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Antarctica—Continent of International Science

The Antarctic Treaty is the first in history to reserve part of the earth for peaceful purposes only.

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International scientific cooperation in the polar regions was an established tradition before the International Geophysical Year. Indeed, the IGY was anticipated by the First Polar Year, in 1882–83, during which 11 nations sent expeditions into the Arctic. The results gave us our first definitive data about the interesting distribution of the aurora and the basis for much subsequent research on this phenomenon. Fifty years later, in 1932–1933, the Second Polar Year again focused attention on the Arctic and produced new information about the ionosphere of immense importance to radio communication.

It was a discussion initiated by Lloyd V. Berkner among a group of scientists in the home of James Van Allen in 1950, about the feasibility of a Third Polar Year, which gave birth to the idea of the IGY. In 1952 the International Council of Scientific Unions created the Comité Spécial de l'Année Géophysique Internationale (CSAGI) to plan and carry out the IGY. From the very beginning the scientific exploration of Antarctica was recognized as one of the prime objectives of the IGY. But the plans for the Antarctic program were really first brought into focus at a meeting in Paris in 1955. Representatives of the governments or of responsible scientific groups of Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, the U.S.S.R., the United Kingdom, and the United States came together to announce plans for their respective scientific programs and the locations of stations where these would be carried out.

This was a meeting which could have been discordant. The Russian statement on the location of its proposed bases revealed two which duplicated locations already preempted by the United States by announcements made in 1954 in Rome. Moreover, there were political overtones because of the somewhat sensitive situation conerning territorial claims in Antarctica. For example, parts of the Antarctic Peninsula are claimed by Great Britain, Argentina, and Chile.

Nations making territorial claims in Antarctica generally proposed to locate their scientific stations in their "own" areas. Neither the United States nor the Soviet Union has ever made any territorial claims to Antarctica, nor does either recognize those made by any nations. Both countries therefore felt free to locate stations at sites best suited to their scientific purposes. The Russian proposal to establish stations on the portion of Antarctica claimed by Australia provoked some dismay which erupted into sharp editorial and even political protests when the stations became a reality.

These comments about the Paris meeting are worthy of note, for all the problems that emerged soon disappeared. Russia withdrew its proposal to locate two of its stations at sites selected by the United States. Political tensions were forgotten. From the beginning, differences melted away and a willingness to adjust national programs for common goals prevailed. There was a flexibility and a simplicity and freedom from political considerations perhaps without precedent in international scientific cooperation.

When all the problems of this initial meeting had been ironed out, the Antarctic program emerged as the combined effort of 12 nations with a total of 48 stations on the margins and in the interior of the Antarctic Continent.

While each nation was responsible for its own scientific program, there was complete freedom of exchange of information.

Ever since the beginning of the IGY the United States and New Zealand have jointly operated Hallett Station. Until recently the United States also operated stations jointly with Argentina and Australia.

Early in the IGY a program for the exchange of scientists was begun whereby research workers of one country joined in the programs of others. This made possible a free and prolonged exchange of scientific information. One of the most effective of these exchanges has been that between the Soviet Union and the United States. This whole program has been one of the healthiest instances of international cooperation, and since the conclusion of the IGY it has been maintained in the continuing program.

The International Antarctic Weather Central at Little America was a further instance of effective international cooperation. Although it was established by United States scientists, the Weather

This article is adapted from the presidential address delivered by Dr. Gould, retiring president of the AAAS, on 28 December 1965 at the Berkeley meeting.

Central was truly international in character, with scientists from Argentina, Australia, France, New Zealand, South Africa, and the U.S.S.R. participating fully in its work.

International cooperation is further reflected in the direct logistic support given by one country to another. The record of scientific effort in Antarctica is full of examples of activities in which nationality had no part: of search and rescue operations, of icebreakers relieving ice-bound ships, or of aircraft flying to the rescue of beleaguered personnel.

Even as the IGY officially began, on 1 July 1957, it was clear that in a period of 18 months only superficial exploration of this vast area would be possible, in spite of the great scientific efforts being mounted. Recommendations were therefore made to the International Council of Scientific Unions that some permanent organization be created to carry on the scientific cooperation in Antarctica after the conclusion of the IGY. The response was immediate, and the Scientific Committee on Antarctic Research, known simply as SCAR, was created in February of 1958 and charged with "furthering the coordination of scientific activity in Antarctica with a view to framing a scientific program of circumpolar scope and significance." Through SCAR the 12 participating countries have established national committees to "frame and carry out an operational program to implement the general scientific program formulated by SCAR." In the United States this committee is the Committee on Polar Research of the National Academy of Sciences, of which Harry W. Wells is executive secretary.

