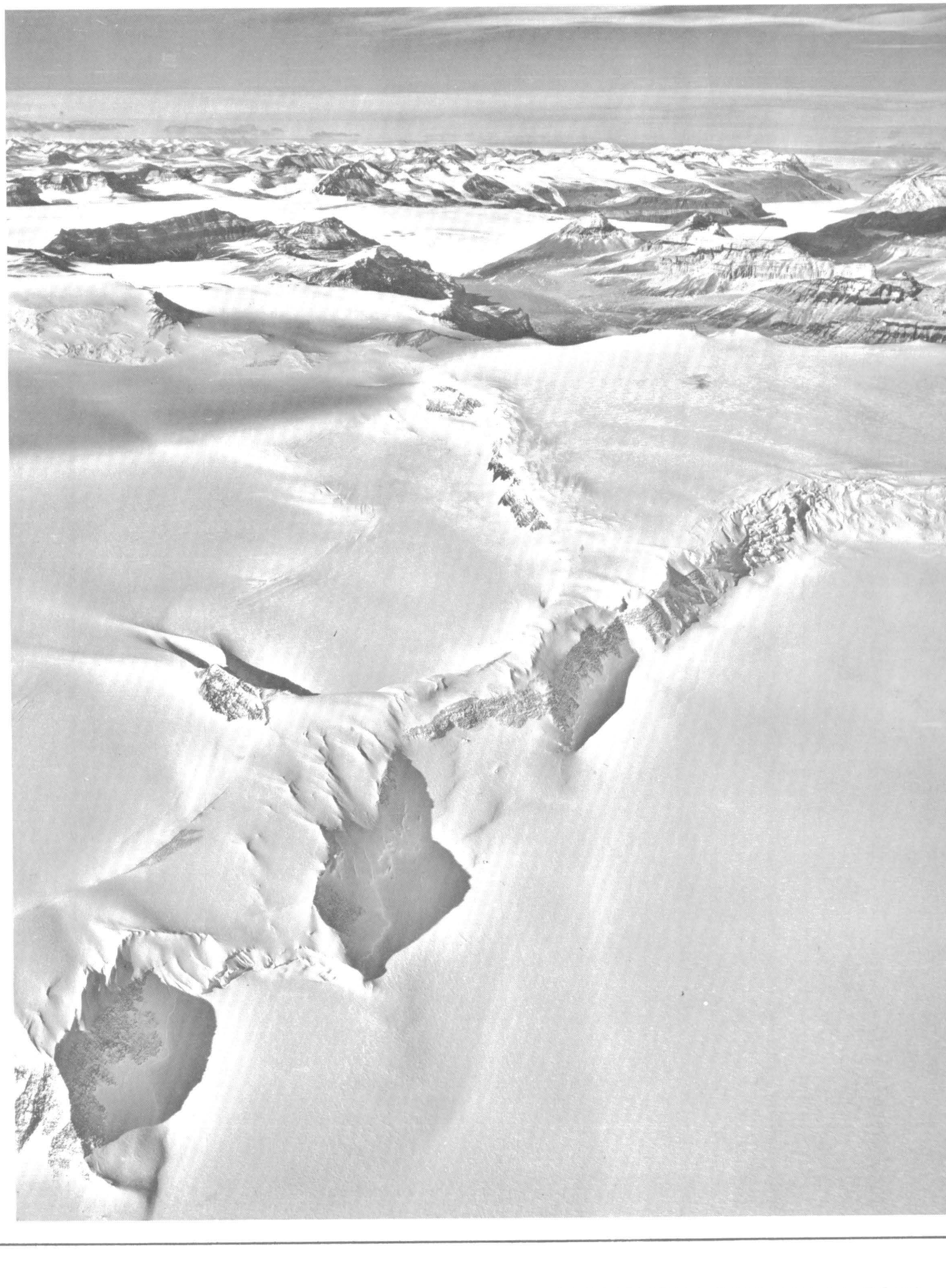
antarctic journal OF THE UNITED STATES



Volume VIII, Number 6 NOVEMBER-DECEMBER 1973

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U.S. Geological Survey

COVER

Polar ice plateau (foreground) and upper parts of Taylor (left) and Ferrar (right) Glaciers, Victoria Land, photographed from an airplane at 78°20'S. 161°30'E. A thin strip of the Ross Sea is visible just below the horizon. Scale at foreground: 1:15,000.

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Greenwich Mean Time is used, except where otherwise indicated.

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Soviet antarctic research, 1972-1973

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On February 13, 1956, the Soviet flag was raised over Mirnyy Observatory on the Wilhelm Coast of East Antarctica (66°33′S. 93°01′E.). Mirnyy thus became the Soviet Union's first and principal antarctic research station for the International Geophysical Year (IGY). Only this past year did Molodezhnaya Station (67°41′S. 45°51′E.) replace it as the center for the Soviet Antarctic Expedition (SAE). Since the start of the IGY, the Soviet Union has opened several new stations in the Antarctic, some of which since have been closed. Six are in operation now (fig. 1). In addition to Mirnyy and Molodezhnaya, these are: Vostok (78°28′S. 106°48′E.), the Soviet Union's only inland station; Bellingshausen (62°12′S. 58° 56′W.), a small station by the tip of the Antarctic Peninsula; Novolazarevskaya (70°46′S. 11°50′E.), a small station on the Princess Astrid Coast; and Leningradskaya (69°30′S. 159°23′E.), on the Oates Coast and the Soviet Union's newest station. A seventh station, Russkaya, on Cape Burks (74°43′S. 137°09′W.), probably will be built on the 19th SAE, early in 1974, giving the Soviets one or more stations in each quadrant of the continent.

About 400 scientists and support personnel, excluding ships' crews, took part in the 17th SAE, departing Leningrad on the diesel-electric ships *Ob'* and *Navarin* (reinforced, dry cargo vessels with icebreaker hulls), the *Professor Vise* (an ice-reinforced scientific research ship), and the *Nadezhda Krupskaya* (a small passenger liner chartered by the Arctic and Antarctic Research Institute, Leningrad, for use during the 17th SAE). A few other expedition members were flown to Perth, Australia, and later transferred to Antarctica on the *Ob'* and *Professor Vise*.

Foreign exchange scientists on the 17th SAE included five glaciologists from the German Democratic Republic, meteorologists from Hungary and Romania, two biologists and a biochemist from Poland, an atmospheric physicist from India, and the author. The latter two and the German glaciologists wintered over.

The tradition of having exchange scientists participate in foreign antarctic expeditions was established during the IGY and given more formal recognition in the Antarctic Treaty, ratified in 1961. Since the IGY, dozens of U.S. scientists have worked at various foreign antarctic stations; 14 have wintered with the Soviets. The Soviet Union has sent a like number of its scientists to winter at U.S. stations. The success of this exchange program has furthered the spirit of friendship and cooperation in Antarctica that has existed among the Treaty nations.

The author boarded *Nadezhda Krupskaya* in the Canary Islands in late January 1972. The ship had sailed from Leningrad 10 days before and arrived at Las Palmas with seven of the 15 winter personnel for Novolazarevskaya and some 50 members of the winter population for Molodezhnaya. He was to winter at Novolazarevskaya to record long-period surface-wave data from distant earthquakes on U.S.-built seismographs for a study of the upper mantle structure beneath the antarctic continent. The voyage to Antarctica took 3 weeks and was put to good use relaxing from hectic preparations for the expedition.

Krupskaya's first call was the Soviet summer camp at the edge of the Amery Ice Shelf, where topographic, geodetic, geologic, and geophysical programs were continuing from the previous season under the leadership of D. S. Soloviev, deputy chief of the 17th SAE for seasonal work. G. M. Muradov was head of the topographic-geodetic group, and G. E. Grikurov headed the geological-geophysical group. These groups had been working in the Prince Charles Mountains since early January. They departed aboard the *Krupskaya* in late February.

By late February the sea ice had become too heavy for the *Krupskaya* to sail through, so she made her rendezvous with *Navarin,* which led *Krupskaya* to within a few miles of Molodezhnaya. The final exchange of wintering personnel was accomplished with the use of two Soviet MI-8 helicopters and a small AN-2 biplane. Then *Krupskaya* sailed for home. *Navarin* continued unloading supplies for the station, departing for Novolazarevskaya in mid-March with the author on board. The other members of the Novolazarevskaya winter contingent had been flown to the station aboard a Soviet IL-14, a plane roughly equivalent in size and capacity to a DC-3, and the Soviets' main air support vehicle in Antarctica.

A few days after arrival at the edge of the Lazarev Ice Shelf. *Navarin* was met by a small tractor train (fig. 2) from Novolazarevskaya, led by the station chief, Vladimir Izmailov. Supplies for the year were loaded aboard and the tractor train departed on April 1 for its arduous 7-day, 100-kilometer traverse across the crevasse-riddled ice shelf to the station. Its arrival was greeted by a joyful welcome just 1 day before the first big storm of winter.

Novolazarevskaya was named in honor of Mikhail Petrovitch Lazarev, commander of the sloop *Vostok* dur-

Mr. Vane was U.S. exchange scientist during the 17th Soviet Antarctic Expedition.

ing the Bellingshausen expedition of 1820, during which the Russians claim to have made the first recorded discovery of Antarctica. The station was opened on February 18, 1961, on the edge of the Lazarev Ice Shelf, but a crevasse developed beneath the station the following year and forced its relocation farther inland. The present location is at the eastern end of the Schirmacher Oasis, a thin strip of exposed, hilly coastline some 15 kilometers long.

The station is situated on a small lake that is fed during the summer by meltwater from the icecap. Sewage unfortunately has polluted the lake beyond use as a water source, and the occupants melt snow for drinking, cooking, and bathing. The general location is considered important enough that plans are being made to build a new station a few kilometers away on a clean lake, even though a new aerology pavilion was just constructed at the present site.

The strip of exposed rock along the coast creates a microclimate that generally is less harsh than the usual coastal antarctic environment. Summer air temperatures of +5°C. are common, and in the winter the thermometer rarely drops below —35°C. The 1972 winter was to be the worst in the station's history, with winds reaching 60 meters per second on three occasions.

The station consists of eight buildings for living quarters and labs and several smaller buildings for storage and isolated equipment (fig. 3). The four original buildings are at the edge of the lake and are built with 1-foot-thick walls of wood and quadruple-paned windows. Large rocks hold the sheet metal roofing in place during heavy winds. These four buildings contain the chief's house (known locally as the "White House"), the radio station and meteorology center, living quarters for the mechanics and aerologists, a community center with dining and recreational facilities, and the diesel-electric station, which also houses the bathing facilities. Other buildings include the balloon launch tower; a small clinic where the two station doctors live (all Soviet stations have two doctors because of an incident at Novolazarevs-

