addressed a report to the State Government (15). Included in their statement is the following:—"Your Committee, in reviewing the position, feels strongly the great advantages to be secured by losing no time in prosecuting researches in the South Polar seas. The proximity of Australian ports gives these colonies a great facility for securing a share in the lucrative Antarctic whaling and sealing trade. The present any longer would be not only to forgo handsome commercial profits, but to abandon also our natural maritime interest in these southern seas, and all the great advantages in relation to the Antarctic regions of our unique geographical position." As a result the Victorian Government promised liberal premiums to sealers or whalers landing in Victoria cargoes of sealing or killed south of 60° S. latitude. This encouragement was followed by an offer of £5,000 towards the expense of a British expedition. Eventually, by 1891, the British government granted 23,000 pounds, together with the offer of £15,000, which was considered about sufficient for the prosecution of a voyage of scientific investigation to the Ross Sea. But the end came swiftly, for, before the undertaking was finalized, the Antarctic Colonies were embroiled in the most acute financial crisis of their history.

In the United Kingdom the British Association Committee, further strengthening their continued efforts, was to meet again, and on this occasion a great deal of attention was given to Captain C. A. Larsen’s keen interest in exploration, the Jason, of the Oceanic Company of Hamburg, accompanied by two other vessels, returned the following year. On that occasion the ice conditions were very favorable, and the sighted new land, Foyen Land, and otherwise extended further south the knowledge of Antarctica in the American sector. Captain Larsen, in the Jason, penetrated as far south as 69° 10′ S. on the east side of the island chain of West Antarctica, whilst the other vessels, the Hestra and Vest struck, reached 69° 10′ near Alexander Land on the Pacific side. The following year, 1894, Mr. H. J. Bull, a Norwegian who had been resident in Melbourne for some time and was fired with the local enthusiasm in Antarctic matters then prevailing, induced the veteran Norwegian whaling magnate, Sven Poynt, to despatch a ship to the Ross Sea to investigate the whale fisheries. Proceeding south in the Antarctic, Bull revisited some of the Ross Sea region explored by Ross. A hunting was effected on Possession Island and at Cape Adare, the latter event being memorable as the first occasion that a human foot had been set on any part of the actual mainland of the continent.

Recent Scientific Explorations.

In the year 1896 the International Geographical Congress met in London. The conference adopted a joint resolution, and on the basis of this to be passed urging all nations to undertake a share in the work. The President, Sir Clements Markham, devoted himself to the launching of a British National Expedition, but several years were to elapse before the undertaking took form.

In the meantime a Belgian expedition, under Lieutenant Adrien de Gerlache, took the field. Their vessel, the Belgica, steamed south from Cape Horn. They added to and improved the charts of the Pacific shores of the Antarctic island archipelago. Eventually pushing south and west, they became frozen into the pack-ice and drifted helplessly during the winter of 1896, touching as far south as 71° 34′ S. and as far west as 100° W. long. De Gerlache's party were the first human beings to experience an Antarctic winter. They did not break out of the ice until the 14th March in the following year. Though they did not add much to the maps, the nature of new coast-line, the results of the expedition greatly enriched knowledge of that region.

As the Belgian expedition was returning, a British expedition financed by Sir George Newnes had taken the field in the Australasian region. This was commanded by C. E. Borchgrevink, a young Norwegian who had taken up residence in Australia and who had already visited the Ross Sea, signed on as a member of the crew of Bull's whaling expedition. Borchgrevink's ship, the Southern Cross, was directed to Cape Adare, which was reached on 17th February, 1899. There a wintering party was landed, the ship returning to New Zealand. This expedition has the distinction of having been the first to spend a winter on the Antarctic Continent."
The following summer the party was relived by the Southern Cross, which then proceeded down the coast of Victoria Land, and along the face of the Great Ross Barrier, where to near its eastern limits, where a land barrier was made. A sledge journey of a few miles, south over the Barrier, secured a chart of the eastern south, of 78° 60' S. This expedition added detail to Roa's chart, and secured a harvest of scientific facts relating to the land and climate.

In the last years of the nineteenth century a very important geographical expedition in the Weddell Sea was conducted from Germany. It was mainly concerned with investigations in lower latitudes, but came under notice here in that they relocated Bouvet Island and fixed its position with accuracy. Their work was conducted as far south as latitude 64° 16' S, in longitude 28° 17' E, which position was reached on 10 December, 1888. They were then within 57 nautical miles of Cape Bateiros, the most northerly point of Endersby Land.

Prior to the departure south of Berghervischt the Royal Society of London held an Antarctic conference to discuss the merit of pressing further explorations. Many of the leading geographers of the period were present. The principal oration was delivered by Sir John Murray, of Challenger fame, who ever since that memorable voyage had advocated continuing investigations in the far south. In the course of his address, when contrasting the North with the South, he said: "In the Scone Emissary there is, almost certainly, a continent at the South Pole which is completely surrounded by oceans, and in those latitudes the most simple and extended oceanic conditions on the surface of the globe are encountered."

Following Murray, Dr. Fritjof Nansen stated he "doubted whether Dr. Murray's theory of a continuous continent was correct, possibly there was a much larger area of the highest order. Oceanography was a feature of their work. In the matter of land discoveries they had also added detail to a blank region of the map. From a captive balloon ascent above the ship when frozen into the pack, ice-covered land of uncertain character was seen, some distance to the north-east of the limit of the ice."

The geographical programme of Drygalski’s expedition was well executed and was a record of the highest order. The expedition finally reached the coast of Antartica, in the summer of 1896-7.

The region selected for investigation was the Antarctic land south of Cape Horn referred to by Nordenskjold as West Antarctica. A party of scientists and a large amount of scientific equipment was shipped. The Discovery spent the summer of 1898-9 exploring the Ross Sea. Late in the season the ship was moored at a nearby head of McMurdo Sound, selected as a wintering station. From this base explorations were pushed far and wide.

The bay ice was still frozen throughout the next summer, and it was not until the summer of 1902-3 that the ship was freed and able to return home with a splendid record of discovery.

This was achieved by this expedition, in an immense forward advance in knowledge concerning the far south. The broad features of their geographic achievement were the following:-

By observations from the ship, discovering, with the help of aerial photographs, the Ross Barrier was discovered; by means of sledge journeys from the wintering base at McMurdo Sound, surveys were made of a very considerable area of mainland and coast-lying islands of the land margin on the western side of the Ross Barrier for a distance of about 380 miles south of their winter quarters.

Barrier, also by journeys extended far across the Ross Barrier they were able to throw much light upon the nature and genesis of that, at that time, unknown barrier. Finally, by scaling the high mountains of the mainland, and then sledge journeys on the plateau of Antarctica, to longitude 146° 35' E, they demonstrated, for the first time, the character of the Barrier to the Antarctic mainland.

Captain Colbeck in the Morning, a relief vessel bringing supplies to Scott's vessel, discovered Scott Island, which lies at the entrance to the Ross Sea. The Ross Sea, lying south of Kerguelen Island, was selected for attack.