SCAR's headquarters are at the Scott Polar Research Institute in Cambridge, England, whose director, Gordon de Q. Robin, is also executive secretary of SCAR. He is assisted by working groups covering various phases of activity in Antarctica. These working groups have already sponsored important symposia on logistics, biology, and geology and are planning additional ones on oceanography and meteorology in 1966.

The 12 participating countries prepare annual reports for SCAR; in addition the observational or scientific data from all stations are deposited in the established world data centers and are available to all on request.

With the conclusion of the IGY on 31 December 1958, the National Science Foundation took over from the National Academy of Sciences the operation of the Antarctic scientific program. The Foundation, building on the IGY experience, immediately expanded its program to include more biology and more medicine, geology, geodesy, and cartography. There was, furthermore, a change in the method of operation in that NSF, through its Office of Antarctic Programs, under the imaginative direction of Thomas O. Jones, left to the participating scientists a large share in the development of the programs. Scientists from universities, government bureaus, and private institutions could follow their own research programs in Antarctica within generous limits prescribed by the Foundation and its advisory groups. There has thus developed in the post-IGY period a program even broader than that of the IGY itself.

In the development of its scientific program the Foundation is advised by the Committee on Polar Research of the National Academy of Sciences, which provides the Foundation with recommendations for long-range scientific objectives.

The IGY program and the continuing U.S. Antarctic Research Program (USARP) have been possible because of the complete and splendid logistic support provided by the Department of Defense, with the U.S. Navy as the immediate responsible agent.

Scientific Programs

In retrospect it seems incredible that, with modern means of transportation and communication, there should have been as late as 1957 an area on this planet as large as the United States and Europe together which was so little known—a continent which had never been the home of man, in whose interior no wintering-over stations had ever been built. Antarctica, the fifth largest continent, was at the beginning of the IGY the terra incognita of our planet. In spite of the achievements of the last 10 years it still is in many ways. Even now we know more about the surface of the moon than about the terrain of Antarctica beneath the ice cap.

Antarctica has an area of 5½ million square miles (14 million square kilometers) in the summer. This area is doubled in the winter as the sea freezes over beyond the periphery of the continent proper, for ice is a perfectly good rock; it differs from all others in that it melts at the absurdly low temperature of 32 degrees Fahrenheit. Antarctica, with its great cover of ice, is the highest of all continents, having an average altitude of more than 1 mile (1½ kilometers).

The real boundary of Antarctica is not the coastline of the continent itself but the Antarctic Convergence. This is a fairly sharply defined zone in the southern oceans between about 48° and 60° south latitude, where the colder waters flowing northward from Antarctica mix with the southward-moving warmer waters from the north. Not only is the Antarctic Convergence an effective barrier to marine life but it marks a definite physical difference in the oceans. In a sense, therefore, there is an "Antarctic Ocean" which is six times the size of the continent itself.

The specific objectives of the IGY required programs in 11 fields of science. Not only in the life sciences but in every field of geophysics, Antarctica presents environmental conditions not duplicated anywhere else on earth. Every field of geophysics demanded, and still demands, data for its development which can come only from Antarctica. It is not surprising, therefore, that among the many achievements of the IGY the scientific exploration of Antarctica was second in importance only to the inception of the space-satellite programs.

It was natural that meteorology should be the field in which the most extensive scientific effort was made, for Antarctica has the world's only ice-cap climate. Upper-air observations and studies of temperature, humidity, and wind were made by all stations of all nations.

It has long been recognized that the main causes of world weather are the interactions of great masses of polar air with masses of warm air at low latitudes. Before the IGY, the role which the great inland ice of Antarctica played was practically unknown. It had long been assumed that Antarctica was a great breeding ground for polar storms. The IGY investigations showed that these storms develop in the surrounding oceans, where westerly winds prevail, and not on the continent proper.

Antarctica was found to be, not a creator of storms, but the world's most tremendous heat sink. Vast quantities of relatively warm air flow, at high levels, from the equator over the vast Antarctic ice cap, releasing immense amounts of heat into space.

The ice cover of Antarctica makes practically all aspects of the meteorological picture seem, at first glance, deceptively simple. The more we know about it the more complex it becomes. There is no typical antarctic weather or climate. Actually the climate at the top of the great high plateau of East Antarctica and that of the coastal regions on the Indian Ocean may vary as widely as the climates of Tucson and Minneapolis. Wilkes Station, on the coastline below Australia, was so much warmer than any of the other six U.S. stations in Antarctica that it was dubbed the Banana Belt.