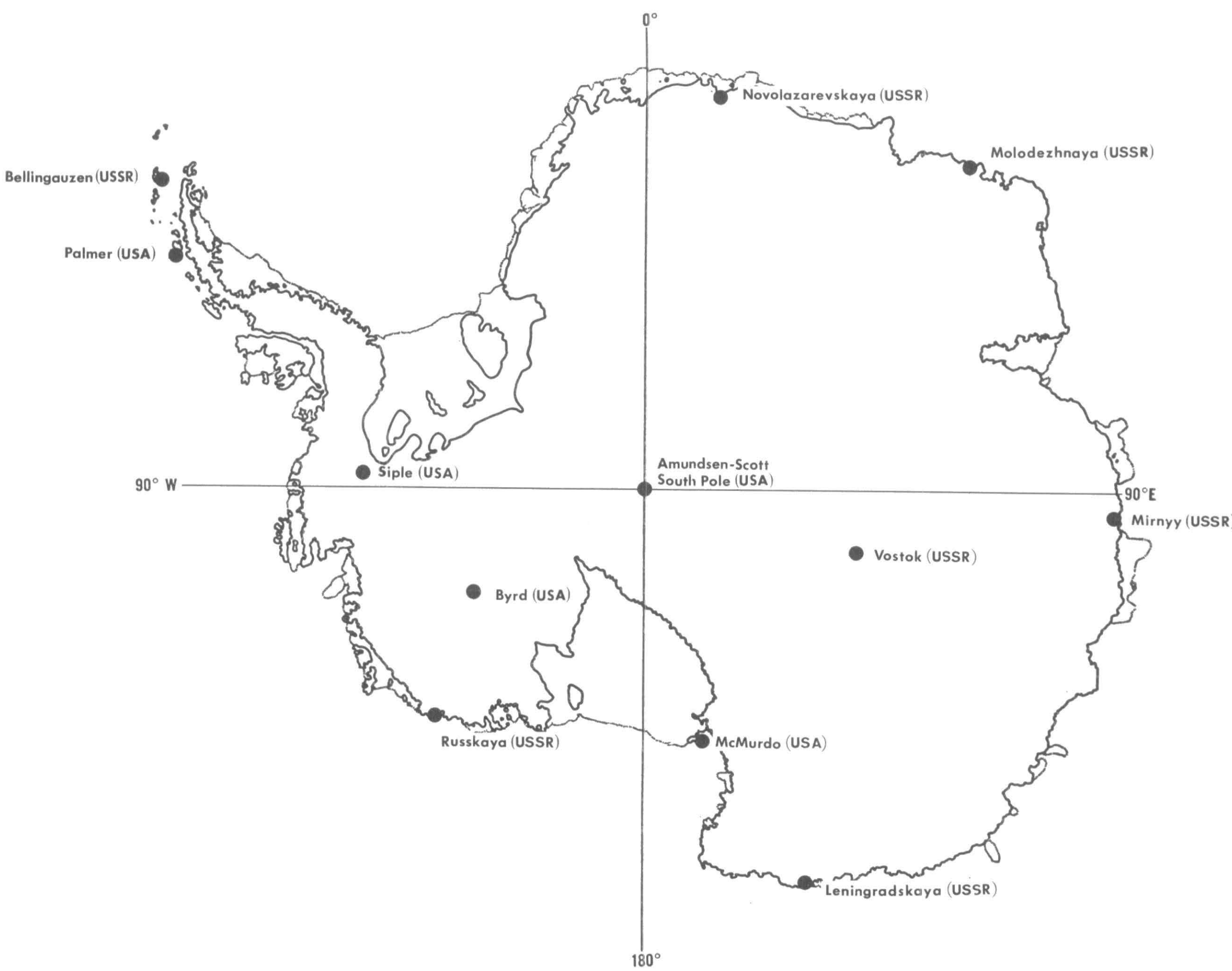


Figure 1. U.S. and U.S.S.R. antarctic station locations.

kaya several years ago in which the station doctor developed appendicitis and had to operate on himself, fortunately with success because of the help of one of the station mechanics); the "farmhouse," combination of living quarters for the geophysicists and astronomers and the seismograph station; a small astronomical observatory; and a new seismology pavilion built for the author. Except for the latter two buildings, the station is typical of other, small Soviet coastal stations.

The number of men wintering on the 17th SAE was 16: 1 cook, 2 doctors, 3 mechanics, a radio operator, a meteorologist, an aurora and magnetic field specialist, the seismologist, 2 aerologists, 2 astronomers, the station chief, and the author. In contrast to most U.S. stations, Soviet support personnel are not military people; rather they are hired for the expedition or are employees of the Arctic and Antarctic Research Institute. Station authority is supremely vested in the station chief. Each Soviet station also has a political leader, who serves as the local Communist Party secretary for party members who are at the station.

Data were collected by the station personnel for several continuing projects. The meteorologist, at 55 the oldest member of the station, made observations every 6 hours on air temperature and humidity, atmospheric pressure, visibility, cloudiness, wind velocity and underlying surface temperature. Many of the parameters also were recorded continuously on 24-hour instruments. Other daily observations included precipitation, snow cover, atmospheric phenomena, and sunshine duration and intensity.

Working in conjunction with the station meteorologist, the two aerologists launched a daily balloon-borne radiosonde (the A-22-IV) for measuring temperature and wind in the lower 40 kilometers of the atmosphere. The balloons were tracked until rupture by a Malachite radio theodolite.

The magnetic field specialist, a veteran of three previous winters in Antarctica and 5 years on Spitzbergen, operated an all-sky camera (C-180) for aurora observations. Also, he operated a magnetic-variation station (MVS), a quartz horizontal magnetometer (QHM), and a balance magnetometer (M-27) for recording variations in the geomagnetic field. Continuous recordings at 20 millimeters per hour were made with the MVS on the D, H, and Z magnetic elements. The QHM was operated four or five times each month for measurements of D and H; the M-27 was operated on the same schedule for Z.

The two station astronomers were engaged in an experimental program of photographic observations of artificial earth satellites. Their equipment consisted of a 25-centimeter-diameter short focus, richest-field refracting telescope with a photographic plate holder attached to the back. Standard exposures were 30-second sequence shots. A smaller standby instrument later was used when high winds damaged the main instrument. The program at Novolazarevskaya was similar to those at Molodezhnaya and Mirnyy. The author did not see these instruments in his later visits to Vostok and Bellingshausen.

A complete set of long- and short-period, Soviet-made seismographs was in operation throughout the year. The instruments were of the SGK and USF types. In addition, the author set up a three-component, long-period station using U.S.-made Sprengnether seismographs (instruments that are identical to the WWSSN seismographs at Amundsen-Scott South Pole Station and at Scott Base). The Soviet seismologist, in addition to operating the sta-

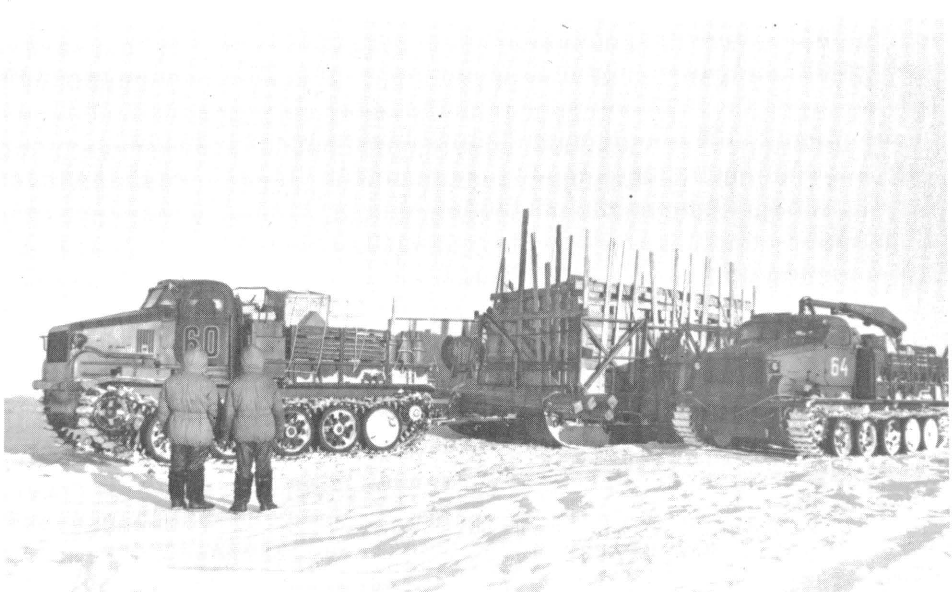


Figure 2. Tractor train on the Lazarev Ice Shelf.
G. Vane

Figure 3. Novolazarevskaya Station during the austral night.
G. Vane

tion seismographic instruments, maintained a KPK recorder for monitoring fluctuations in the earth's electromagnetic field.

Other scientific work at the station included snow ablation measurements and hydrologic observations of the local lakes by the station chief who is an oceanographer with the Arctic and Antarctic Research Institute, and monthly physical checkups by the station doctors.

For the most part, station life went smoothly and routinely. Morale remained high throughout the winter. Except for a few minor personality conflicts held in check by the people involved, the group worked and lived together very well. The station chief remarked on the voyage home that, on a scale of five, he would rate the year a "four plus," and most of the men agreed.

Some of the high points of the year included the rousing Fourth of July party given in honor of the author, which included a spectacular fireworks display and a superb banquet prepared by the station chef. During the spring, two traverses were made across the ice shelf to retrieve the remaining supplies left there several months before. The warm reunions with the crews after each of these trips was testimony to the friendship that had grown among us during the winter. Another day well remembered came in late spring with the first harvest of fresh cucumbers. The geophysicists and astronomers had planted a few window boxes at the "farmhouse," using some old, dried seeds, and were so enthusiastic over the first sprouts of green that the project quickly grew into a full-sized greenhouse that, by year's end, produced 50 kilograms of tomatoes and cucumbers plus fresh onions, chives, and several kinds of flowers.

So, in the manner peculiar to Antarctica, the year passed quickly. With the approaching summer came news over the radio of the coming season's work, and all community gossip was devoted entirely to discussions of the ship and airplane schedules for the 18th SAE (fig. 4). The author received an invitation to visit some of the other Soviet antarctic stations before returning home. On December 29, after a week's delay caused by bad weather, the first of the two yearly flights to Novolazarevskaya arrived from Molodezhnaya, bearing meat (the last of which had been eaten at Novolazarevskaya two weeks before), fresh fruit and produce, three new station personnel for the coming year, and visitors, including Dr. Yuri Israel, deputy head of the Hydrometeorological Institute in Moscow, and Dr. V. G. Averyanov, chief of the winter staff of the 17th SAE. The plane departed 12 hours later. After a pleasant 1-day visit to Japan's Showa Station, it arrived at Molodezhnaya on December 30, giving everyone a day to rest up for the big New Year's Eve celebration.

Molodezhnaya was opened as a permanent station on January 14, 1963. Since then it has grown from a small scientific outpost to the bustling center of the Soviet Antarctic Expeditions (fig. 5). Wintering personnel on the 17th SAE numbered 128. In the summer there usually are 200 persons at the station. A wide range of scientific programs is carried out, with concentration on meteorology. In addition to projects like those at Novolazarevskaya, the meteorology program at Molodezhnaya includes temperature and wind radar soundings of the atmosphere, use of U.S. satellite information in antarctic weather forecasting, and a meteorological rocket launching facility that launches a 15-kilogram package of instruments on a 478-kilogram M-100 rocket each Wednesday for measuring temperature, pressure, and wind velocity (fig. 6). The rocket attains an estimated maximum height of 110 kilometers when the instrument package separates and descends by parachute, sending the data by radio. The instrument package is not recovered.

Other research at Molodezhnaya comprises geomagnetism, visual aurora observations, radio-wave propagation studies, glaciology, photographic observations of artificial earth satellites, and medical research. Biological and geological research has been conducted in the past. To date, three U.S. exchange scientists have wintered at Molodezhnaya including Dr. Edward S. Grew, current exchange scientists on the 18th SAE.

From Molodezhnaya, the author flew to the Soviet base camp on the edge of the Amery Ice Shelf to meet *Navarin* for a tour of the other Soviet coastal stations. Geological and geophysical work was continuing for the summer season of the 18th SAE in the Prince Charles Mountains, with Dr. Grew participating in the geology field work in the Mt. Menzies area. Dr. Boris Lopatin, Soviet exchange scientist at McMurdo in 1968, was chief of the geological party. As in the previous year, field parties reached base camp in early January, working until late February. The Amery work has been the Soviets' only summer field activity in the last 2 years.

After completing her work at Amery, *Navarin* sailed on to Mirnyy with supplies for that station. The first ship of the season, she was welcomed with a fireworks salute and banners by a small group of men led by station chief N. N. Ovchinikov.

The winter population at Mirnyy was 43. The buildings of the station, originally constructed above snow on bedrock, have since been covered by up to 9 meters of snow (fig. 7), making life at the station difficult. Entry is by means of dark, slippery stairways leading down through shafts constructed beside the buildings and extended upwards as the snow becomes deeper and deeper. Summer brings its own problems with a continual flow of meltwater down into the buildings. The water has to be brought to the surface by constantly operating pumps. Despite the hardships, a full complement of scientific programs is carried out year-round. Although no longer the center for the Soviet antarctic efforts, Mirnyy still plays the important role of starting point for the Vostok tractor supply route. New, two-story buildings on stilts, of the type successfully used at Molodezhnaya, are being built on a nearby hill west of the station center to replace the buried buildings.

