

U.S. Geological Survey

**ICE-BOUND CONTINENT**—Weird landforms of the Antarctic Continent, including submarine mountains in the surrounding oceans, stand out in bold relief on this map-model prepared by the U.S. Geological Survey.

GENERAL SCIENCE

# Science Probes Antarctica

Under a treaty signed by 12 nations, international scientists are conducting biological, physical and geological environmental studies on the ice-bound continent of Antarctica.

By BARBARA TUFTY

See Front Cover

► THE ICE-BOUND CONTINENT of Antarctica is yielding many wonders about animal behavior and plant life, world communications, cosmic rays and high-energy atmospheric waves, the world's food supply and the shape of our earthly planet. This is the payoff of the intense research and growing interest in the continent surrounding the South Pole.

Even though the sun is now moving into the Northern Hemisphere and winter night and bitter cold sweep across the frozen bottom of the earth, international scientists continue their high-powered studies in full cooperation under a treaty agreed to by twelve nations.

President Lyndon B. Johnson recently praised the efforts of these scientists, and expressed keen interest in the experiments and the cooperative manner in which they are being carried out under a 12-nation treaty.

Antarctica, the fifth largest continent, is the first large area of the earth to be set aside for peaceful purposes, where men of different nations under a treaty are free to move about, exchange information and equipment, and to cooperate in the study of this land of ice and snow covering nearly all its six million square miles.

Once known as Terra Australis Incognita, Unknown Land of the South, Antarctica was first discovered by accident of wind and tide in the early part of the

16th century, when Amerigo Vespucci may have reached South Georgia, an island in the extreme South Atlantic. The next chronicle of that region of the world came in 1603, when a pirated Dutch ship may have hovered within sight of islands near the Antarctic Circle. From then on, ships of other nations passed near the icy land in search of seals and whales, and for the thrill of exploration and discovery. French, German, Norwegian and English were later joined by Russian, Belgian, Scottish, Australian and American explorers, culminating in the famous and desperate race to the geographic South Pole site by the Norwegian Roald Amundsen, who reached the Pole on Dec. 14, 1911, and the Englishman Robert Scott, who died with his companions on the return trip.

## Men of Many Nations

Today men of many nations work together under the Treaty of Antarctica, ratified on June 13, 1961, bringing together twelve nations in political and scientific cooperation—Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Union of South Africa, Russia, the United Kingdom and the United States.

Under terms of the treaty, all territorial claims of these nations are to be held in abeyance for a period of not less than 30 years. With no political barriers, scientists from different nations have been extremely cooperative in exchanging information about their expeditionary plans, research activities and stations. The treaty further states that the Antarctic may not be used

for testing weapons or nuclear explosions, nor may it be used as a disposal area for radioactive waste material.

Groundwork for this treaty started less than ten years ago, during the International Geophysical Year 1957-58, when nations joined together to set up scientific stations and began intensive research on the South Pole.

The American part of the project, called the U.S. Antarctic Research Program, is essentially planned, coordinated and financed by the National Science Foundation.

The U.S. maintains two permanent underground stations, in use all year round. One is at Byrd, where research in meteorology, seismology, ionosphere, aurora and radio noise is conducted. The other is at the South Pole Station, called the Amundsen-Scott South Pole Station, located at the geographic South Pole, the only U.S. station on the high polar plateau of East Antarctica. McMurdo Station, located on Ross Island and the largest of all stations, is the site from which many famous early expeditions started. Eights Station is a small station with emphasis on upper atmospheric physics. Hallett Station, closed for the Antarctic winter, is a center for marine and terrestrial biological research. Palmer, the newest station, is established along the Antarctic Peninsula.

Stations of other nations are conducting research in about the same fields as those of the U.S. Russia, with four stations all year round, is doing research on the upper atmosphere, geology and glaciology. The British perhaps place more emphasis on biology. New Zealand, Australia, South Africa, Chile and Argentina have similar research programs, on a reduced scale. Japan and Norway now have inactivated their stations for an indefinite length of time.