While the British were busy in the Ross Sea, expeditions of other nations were also afoot. A splendidly equipped and manned national expedition had gone forth from Germany in the Gauss, a vessel specially constructed to withstand ice pressures. Professor Brich von Drygalski, who had already seen service in Greenland, was appointed in command of the expedition. The unknown region between Whinnen's Termination Land and Endersby Land, lying south of Kerguelen Island, was selected for attack.

In the summer of 1901-2, after landing a subsidiary co-operating party at Kerguelen, the Gauss proceeded further south to the pack-ice in the neighbourhood of 95° E. After some days working a way south through the ice the ship finally became frozen in a position several miles south-west of the intersection of the 69th degree of S. latitude and the 95th degree of E. longitude, where the ship remained held in place by grounded bergs, until the following summer, when it gradually drifted with the pack-ice until released late in the autumn.

The scientific programme of Drygalski's expedition was well executed, and was a splendid record of the highest order. Oceanography was a feature of their work. In the matter of land discoveries they also added detail to a blank region of the map. From a captive balloon ascent above the ship, when frozen into the pack, ice-covered land of uncertain character was seen, some distance to the north-east of the limit of the ice. Scientific work was carried out on the coast of the extinct volcano peak, Gauss Berg, was subsequently visited by sledge across the intervening frozen pack-ice during the winter.

An important Swedish expedition, organized by and in command of Dr. Nordenskjold, reached the Antarctic in the summer of 1911-12. The region selected for investigation was the Antarctic land south of Cape Horn referred to by Nordenskjold as West Antarctica. A party of scientists and a large amount of scientific equipment was shipped. The Discovery spent the summer of 1898-9 exploring the Ross Sea. Late in the season the ship was moored at a nearby head of McMurdo Sound, selected as a wintering station. From this base explorations were pushed far and wide.

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About this time Dr. Jean Charcot, the famous French scientist and explorer, contributed considerably to the detailed charting of the island chain of West Antarctica, and sighting a new coast line named it Loubet Land. In his vessel, the Prosperite, he spent two summers and the intervening winter of 1904 in that region.

At the Eighth International Geographical Congress held in New York in 1904, before the success of the various Antarctic expeditions of the opening years of this century, the need for a systematic and continuing exploration was clearly recognized, and the scientists of the continent were urged to proceed.

Fortunately there was practically no delay in the continuation of the work, for Lieutenant Ernest Shackleton, formerly a member of the staff of the Discovery expedition, secured sufficient financial assistance to purchase a small vessel, the Nimrod, and sail for the Ross Sea in 1907. The Australian and New Zealand Governments contributed substantially to the cost of this expedition. Furthermore, the scientific personnel of the party was strengthened at the last moment by the addition of Australian members. Most notable was the inclusion of Professor T. W. B. Clagett (afterwards Sir Edgeworth), who acquitted himself magnificently in the south and contributed notably to the success of the enterprise. The recent passing of this grand old man of Australian science has left a real gap in our ranks, for twice he held the office of President and has always been a tower of strength to this Science Association.

Shackleton's avowed object was the attainment of the pole. The ship was to act as transport to convey a hut and wintering party to the Ross Barrier. A wintering station was to be established near the eastern limit of the Barrier, where a few stretches of the ice front had been observed during the cruise of the Discovery. The hut itself was to be placed on the plateau known as the Bay of Whales, Shackleton had made an advance there in 1903-4, and the site was selected for a wintering station.* After consultation with some members of the party, his plans were changed. The ship was turned west, and his land base established at McMurdo Sound.

Considering the limited staff and facilities for scientific work, the results achieved by the expedition were very notable. The outstanding event was the attainment of a high southern latitude, and the geographic miles of the Pole, a record for proximity to the spinning axis of the earth, were 1,134. Not even at that time, attained in the Arctic. Several hundred miles of mountainous coastline beyond Scott's southernest south were charted, evidence gained as to the southern limit of the Ross Sea. The flat coastal nature of the polar locality established. Other parties made respectively the first appearance of Mount Erebus (13,500 feet) and a sledge journey to the South Magnetic Pole. In the course of the summer, minor improvements were effected to the charts of portions of the coast of Victoria Land and the Isabella region of the interior.

Dr. Charcot set out on a second Antarctic Expedition in 1906, in a small, well-found vessel, the Pourquoi Pas. He visited his old haunts on the Pacific coast of the Archipelago of West Antarctica, and discovered Baffin Land and Charlott Land further to the south in the same island chain. He then cruised far to the west along the pack edge in a high latitude, eventually reaching as far as 118 deg. 50 min. W. in latitude 70 deg. 8. Very valuable geocentric and other scientific data were secured.

Before Shackleton returned, Scott was again making elaborate preparations for a well-equipped expedition to proceed south in 1910. The attainment of the Pole was to be the central object, but the preparation of complete scientific programs was also a main feature of the expedition. At the same time, the already famous Norwegian explorer, Roald Amundsen, was equipping an expedition, which it was believed was to sail in the same season. However, shortly after the vessel set sail, the world and Captain Scott were advised that they were heading for the South Pole, though nothing was said as to where in Antarctica a landing was intended. Amundsen selected a landing and wintering station the Bay of Whales in the Ross Sea. Scott had evidently assessed the suitability of the locality from published descriptions of the area. In doing this, he accepted a risk that had not appealed to his predecessors. However, it turned out to be most suitable; with many factors, particularly climate, in its favor. Employing dogs for transport, Amundsen's party reached the South Pole on 14th December, 1911, the first human beings to arrive at that remote spot, forestalling Scott's party by 34 days. The sledging operations were conducted in a masterly fashion and in no way strained their resources.* A subsidiary party was led by Sir Ernest Shackleton, and a scientific and photographic expedition was undertaken, together with a polar expedition led by Professor W. S. Bruce. The scientific work was very successful, and the party was able to return to England in good health.

Returning to Scott's adventures, his ship the Terra Nova reached the Ross Sea on 15th December, 1910, and landed the main party at McMurdo Sound. After landing the main party at McMurdo Sound, the ship proceeded south along the Ross Barrier to avoid the ice, and the main party established a base at Cape Adare in accordance with a plan made by the expedition. In the course of the summer, the party was able to make many improvements to the charts of the coast of Victoria Land and the Isabella region of the interior.

*It is interesting to note that subsequently their work was found to be in error, and that the Bay of Whales was not actually reached by the expedition.
77° 45'S. There they had come to what is evidently the head of navigation in those waters, but probably attainable only in favorable seasons. They discovered a high ice-covered land, promptly named Prince Leopold Land, forming the eastern shore of the Weddell Sea. Extending from the land to some distance to the west, as the southern limits of the Weddell Sea, a floating barrier-like formation like that of the Ross Ice was observed. Fuchs's intention was to winter upon and explore this important discovery. In this, however, they were disappointed, for after they had landed but timber and stores upon which they appears to be permanent ice, it suddenly broke up and drifted away. Then their ship became frozen into the pack and drifted helplessly north during the coming winter, until liberated, fortunately without serious damage, the following summer. During the drift, a short sled journey over the frozen pack-ice to the west in search of Morrell's fictitious New South Greenland was undertaken. No trace of land was found.