On 7 May 1957 the South Pole had a temperature of −100°F, while at Little America, less than 800 miles away, the temperature was 30° above zero. Differences of 100 degrees between the top of the plateau and the coast are not uncommon.

The lowest temperature yet recorded at the Amundsen-Scott South Polar Station is −112°F, whereas the lowest yet recorded anywhere on earth, −126°F, was recorded at the Russian station Vostok, inland from the Pole and 2000 feet above it.

At the South Pole the monthly average temperatures range from −13° to −80°F. On the other hand, the North Pole, which many had thought might be as cold as the South Pole, showed a range from 32°F, for July, to a low of −31°F for its coldest month.

Precipitation in Antarctica shows a variation not unrelated to the variations in temperature. The coldest parts of the continent receive the least precipitation, and the warmest parts, the most. In terms of water content, at some coastal areas, such as Wilkes Station, the snowfall may be the equivalent of as much as 15 inches (38 centimeters) of water per year. At the Pole it is 2.75 inches per year, and on the high plateau in the interior of the continent it is less than 1 inch per year. The probable overall precipitation is not less than 4 or more than 6 inches per year. This is less precipitation than many deserts receive. For example, the precipitation in Tucson, Arizona, in the Sonoran Desert averages 11 inches. Antarctica is, then, truly not only a cold desert but an exceptionally dry one.

The Inland Ice

The most distinctive feature of Antarctica is the great ice sheet which not only covers almost all of the land but in places extends, in the form of permanent floating ice shelves for hundreds of miles over the sea. The Ross Ice Shelf, the largest of these shelves, is as large as the state of Texas.

The average thickness of the ice is about 7000 feet (2100 meters), and the maximum thickness yet measured is 16,500 feet. The volume approximates 8 million cubic miles ($\sim$ 33 million cubic kilometers). Antarctica contains at least 90 percent of the world's ice and nearly 2 percent of the world's water. The ice is thickest on the high plateaus in areas of least precipitation and thinnest in areas along the coast where the precipitation is greatest. This anomaly suggests that when an ice sheet grows into a continental glacier the pattern of precipitation changes. Perhaps the ice sheet develops its own climate and eventually becomes so large, with such a cold interior, that it begins to starve through lack of precipitation. There is little doubt but that the immediate result of a general increase in temperature would be an increase in precipitation and an expansion—at least a temporary one—of antarctic ice.

The stability of the great inland ice is the most important factor governing sea level. The removal of but a few feet of surface ice as melt water would raise the sea level perceptibly, with disastrous results to all seaports and seacoasts. Were all the ice to melt, the sea level would rise at least 250 feet. It is therefore of fundamental importance to discover the present degree of stability of the antarctic ice cap. There is no question but that in the remote past it was much thicker than it is now. Glaciated mountain tops 1000 and even 2000 feet above the present levels of the ice testify to former greater thicknesses. Furthermore, in many places about the periphery of the continent raised beaches reflect the uplift of the land that occurred when it was relieved of a part of its ice load.

Whether the ice is currently advancing or waning is a moot question. The period in which accurate measurements have been made is too short for us to be dogmatic about this, but it is clear that no major changes have occurred in the recent past; such changes would be reflected in greater changes in sea level than are known to have occurred.

A thorough exploration of the inland ice may help to answer questions about how glaciers are born, how they grow, and how they die. Theoretically, the great ice sheet is a record of total geophysical events which extends from the present back perhaps as far as a million years.

The glaciologist tries to read in the ice a record of the annual temperature, precipitation, and prevailing wind direction at the time the moisture fell as snow. Such records are becoming available from ice cores. Deep-drilling techniques are being perfected at the U.S. Army's Camp Century in Greenland and will, in the predictable future, enable us to obtain cores through more than 10,000 feet of ice.

Materials entrapped in the snow and the ice provide the world's most important field for research for investigators of cosmic dust and of manmade pollutants. The snows and ice record not only nuclear explosions but the first major lead smelting and the use of lead in gasoline. During the present austral summer, measurements will be made of the concentration of common lead precipitated on the ice surface over the last 60 years. Such studies have been made in Greenland and are said to have indicated an alarming increase in lead concentration in the last decade as a result of the precipitation of decomposed lead alkyls which originated from the burning of leaded gasolines. A comparison of results of the Greenland and Antarctic studies will be illuminating. Certainly, from the standpoint of atmospheric pollution, Antarctica should be the cleanest area on earth. Perhaps here we will get some real insight as to the seriousness of the pollution problem.

