Soviet Research in Antarctica

The Soviet ship Ob recently returned to Leningrad from the Antarctic, having transported the winter crew and equipment of the 15th Soviet expedition to the continent. At the request of SCIENCE NEWS, *the head of seasonal studies of the 15th expedition, Master of Geographical Sciences Pavel Senko, and Dr. Mikhail Ravich, discuss the latest research being conducted by Soviet scientists in Antarctica. Arrangements were made through the Novosti Press Agency.*

Research in Antarctica revolves around three elements—earth, air and water—and recent Soviet expeditions have been concerned with all three.

In the southernmost continent, most water is ice, and every Soviet Antarctic expedition includes glaciologists. The 24-million-cubic meters of ice in the continent conceal sources of information that can be used to trace natural conditions over a period of tens of thousands of years. At a depth of three to four kilometers, for instance, layers of ice formed about 50,000 years ago contain particles of cosmic dust and particles of terrestrial origin, spores of plants and microorganisms and even archaic air trapped in ice cavities and compressed there under a pressure of several atmospheres.

At a more modest level, interesting glaciological structures have been observed. During the first trial drilling of the ice shield at the Lazarev station a layer of brine was discovered at a depth of 138 feet, each quart of the brine containing almost half a pound of salt. Scientists think that this brine originated in the ice thickness as a result of the impregnation of ice with seawater. They say there may be places in Antarctica where seawater has been fully frozen out and where nearly dry salt lies between layers of ice.

Trial drilling of the shield has also been started at the Vostok station, using a thermoelectric drill that is capable of going to great depths. At the Leningrad Mining Institute a new model of an ice drill, based on the principle of action of strong high-frequency electromagnetic fields, is being prepared for tests. The drill cuts the core every five meters and removes water and crushed ice from the well by a liquid dielectric with a low melting temperature. The ice drill also compensates for the pressure of the ice shield, preventing the well from clogging with ice.

Glaciological studies were also made jointly with French scientists during the 880-mile trek of a tractor-drawn sleigh train from the Mirny observatory to the Vostok station. A similar journey was undertaken five years ago to study the balance of the ice shield. There is a hypothesis that the Great Antarctic Shield is gradually sliding into the sea at a rate of about 330 feet a year. Were it not for a constant accumulation of ice, Antarctica would long have been free of its ice cover. To learn how much ice is accumulated and how much of it slides off the continent, scientists set up special survey stakes in the form of precisely measured pentagons along the route to the Vostok station. During their latest trek they checked these survey stakes and determined the speed with which the ice masses creep.

Another basic research area in the Antarctic is meteorology. The construction of a complex for the launching of meteorological rockets has been completed at the Molodyozhnaya station and the main Soviet Antarctic research center has been moved there. The complex consists of three permanent metal-panel buildings, an enclosed launching pad (the roof over it slides open only during launchings), a storage depot and a laboratory for the adjustment and readying of rockets. Every week rockets are launched to altitudes of 60 or more miles and the information they obtain is transmitted to all the world meteorological centers.

Studies of earth tides (SN: 6/13, p. 579) were also begun. In cooperation with scientists from the German Democratic Republic, sensitive equipment was dug 20 feet deep into the snow at the Vostok station. It was conjectured that since the Vostok station is situated about 11,500 feet above sea level, the influence of lunar attraction might be felt better there, especially when the planets are closest to each other. This conjecture proved correct.

Antarctica's geological structure is still insufficiently studied, largely because of the thickness of ice, about 10,000 feet, covering the entire continent. Areas without ice take up only 0.5 percent of the area of Antarctica, and an additional 5 to 6 percent of the continent has rare outcroppings of bedrock. The geological structure of the rest of Antarctica's territory can be studied only by geophysical methods.

Depth seismic soundings to determine the thickness and structure of the earth's crust were carried out on a section 250 miles in length in Queen Maud Land near the Soviet Novolazarevskaya station, where the transition of continental crust into oceanic crust is most clearly traced. It turned out that the thickness of the earth's crust in that area is about 25 miles. Its upper layer is formed not from the usual granites but from the so-called charnockites that were first discovered in India in 1901.

Charnockites are the predominant rock of the crystalline foundation of Gondwana, the southern supercontinent that is thought to have existed in ancient times (SN: 2/28, p. 229). According to this theory, some 200 million years ago South America was joined with Africa and this single continent drifted apart only at the end of the Jurassic period. In the first half of the Cretaceous period, about 100 million to 135 million years ago, both parts gradually moved apart like giant drifting ice floes and the Atlantic Ocean formed between them. Another global fracture took place earlier: India, Australia and Antarctica separated from Africa, and the Indian Ocean formed. Scientists in different countries find many confirmations of this theory: the similarity of the contours of these continents, the affinity of rocks lying in the covers of these continents and the similarity of mountain folding.

Soviet researchers have obtained new evidence supporting the theory of continental drift. They studied over 30 areas in eastern Antarctica that had formerly been blank spots for geology and made more than 200 measurements of the absolute age of rocks.