Next in order came the Australian Antarctic Expedition of 1911-14. After returning from the Shackleton expedition in 1908, plans for continuing exploration in the region immediately south of Australia were formulated in my mind. The plans were formally brought forward at the Sydney meeting of this Association in January, 1911. The main feature proposed was the simultaneous operation of several shore parties wintering at suitable intervals apart.

Largely through the advocacy of the then President, Sir David Urquhart, and with the support of Sir Edward Denison, who was then absent in India, the Science Association gave the undertaking its full approval. An Antarctic Committee was appointed, and one-third of the entire capital of the Association was voted, which was definitely placed the hallmark of Science upon the proposals. The necessary funds were eventually secured from private and government sources. The vessel Aurora was purchased. In the summer of 1911-12, three parties were landed: one on Macquarie Island, chiefly as a weather station and “wireless” connecting link with the Antarctic, and two others on newly discovered Antarctic shores named respectively King George Land and Queen Mary Land. As a repercussion of Amundsen's invasion, the landing of a party at Adare, which was part of the original plan, had to be abandoned as it was already occupied by one of Scott's parties. The newly-discovered lands were explored by sled journeys, one of which carried knowledge of the Antarctic plateau 200 miles to the south near to the Magnetic Pole. The ship's party, under Captain K. E. Davis, also located new land which was charted as Wilkes Land. The geographical

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*My notion in naming this section of coast "Wilkes Land" was solely prompted by the knowledge of discovering Wilkes had named several of his lands after officers of his staff, but, of course, none after himself. Having satisfied everyone that his name was attached to it. For this I have the authority of the expedition's journal, and certainly not by coincidence. That Wilkes had seen this part of the coast, and, secondly, that the term Wilkes Land has appeared on many maps for long past, signifies the visn of the region between 100 deg. E. and about 160 deg. E. longitude. The association is that by altering Wilkes's name to a section of the whole of that area, some maps record as Wilkes Land, a negative compliment is being paid to Wilkes. My viewpoint has been, firstly, that evidence is conclusive that Wilkes did not sight the coast we charted as Wilkes Land. Second, the appearance of the term "Land reported by Wilkes" or in other name "Wilkes Land" over the wider area is something that was intended to convey the fact that there was the sector through which reduced his crew in no way definitely established the continuity of land through that sector, and as a portion of it already had the prior title "Adesta Land." It is not appropriate to me that the application of the title Wilkes Land as a geographic term could be correctly applied thereof. I should still like to honour Wilkes if I can.
addition to the map amounted to about 1,000 miles of new coastline. A wealth of scientific information was secured by the staff at each of the land bases, and from the ship abundant soundings and dredgings were effected. As a consequence, knowledge of the whole of the formerly vague sector 155 degrees to 90 degrees east longitudes was put on a sounder basis.

By examination of the lands located, and by soundings made in the seas around this sector and by inferences drawn from the examination of dredged bottom deposits, there was left little doubt that there extends from the Ross Sea to beyond Gaussberg a continuous land mass. However, the ship was not able to come within sight of a very considerable length of the coast thus anticipated. After operations extending over three summers and two winters, the Expedition returned just as the Great War broke out. This event was catastrophic in that it eliminated the means both of adequately financing and rapidly producing the reports of the Expedition. A brake was imposed upon further Antarctic exploration for some time.

However, Sir Ernest Shackleton was just on the point of sailing south on his second expedition as hostilities began. Notwithstanding this extraordinary circumstance he was ordered to proceed. His main party in the *Endurance* was bound for the southern Weddell Sea. From there it was planned that a land party should cross Antarctica by way of the Pole, and be picked up at McMurdo Sound by a supporting party which was to proceed south from Australia in the *Aurora*.

Almost after sighting new coast, the Caird Coast, between Coats Land and Prince Leopold Land, on the eastern side of the Weddell Sea, the *Endurance* became frozen in and drifted helpless during the winter until crushed and finally sunk on 21st November, 1915. The story of the escape of the party from the disintegrating ice to an asylum on Elephant Island and of Sir Ernest Shackleton's boat journey to South Georgia in search of help is an epic. The drift of the *Aurora* in the pack-ice of the Ross Sea during the winter of 1915, after breaking from her moorings at McMurdo Sound, was also a startling adventure.

Soon after the cessation of hostilities Shackleton again began preparations for a further adventure. He sailed on his third expedition on 21st September, 1921. His vessel, the *Quest*, 125 tons, was very small for the work. The proposal was to proceed south-east from South Georgia and explore the sector between Coats Land and Enderby Land. Unfortunately Sir Ernest Shackleton died suddenly whilst the *Quest* was in harbour at South Georgia. The voyage was continued in charge of Commander Wild, formerly second in command. In a shelling seen the *Quest* reached 86° 17' S. and 179° 9' E. long. The pack-ice everywhere stemmed them off from further approach towards possible land. It is now known that they were then within 30 nautical miles of the coast of Princess Elizabeth Land as charted by the Norwegians.

This brings us to the end of that section of modern scientific exploration in Antarctica which Hayes (17) refers to as the "Heroic Era," and still leaves for review Hayes's "Mechanical Era," in which aviation and tractor sledges figure importantly.

The next important advance in Antarctic geography was made by Sir George Hubert Wilkins, a South Australian, who had already earned fame in the Arctic region. Wilkins's special interest lay in the sector south of the Pacific Ocean, between the Weddell and Ross Seas. He, for the first time, employed with success aviation as a means of exploration in the Antarctic. In 1928 he, in company with Lieutenant Ellison as pilot, set out on a venture sponsored by the American Geographical Society. Two planes were transported to the whaling station at Deception Island of the South Shetlands, which was adopted as a flying base. On 20th December they set off on a very notable non-stop flight of ten hours' duration, which took
them to 71° 56' S. latitude and 46° 15' W. longitude and back to their base. In the course of this flight they had crossed over the high tableland of Graham Land* (Trinity Land) to the Weddell Sea side and thence proceeded north along the west coast of a Government interdepartmental committee in London, known as the "Discovery Committee." The old Discovery of Scott's first expedition was acquired and fitted for prosecuting these investigations in the southern seas. Later two other vessels were added, by means of this fleet a continuous programme of oceanographic research has, during the last ten years, been prosecuted in the Southern Ocean and extended into the Antarctic. The operations of the whalers were carried out under the direction of Dr. Stanley Kemp have gradually accumulated a vast amount of oceanographic and other scientific data concerning the far south.

Reference must now be made to the operations of the Norwegian whalers (18). It is to be noted that Mr. O. Chr. Christensen and his Consul Lars Christensen, pioneers and commercial magnates in Antarctic whaling, have been referred to as Norwegian Enderby, on account of their interest in gathering the exploration of Antarctica. An extended programme of Antarctic exploration was inaugurated by Lars Christensen in 1921, for which work a small wooden vessel, the Novaja, 250 tons, was fitted out.