During the past season, traces of DDT were found in penguins, seals, and some fish in Antarctica, but no traces were found in polar snows. Apparently the DDT is not the result of atmospheric dispersal. How did it get there, and why are not other pesticides present?

Extraterrestrial particles, which have been bombarding the earth throughout the formation of the great ice sheet, can be dated by their positions in layers of ice. If further research should show that these particles have a recurring pattern, it might be possible to predict the amount and kind of particles space vehicles will encounter.

The Land

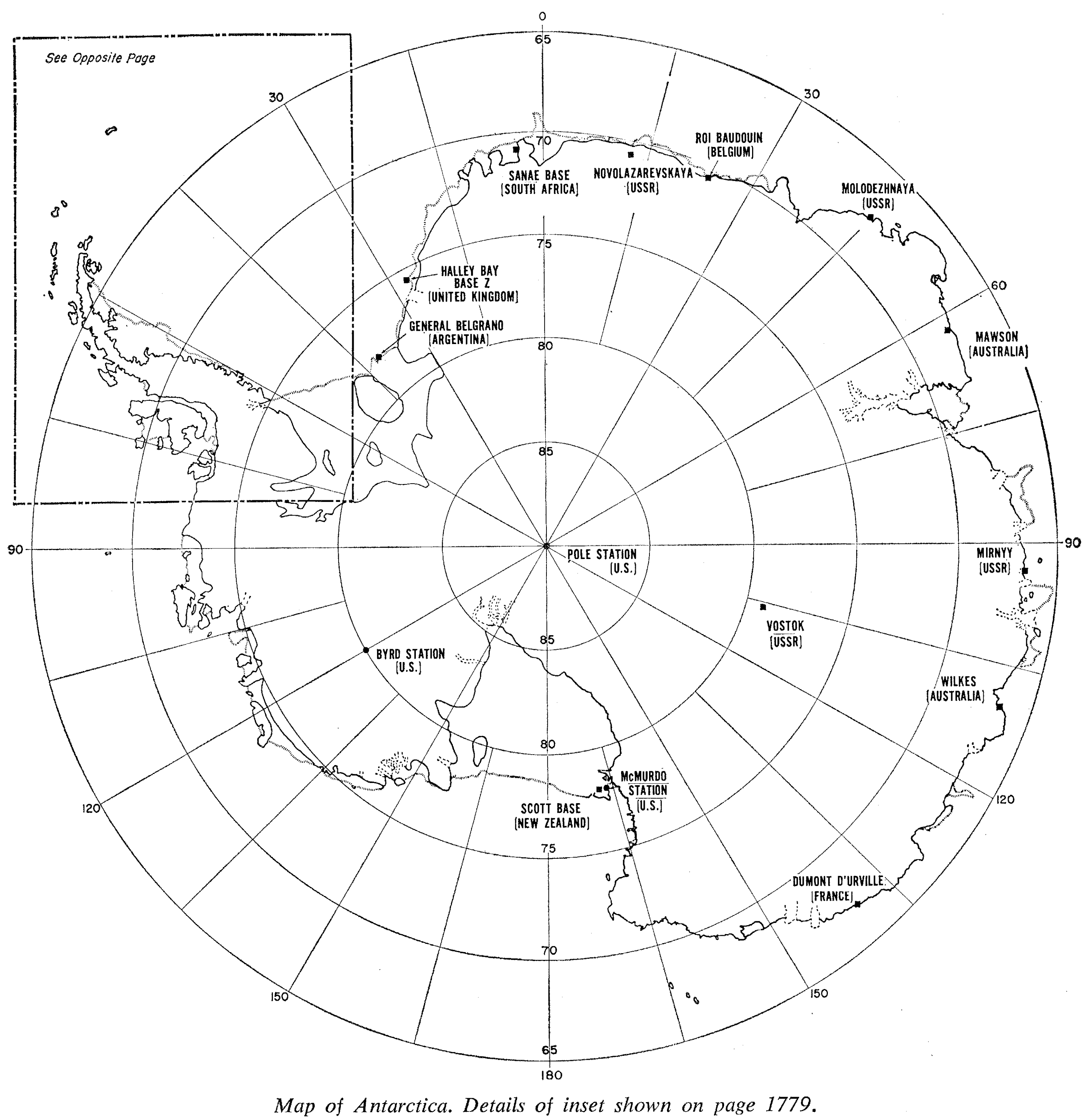
The over-snow traverses which produced data about the thickness and general character of the inland ice have also revealed much about the topography of the underlying terrain and have revolutionized many earlier assumptions about the continent.