Flying to Vostok aboard an IL-14, the supply "road" used by the tractor train each year—a brilliant white, straight line streaking across the polar plateau—was clearly visible from 900 meters. The flight takes 6 hours, and the plane usually takes off again for the return flight to Mirnyy within 15 minutes of landing at Vostok. Vostok was opened on December 16, 1957, and has operated continuously since then, except for the period January 21, 1962, to January 23, 1963. The station (fig. 8) is located about 3,488 meters above sea level, and has the distinction of being the coldest inhabited spot on earth. A temperature of —88.3°C. was recorded in the early 1960s, and temperatures of —80°C. are common each year during the polar night.

The Vostok crew on the 17th SAE numbered 27, un-

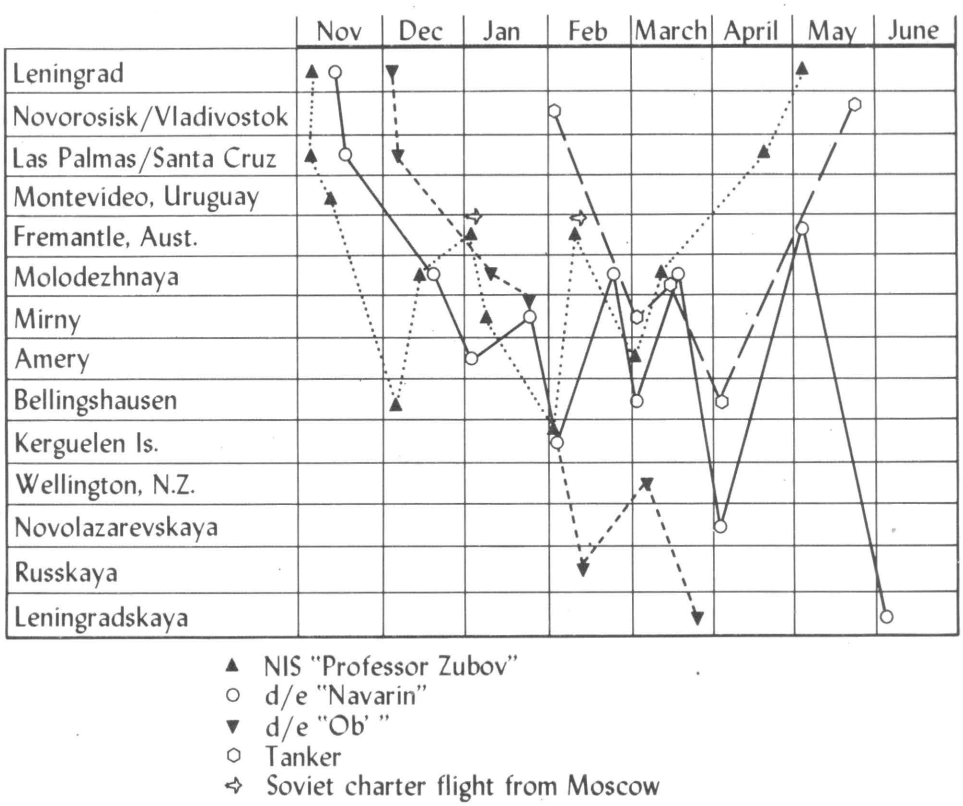
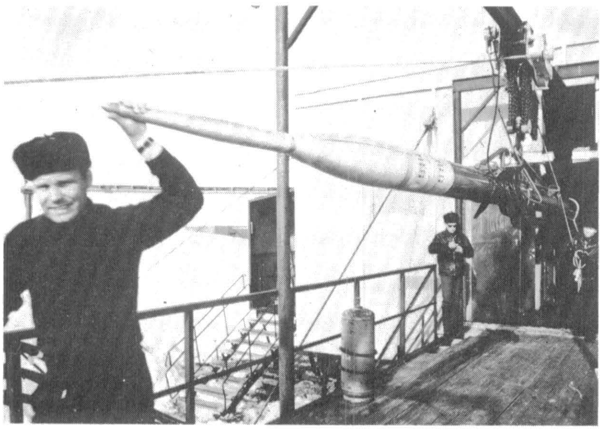


Figure 4. Logistics plan of the 18th Soviet Antarctic Expedition.

G. Vane

Figure 5. Molodezhnaya Station. Buildings are on stilts to prevent drifting over by snow.
G. Vane



G. Vane

Figure 6. Soviet M-100 meteorological rocket being prepared for launch at Molodezhnaya.

der the leadership of V. A. Ananyev. In addition to the standard meteorological and geophysical programs, Vostok also has an extensive biomedical program in which five medical doctors participated, and a deep-drilling program which had completed coring the ice-cap to 952 meters by mid-January and was already 775 meters into a second hole. Also at Vostok are complex micropulsation and riometer systems, operated jointly by the National Oceanic and Atmospheric Administration, Environmental Research Laboratories, and the Institute of Physics of the Earth, Moscow, U.S.S.R. Through this program, four U.S. researchers have wintered at Vostok in the last 10 years.

After finishing her work at Mirnyy and helping to unload supplies and personnel from *Ob'* and *Professor Zubov,* sister ship to *Professor Vise, Navarin* sailed on to the Kerguelen Islands with meteorological rockets for

Figure 7. Mirnyy Station. Completed 18 years ago, most of its buildings are drifted over.
G. Vane

the joint Soviet-French atmospheric studies under way there. After refuelling and taking on fresh supplies in Montevideo, *Navarin's* next antarctic call was Bellingshausen Station.

Bellingshausen had a winter population of 15 during the 17th SAE. A. N. Chilingarov was a leader of this small station on King George Island which was opened on February 22, 1968. Bellingshausen has year-round programs in meteorology, geomagnetism, and coastal hydrology, including observations of marine ice and icebergs. Summer programs in the past have included biology, geology, and on the 18th SAE, paleobotany.

The station is located on Potler Cove (fig. 9). Transportation between ship and shore consists of two amphibious vehicles and a small cutter. These facilities are shared with the nearby Chilean station, El Presidente Frei, which is the center for the Chilean meteorological program. The Soviets now are in the process of replacing the wooden buildings of the original Bellingshausen Station with smaller versions of the metal, prefabricated buildings on stilts used at Molodezhnaya, thus indicating a long-term interest in this location.

The only Soviet station not visited on the tour was Leningradskaya, opened on February 25, 1971. The station is still under construction, but its 17-man staff did meteorology, geomagnetism, visual aurora studies, observations of marine ice and icebergs, and reportedly, experimental photographic observations of artificial earth satellites.

The Soviet Union thus is continuing an active program of antarctic research and exploration. The number of Soviet stations has increased at a rate of about one every 3 years during the past several years, and although scientific activity still concentrates primarily on meteorology, future exchange scientists on Soviet Antarctic Expeditions can expect research possibilities in many fields. From the author's experience, wintering with the Soviets is a personally rewarding, once-in-a-lifetime opportunity.

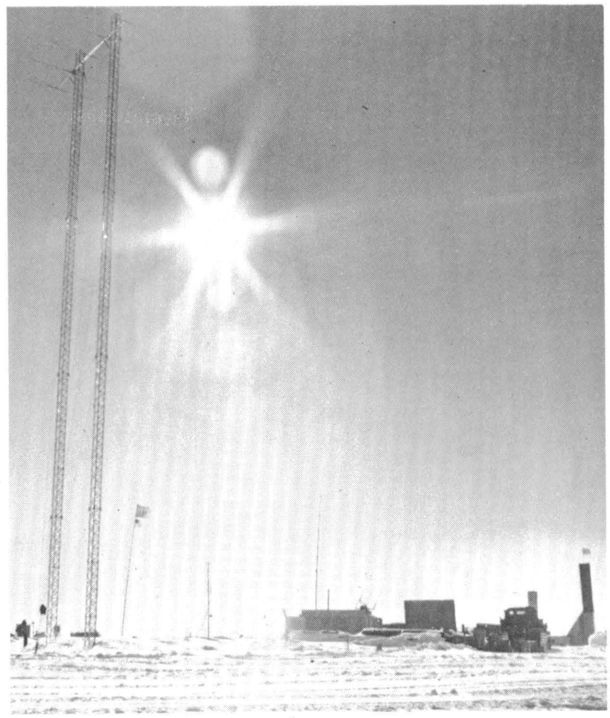


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Figure 8. Vostok, the Soviet Union's inland station. On the left is the U.S. National Oceanic and Atmospheric Administration's forward-scattering antenna. The tower at right houses a thermal drill rig.

The author thanks his many Soviet friends and colleagues whose efforts made the expedition both a scientific success and a most enjoyable experience, especially Dr. Vladimir Izmailov, chief of Novolazarevskaya Station, Mr. Anatoly Norman, station seismologist, Dr. Vyacheslav Averyanov, chief of the 17th SAE wintering party, Dr. Pavel Sen'ko, chief of the 18th SAE, and Captain Yuri Karlov, of the *Navarin*. This work was supported by National Science Foundation grant GV-31216. This is publication number 1251 of the Institute of Geophysics and Planetary Physics,. University of California, Los Angeles.

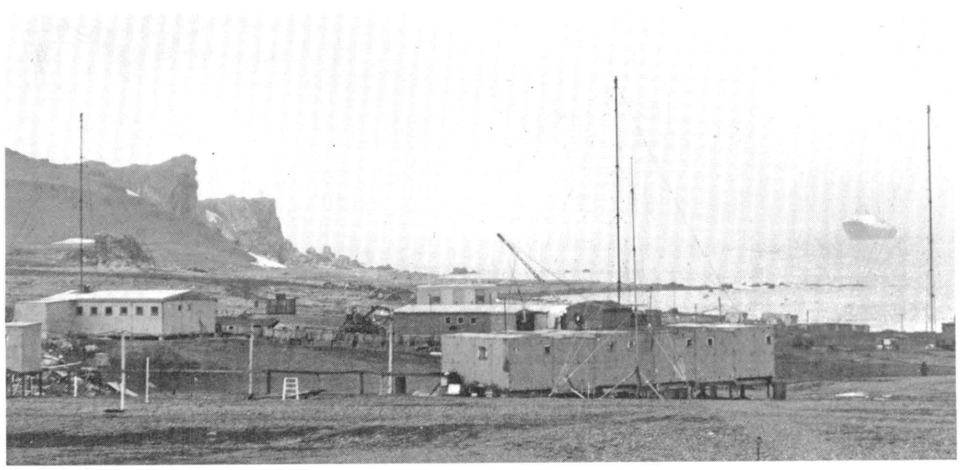


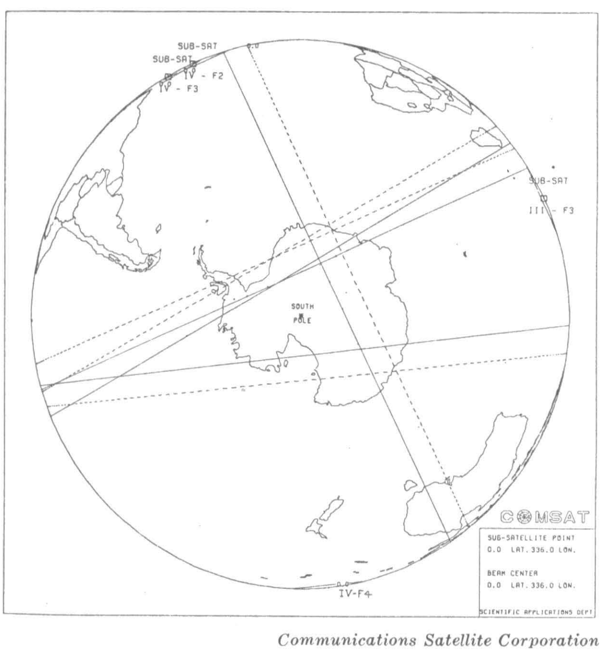
Figure 9. Bellingshausen Station with *Navarin* anchored in the harbor (right).
G. Vane

Unmanned geophysical observatory

MICHAEL J. SITES
Stanford Electronics Laboratories
Stanford University

Antarctica's importance for scientific research has led most Antarctic Treaty nations to operate stations year-round. Nevertheless, harsh climate, remoteness, and consequent high costs constrain science programs. The logistics cost is especially high for inland stations, to which all supplies must be brought by air or by over-snow traverse. Even with the ski-equipped LC-130 airplane, constructing a station such as the new one at the South Pole is costly and takes years. As a consequence, there are only three year-round inland stations: South Pole (U.S.A.), Siple (U.S.A.), and Vostok (U.S.S.R.).