During the summer seasons 1927-28 and 1928-29, visits were made to Novaja Island and Peter I. Island. The first, as we have seen, was a French discovery, but rediscovered and first landed upon by a Britisher. The second was a Russian discovery. Both were promptly annexed for Norway. For the summer campaigns of 1929-30, two of Norway's leading navigators, with efficient aeroplanes, accompanied the Novaja on an extensive exploratory cruise south from Bouvet Island. Commander Hj. Riser-Larsen accompanied Amundsen on his Arctic flights, was in complete command of the Novaja for this cruise. It subsequently transpired that one of their objectives was to raise the Norwegian flag on Enderby Land. On 22nd December, 1928, Riser-Larsen, in his assistant aviator, Capt. Elaboro Holm, raised the Norwegian being held off by the pack-ice, flew from her to the coast, and landing in a lane of open water, hoisted the Norwegian flag on what appears to have been grounded ice, or an ice-covered shelf or bar, not far from the ice-cliff coast of the land. We of the B.N.Z.A.R. Expedition, also in those waters at that time, arrived in the Discovery three weeks later, and took formal possession for the British Crown of Enderby's discovery* and other land to which we had discovered during the previous month. The Norwegian Government, upon representation from His Britannic Majesty's Government, requested, by radio, their explorers to take no further action in regard to Enderby Land.

Throughout the cruise, the Novaja had as a supporting mother-ship a small trading ship Hovinsmaeren. They were thus able to receive and reprovision at frequent intervals, allowing their exploratory operations to continue throughout the entire season. In the later season, when working west along the pack-ice from Enderby Land towards Costs Land, they made a number of flights across the pack-ice to within sight of two extensive stretches of new coast line. That west of Enderby Land was named Queen Maud Land. The other area extending north-east of Costs Land was styled Crown Princess Martha Land.

The following year, 1929-30, the Novaja, under Captain Gunnar Hilsen, circumnavigated the Antarctic region, pursuing oceanographical

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* Riser's observations showed Enderby Land to extend as far west as 45 deg. E. longitude.

* The Admiralty chart still adopts the name Graham Land for this large island part of which, it was believed, Bruce sighted in 1832 and named after the then First Lord of the Admiralty. More recently it has been clearly demonstrated that the first time Graham Land was the first to sight part of this Island, which he charted in 1831 as Trinity Land in compliance to the Trinity Board. On the basis of priority "Trinity Land" we replaced "Graham Land" on some maps.
investigations, but towards the end of the summer season Risér-Larsen again joined her, and visiting the region between his two previous discoveries, located another stretch of the Antarctic coast charted as Princess Ragnhild Land.

More recently still, in the 1933-34 season, a new section of the coastline of the continent was sighted, in the neighbourhood of 85° E. longitude, by an aeroplane reconnaissance from one of Consul Lars Christensen’s ships. This was named Princess Astrid Land, a link between Princess Elizabeth Land, seen to extend eastward to about the eighty-second meridian of east longitude, and Kaiser Wilhelm Land, seen to extend west to about the eighty-seventh meridian of west longitude.

Our British, Australian, New Zealand Expedition which departed south in the Discovery in 1929 was, at its inception, sponsored by the Commonwealth Government. It was offered and accepted command of it. A committee of control was set up, composed of Government representatives and members of the Antarctic Committee of the National Research Council. While fundamentally Australian, it received strong support from the British Government and from the other Empire units of the southern hemisphere, namely, New Zealand and the Union of South Africa. Some of the leading citizens of the Commonwealth also contributed to the cost, most notably Sir MacPherson Robertson. The famous old Discovery, which had been reconditioned by the Discovery Investigations Committee, was obtained under charter, and equipped for an extended cruise in the sector between Enderby Land and King George Land. A full scientific programme, especially stressing oceanography, was arranged. A small “Moth” seaplane was taken for making reconnaissances when amongst the pack-ice. My old friend, Captain J. K. Davis, secured the necessary leave from his post as Director of the Commonwealth Shire of Wandering, and was second in command, took charge of the handling of the ship for the first cruise.

The work conducted in Antarctic waters through the two summer seasons 1929-30 and 1930-31 resulted in the amassing of an immense amount of data regarding the region lying south of Australia and the Indian Ocean, between the forty-fifth and the one hundred and eightieth meridians of east longitude. Long stretches of the coast were discovered. There have been added to the map MacRobertson Land, Princess Elizabeth Land, Bannack Land, and Lars Christensen Land; also Kemp Land and Enderby Land were rediscovered and mapped. The coastline thus entered upon the chart extends through about 40° of longitude. Furthermore the existence of Wilkes’s Knox Land was confirmed, and an appearance of land was recorded near where Balleny’s Sabrina Land has appeared on the map. By means of an echo sounder installed in the keel of the ship, an elaborate record of sea-floor depths was obtained, sufficient to establish the limit of a continental shelf throughout the sector. Thus perhaps the most important outcome of the expedition is that, in conjunction with the discoveries made on the former Australian Expedition to the same sector, and observations by British and other expeditions elsewhere, the presence of a real continent within the ice has been finally established, with its main bulk towards the Indian Ocean, as prognosticated by Captain James Cook 160 years ago.

Unfortunately, the scientific data secured on our expedition are so voluminous that our Committee has not yet been able to secure the necessary finance to cover the cost of printing the reports.*

*Since this was written, the Commonwealth Government has arranged to have printed such reports as are presented for publication.

During 1932, the Discovery Investigation Committee prosecuted an extended circumpolar oceanographical programme in Discovery II. At present the ship is making a more exhaustive examination of the Southern Ocean to the south of the western Indian Ocean.

During the summer of 1932-33, Risér-Larsen was again in the Antarctic. With several companions and extensive dogsledging equipment, he was landed on thickly ice-locked land to himself, had discovered west of Enderby Land. The intention was to slide west around the whole coastline as far as the northern extremity of Trinity Land (Graham Land). Unfortunately, within the first days of the trip the apparently very solid sea-ice broke up, and drifted away with them to the north-west. By good luck the party were rescued by a Norwegian whaling vessel which had picked up their S.O.S. wireless signals.

Recently important developments have proceeded elsewhere. The Pacific Quadrant, which has been the most neglected of all Antarctica, is now receiving the attention that it deserves.

Admiral Byrd has returned to the attack again, and once more established at Little America has been engaged during the past year rolling back the unknown still further to the east. By aeroplane, dog sledge, and-motor tractor, the work has progressed apace, and his programme is not yet completed. However, we have learned by wireless of one geographical discovery of supreme importance made by his expedition, namely, that the land of the high plateau of East Antarctica is joined to Marie Byrd Land of West Antarctica, thus determining the existence of only one really large land mass in the Antarctic Regions—The Antarctic Continent, Antarctica.

Further light may yet be shed this season on the distribution of land in Nordenskjold’s West Antarctic region by Lincoln Ellsworth’s expedition now at Deception Island. Sir Hubert Wilkins is once more in the Antarctic associated with Ellsworth’s expedition.