The continuous ice cover gives a deceptive suggestion of topographical simplicity and uniformity. Actually, Antarctica consists of two major provinces. One, below Africa and Australia, is the great continental shield known as East Antarctica or Gondwana Province. The opposite and much smaller part, which lies below South America and the Pacific Ocean, is called West Antarctica or the Andean Province.

If the ice were to melt, Antarctica would present a vastly different picture. Stripped of its majestic cover of ice it would no longer be the highest continent. Indeed, it might be one of the lowest. West Antarctica, which has been the major field for U.S. activities, would become a great archipelago, no longer part of the continental land mass, while East Antarctica would remain above sea level but as a low-lying, fairly monotonous plateau.

Rock exposures are found only over 5 percent of Antarctica's vast area, yet the contents of these rocks raise fundamental geological questions of world-wide import. Even as the ice cap holds a major key to recent events on the earth, the older rocks of Antarctica hold a major key to such crucial questions as land bridges, continental drift, paleoclimates, and wandering magnetic poles.

Geological discoveries of the past 10 years demonstrate beyond a doubt that



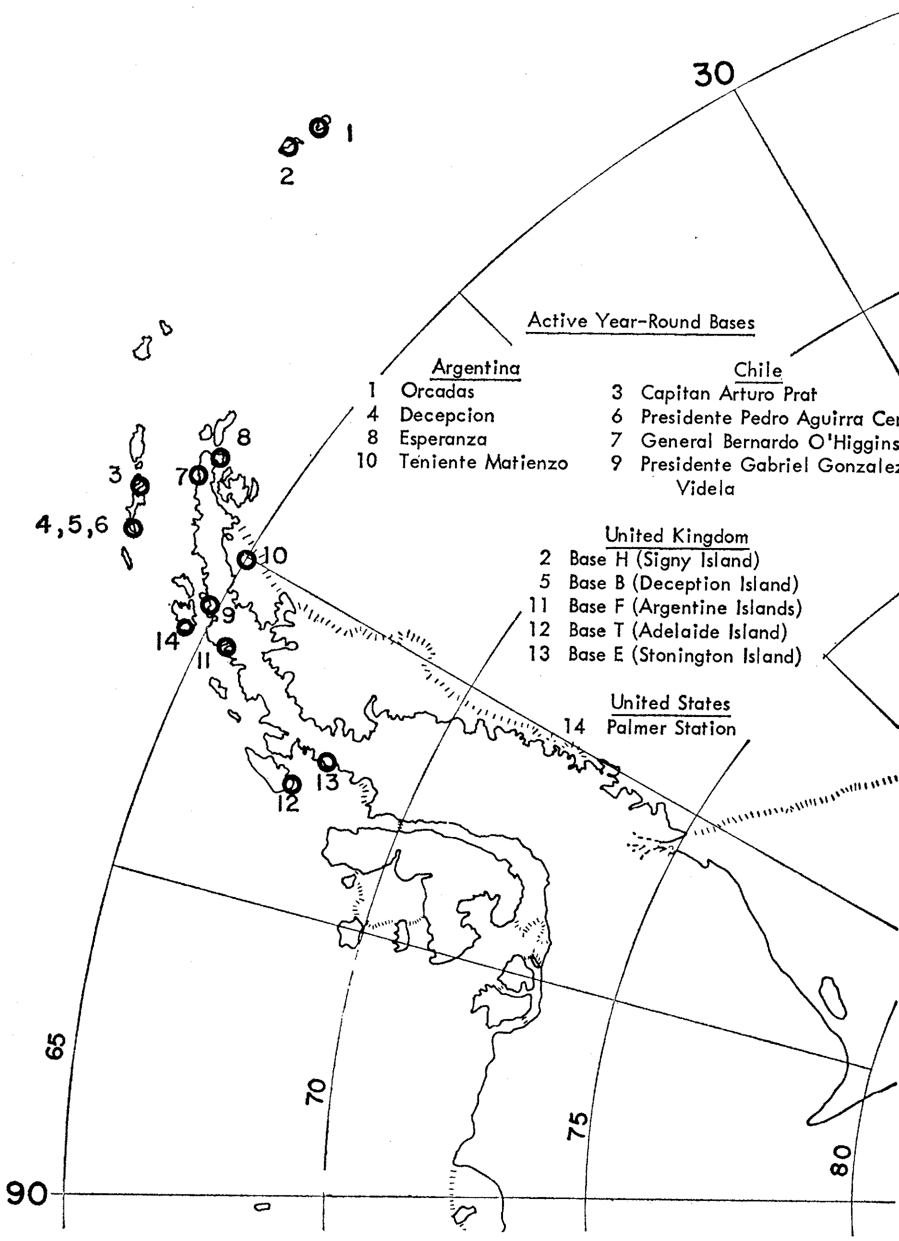
Map of Antarctica. Details of inset shown on page 1779.