It turned out that the groups of continents once belonging to Gondwana can be established not only by the structure of the covers but also by the forming of the crystalline foundations that had originated during the earliest stages of the existence of the earth's crust. In eastern Antarctica Soviet scientists discovered their numerous outcroppings. Under the influence of the tremendous load of the 20-kilometer thickness of sediments, mighty tectonic movements and the heat of the earth's bowels, these ancient sedimentary-volcanic rocks became monolithic crystalline shales and various granites with a preponderance of charnockites.

. . . Antarctica

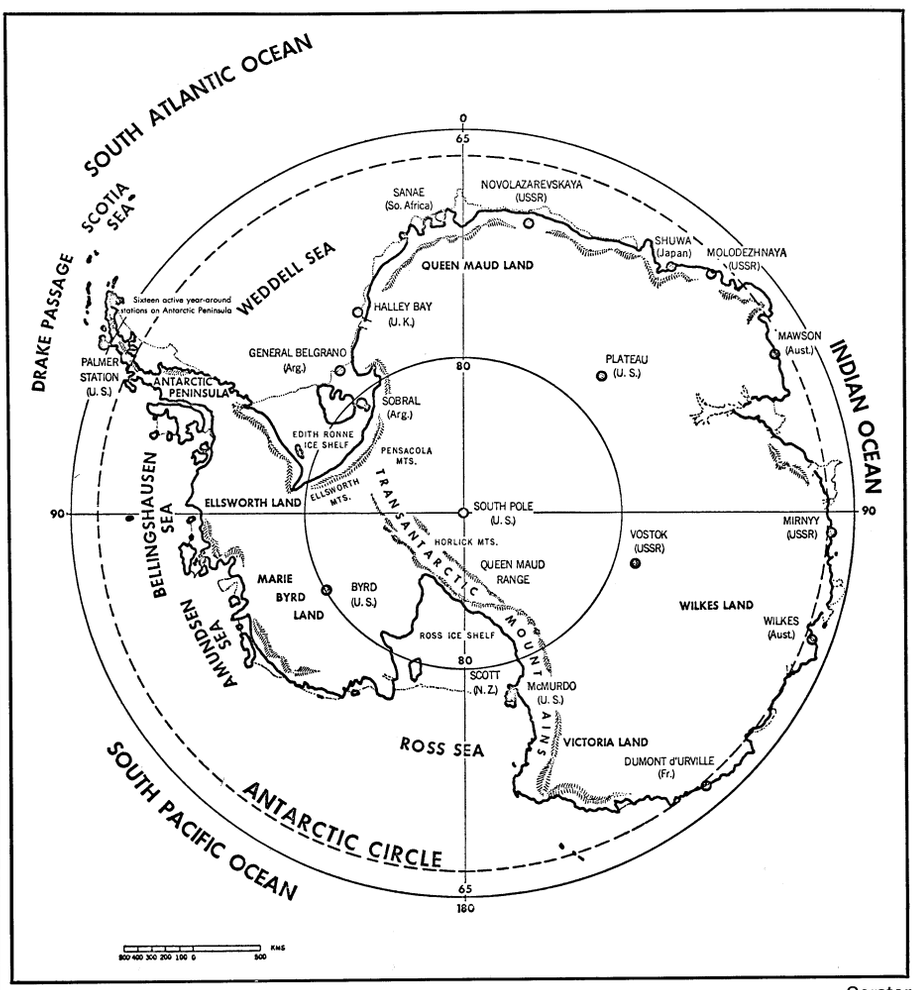
The thickness of the foundations in every continent that once belonged to the Gondwana platform is about the same—about 12.5 miles. By the area of bedding they take up 30 to 50 percent of the territory, whereas the corresponding figure for continents in the Northern Hemisphere is not more than 15 to 20 percent. Thus, only four major outcroppings of the crystalline foundation can be named on the entire territory of the Soviet Union: the Aldan and Abakan shields, the Ukrainian massif and the Kola-Karelian region. They take up less than 10 percent of the country's territory.

Soviet scientists say Gondwana is 3 billion years old. In the long period of its existence Gondwana's crystalline foundation experienced numerous changes. They took place simultaneously throughout the supercontinent's territory at five different time periods during the past 2,700 million years, they say. The traces of these changes can be found in some sections of the former supercontinent's platform.

The problem of Gondwana is important not only because it explains the present position of continents and oceans. It is also significant from a purely practical point of view. If the Gondwana continents have a similar geological structure, then the entire complex of Gondwana mineral deposits is characteristic of them: uranium, thorium, copper and nickel ores, the world's biggest deposits of gold and diamonds, very large deposits of coal and oil.

Indeed, a number of useful resources have been discovered in Antarctica. In the Prince Charles Mountains Soviet geologists discovered tremendous seams of iron ores, and in Queen Maud Land they found huge accumulations of mica in ancient marbles (separate seams are enriched with graphite), mountain crystal in pegmatite veins, lenticular titanomagnetite and others.

The main direction of Soviet geological research in Antarctica is connected with studies of ancient crystalline foundations. Soviet scientists have hardly dealt with studies of younger formations of the Antarctic platform's cover, including fossil remains of vegetation and animals—amphibians and reptiles—found in the cover's strata (SN: 3/28, p. 324). □



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Russian stations in Antarctica are sites of weather, ice and geologic research.