How do creatures live and thrive in sub-

freezing temperatures? How can seals dive rapidly several hundred feet under the ice water without developing the "bends" that afflict human divers? How do penguins find their way home across vast barren territories without a compass?

U.S. scientists and others are finding answers to these questions as they work in research stations under and on the ice of the Antarctic.

The enormous ice cap that covers Antarctica is not kind to living things. Here, where sunlit summer lasts only during December, January and February, the only plants that appear are primitive, low-lying mosses and lichens, and only three species of flowering plants—two grasses and one herb. No large land animals pace this icy land, for there is little or no food to support them. The most abundant land animals are insects and their relatives—mites, ticks, springtails, lice, midges and fleas. Microscopic creatures also have been found—the rotifers, nematodes and protozoas.

### Sea Filled With Life

The icy blue sea that surrounds the continent, however, is teeming with life—microscopic plants and animals, as well as seals, penguins, shrimp, krill, sponges and fish. These seas, which completely encircle Antarctica, are considered one of the greatest sources of untapped food supplies yet known to man.

The icy waters move clockwise around Antarctica in what is called a circumpolar current, which is mixed with upwelling currents that churn nutrients and inorganic matter from the bottom of the sea. Heavy ice water from the cold continent slips to the ocean floor and moves northward, being replaced by warmer water flowing south and rising close to the surface near the continent.



National Science Foundation

**FLIGHTLESS BIRDS**—*Johns Hopkins University biologist Richard Peterson records information about Adelie penguins, numbered for identification, as part of a project on penguin behavior.*

These various currents of water bring basic feeding material near the surface, upon which plankton, tiniest of animals and plants, feed. In turn the rich plankton pastures feed larger creatures, and thus attract and sustain a long chain of life—krill, fish, squid, marine birds, penguins, seals, whales, and at the end of the food chain, man.

Among the many sea creatures, the relatively friendly Weddell seal has been carefully studied for its remarkable power of finding its way in dark, murky waters by echolocation, and for its ability to dive to about 1,500 feet and stay under water for at least half an hour, holding its breath while actively swimming, hunting and eating. Scientists have learned that the mechanism for the seal's easy diving involves shunting blood to its heart and brain, increasing myoglobin in muscles to hold more oxygen, piling up muscular waste products for later oxidation, and being able to tolerate large amounts of carbon dioxide in the blood. The fish seen on this week's front cover, a 50-pound *Dissostichus mawsoni*, was taken from the mouth of a seal.

Other objects of much research are the penguins, those little "men in tuxedos," which have lost all ability to fly but which possess a highly developed sense of direction that enables them to waddle across long miles of ice and snow to find their way home. Scientists are also curious as to how these often comic and pleasant creatures treat their population explosion, for birds of all ages are crowded tightly together in apparent tranquility, in rookeries with as many as a million individuals.

The Antarctic has vast numbers of sea birds, including the fulmars, petrels, terns, and the world's most southerly bird, the South polar skua. These sea birds have the exceptional ability to live on the salt water of the ocean, and can eliminate excess salt by means of a gland in the nose—a gland 10 times more effective than a kidney for this purpose.

### Earth's Restless Refrigerator

The white shining ice cap at the bottom of the earth is the coldest, windiest, highest and stormiest ice factory on this planet.

From this restless and inhospitable refrigerator, billions of tons of icebergs break off each year and float thousands of miles northward, chilling the warmer waters, creating great sea currents and influencing the climate of northern lands.

These chunks of ice break off from everlasting glaciers that sluggishly flow to the encircling seas from the South Pole. They are part of the powerful ice mass that covers nearly 6,000 miles of mountains and plains, valleys and rockbeds.

Here on this continent, man has encountered the coldest natural temperatures in the world—126.9 degrees Fahrenheit below zero, recorded at Vostok, one of the Russian stations. Temperatures are coldest at the high elevations of the polar plateau near the center of the somewhat circular continent, where they average about 70 degrees below zero F. Along the coastal regions, the temperatures are somewhat warmer, averaging five to 20 degrees be-



National Science Foundation

**ICY PUZZLE**—*Belgian geophysicist Tony Van Autenboer (left) and University of Wisconsin geologist Thomas Berg use a SIPRE auger to determine why water lies between the top and bottom layers of ice.*

low zero, while during the four summer months from December to April, they may rise above freezing (32 degrees F.).