the present geographical isolation of Antarctica is of recent occurrence and that no analogous period of isolation occurred earlier in geological time. The new information demands serious reconsideration of the hypothesis of continental drift, which assumes that India and Southern Hemisphere land masses were all united in one great land hemisphere, with Antarctica as its heartland. According to the hypothesis this land mass, known as Gondwana Land, existed presumably throughout Paleozoic and into Mesozoic time; it broke up and drifted apart in late Mesozoic time.

Recent fossil finds of both plants and animals of the same age as, and identical with, forms found on the other southern land masses, and the existence of tillites of late Carboniferious age 900 feet thick in the Horlick Mountains of the Queen Maud Range, cannot be explained on the basis of Antarctica's present isolation. No longer can it be assumed that the late Carboniferous tillities found in South America, Africa, India, and Australia represent local phenomena. In the light of the new information from Antarctica there is but one explanation, and that is extensive continental glaciation—an explanation hardly consistent with present land relationships.

To the geological and paleontological evidence for this hypothesis must be added the long-recognized fact that the shapes of the southern land masses fit together like pieces of a jig-saw puzzle. As recently pointed out by George Woollard, director of the Geophysical Institute in Hawaii, even more impressive is the spectacular precision with which the continental shelves, which have not been changed by erosion, fit together.

If there was a Gondwana Land, Antarctica was its keystone.



Detailed map of inset for map of Antarctica on page 1778.

Upper-Atmospheric Physics

Upper-atmospheric physics is concerned with the interaction of fields and particles and the way in which they affect the earth's environment. The particles may be terrestrial or extraterrestrial in origin, and they may be charged or uncharged. Antarctica provides a platform as unique for the study of these phenomena as for study of weather, climate, and glaciology. Only in Antarctica are the geomagnetic and geographic poles over land. The area of U.S. operations is magnetically conjugate to eastern Canada, a fact which is important in studying magnetic fields, cosmic rays, aurora, radio propagation, and whistlers.

Most low-energy cosmic particles are trapped in the Van Allen radiation belts which surround the earth at distances up to several earth radii. Such trapped particles shuttle back and forth along lines of magnetic force, and, where these lines plunge in almost vertically over the geomagnetic poles, both low- and high-energy particles pour into the earth's atmosphere. It is no accident that one of the largest cosmic-ray counters in the world is located at the U.S. base on McMurdo Sound.

Auroras are the visible manifestations of collisions between very-low-energy cosmic particles and the particles of the atmosphere.

During the antarctic spring and fall many of the ionospheric phenomena are diurnal, showing an association with the sun. The surprising thing is that in the dark periods, the antarctic winter, there are still some phenomena of diurnal character. These have not been fully explained, but it must be that the diurnal phenomena which can continue to exist during the dark period cannot be due to local ion production but must be due to transport from regions which do have alternate dark and lighter periods at this time. The need and desire to understand the mechanism involved continue to be major reasons for performing ionospheric research at high latitudes.

The ionosphere, because of its reflectivity, makes possible all normal high-frequency radio communication and is therefore of immense practical as well as scientific interest. Charged particles arriving in polar regions may so disrupt the ionosphere that it absorbs rather than reflects radio waves. Communication blackouts, often of serious proportions, result.

Life of the Land

Land life, both plant and animal, is notably sparse in Antarctica. It is restricted to the limited ice-free areas, particularly those near the sea. An important source of nutrients is the excreta of birds that come to the ice-free areas to nest during the summer. Algae, mosses, and lichens depend in part on these nutrients for their existence, and a few primitive animal forms in turn depend upon this primitive vegetation. There the chain ends, for nothing eats the animals. Here may be found answers to questions of how living organisms manage to survive at all, for Antarctica has a shortage of life-supporting resources unparalleled anywhere else in the world.

Most of the vegetation is lichens, of which there are about 350 species, and all the terrestrial animals are arthropods, of which there are about 60 species. The most abundant are free-living mites and springtails, which are small, primitive insects.

Terrestrial life is possible only because of the microhabitats. While air temperatures may remain very low, rock temperatures may rise rapidly in periods of prolonged sunshine. The layer of warm air immediately above the rock is a microclimate which may be as warm as a warm summer's day in mid-latitudes. For obvious reasons there are no flying insects! The largest land animal is a wingless fly.