Finally, we may confidently hope that the efforts of another South Australian explorer, John Bynail, now proceeding to establish a wintering base in the West Antarctic archipelago, will meet with a full measure of success.

The Nature and Area of the Polar Continent.

Having reviewed the story of the discovery of a continent beneath Antarctic ice, we may pass on to take stock of it.

To commence with, be it observed, this seventh continent is not as other continents are. It is, however, as northern Europe and northern North America were a hundred thousand or more years ago, in the height of the great Pleistocene ice age. Still longer ago, perhaps as much as 10,000,000 years, it is probable that there were snow-falled glaciers everywhere in the world, except on high mountains—not even at the poles.

It was a climatic revolution, the real cause of which is yet undecided, that caused the mild conditions formerly existing even to the poles. In the midst of glacial rigidity, there ensued a canopy of snow and ice which crept irresistibly from higher to lower latitudes. Perhaps several hundred thousand years passed by as the ice gathered force and extended its kingdom over land and sea, obliterating plant and animal life from whole regions where formerly they flourished. Then a halt was called and, as certain as had been the advance, the retreat began, in spasms perhaps, oscillating and uncertain at times, until vast regions of the earth were reclaimed. So, gradually, the innumerable ice retreated to the Polar
zones, where, to-day, alone can be found large regions thus buried. Greenland in the Arctic, and the Antarctic Continent and the West Antarctic Archipelago in the south, are now the only great land areas still remaining beneath the yoke of ice. The story of the past forces the conviction that in time these last strongholds of the frost king will be captured, the armoured forts of ice silently returning to the ocean basins, as in pre-glacial times. Then, and not till then, will our great Antarctic Continent bear the full fruits of all that is implied in the term "land."

But that will be a long time hence. So we must take it as we find it, for the moment, a slab of ice. Doubtless a topography of wonderful relief lies below the smooth surface, but no hint of this is evidenced, except in specially favoured regions where mountain ridges or coastal cliffs peer through the ubiquitous snow. The total area of such rock outcrops occurring on the Continent itself can scarcely be less than but may not exceed 15,000 square miles, the bulk of which is certainly distributed along the Ross Sea coasts.

A careful estimate of the approximate area of the continent, based on present knowledge concerning its limits, gives a figure, in round numbers, of 4,600,000 square miles. Thus on the basis of these figures the rocky pediment of the land is accessible to the extent of scarcely more than one-fifth of 1 per cent. of the total area.

There is every reason to believe that beneath the ice cap a diverse land topography lies buried. In some localities near the land margin, where the ice sheet is able to make its way slowly down to the sea, bold, brave mountains raise their heads triumphantly to heaven. The highest summit yet recorded is Mt. Nansen, estimated to exceed 18,000 feet in height, which stands near the Pole in the Ross Sea region. Farther from the coast the rising tide of ice has submerged every vestige of rock beneath a vast flat dome which reaches an elevation exceeding 10,000 feet, as at the Pole. A very large part of this ice-cap appears to have an elevation above 8,000 feet, and only quite a narrow coastal zone is anywhere below 3,000 feet above sea-level. There is no reason to suppose that the underlying continent is without its lowland areas, consequently the probability is that, in some places, the thickness of the ice sheet measures many thousands of feet. Colossal though this ice-cap is, it is but a shrunken remnant of its former self—as developed in the culminating phase of the ice-age.

Record of the Culminating Phase of the Ice Flood.

The ice flood has written its own story, indelibly recorded in geological features of unmistakable import. Undeniable criteria have been found to indicate that rocky mountains, which to-day rise high above the margin of the ice-cap, were formerly submerged. At that time the great ice-cap extended considerably beyond its present boundaries. Everywhere beyond the margin of the continent are to be found, beneath the sea, immense terminal moraines which outline the former maximum extension of the ice-cap. These built-up mounds on the sea floor are often 50 to 100 or more miles from the present land front, and they are of the order of hundreds of feet high. Off the coast of Adelie Land, the height of the main shelf moraine is possibly to be reckoned at something of the order of 3,000 feet.

It is the existence of this submarine terminal-moraine ringing the Continent that imposes difficulties in approach to many sections of the coast, for gigantic kerguel from the present ice face become grounded
in 600 to 1,000 feet of water upon these off-shore banks. The grounded
bergs then hold up the floating pack-ice and impose an ice blockade of the
deep waters. Of course, where the seafloor suddenly plunges to a
considerable depth immediately along the margin of the land, such as on
the faulted coast of the western shores of the Ross Sea and the eastern
shore of the Weddell Sea, the submarine moraine dump may not show
the waters sufficiently to obstruct floating bergs, in which case a relatively
free, navigable coast is presented.

Large areas of ice-decked ocean thus held by grounded bergs may
endure for years; but, from time to time, sections of it will be cleared
away for a season, doubtless chiefly owing to the operation of periodic
perturbations in explanation of certain movements of the Polar ice has been
made by Dr. Otto Pottersen (19). This periodic release to lower
latitudes of exceptional quantities of Antarctic ice must in turn have
done climatic repercussions.

**Extreme Frigidity and Climatic Repercussions.**

The great ice sheet, continental in proportions, has, as we have seen,
other simple surface features—a high plateau descending with rapidly
increasing curvature as the sea is approached. Many features conspire
to make its surface the coldest region of the earth. Firstly, its circum-
lar location not only reduces its quota of direct heat from the sun,
but limits its participation in the facilities, enjoyed by the Arctic regions,
for receiving sun's heat indirectly by ocean currents. Secondly, the
mean average height of the surface, greater than that of any other con-
tinent, limits the blanketing effect of the atmosphere. Thirdly, as the
temperature is perpetually below the frost point, the maximum possible
water-vapour content of the atmosphere is extremely low and, over the
interior, clouds are at an absolute minimum. These features of the
atmosphere, aqueous vapour in its invisible and in its condensed form as
clouds, exert an important blanketing influence in the retention of earth
heat. Finally, the whiteness of the surface and its dazzling reflectivity
allow the ice-capping of the land small opportunity of trapping radiant
solar heat.

It is thus that the Antarctic is the world's greatest refrigerator.
Greenland, in the Arctic, acts in like manner, but on a very much smaller
scale. There is ever a vast outpouring of cold dense air from the high
plateau of Antarctica down the coastal slopes and away to the north.
Periodically the outward rush of air is vastly accelerated, then is
developed the pent-up fury of an Antarctic hurricane, which, when
experienced in the coastal zone, is never to be forgotten.