As if these bitter temperatures were not hostile enough to living beings, some of the world's wildest winds sweep across this region, speeding as fast as 200 miles per hour as they scream down the sides of the polar plateau and churn across the oceans. (As a comparison, the destructive hurricanes of tropic and temperate regions blow at speeds of about 135 mph.) The Antarctic winds create three of the stormiest places in the world—around the Ross Sea, around Cape Hope between South America and the Antarctic Peninsula, and on the seas between South Africa and Antarctica.

With 90% of the world's ice locked up in its cold storage, Antarctica is easily considered the world's largest ice mass. Snow and ice have been measured 16,000 feet thick at the Pole. The average height of the ice sheet above sea level is estimated at 7,500 feet, thus making Antarctica the continent with the greatest average height, and a potential source of fresh water for the thirsting world. In calculating the amount of water locked in ice here, scientists have figured that if the ice cap should melt, the oceans of the world would rise 200 feet, drown every coastline, and wipe out every port, harbor, bay and coastal city.

This continent was not always ice-locked, for geologists have found ancient logs of petrified wood encased in sedimentary rock, fossil leaves, twigs and extensive coal beds that testify to an earlier, warmer climate in this region. Yet at even another era, the ice cap was 1,000 feet thicker than today.

Is this massive ice sheet growing or shrinking at present? Geologists are not sure, but they are trying to find out. In

(Continued on p. 365)

## Science Probes Antarctica

(Continued from p. 359)

never-ending research, these earth scientists traverse the continent by foot, plane, motor toboggans and trucks to probe the deep ice cap and discover the nature of the rock lying beneath, to measure the direction and flow of glaciers, to analyze the change of snow to ice under enormous pressures of perpetually falling snow. They are mapping one of the world's great mountain chains, the Transantarctic Mountains, which divide the continent roughly into two hemispheres. Much of the mountains visible above the gleaming snow and ice are ancient volcanoes. One of them, Mount Erebus, towering almost 13,000 feet high, is still active, the world's southernmost live volcano, spewing its fiery ash and smoke over nearby stretches of ice.

The term South Pole can be confusing, since five poles have sometimes been defined:

1. The geographic South Pole, southernmost point on the earth's surface.
2. The geomagnetic pole, where lines of the earth's magnetic field converge.
3. The ever-changing magnetic pole where the needle on a compass points straight down.
4. The pole of inaccessibility, farthest point inland from all shorelines.
5. The spin pole, the imaginary point at which the axis of the spinning earth sticks out.

### Peer Into Space

The ice cap of stable Antarctica makes an excellent platform for man to examine the heavy space traffic of cosmic rays, protons, electrons and other nuclear particles that fill earth's atmosphere, its radiation belts and space.

A highly turbulent magnetosphere circles the earth like a doughnut 40,000 miles thick. This doughnut-shaped magnetic field helps to keep some of the sun's streaming lethal radiation from bombarding the earth. Many solar particles are trapped in this field, where they spiral back and forth from pole to pole along lines of force without ever reaching earth.

These bands of radiation, the Van Allen belts, start about 600 miles from the earth's surface and extend about 40,000 miles out into space.

The doughnut shape of this magnetosphere results from the shape of the earth's magnetic field, which resembles the field of a bar magnet thrust through the earth's center at a large angle from the axis of rotation.

Occasionally some of the solar particles caught in the field "leak out," agitating the air molecules in the earth's atmosphere and creating brilliant auroras. These leaking particles, plus cosmic rays and other radiation, are being carefully examined by scientists of all nations at Antarctica.

In a briefing to the President, Dr. Leland J. Haworth, director of the National Science Foundation, which plans and finances U.S. Antarctic projects, showed a diagram of the earth's magnetic field, and pointed out how the polar regions are in areas in

which the magnetic lines of force are vertical.