While there are no terrestrial vertebrates, the ocean supplies several which spend part of their time on land or on the ice sheet. Two have become important subjects for research: the Weddell seal, southernmost of all mammals, and the flightless penguin.

The Weddell seal has surprised observers by diving to depths of 1500 feet and remaining submerged for as long as 30 minutes in his quest for food.

The Adélie penguin is one of many creatures throughout the world which show adaptation to a harsh environment. He nests in ice-free areas along the Antarctic coasts and migrates northward during the winter. He has capacities for navigation that make even the homing pigeon take a backseat. The Adélie's built-in biological clock, together with his capacity to navigate by the sun, enables him to keep on a straight course with remarkable exactness and return to his own rookery. Each rookery, by the way, has its own "standard time."

Six Adélies were released 2400 miles from their rookery, and three made it back in 10 months. Several were flown to the South Pole and released. They looked around a bit, cocked their eyes toward the sun, and started off in an exactly straight course for their home rookeries. They were of course picked up, put aboard the plane, and brought back, lest they perish on the way.

Life in the Sea

Even as the Antarctic Continent proper is noted for its paucity of life, the universal ocean which surrounds the continent is noted for its great abundance. Acre for acre, the waters of these oceans are potentially richer food-producing areas than any others on the globe. The richness of life is traceable to the abundance of nitrates and phosphates, which are brought up to the surface by upwelling currents south of the Antarctic Convergence.

Though the number of species is not great, the abundance of life is enormous. The productivity of this region is reflected by the presence of the largest creature which has ever lived, the great blue whale, whose food capacity is 1 ton of shrimp per day, and which is five times as large as any dinosaur.

There are many more species of fish in antarctic waters than in the Arctic. A striking evidence of the effectiveness of the Antarctic Convergence as a biological barrier is the fact that 90 percent of bottom-dwelling antarctic fish are not found elsewhere in the world.

One species of antarctic fish is notable for the absence of hemoglobin in its blood. Because of the high concentration of oxygen in antarctic waters, this white-blooded fish manages to get along without red corpuscles. It would die in any other environment.

Studies made by the National Science Foundation's laboratory ship *Eltanin* suggest that antarctic waters are the source not only of major ocean currents but of all ocean life as well. This vast protein-rich region may very possibly one day be a major source of food for a hungry world, for no matter how far man proceeds in his reaches into space, his continued survival and welfare will depend upon the resources of his mother planet earth. Antarctica may repay many times over in food productivity the cost of the continuing research efforts being made there.

The Antarctic Treaty

Important as the scientific results of the IGY Antarctic program and global program were, in the long run it may be the human and social results which will prove to have been most important. This vast global effort was carried out in a period of almost unprecedented worldwide turmoil and unrest. However, in the midst of all the tensions at political levels, scientists of the IGY demonstrated that reasonable and rational conduct at the scientific level was possible. And it was the IGY cooperative efforts in Antarctica, coldest of all the continents, that witnessed the first thawing of the cold war.

To be sure, international scientific cooperation is not new. It has existed for many centuries, but the IGY did add a new and significant dimension. It demonstrated, as never before, that the international community of science is the most hopeful of all examples of world cooperation and organization.

Scientific cooperation in Antarctica led to the creation of a political document without precedent—the Antarctic Treaty. In his call for a meeting on 3 May 1958 to consider the formulation of such an instrument, President Eisenhower said: "The United States is dedicated to the principle that Antarctica shall be used only for peaceful purposes," and he invited representatives "to confer with us to seek an effective joint means of keeping Antarctica open to all nations to conduct scientific or peaceful activities there."

The treaty which was the outcome of this meeting did six things. First, it guaranteed the nonmilitarization of the whole continent. Second, it prohibited all nuclear explosions. Third, it froze all national territorial claims and rights for 30 years. Fourth, it provided for an unprecedented system of unilateral inspection of any part of Antarctica by observers of any signatory nation. Fifth, it reserved Antarctica for peaceful purposes only. Sixth, and most important, it insured the continuance of the international scientific cooperation which characterized the IGY.

While this treaty was a means of quieting territorial claims, it was more than that: it was the first treaty ever designed to protect a scientific program. Then, this political instrument left to a nongovernmental agency, SCAR, the coordination of the program.