The climate of the world is a function of solar radiation acting through
the equatorial regions, which serve as the boiler of the heat engine, the
Polar regions being the condensers. The intensity of the atmospheric
movements is in relation to the range between the temperature of the
tropical lands and of the Polar lands. The Antarctic, being the principal
condenser, is, therefore, a prime factor in world climate. Obviously the
Antarctic regions exert a very important controlling influence on the
climate of the Southern Hemisphere, but before knowledge is sufficient
to draw useful deductions, observations on a vastly more extended scale
are necessary.
Nature and Structure of the Underlying Rock Platforms. Returning to the consideration of the real land beneath the mass of ice, it appears to be constituted of two somewhat distinct blocks. The main unit extends from the Weddell Sea around, south of Africa, to the Ross Sea. This has the character of a region of blocks uplifted. Both in its geological structure and in its history it has been, in common with Australia and South Africa. On the side facing the Pacific, from the Ross Sea to the Weddell Sea, it is limited by a fault line, which marks the west coast of the Ross Sea and extends to the east coast of the Weddell Sea. Both the Ross Sea and the Weddell Sea appear to owe their origin to the faulting. The structure zone is marked by volcanic outpourings of Tertiary to Recent age. The volcanic activity extends, with the present active Mt. Erebus, is one of the numerous central extrusions along this line. Stratigraphically, the outstanding characteristics of this section of Antarctica, as mentioned in East Antarctica, is the monomictic development of a crystalline Precambrian complex and a limited nature of post-Cambrian sediments. Earlier Paleozoic beds, including Cambrian and Devonian, are notable. Permian and Triassic (Gondwana) beds are widely spread, and carry thin seams of a poor grade of coal. From this period on there is a gap in the evidence as yet available, until we come to late Tertiary, Pleistocene and Recent times. Of this group, basaltic lavas, including alkaline types, have a considerable development, and, of course, moraine debris is scattered far and wide. That these are at least limited areas of Tertiary age beneath the ice is strongly suggested by the occurrence of lignite in morainic mud brought up in icebergs off the coast of King George Land.

The subsidiary section of the Antarctic Continent is styled by many geologists as West Antarctica. This lies on the Pacific side of the great fault line postulated as joining the Ross and Weddell Seas. The King Edward Land and Marie Byrd Land sections are generally similar to those distinguishing the main division of the Gondwana continent; but little geological information concerning this region is yet available. The Archipelago of West Antarctica, extending south from the Scott Antarctic, heads into this lesser section of the continent, but its structural relation to the other is yet unknown. This section has the characteristics of the Andean belt of South America. The rocks there exhibit folding, which is characterized in other parts of this region by the existence of the Cretaceous and Tertiary. Is there, as a notable succession of post-Cambrian and post-Cretaceous and Tertiary.

In surveying the stratigraphy of this region, a feature of note is that while Cambrian and Gondwanal types are found in the strata on the Eastern side of the Pole, both with their characteristic colias, in the west, in the past, there has not yet been discovered a sedimentary record for glacial epochs. This is remarkable, for even here in Australia there is abundant evidence of recurrent glaciations. It certainly seems paradoxical that there is in Australian strata, distinct phases of geological history, whereas in Antarctica, at the Pole itself, no older units have yet been found. It may be argued, of course, that the glacial periods recorded in Australia were limited in Antarctic time, but it seems reasonable that some evidence of glaciation in bygone ages previous to the present glacial onslaught. This is remarkable, for even here in Australia there is an abundance of evidence of recurrent glaciations.

Catastrophic Effect of Glaciation on Pre-existing Life. The fossil evidence already to hand indicates that Antarctica in past ages has been ravaged by a wide range of animal and plant life. The present glaciation has been catastrophic in regard thereto. All life on the continent has been exterminated. The glaciers and ice caps which are very scarce and the few types of microscopic animal life existing there are confined to specially favoured locations are probably recent re-introductions. Even the marine shallow-water life has suffered strange modifications and changes owing to the uplift of the ice sheet of the whole of the continent during the period of ice invasion. The effect is not so noticeable in the case of invertebrate life as it is with the flora, which exhibits curious restrictions in the range of genera represented.

The Life of the Environing Seas. The glacial epoch, however, has not had the same retrograde influence as the plankton population. Cold polar waters are notoriously rich in microscopic plant life. The annual flush in growth comes with the brilliant sunlit period of spring and summer, when in high latitudes there are 24 hours daylight to foster plant growth. Further, these cold waters are characteristically rich in nitrates, which is so necessary for plant development. The consequent growth of dinoflagellates, and other similar forms, thus usually so prolific, that the colour of the sea water is determined thereby.

With a rich basal vegetable population, Antarctic seas are able to support a rich animal population: small planktonic crustaceans, principally copepods, amphipods and the like. In turn these are the food supply for fish, and directly and indirectly, seals and penguins, and pre-eminently of the whaling. The baleen whales are designed to live almost exclusively upon the Antarctic Blue Whale, the dominating feature of the life of these seas, is based upon the microscopic plant life which is the abundant and rich plankton concentration results in a tremendous whale community. Antarctic Blue Whales have been caught as much as 130 feet in length and weighing 250 tons. No creature, even of the protracted life, approaches the bulk of these southern whales of today.

Seals in great number and representing four species inhabit the pack-ice and the shores of Antarctica. However, the most characteristic feature of the life of the Antarctic seas and their rich plankton concentration results in a tremendous whale community. Antarctic Blue Whales have been caught as much as 130 feet in length and weighing 250 tons. No creature, even of the protracted life, approaches the bulk of these southern whales of today.

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The Question of Administration. This brief sketch suffices to illustrate the nature of Cook's ice-bound continent. The question which now occurs is, of what use is it to be administered? What role is it to occupy in human affairs?

To begin with, it can be said that this will depend very much upon whether it is merely rapacious for what it offers to the moment, and then left for ever desolate, or whether it is brought under some system of wise control and development. To secure the latter desideratum it cannot be...
left a no-man's-land. It must be secured under authority, competent enough to impose restrictive regulations. This means, so far as it is known at present, no human inhabitants it requires some external Government or Governments to exercise jurisdiction over it. Otherwise the few Governments that are better, in order to more certainly secure inhabitants, is to provide for the welfare of the territory. However, right or wrongly, the Berlin act. Perhaps certain to secure ultimate benefit for the nation. However, right or wrongly, they may be that other nations need feel disposed to press claims to a share in the grant of administration of the still-claimed section of Antarctica.

Contiguous British domains have already, in recent years, laid claim to a considerable portion of the land area, and rightly so, for not only does it offer to the British a leading part in the discovery of Antarctica, but her proximity lands are geographically in the best position to administer control in development.

**Territorial Claims.**

France has maintained the claim over Adelie Land made in 1896 by her explorer Dumont d'Urville. d'Urville's claim was for land said to have been sighted by him between latitudes 60° S. and 67° S., and between longitudes 128° E. and 130° E. The area of land thus claimed by France would amount to about 5,500 square miles. In October, 1924, the French Government confirmed its national rights over Adelie Land, and the Antarctic territory to the South of Macquarie Island, by proclamation for the preservation of the native fauna.

In 1928 the Government of the Falkland Islands formally annexed Subantarctic and Antarctic lands lying to the south of the international meridian, making a total of about 600,000 square miles. This does not include the Subantarctic Islands and the Antarctic archipelago.

In 1923 the Ross Sea region, extending between longitudes 160° E. and 180° W., which includes the Balleny Islands, was formally proclaimed British, and appended to the Dominion of New Zealand. The mainland area within these limits is about 150,000 square miles, or an area of 50,000,000 square miles.