"These lines deflect charged particles into circular paths, trapping some of them, like great peels from an orange, into the Van Allen radiation belts in space, and causing others to strike the polar regions in abnormal numbers," Dr. Haworth said.

Some electromagnetic radiation tends to follow the magnetic lines. Lines of force beginning in Antarctica end in the northeastern United States and Canada. Energy from one area travels far out into space along these lines and returns at the opposite, or conjugate, point.

Very low-frequency signals called "whistlers" bounce constantly and swiftly back and forth from north to south. Scientists are now attempting to make their own low-frequency whistlers and send them back and forth over these same magnetic lines. A copper wire has been stretched 21 miles across the Antarctic ice to fling these signals spaceward, in an effort to check out a possible low-frequency communications system.

By launching research balloons simultaneously from north and south conjugate point areas, scientists are investigating such high-altitude radiation phenomena as auroral zone X-rays, solar proton showers and the loss of charged particles from the earth's radiation belts.

Investigations of both low-energy and high-energy cosmic rays are enabling scientists to learn more about earth's geomagnetism and upper atmosphere, and about solar physics and interplanetary space.

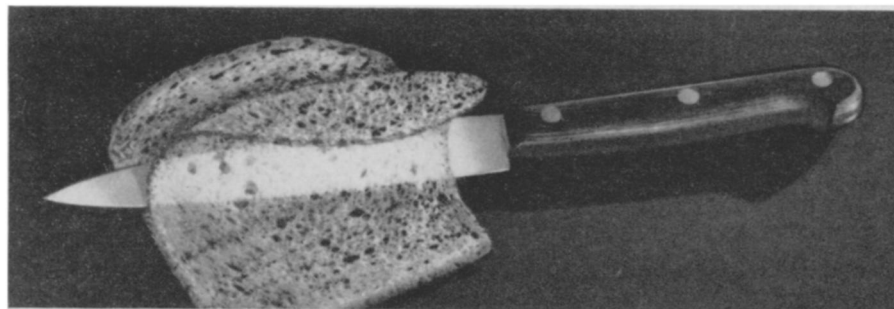
• Science News Letter, 87:358 June 5, 1965

## Are You A 3rd Grade Reader?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, anyone, regardless of his present reading skill, can use this simple technique to improve his reading ability to a remarkable degree. Whether reading stories, textbooks, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds by following this method.

To acquaint the readers of this publication with the easy rules for developing rapid reading, the company has printed full details of its interesting self-training method in a new book, "Adventures In Reading Improvement," which will be mailed free to anyone who requests it. No obligation. Simply send your request to: Reading Program, 835 Diversey Pkwy., Dept. 264A, Chicago, Ill. 60614. A postcard will do.



Oil-tempered carbon steel blade with "zero edge" can slice fresh bread 1/16 inch thin.

## Who else wants really **sharp** knives?

Send for free brochure "Kitchen Cutlery that Really Cuts"

Think they don't make sharp knives any more? Comus PRO knives are different — they really cut! And you can try these professional quality knives for 30 days without risking a penny.

### The Secret is the Steel

The remarkable Comus PRO knives are *not made of stainless steel*. The blades are not scalloped or saw-toothed. Instead, they are razor-keen, high-carbon, cutlery steel — forged, ground and oil-tempered to hold their edge. This is the steel used for professional cutlery . . . These are the knives used by professional chefs.

### Still Sharp in 1974?

Yes! Carbon steel does make an astonishing difference. Comus PRO knives are

so sharp you can thin-slice ripe tomatoes and fresh bread — carve rare chuck as if it were finest tenderloin — chop and mince vegetables like lightning. And a few occasional swipes on steel or stone keeps your Comus PRO knives factory-sharp for ten, twenty years, or even more!

### Send for Free Brochure

Comus PRO knives are not sold in any store, so send today for our free brochure. By return mail, we'll send you pictures, prices and facts on the new Comus PRO knives. Then *you* decide whether you want to try them for 30 days at *our* risk.

### Write today to:

Comus Division, Breck's of Boston  
Y51 Breck Bldg., Boston 10, Mass.