The very words of the treaty are almost prose poetry, and a few words from the preamble are worth quoting here. After naming the 12 nations involved, the preamble states its assumptions and reveals its spirit in these clauses:

> Recognizing that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord. . . .
>
> Convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interest of science and the progress of all mankind;
>
> Convinced also that a treaty insuring the use of Antarctica for peaceful purposes only and the continuance of international harmony in Antarctica will further the purposes and principles embodied in the charter of the United Nations; . . .

The details of the treaty are then given.

In his analysis of the treaty, Herman Phleger of the State Department, who led the United States delegation, says: "This treaty for the first time in history devotes a large part of the world to peaceful purposes. It is the first treaty which prohibits nuclear explosions with adequate inspection. It is the first treaty to provide freedom of scientific investigation over large areas and it constitutes a precedent in the field of disarmament, the prohibitions of nuclear explosions and the law of space."

In other words, this is history's first test ban and disarmament treaty. I do not think I exaggerated when, in my capacity as chairman of the Committee on Polar Research of the National Academy of Sciences, I made the following statement before the Senate Committee on Foreign Relations concerning the proposed treaty.

> We know that civilization has evolved largely on the basis of precedents and that a peaceful world depends on the chance of international cooperation. I think it was our hope during the IGY that the intergovernmental cooperation which characterized this vast program would find its way into some kind of permanent cooperation. I believe the Antarctic Treaty is a breakthrough of historic importance. I believe the IGY and especially the Antarctic program has laid new foundations for unifying our planet. It ushered in a new world of cooperation. I believe if the spirit which obtained during the IGY and which finds expression in the Antarctic Treaty is nourished and spreads as it should, history may take a new and more hopeful direction in our time.
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> The Antarctic Treaty is indispensable to the world of science which knows no national or other political boundaries; but it is a document unique in history which may take its place alongside the Magna Carta and other great symbols of man's quest for enlightenment and order.

The treaty was duly approved by all the signatory nations and officially implemented as of 23 June 1961. It created no formal secretariat or organization, but the signatory nations meet every year or two to discuss problems of mutual concern. The various governments have, as a result, approved 26 measures for greater cooperation since the treaty went into force. Perhaps the most important is the "Agreed Measures on Conservation." These measures may provide the means for conservation in Antarctica before it is too late.

As a result of Antarctica's isolation and of the fact that it has never been the home of man, the flora and the fauna represent the only sizable assemblage of organisms on our planet as yet uncontaminated by man. Fortunately, neither by accident nor by design has man yet succeeded in introducing new plants or animals into Antarctica. Perhaps here we shall be able to preserve a part of our planet not spoiled by man.

Inspections authorized by the treaty have been carried out with friendliness and success by several nations. In the austral summer of 1963–64 the United States sent inspectors to the bases of a number of our Antarctic Treaty partners, including the U.S.S.R. We, in turn, have opened our stations to our partners whenever they wish to come.

The spirit of the Antarctic Treaty is spreading. Provisions were made by the 12 SCAR nations which originally ratified the treaty for accession by other states, whether they were directly involved in Antarctic operations or not. There are now 15 signatories of the treaty; Denmark is the most recent.

The Department of Defense, which is responsible for the logistic support of the U.S. Antarctic Research Program, and the National Science Foundation, which is responsible for its operation, have worked together in harmony as notable as that among the various Antarctic-program nations. With the implementation of the Antarctic Treaty the Department of State became a third important U.S. partner.

In recognition of this partnership, an Antarctic Policy Group was established in May of 1965. It consists of the Assistant Secretary of Defense for International Security Affairs, the Director of the National Science Foundation, and, as chairman, the Assistant Secretary of State for International Organization Affairs. In consultation with other agencies of the government this group is responsible for (i) the definition of U.S. policies and the promulgation of overall U.S. objectives and guidelines for action in Antarctica, and (ii) the review and approval of plans for U.S. activities and programs in Antarctica. On 20 May 1965, President Johnson, commenting upon the establishment of this group, made the following remarks.

> Our objectives in Antarctica can be summarized in four very simple statements. We stand behind the Antarctic Treaty and will do everything in our power to insure that the Antarctic region will be a place of peace rather than a place of hostile international rivalries. We strongly favor international cooperation among the nations which are active in Antarctica. We support with all our resources scientific research in Antarctica, further exploration and charting of Antarctica, the development of new methods of transport and logistics in that region and the preservation of unique plant and animal life there. Finally, we earnestly hope that these great projects and peaceful cooperation in Antarctica will yield resources which every nation needs and every nation can use.
>
> The world toward which we are all working is one in which the earth will yield up enough for every man in every country. A world of peace in which the very deserts bloom and the polar ice is turned to enrichment of man's life.