In 1911-14 our Australian Expedition had the label and took possession of the new territory discovered, and, on account of the discovery, created the Australian Commonwealth. The main islands within these limits are Magnetic Island, about 200,000 square miles, and the Eclipse Island, of about 50,000 square miles.

In 1919 the Australian Expedition was led by Dr. Scott, the medical officer of the British Antarctic Survey, and the expedition was subsequently returned to the Dominion of New Zealand. The total area of the ice-clad land involved amounted to about 20,000,000 square miles.

There are two unclaimed sections. The one is south of the Atlantic Ocean extending between 20° W. and 45° E. Long. This is a land region of over 1,000,000 square miles in area, in which the

Norwegian have been specially interested, and in the exploration of which they have been principally concerned. The remaining sector is that south of the Pacific Ocean, between 20° W. and 150° W. Long., where there is 50,000 square miles in area. It is not yet annexed, and in that

Prospects for Economic Development.

Immediate prospects of commercial development in Antarctica are tied to the fisheries, and whaling is the division ascendant just now. The rise of this Antarctic whaling industry is a very modern event, for it is in recent years, only, that the technique has been evolved for the capture of the very large and powerful Fin Whales and Blue Whales which inhabit the seas. They are hunted by small vessels, referred to as "chasers" or "catchers," which in general appearance resemble North Sea trawlers, though capable of a speed of 30 knots. Mounted in the bow is a powerful harpoon gun. When fired, the head of the harpoon explodes several seconds after impact with the whale; thus the animal is promptly despatched. As already noted, modern Antarctic whaling developments commenced in a small way in the year 1905. In the earlier stages the operations were usually conducted in conjunction with shore stations for treating the catch. Since then the industry has grown to enormous proportions, and it has been found greatly advantageous to replace the shore factories by floating factories. The modern form of the latter is a vessel of about 25,000 tons, complete with all the equipment for working the whale. The upper deck is a vast, open working-floors, where the whale is worked as at a time, after having been butchered up from the sea through a steam tunnel, are reduced to fragments and fed into the digesters within an hour.

These factory ships, or "mother" ships, as they are termed, each in company with their respective attendant "catchers," in the number of six to ten, dispose themselves throughout the whaling grounds, quickly filling up with blubber oil at the expense of the whale.

By the year 1909, the Antarctic whaling fleet had reached a total of 260 vessels of a total capacity of 600,000 tons, and the 100,000,000 tons of oil are produced. This oil is worth about £20,000,000 sterling. The latest type of whaling factory ship has a capacity of about 25,000 tons, and the vessel of 10,000,000 tons of oil to fill storage tanks, which necessitates the killing of 1,000 average Antarctic whales.

Since 1905 to the present day over 300,000 whales have been taken in Antarctic waters, producing products valued at over £70,000,000 sterling. Though restrained by the present period of world depression, the boom continues, and the whaling industry is divided into two sections. The South Australia and New Zealand whaling grounds are the most important, and they are widely dispersed in the Southern Ocean, extending from 40° S. to 55° S. and 120° W. to 175° W.

There are two unclaimed sections. The one is south of the Atlantic Ocean extending between 20° W. and 45° E. Long. This is a land region of over 1,000,000 square miles in area, in which the
As a winter-sports ground for diversion in summer, Antarctica would be a treat to Australia, but by our present methods of travel, it is too far distant to be likely to be of any value for a long time to come. If I see no reason to delay the despatch of our ports of modern line-summer pleasure cruises amongst the pack-ice. There would be no difficulty in establishing land settlements at the favourable spots along the coast, provided commercial developments can ensure sufficient income. Thus, should reasonably rich mineral deposits be located in accessible localities there need be no delay in working them. But so far the only extensive occurrence of useful mineral known is that of coal. Although widely extended in its distribution in Antarctica, coal is not a commodity of sufficient value to be shipped for the present. Shipping costs involved in transport from ice-bound shores. Gold, however, accounts for a high value and less bulk for export, would be particularly beneficial. The elements offering best prospect for economic development under Antarctic conditions. But useful deposits of the yellow metal have yet to be found, though the bulk of the known rock formations of Antarctica are quite favorable as matrices for auriferous reefs. We have already located Antarctica occurrences of all the commoner base metals—but, so far, not in commercial quantities. The present plan itself is a mineral with a definite commercial value. A route was established between King’s and the South Pole, but this route is not at all suited for the purpose. If this plan were adopted, it would be possible to ship coal from Antarctica to Australia. Probably few people know that there were plans for the establishment of a coal mine in the South Pole region. It is a pity that this plan has not been carried out. Probably few people know that there was a coal mine in the South Pole region. It is a pity that this plan has not been carried out.

Another feature of some sections of the Antarctic coastline which may be turned to account, is the continuity, year in year out, of gales of wind descending from the ice plateaux of the higher mountain ranges. The northernmost point of the coast of Adelie Land has an average annual velocity of about 50 miles per hour. To live in such a climate is, of course, a most enviable lot, but those of us who have done so have not failed to be impressed with the vast amount of energy represented by those air currents and available to man. It is, a course, a secondary form of solar energy, but so disposed as to be easily convertible to electricity. Owing to the high velocity of those winds would be possible, the erection of only a limited installation of small atmospheric generators, to harness the whole of the available energy. In the present state of electrical science, such power could not be exported as current, but it might be converted to salable commodities. Some day, therefore, there may thus be produced for export atmospheric-nitrogen products and other power-consuming manufactures.

I visualize that, before long, operations will be conducted from Australia and New Zealand into the southern region much after the plan of the Hudson’s Bay Company. There will be isolated settlements. Each individual will reside the year round, collecting seal products and penguin eggs, as well as fish products of various kinds. One of their diversions and duties we be to broadcast weather reports each day. They may take the opportunity to breed Arctic white foxes, for the satisfactorily rearing of which the climate should be suitable, and also as a food supply, there would be an abundance of meat food available from seal and penguin carcasses. Such far-farming, both in the Subantarctic islands and on the Antarctic mainland, is sure to develop sooner or later, primarily because of the abundance of suitable food available at no cost whatever.

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approximate latitude of 50° S. In its early results, the expedition was no doubt to India Company, but it did useful work exists over a large part of the South

d. century, both in France and in England, were interested in the existence of the great "island" in the despatch of Captain
mission to investigate the fascinating

subject ran high amongst French savants. French expeditions were sent to the Pacific Ocean in the 1770s, when bound for the Pacific Ocean via the good fortune to fall in with two small
cams. These were known respectively as Islands. The other expedition, under Joseph de Kerguelen-Trémarec, aimed at the south of the mid-Pacific Ocean. It was successful, for in February, 1772, they

as the Kerguelen Archipelago. This was the first attempt to sight a new land in the South Pacific Ocean, and the South American shore was

mislabeled "island" on maps of the Pacific Ocean. In 1770, James Cook was despatched in the command of a scientific expedition with the

expedition, as chief objective.

now the story of that famous voyage of Captain Cook, they proceeded across where an astronomical programme was sailed south on a voyage of discovery in the south and west, including a circumnavigation of the east coast of New

lactric problem, Cook accomplished much
cover, for he had shown New Zealand and Australia to the south and west, including a circumnavigation of the east coast of New

He then elaborates "reasons for thinking the northward of 40° S.; of what can be 10° I can give no opinion."