The low number of inland stations handicaps projects that require knowledge of large-scale physical processes of the magnetosphere, the ionosphere, and the lower atmosphere. Frequently researchers need data from additional locations to define the scale size and propagation direction of phenomena observed at the manned stations. Even on the coast, where the station density is higher, locations of scientific interest may be difficult to reach or have a particularly inhospitable climate. Although the cost of even small manned facilities at the required locations would be prohibitively expensive, in many cases suitably designed automatic stations could acquire the necessary information at a much lower cost.



Communications Satellite Corporation

Figure 1. Intelsat coverages of Antarctica. The solid line is the 0° angle look, and the broken line is the 5° angle look.

These considerations led the National Science Foundation to fund a feasibility study for an automatic station that would incorporate most of the passive observational programs in meteorology, seismology, and upper atmospheric physics. Funds later were made available to Stanford University for construction and testing of a prototype observatory.

The resulting unmanned geophysical observatory (UGO) allows scientists to conduct year-round experimentation and monitoring at locations in Antarctica that are remote from the manned stations. Data are transmitted directly to the United States in real-time via Intelsat synchronous communications satellites. In the feasibility study, techniques examined for data retrieval were storage on magnetic tape, transmission via high frequency radio link, and direct read-out by polar-orbiting satellites. The only means found for handling the anticipated large volume of data is direct relay to a synchronous satellite (Jenny *et al.*, 1969). Using synchronous satellites limits station deployment to latitudes lower than about 80°S., but a significant fraction of Antarctica is nonetheless accessible (fig. 1).

The observatory consists of an insulated cylindrical capsule on a 6-meter pyramidal tower. The capsule contains the communications equipment, the data acquisition system, and the experiments themselves. A passive heat pipe thermal regulator holds the capsule temperature to 10° to 20° C. despite large changes in the external air temperature, thus providing a laboratory-type environment inside the capsule. The capsule and tower can survive winds of 240 kilometers/hour and are capable of field set-up without the use of heavy equipment. Fig. 2 shows the nearly completed observatory at McMurdo. Although the observatory is on a volcanic ash permafrost at McMurdo, a snow foundation worked at Byrd Station for 2 years.

Electronics

Data encoder. Experimental analog or digital data are brought to the data encoder. The encoder samples the channels either sequentially or under control of a memory. Analog data are digitalized into eight-bit words plus a single parity bit and put into a serial stream along with a frame synchronizing word and any digital data. Under sequential sampling, each channel is sam-

Figure 2. The unmanned geophysical observatory at McMurdo, January 1972.
M. Sites

pled once per frame, and the channel sampling rate is controlled by the number of channels to be sampled and the bit rate. However, by using memory control a channel may be sampled many times per frame, permitting a higher sampling rate for selected channels.

Data transmitter. The serial digitalized data stream then goes to the data transmitter, where it either frequency modulates a 5.5-kilohertz subcarrier or phase modulates the radio frequency (RF) carrier directly. These two modes of operation allow a wide-band analog channel, extending from 50 hertz to 3 kilohertz, to be transmitted along with the digital data, if required. The 5.5-kilohertz subcarrier is summed with the wide-band analog channel, and the composite signal is used to frequency modulate the RF carrier to a peak deviation of approximately 20 kilohertz. Uses of this channel include very low frequency (VLF) research and voice transmission. Whenever wide-band analog transmission is not required, the direct phase modulation provides superior performance. The RF carrier is derived from a phase-locked microwave source operating in the 5.925- to 6.425-gigahertz band. The modulated RF carrier is amplified to the 20-watt level by a travelling wave tube amplifier (TWTA) and then is brought to the antenna via flexible waveguide. The antenna assembly consists of the transmit band-pass filter, orthocoupler, circular polarizer, and parabolic antenna. The antenna is 2.2 meters in diameter and has a Cassegrain feed. A fiberglass radome minimizes snow accumulation and wind loading.

Command decoder and command receiver. Commands may be sent to the observatory from the United States to turn experiments off and on, to change data rates, to select which channels are to be sampled, to change transmit and receive frequencies, to switch in redundant circuits, and to turn the transmitter off if a malfunction should occur. Commands are sent from the control center computer to the earth station where the commands modulate an RF carrier. The modulated carrier is transmitted by the earth station via the satellite to the observatory and is downconverted from 4 gigahertz and demodulated by the command receiver. The received commands are checked for errors in the command decoder. If none are found, the commands set or reset latching relays, which in turn control whichever function is being modified. The latching relays provide isolation between the command decoder and the controlled circuit as well as a nonvolatile memory.

DC/DC converter and power distribution. The various voltages required by the transmit and receive electronics are provided by dc/dc converters operating from the main 28-volt supply. Each experiment has a separate dc/dc converter. The separation provides isolation and allows the experimenter greater flexibility in choosing the voltages at which the experiment electronics will operate. Experiments are equipped with a single-shot fuse to disconnect a faulty experiment. Sensors disconnect the dc/dc converters from the 28-volt supply to prevent damage in the event of voltage fluctuations. Fig. 3 is a block diagram of the UGO electronics.

Experiment interface. Each experiment is allocated a volume of 12.7 x 12.7 x 30.5 centimeters, including connectors and wiring bends. The present observatory capacity is 12 experiment modules of this size. Analog experimental data must be buffered to a 0- to 5-volt level before being sent to the data encoder. Digital data must be transistor-transistor logic compatible. Because the cost of providing power is high, each experiment is limited to 5 watts. Thus, consideration should be given to the use of complementary metal oxide semiconductor logic and other low power circuits. Since the experiments must operate for 1 or more years in the field without calibration or repair, they must be reliable, rugged, and either free from drift or self-calibrating.

Satellite system and earth station equipment

After transmission the signal travels over 40,000 kilometers to the Intelsat IV satellite and then is retransmitted, along with other trans-Pacific telecommunications, to an earth station operated by Communications Satellite Corporation, Jamesburg, California. The station at Jamesburg provides an antenna gain to noise temperature ratio in excess of 41 decibels. The Intelsat system is a good choice for the UGO because (1) satellite availability is virtually guaranteed, as is replacement of a failed satellite, and (2) the highly sensitive earth station operates with the satellite 24-hours per day.

After reception and amplification at the earth station, the data carrier is downconverted from 4 gigahertz and demodulated by a narrow bank receiver. Telephone lines carry the data approximately 200 kilometers to Stanford University. The command modulator and transmitter also are located at the earth station. Commands for the antarctic equipment are sent from Stanford to the earth station by telephone lines. The use of telephone lines allows the data processing center to be located anywhere in the United States and yet maintains effective control of both the earth station equipment and the antarctic electronics.

Stanford University equipment

At Stanford University the data are read into an online minicomputer (Hewlett-Packard model 2115A). The computer scans the data streams until frame synchronization is found. Then the data from each experiment are separated out and put on nine-track, 800-bits-per-inch magnetic tape along with timing and error control information.

After data are received, formatted, and stored on magnetic tape by the minicomputer, the tape undergoes a second stage of processing in which the data from a particular experiment are separated and an individual user's tape for each experiment created. The user's tape contains time-of-day and detected transmission error information in addition to experimental data and is formatted for efficient user processing. This tape then is mailed to the user. However, for users requiring real-time data, direct access to the minicomputer is available. These data normally would be transmitted to the user over the switched telephone network, allowing the data to be available within a few seconds after being taken.

The data on the user's tape are arranged in record lengths of 4,080 eight-bit bytes. The first 80 bytes identify experiment number, time of day, time increment between sample points, and information as to the existence of transmission errors in the data. The remaining 4,000 bytes contain the data with each eight-bit word occupying one byte.

Whenever it is necessary to send commands to the antarctic equipment, the computer tunes the UGO command transmitter at the earth station until the antarctic receiver locks onto the command carrier. Commands are then typed directly into the computer for transmission.

Field tests

The prototype was tested on the ice cap at Byrd Station from November 1969 to November 1971 to verify the mechanical integrity of the structure and the snow foundation and to determine the characteristics of the passive thermal regulator system. Then it was moved to

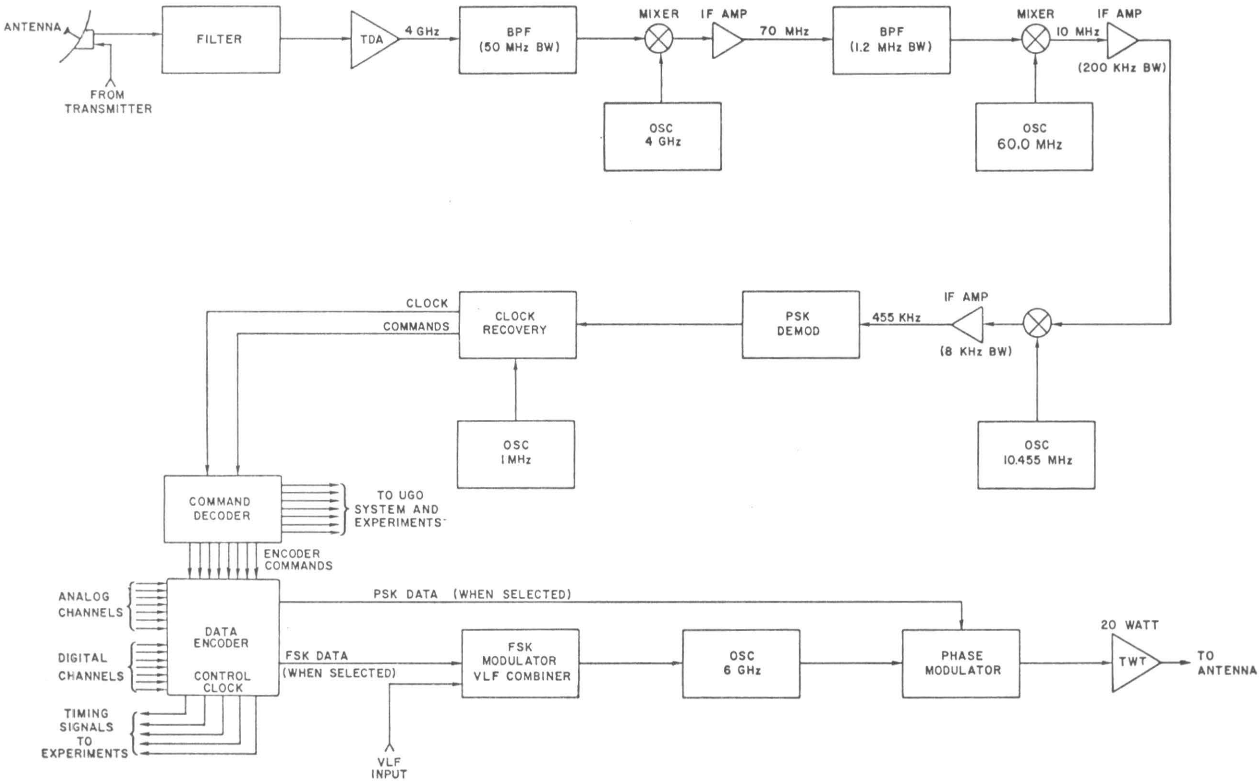


Figure 3. Block diagram of UGO electronics.

Arrival Heights, near McMurdo Station, where the communications package and a partial experimental complement was installed. The observatory was operated for 1 year with power from McMurdo Station to allow independent test of the propane thermoelectric generators. Operation began in January 1972 and, except for a break in early February when Intelsat IV replaced Intelsat III, continued to January 1973. The only unintentional outages occurred when the McMurdo power system was down.

The equipment at Jamesburg earth station and a computer at Stanford also performed well despite a few minor problems. Extensive losses of data occurred only because of an intermittent telephone line connection between Stanford and the Jamesburg earth station that took several weeks to correct.

During this year-long test the UGO returned 32 channels of data including measurements of ionospheric absorption with a 30-magahertz riometer [1], observations of rapid geomagnetic micropulsations using an iron-core magnetometer [2], internal voltages and temperature of the electronics package, power production of the thermoelectric generator, wind speed, and ambient air temperature.

In January 1973, a 50-megahertz riometer, a second micropulsation channel, and an auroral photometer [3] were added. But after less than 1 month of operation a line transient on the McMurdo Station power system damaged the UGO transmitter, causing operation to cease.

Although the loss of most of the second year's operation was disappointing, the experiment demonstrated that reliable, long-term operation of automatic stations under antarctic conditions is possible and that synchronous satellites can be used in Antarctica despite low elevation angles to the satellite. The reliability of a satellite communication link was demonstrated by the uninterrupted flow of data during the intense geomagnetic storm of August 4 to 7, 1972, which blacked out high frequency communications to McMurdo for several days.

Capability of the design

The present UGO design has significant advantages over other existing automatic stations. The Intelsat satellite data link provides a highly reliable, continuous communication channel that is immune to ionospheric disturbances and allows data to be made available to

[1] Supplied by Dr. Hugh Chivers, University of California, San Diego.

[2] Supplied by Dr. Ward Helms, University of Washington, and Dr. Harold Liemohn, Battelle, Pacific Northwest Labs, Richland, Washington.

[3] Also supplied by Dr. Liemohn (see footnote 2).

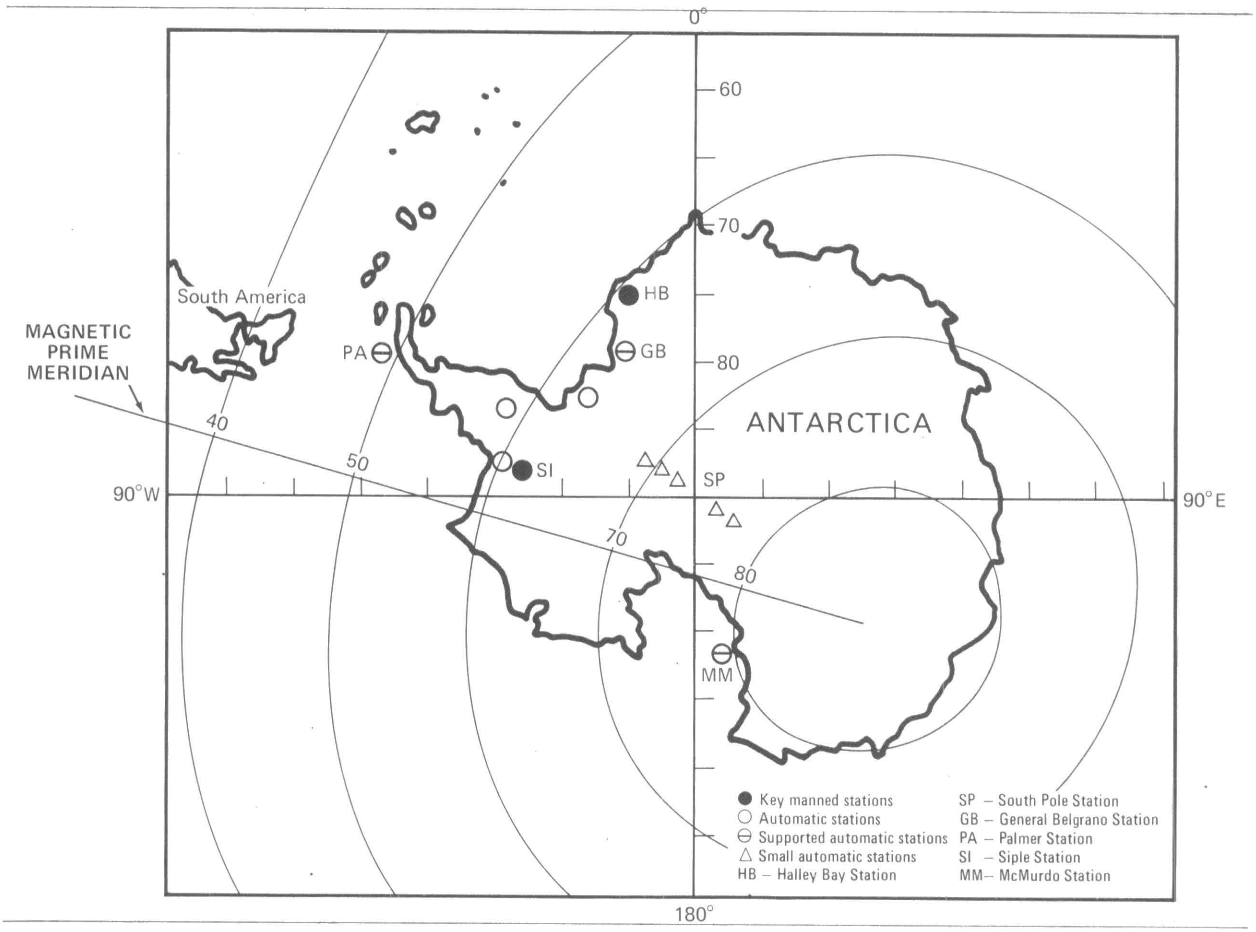


Figure 4.

experimenters within a few days (or immediately, by using telephone lines). The small size and weight of the UGO allow it to be transported to a new site and quickly set up without the use of heavy equipment. The long lifetime and low maintenance result in minimum support requirements. Moreover, since data are transmitted directly to the United States there is no requirement for men and equipment in the Antarctic to monitor and collect data from the station. The station can accommodate a large number of experiments and provides a flexible, easy-to-use data acquisition system, as well as a controlled thermal environment. Its modular construction also allows substitution of alternative communication systems using high frequency radio, polar orbiting satellites, or the Synchronous Meteorological Satellite (scheduled for launch in early 1974) if preferred to Intelsat.

Future of automatic stations in Antarctica

Two recent reports have reemphasized the potential of automatic stations in upper atmospheric physics. One, by the joint *ad hoc* study panel on the International Magnetospheric Study, charged with setting guidelines for participation by the United States, points out that the ability to correlate satellite and ground-based measurements is essential to understanding coupling mechanisms between the magnetosphere and the ionosphere. One of the principal recommendations of this panel is a network of automatic stations in Antarctica to obtain the necessary spatial resolution (National Academy of Sciences, 1973).

Another panel, established by the Academy's Committee on Polar Research, examined outstanding questions relating to study in upper atmospheric physics and looked at how best to use automatic stations to obtain the necessary data. Its report (National Academy of Sciences, in press) gives a plan for a network of manned and automatic stations. The report notes that (1) automatic stations are best used in conjunction with manned stations as a technique for economically enhancing scientific productivity, (2) automatic stations can be moved easier than manned stations, (3) the cost of such stations is a fraction of the cost of manned stations, (4) a network of automatic stations should be deployed in the Siple and South Pole vicinity and later merged into a complex that could include stations near the geomagnetic pole and elsewhere, and (5) a multidisciplinary committee of scientists interested in automatic stations should be established to advise the National Science Foundation on automatic station development and use in upper atmospheric physics and other disciplines.

Fig. 4 shows the proposed upper atmosphere research network in a fully developed configuration. Stations near the South Pole would transmit only small amounts of data (on the order of 10 bits per second) over distances of up to a few hundred kilometers. The supported stations would have the same data handling capability as a UGO, but would mount the electronics in a laboratory, saving the expense of the capsule and support tower and allowing repair, if necessary.

Multidisciplinary use

Although the UGO was developed primarily for upper atmospheric physics, it is flexible and can be used by many disciplines. Here are some potential uses:

Biology. Use of automatic stations would permit year-long study of animal life, changes in sea and lake ice, and microclimate. The most important region is the few meters just above and below the soil or water surface. Measurements might include (1) the extent, duration and depth of soil thaw (soil temperature), (2) soil and air humidity, (3) near-surface wind profile and temperature, (4) intensity and duration of visible light, solar radiation, and ultraviolet, (5) evaporation rate, (6) total radiation and net thermal exchange, (7) biological particle sensor/collector, (8) gas analyzer or mass spectrometer, (9) relay of data collected by sensors implanted in animals.

Oceanography. The UGO can be either a relay station for collecting meteorological and oceanographic data from sea and ice buoys over a large area or a direct monitor of temperature, salinity, current flow, etc. Data from bottom pressure gages, acoustic transmitters for determining ice movement, electric field recorders, and other sensors may be transmitted to a UGO on an ice shelf by either sonar or cables.

Earth sciences. The ability to monitor remote processes instantaneously would be particularly useful in earthquake monitoring. Instrumentation also could be placed in such hazardous locations as active volcanoes.

Meteorology. The UGO can support synoptic and operational meteorology as well as micrometeorology experiments. Inclusion of meteorological instruments in a UGO would allow prompt transmittal to the World Weather Watch. Micrometeorology measurements, while not required in real time, involve so much data (on the order of a few thousand bits per second) that a UGO, with its high transmittal rate, is the only feasible way of obtaining this information at a remote location. A meteorology package might measure air temperature, atmospheric pressure, surface wind direction and velocity, cloud height, surface visibility, humidity, temperature and wind component profiles, direct and reflected radiation in various spectral bands, and polarization of scattered light.

Upper atmospheric physics. The UGO largely was developed for use in upper atmospheric physics research because of the obvious need in that discipline for wideband data capability. With its direct satellite link, the present UGO can provide nearly two orders of magnitude greater data capacity than other existing automatic station techniques, a feature essential for very low frequency (VLF) spectrum recording and micropulsation work in the 1-hertz range and above. A typical UGO might carry instruments or experiments of the following types: (1) three-axis magnetometers including both fluxgate and iron-core types, an absolute reading instrument, and instruments to measure direction of arrival of ultra low frequency (ULF) waves, (2) auroral photometers—fixed or scanning, (3) riometers—fixed or scanning, (4) VLF spectrum receivers, (5) instrumentation to measure VLF phase, amplitude, and direction of arrival, (6) instrumentation for auroral hiss and atmospheric noise levels, (7) oblique ionospheric sounding receiver (operated in conjunction with a transmitter at a manned station), (8) ionospheric scintillations experiment, (9) VHF polarimeter for ionospheric electron content measurements, (10) earth current experiment, (11) electric field experiment.

Present work

This austral summer the UGO electronics will be brought back to the United States for refurbishing, including the installation of an improved data system that will allow experimenters greater flexibility in sampling rate and data resolution than the present design. The new data system also will consume much less power.

In addition to work on the data system, a complete set of redundant electronic subsystems will be added for greater reliability. Redundant electronics were not provided for the prototype since the additional cost would not have been justified for test purposes. These modifications will allow the present UGO to be placed in the field with a partial experimental complement in the 1974-1975 season or a complete package in the 1975-1976 season.

Work also is progressing on the design of a smaller automatic station that would be suitable for a network of automatic stations near the South Pole (Sites, in press).

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U.S. Antarctic Research Program, 1972-1973

This section contains the balance of reports on U.S. programs in Antarctica and related Stateside data analyses and support activities during 1972-1973. The first installment of such reports was in the September-October issue.

Geological investigations at McMurdo Station, 1972-1973

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I joined the U.S. Antarctic Research Program in mid-December 1971 and spent more than a year at McMurdo Station and in the mountains of southern Victoria Land and the Lassiter Coast. During the austral summer of 1971-1972, and at the beginning of the 1972-1973 summer, I examined metamorphic and igneous rocks in the coastal area of southern Victoria Land between Skelton and Mackay Glaciers. U.S. helicopter support and voluntary assistance for this work are greatly appreciated.

The region between Skelton and Mackay Glaciers is one of numerous antarctic regions that have been fairly well explored by scientists. Important contributions to the geology of this area have been made by geologists of New Zealand and the United States. Additional evidence was provided by Soviet geologists and scientists from other countries. Some problems in the geology of crystalline rocks of southern Victoria Land, however, have not been solved satisfactorily. On the basis of my field observations and previous data, I mapped three metamorphic and five igneous complexes of pre-Beacon age and more precisely defined the boundaries of the Beacon Group sediments and dolerite sills. During the winter period, a preliminary geological map of the area studied was compiled on the basis of a single legend. An aerial photo interpretation helped to solve these problems. Aerial photos of the dry valleys were taken by U.S. Navy photographers at my request. Field data will be verified in U.S.S.R. laboratories. However, it is necessary to note the importance of the discovery of amphibolite-facies granite-gneiss domes. Following L. V. Klimov, the author considers them as the oldest formations of the area, which can be compared with similar formations of the east antarctic crystalline basement complexes.