Nominated from the South Land by Tasman.
ed as Graham Land on the Admiralty's charts as Palmer Land. On applying to the whole island map, which, seeing year by year from Bransfield, as already seen, Palmer proceeded south in a stout ship, was firmly attached and then traced the coast seaward, a continent upwards of fifteen degrees, on the 49th of west longitude. On that Palmer probably did follow, being from "Palmer's Land," the land cut out into the Weddell Sea to the 49th of west longitude of the term "continent" in this instance that can be attached to the of the early explorations.

Up Borne, discovered and charted the coast of the earlier charts they appear

's Fine Achievement.

ling enterprise there enters the field of national importance. Russian expedition of two

Fabian Gottlieb von Bellingshausen, a vessel Porosok and Mury in 1819 s circumnavigation in high southern

was occupied in the task; which was its. On their outward voyage, after 22 sailed east about the South Pole

fall of Cook was mapped and shown 1, to which von Bellingshausen added it the group.

set in high southern latitudes, closely on the entire Antarctic regions. At two

very close to sighting the ice coast to within about 15 miles of the farthest Land and 30 miles of the

Land as recently laid down by J. Island and Alexander I. Land, to Circle to the south of the eastern

ally appeared amongst the American, had been discovered and charted by the south, and whose existence

own ships arrived on the spot.

Cook's, a great achievement. He considerably higher average latitude however, he had the advantage of

the preservation of foods and in 3 operating in the far south must on that region from the experience

ice Cook laid a foundation for the under such difficult circumstances. ast commendation for the complete

y regret is that the intimate and has appeared only in Russian, and

lands. In the progress of von

rne had been crossed and recrossed
new ice-covered land which he called Knox
neighbourhood of the Antarctic Circle. In
land discoveries, the record of the voyag-
ices of land, and the sighting of land at many
so, to the west. That some of these appear-
tviews of distant cloud banks or floating ice.
The subject has been the cause of much con-
A careful inquiry in the light of present
region traversed by Wilkes, after making ev-
things of the atmosphere concurrently with
conditions, appears to indicate that it is
land in two other localities, namely, between
ast longitude, which he refers to as Buda-
itude 127° east, a portion of his North's
er, that there is but a slender prospect that
ion in those localities. Wilkes seems to
appearances of land as definite land, and,
to conjure up a continent.
ook, after his long circumnavigation of the
failed to find a continent extending beyond
sure and distribution of the floating ice that
hops a continent, existed within the pack-ic
s to be noted that on the eighth day after
he in the Australian sector, at a time when
located and distant appearances of land
view at the time (14). He was then
the land discovery within 2,300 miles, nor
in the region where no soundings had ever
lon in longitude 147° 30' E, the packet-ic
he took to be distant ice-covered land, he
in our endeavour to reach the Antarctic
size in this loose fashion indicates that
at the term Continent connotes, or else his
a pre-conceived notion of the existence of
a sea of the form was premature.
ates arguments supporting the assumption
a ice-bound area. A principal general caus-
ly the same as that which Cook promul-
it the conclusion of the cruise, Wilkes had
argument for a continent within the ice.
and to strengthen Wilkes's case for discovery of
soundings. It has been stated (12) by Mr
able further to prove that a continental shelf
Wilkes's records for soundings, and can locate
two localities. Once when in a small pack-bound
ice on the 20th and 26th January, 1839,
over, near the meridian of 150° E., they got
15 miles of each other. In his account, Wilkes
150° E., they got
of their sounding equipment.
prints of Wilkes's assumption of the existence of
a fragment of ice collected from the shores were for
the latter. This ice, in fact, when sighted and
off Knox Land, at the extreme western end of
continent' had been adopted in the report of
come to what is evidently the head of but probably attainable only in favorable ice-covered land, presently named Prince\n
extrem shore of the Weddell Sea. Extending\nce to the west, as the southern limit of the\n
ice formation like that of the Ross Sea.\n
\n
Station was to winter upon and explore this however, they were disappointed, for after and stores upon what appeared to be por\n
e up and drifted away. Then their ship \n
\n
and drifted helplessly north during the d, fortunately without serious damage. the \n
\n
the drift, a short sledge journey over the n search of Morell's fictitious New South o trace of land was found.\n
stralian Antarctic Expedition of 1911-14: skeleton expedition in 1909, plans for con-\ngien immediately south of Australia were plans were formally brought forward at the fation in January, 1911. The main feature operation of several shore parties wintering.\n
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-day, along can be found large regions thus buried.

e Arctic, and the Antarctic Continent, and the West- the cold only great land areas beneath the yoke of ice. The story of the past forces in these last strongholds of the frost king to

army of ice silently returning to the ocean basins, as

Box. Then, and not till then, will our great Antarcti

e full fruits of all that is implied in the term "land" be a long time hence. So we must take it as we must part a slab of ice. Doubtless a topography of lies below the smooth surface, but no hint of this is in specially favored regions where mountain ridges or through the ubiquitous building. The total area of such

ccurring on the Continent itself can scarcely be less than 10,000 square miles, the bulk of which is certainly

the Ross Sea coast.

mate of the approximate area of the continent, based upon

ej concerning its limits, gives a figure, in round numbers, are miles. Thus on the basis of these figures the rocky

land is accessible to the extent of scarcely more than 2% of the total area.

reason to believe that beneath the ice cap a diverse

Ess buried. In some localities near the land margin,
est able to make its way slowly down to the sea, bold,
raise their heads triumphantly to heaven. The highest

described is Mt. Naam, estimated to exceed 15,000 feet in

ands near the Pole in the Ross Sea region. Further

the rising tide of ice has submerged every vestige of rock

flat dome which reaches an elevation exceeding 10,000

-pole. A very large part of this ice-cap appears to have

no 8,000 feet, and only quite a narrow coastal zone is

3,000 feet above sea-level. There is no reason to suppose

ring continent is without its lowland areas, consequently it is that, in some places, the thickness of the ice sheet

thousands of feet. Colossal though this ice-cap is, it is

remnant of its former self-as developed in the cut

of the ice-ages.

the Culminating Phase of the Ice Flood.

has written its own story, indelibly recorded in geological

issuable import. Undeniable criteria have been found

rocky mountains, which to-day rise high above the margin
were formerly submerged. At that time the great ice-cap
rubly beyond its present boundaries. Everywhere beyond

continent are to be found, beneath the sea, immense

as which outline the former maximum extension of the

built-up mounds on the sea floor are often 50 to 100 or

the real land front, and they are of the order of hun-

h. Off the coast of Adelaide Land, the height of the moun
tains is possibly to be reckoned at something of the order

of this submarine terminal-moraine ringing the

imposes difficulties in approach to many sections of the

derve shed from the present ice face become grounded.