During the winter, the author made preliminary de-

Dr. Kamenev was U.S.S.R. exchange scientist at McMurdo Station for 1972.

termination of samples collected. Working at the earth sciences laboratory and at the Eklund Biological Center, rocks were described and cut, and polished sections and photographs of samples were made by using equipment at the laboratories and at New Zealand's Scott Base. Winter traverses on Hut Point Peninsula enabled the collection of more samples of Ross Island volcanics for my Institute collection. Some peculiar features of these volcanics were examined—in particular, pillow lavas in the southern Observation Hill and tuff-breccia in a region of the Second Crater. There have been no earlier reports of these features.

During the 1972-1973 austral summer, at the National Science Foundation's invitation, I took part in the Lassiter Coast project with field parties of the U.S. Geological Survey. This project dealt with the exploration of the northern Lassiter Coast and the southern Black Coast. The field party consisted of six persons and was headed by Dr. P. D. Rowley. Geologists and exploration facilities were transported aboard an LC-130. For field transportation, motor toboggans and Nansen sledges were used. Despite severe field conditions and the remoteness of the region explored, scientific studies were effective and the collaboration excellent. This helped me to contribute to the geological mapping of the Lassiter Coast and Black Coast and to collect many samples and obtain valuable data about metamorphism, lithology, and magmatism of these unique regions. Brief results of these activities are summarized in Rowley (1973). In my opinion, the different grade of metamorphism of sedimentary rocks and volcanics from the Lassiter Coast shows that not all of them belong to the Jurassic Latady formation. Fillites and metavolcanics tentatively can be compared with the Triniti series of English geologists. Analysis of the field data suggests that not all of the mapped intrusions belong to the Cretaceous Andean complex. The presence of the older intrusions also may be assumed, and these have been assigned to the metamorphosed melanocratic diorite of Mount Coman.

The cooperation between myself and U.S. geologists under the exchange scientist program was fruitful in all respects. This paper would not be complete without mentioning the cooperation that prevailed throughout my stay. I have many fond memories regarding my colleagues who wintered over, the assistants in the field, the pilots and other support personnel, and the scientists with whom I worked and lived in the mountains of the Lassister Coast and at McMurdo.

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Pb-210 concentration in ice measured at South Pole Station

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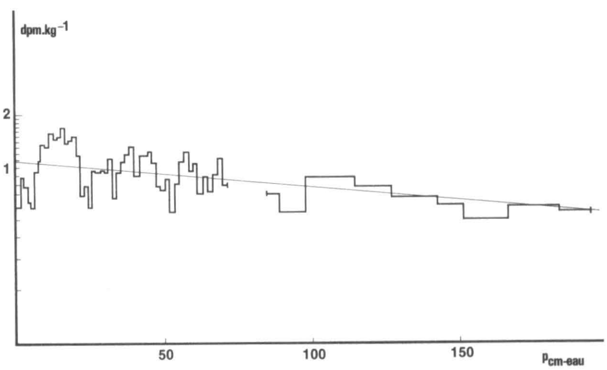
At Amundsen-Scott South Pole Station, during the 1971-1972 austral summer, firn samples were collected in a 2-meter-deep pit. Each sample represented a 4-centimeter-thick layer of snow and carefully was collected and sealed in a polyethylene bag. Also an ice core was taken at a depth between 2 and 4 meters. All of these samples were sent frozen to France, in special plastic containers.

After chemical separation, and with the use of alpha particle spectrometers, we measured the Pb 210 concentration in the ice (fig.). By using the Goldberg method, we computed the average decrease of the Pb 210 concentration and thereby obtained the rate of snow accumulation. We found a mean annual rate of 10.0 centimeters of water, between 1952 and 1971.

This result is somewhat different from the figure computed by Picciotto, who used the same method (1962). The variations of the Pb 210 concentration around the average value seem to be very important and definitively can not be attributed to manipulation errors. Therefore the maximum depth of our sampling appears insufficient to accurately compute the rate of accumulation. The regular variations of the observed Pb 210 concentration, however, were thought of sufficient interest to justify further work.



Pb-210 concentration in the ice.

Analysis of the concentration of microparticles in the long ice core from Byrd Station

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During the past year measurements were made of the concentrations and size distributions of microparticles in 15 representative sections, averaging 1 meter in length, taken from the 2164-meter-long ice core from Byrd Station. The study was designed to clarify relationships between microparticle concentrations and climate, by comparing the concentrations and size distributions with $\delta 0^{18}$ values of ice from the same depths. Relationships were established over seasonal, decennial, and millenial time intervals, and we determined an outline chronology for the ice core.

The particle analysis is based on the hypothesis that the stratigraphic record of snow deposition in the dry snow facies of an ice sheet is preserved in the variations of microparticle concentration and size distribution. Basic procedures for the analysis were established by Marshall (1962), and were improved by Bader *et al.* (1965), by Taylor and Gliozzi (1964), and especially by Hamilton (1967, 1969). In our study the use of a multi-channel Model "T" Coulter Counter enabled considerable improvements in the rate and quality of data collection.

For all but two of the sections, microparticle analyses (number of microparticles in 14 size ranges, from 0.518 to 13.1 μ diameter) were made at 2 or 2.5 centimeter intervals. For the two sections, a 76-centimeter section from 1377 meters and a 156-centimeter section from 1599 meters, the sample spacing was 1 centimeter.

The total concentration of microparticles (defined as the number of particles greater than 0.65 μ diameter in a 500 μl sample of meltwater) is greatest in the samples with the largest negative $\delta 0^{18}$ values. The profiles for the section from 1377 meters is given in fig. 1. Fig. 2 shows the profiles of concentration of small particles (0.65μ to 0.82μ diameter) and of the $\delta 0^{18}$ values (Epstein *et al.*, 1970) for all of the core sections. The two profiles match well, except for the first peak of the particle profile, between 400 and 900 meters in depth. In this depth range the core was fractured badly (Gow *et al.*, 1968), and therefore it is highly probable that the samples were contaminated with dust during drilling, transport and storage. Elsewhere in the profiles the relationship is clear between particle concentration and paleotemperature, as given by the $\delta 0^{18}$ values. Possible explanations and implications are given by Thompson (1973).

Earlier work by Marshall (1962), by Taylor and Gliozzi (1964), and by Hamilton (1969) demonstrated the periodicity of particle concentrations, and gave strong indications it is an annual period. Accepting this, the separation of peaks in the concentration profiles (for several ranges of particle sizes) in the measured sections has been interpolated for the unmeasured sections. The age of the bottom ice thus is estimated to be between 20,000 and 30,000 years, much younger than most other estimates (Johnsen *et al.*, 1972, gave 84,000 years). If annual positive balance remained constant, the vertical strain rate calculated from the thinning of annual layers is -28×10^{-5} yr^{-1}, in remarkable agreement with the -27×10^{-5} yr^{-1} calculated by Whillans (unpublished) from the Byrd Station strain net. By applying this new

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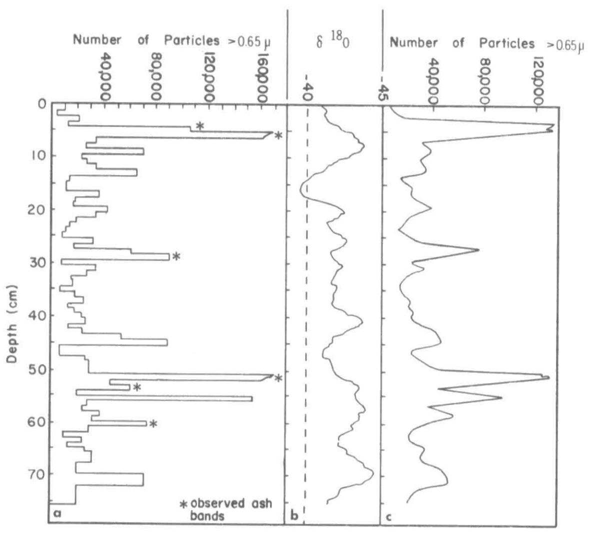

Figure 1. Vertical profiles from Byrd ice core: (a) particle concentration from 1-centimeter samples; (b) $\delta 0^{18}$ values after Johnsen *et al.* (1972); (c) particle concentration where the sample size mathematically was increased to 2 centimeters for 15,500 year-old ice. High particle concentrations tend to occur in ice with high negative $\delta 0^{18}$.

time scale for the Byrd core, to the δO^{18} profile (Johnsen *et al.*, 1972), a substantially improved match is obtained with the δO^{18} profile from Camp Century, Greenland.

Plans for 1973-1974 include microparticle measurements in near-surface ice samples, taken at points along the Byrd Station strain net from Byrd Station to the ice divide, to determine the effect on concentrations and size distributions of variations in snow accumulation rates and mean annual air temperature. This information is essential for a full interpretation of the existing data from the Byrd core.

An analysis already has been started of the microparticles in sections of the core from Camp Century, Greenland, to permit a comparison of the microparticle and δO^{18} profiles for both hemispheres (Johnsen *et al.*, 1972; Epstein *et al.*, 1970) during and after the Wisconsin glaciation. These studies should give information on atmospheric conditions in both polar regions that must be explained in any theory of glaciation.

This work is supported by National Science Foundation grant GV-32899, awarded to The Ohio State University Research Foundation and the Institute of Polar Studies. The Coulter Counter and associated equipment were purchased through funds from the Graduate School, The Ohio State University.

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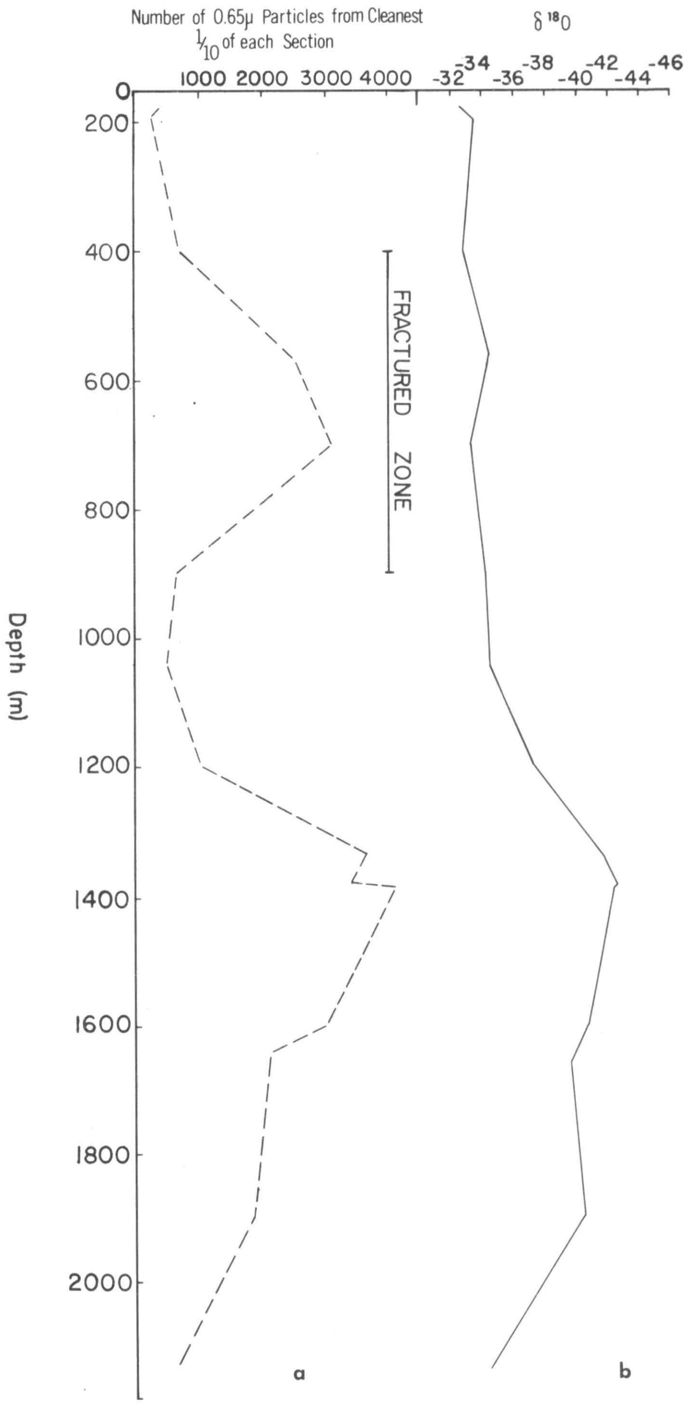

Figure 2. Data from Byrd ice core: (a) profile obtained from plotting the number of 0.65 μ to 0.82 μ diameter particles for the cleanest 10 percent of the samples from each of the core sections against depth; (b) profile obtained from plotting Epstein *et al.*'s (1970) δO^{18} values for the core sections (from Thompson, 1973).

Silver concentrations in antarctic snow and firn

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Most weather modification projects and experiments conducted throughout the world since the late 1940s have involved the release of silver-iodide into the atmosphere. The amount of silver contained in the precipitation can be used as an index of targeting efficiency and potentially is useful in the assessment of the success of the seeding effort. Basic to such uses is the establishment of a world-wide "baseline" for silver concentration in precipitation, to which other measurements can be compared. By virtue of its remote (i.e., clean) location and its high polar ice sheet (virtually no melting), Antarctica is a suitable place to seek the baseline and study its past variations.

In order to accomplish this, samples of snow and firn were taken at Siple, Byrd, and South Pole Stations (Warburton, 1972; Warburton and Young, 1970). Samples were collected with a carefully cleaned stainless steel SIPRE auger, or polyethylene scoop, from pits dug by us or by others (e.g., the "lead mine" at Byrd). Initial attempts to measure the silver concentrations in several large volume samples, following the well-established procedures of Warburton and Young (1972) (pre-analytical ion exchange concentration followed by neutron activation analysis), indicated that greater sensitivity was needed to measure the low silver concentrations found in antarctic precipitation. The continued use of the ion exchange concentration procedures and an Ag-radioisotope tracer to determine transfer efficiencies, when combined with a flameless atomic absorption analysis technique, provided the required sensitivity.

The results of analyses of 65 samples are summarized in the table. The average original sample volume was 1780 milliliters and the average transfer efficiency was 0.77. Quoted statistics include an evaluation of standard line uncertainty, counting statistics for transfer efficiencies and uncertainties in the five-times-repeated measurement of each sample. Prior to these analyses, the lowest measured concentrations of silver in precipitation were reported from the Sierra Nevada, where a background of $4x10^{-12}$ grams/milliliter is well-established (Warburton and Young, 1972). Although there is no significant variation in silver values at South Pole Station, concentrations at Siple and Byrd Stations vary by factors of two and three, respectively. Because the higher values at Byrd Station occur over the last two decades, it is possible that there was a relatively recent world-wide anthropogenic component to the silver content of the snow. The variation in natural supply from known sources and atmospheric transport factors might also be expected to produce a two- to three-fold variation on a seasonal or year-to-year basis. These matters are being investigated.

The average silver concentration for the antarctic snow and firn samples so far studied is $8x10^{-13}$g silver/milli-

Silver concentrations ($x10^{-12}$ grams/milliliter) measured in samples from Byrd, Siple, and Pole Stations.

Station	Depth (meters)	Mean concentration ($\bar{c}$)	Number of samples	$S\bar{c}$	Intervals for samples at 95 percent confidence level		Average sample F.S.D.*	Approximate year of deposit
Byrd	0.3	1.08	7	.12	1.36	.80	.14	1969
	1.5	.56	7	.11	.82	.30	.20	1965
	2.7	1.33	8	.18	1.74	.91	.15	1960
	4.9	1.59	8	.25	2.17	1.01	.17	1951
	6.7	.52	6	.12	.80	.24	.23	1942
	15.2	.48	6	.09	.70	.26	.24	1894
Siple	0.8	.39	6	.08	.60	.20	.23	1969
	2.3	.76	5	.15	1.15	.37	.20	1947
Pole	0.3	.40	6	.10	.64	.16	.24	1970
	4.0	.34	6	.08	.54	.14	.26	1968

* F.S.D. is fractional standard deviation.

liter. This appears to provide an excellent baseline value for silver in precipitation.

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Analysis of iodine in antarctic snow

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Snow collected at Byrd Station in 1969 and 1970, and at Byrd, Siple, and Pole Stations in 1971 and 1972, at depths down to 6 meters, is being analyzed for iodine. Preliminary data indicate that the iodine concentration at these inland stations is at least two orders of magnitude lower than that previously reported for coastal snow in polar regions (Duce, 1966; Sugawara, 1961). Analysis is by ion-exchange concentration, followed by neutron activation analysis.

Samples were sealed in polyethylene bags and kept frozen until analysis. The sample is melted in a container connected to an anion exchange column containing Dowex 1 resin in the NO_3^- form. Extensive cleaning of the resin was necessary to reduce the resin's initial iodine content of $\sim 5\text{x}10^{-8}$gmI/gm below $3\text{x}10^{-10}$gmI/gm (fig. 1). Radioactive ^{131}I is added to the melted sample and used to determine the overall yield following activation analysis. Samples typically are 1 to 3 liters when melted. The ion exchange column is eluted with iodine-free 5M NH_4NO_3 prepared from HNO_3 and NH_3. The iodine comes off in approximately 5 milliliters of the eluate that is collected and frozen in a cleaned, 2-dram polyethylene vial.

Iodine content of the eluate is determined by γ-ray spectrometry of the 25-minute half-life ^{128}I produced by the thermal neutron reaction ^{127}I(n, r) ^{128}I. Irradiation of the eluate is in a Triga reactor at a thermal neutron flux of $4\text{x}10^{12}$ neutron cm^{-2}sec^{-1} for 10 minutes. Chemical separation of the iodine from its eluate matrix following irradiation employs oxidation and reduction to insure isotopic equilibrium and to obtain the iodine as iodide that is precipitated as PdI_2. This is collected on a filter, dissolved, and precipitated a second time, as PdI_2. The final precipitate is collected on a 2.54-centimeter filter disc and sealed between polyethylene sheets. The sample is counted 17 minutes after irradiation, on a 3x3-inch solid NaI(T1) crystal for 4 minutes. Fig. 2 is a typical γ-ray spectrum. Minimum detectable amount is about $3\text{x}10^{-10}$gm I. A day or two following irradiation, the samples are counted for their ^{131}I tracer activity, and the overall yield determined. Yields of 75 to 90 percent routinely are obtained.

Polyethylene bags and containers have been identified as a source of iodine contamination of aqueous solutions. In a typical case, water with an initial concentration of less than $5\text{x}10^{-13}$ grams per milliliter increased to $30\text{x}10^{-13}$ grams per milliliter after storage in a 20 liter

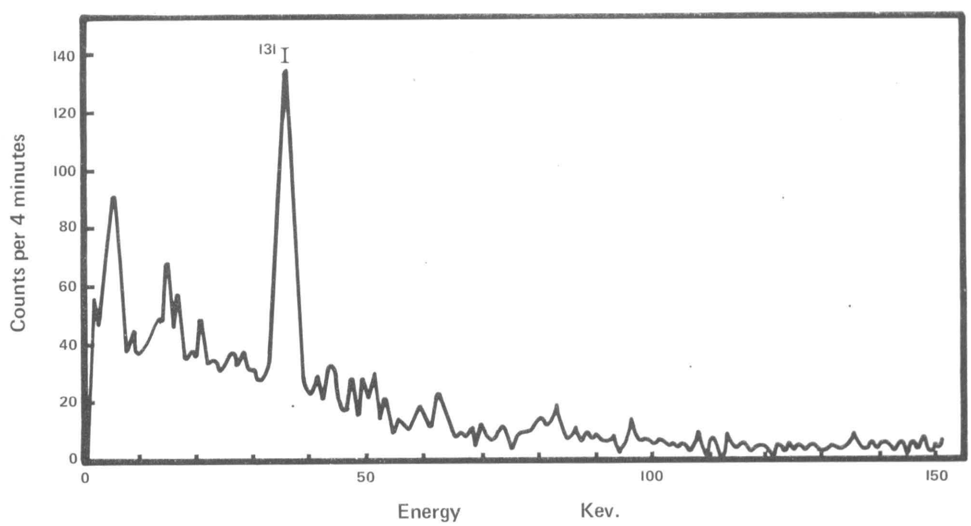

Figure 1. Blank elution of cleaned Dowex 1 resin.

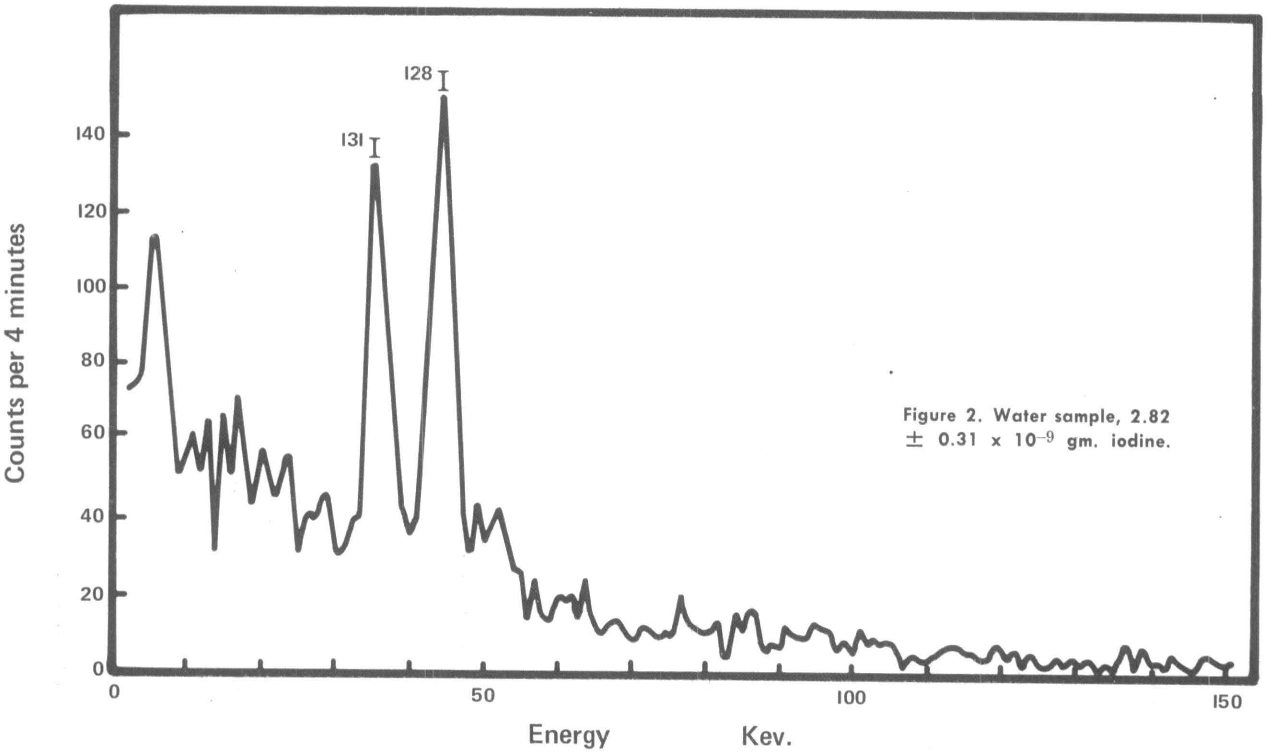

Figure 2. Water sample, 2.82 ± 0.31 x 10^{-9} gm. iodine.

polyethylene bottle for 1 month. This source of contamination is being eliminated from the analytical procedure and we are investigating the possibility of contamination of the frozen snow samples packaged in polyethylene. Elimination of contamination by polyethylene would appear to lower the observed iodine concentration in the samples already processed by at least a factor of two.

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Folding of cold ice

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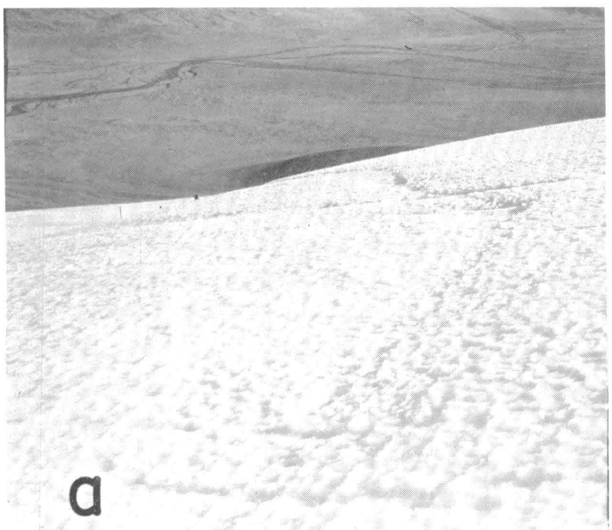
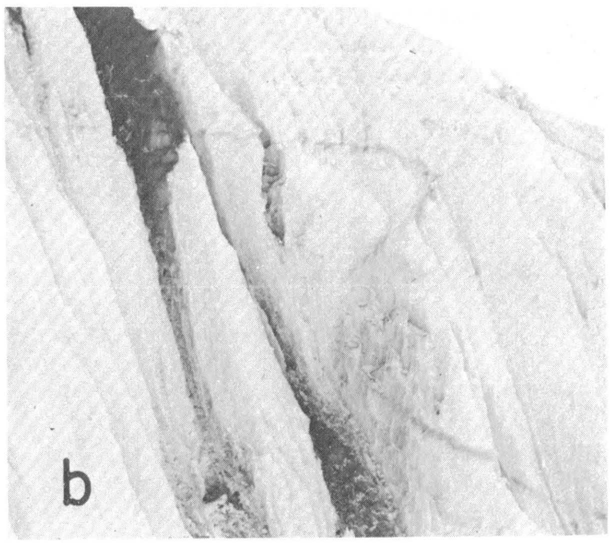
Dort (1970, p. 114) noted folded sedimentary layering in a number of glaciers in southern Victoria Land and without explanation speculated that this deformation occurred when the glaciers were warm. This speculation is not supported by studies of deformation at Meserve Glacier, Wright Valley. Many glaciers in southern Victoria Land have conspicuous trains of undulations, known as wave ogives, on their surfaces. Perhaps the most extreme example is Bartley Glacier in Wright Valley (fig. 1). Holdsworth (1969, p. 127) adapted the buckling theory of Biot (1960) to ogive formation and showed that this theory could predict the observed dominant wavelength of the wave train on Meserve

M. J. McSaveney

Figure 1. Wave ogives on Bartley Glacier, Wright Valley.

Figure 2. Wave ogives and folded sedimentary layering on Meserve Glacier, Wright Valley. Below left (a) shows a curved "dust band" intersecting an undulating surface. Bottom right (b) shows a recumbent fold.
U.S. Navy





Glacier and of wave ogives around the world. Folding of sedimentary layering is associated with the buckling and subsequent deformation of wave ogives on Meserve Glacier (fig. 2).

Deformation of ice in ogives on Meserve Glacier is an ongoing process. It is evident that folding occurs in cold ice and need not relate to a warmer time. Folding and ogive formation are related to the internal stress regime and viscous properties of glacier ice. In glaciers with appreciable concentrations of sand, as those reported by Dort, viscous properties of the ice and sand layers may strongly influence the nonhomogeneous strain observed as folds. This work was carried out under National Science Foundation grant GV-28804.

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Recession of Meserve Glacier, Wright Valley, between 1966 and 1972

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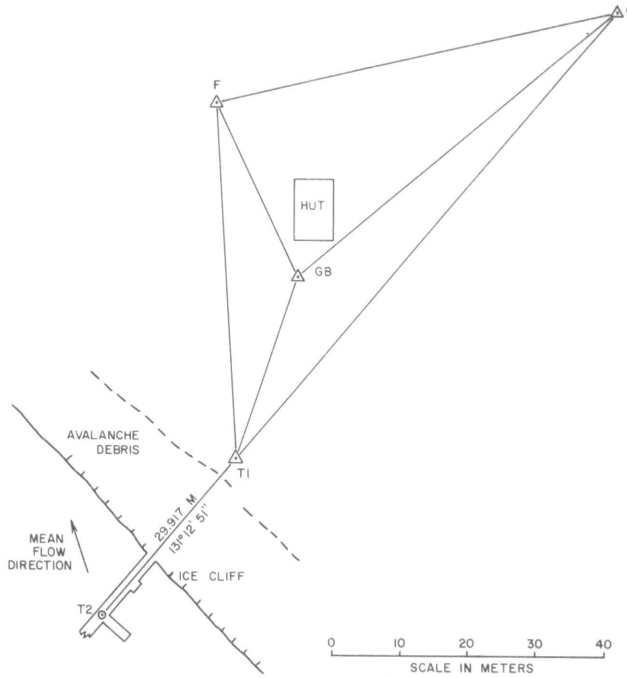
Measurement in January 1972 of the distance between the ice cliff margin of Meserve Glacier and survey stations T1 and GB (fig.), adjacent to Meserve Hut in Wright Valley, revealed a probable 0.55 meter retreat of the ice cliff since January 1966. Interpretation of the data is not without ambiguity, however, because initial measurement was not made for this purpose and remeasurement was made without full knowledge of the earlier data. Two extreme interpretations of the data can be made: no change in the distance or a recession of 1.75 meters. These interpretations are less likely than the intermediate value, because they are based on less likely interpretations of the data.

In the 1965-1966 field season Dr. G. Holdsworth established survey stations at Meserve Glacier (three are shown in the figure). GB served as a gravity base station. T1 was the first of a series of ice tunnel survey markers, and it was outside of the tunnel in a direct line between



From G. Holdsworth

Map of glacier margin and survey stations at Meserve Hut, Wright Valley, January 1966.

the tunnel and station a_0. In January 1972 all trace of the tunnel had vanished, although the survey stations outside of the glacier remained undisturbed. The distances between GB-T1 and T1-ice cliff, in the line of GB-T1, were measured with a hand-held steel tape. The stations and direction were chosen for three reasons: (1) distances and direction were easiest to duplicate, (2) direction appeared to be almost perpendicular to the ice cliff, and (3) ignorance, because it was not known that the tunnel had been in the line a_0-T1.

Distances for the 1965-1966 season have been scaled from a mylar copy of a map prepared by Holdsworth, and are not based on direct field data. Measurement of the line GB-T1-ice cliff on this map gives a distance of 49.25 meters. By coincidence this is precisely the same distance obtained in 1972. One interpretation of the data therefore is no change at all. The angle between mean flow direction and the ice cliff, however, as plotted by Holdsworth, is at variance with that reported by Holdsworth (1969) and by Anderton (in press). These are more in accord with data obtained in 1972. Holdsworth and Anderton report that flow direction and bubble lineation are parallel at the base of the ice cliff, but measurements made 2.5 meters above the base of the glacier in 1972 (McSaveney, 1973) show a slight divergence of these parameters that perhaps was not noticed by the earlier workers. Hence two other interpretations of the data can be made in which the orientation of the ice cliff is rotated on the map in relation to the mean flow direction (with mean flow direction being either as suggested by deformation measured in 1972 or parallel to bubble lineation).

In Holdsworth's mapping the precise position of the ice cliff probably was not critical, and the orientation of it was even less important. Also, the angle between the ice cliff and the line GB-T1 in 1972 was much more nearly a right-angle than is shown for 1966 (fig.), and there is no evidence for such a significant change in cliff orientation. If cliff orientation is rotated about the tunnel entrance to accord with the first of the suggested flow directions, the distance GB-T1-ice cliff becomes 47.5 meters in 1966, indicating a 1.75-meter retreat. The second alternative, most favored because bubble lineation should follow deformation direction at the very base of the glacier, gives a distance of 48.7 meters and a 0.55 meter retreat. The ice-cliffed margin of Meserve Glacier adjacent to Meserve Hut has retreated at a net rate of 0.09 or 0.30 meter each year. The lower value is more probably correct. If no change in the measured distance has occurred, then a large and improbable rotation of the ice cliff has taken place for which there is no observable evidence.

In assessing the state of balance of the Meserve ice cliff in this area, Bull and Carnein (1970, p. 441) found that between 1966 and 1967 the ice cliff should have receded 0.049 meter. The distance was too slight for them to measure, however, and they concluded there was effectively no change. Their conclusion that long-term balance of Meserve Glacier is probably very slightly positive does not seem to be substantiated by any direct measurement. A slightly negative balance is more probable if the cliff is receding. In January 1974 the distances T1-ice cliff again will be measured, this time in two directions: 1) in the line GB-T1, and 2) in the line a_0-T1. These measurements may solve the problem, or create new ones. Eileen McSaveney assisted in the 1972 ice cliff observations. Dr. G. Holdsworth provided the earlier data. This work was carried out under National Science Foundation grant GV-28804.

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Relative yearly totals of solar radiation incident on various slopes for latitude 77° 30′ S.

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As part of a study of the evolution of a wave ogive train on Meserve Glacier, Wright Valley, a numerical simulation was made of yearly totals of solar radiation incident on slopes of various azimuths and inclinations. Results of this simulation may be useful to others interested in effects of solar radiation on various micro-environments. The geographical bearing and altitude of the sun were calculated at half-hourly increments throughout that part of the year when the sun appears significantly above the horizon at latitude 77°30′ S., using the relationship:

$$\sin \gamma = \sin \Phi \sin \delta + \cos \Phi \cos \delta \cos t$$

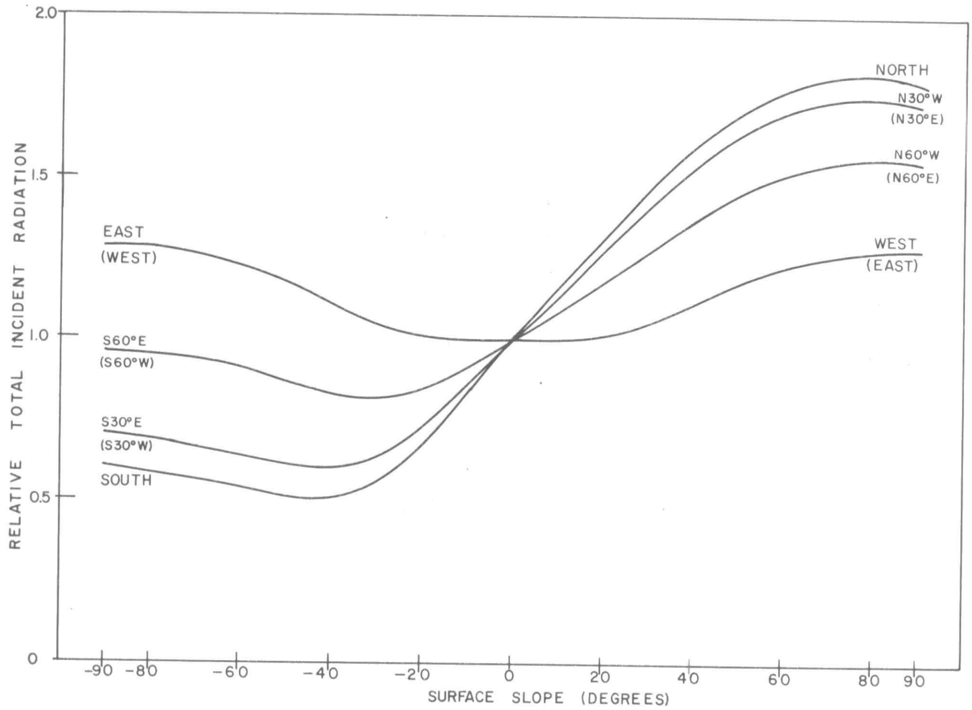
where γ is solar altitude, Φ is geographic latitude, δ is declination of the sun and varies ± 23.5 degrees through the year, and t is the local hour angle of the sun (equivalent to geographical bearing of the sun for the northern hemisphere). Dates when the sun no longer is significantly above the horizon were obtained from tables in Kasten (1962).

A check then was made to ensure that the sun was above the local topographical barrier. Wright Valley was assumed to be an elliptical basin of constant wall height with the point of computation at the center of the ellipse. Then a check was made to ensure that the angle of incidence of the radiation beam was positive and greater than zero. Finally the magnitude of the incident beam was modulated by the relative optical air mass of the beam path, computed through the formula

$$m = 1/[\sin \gamma + a(\gamma + b)^{-c}]$$

where m is relative optical air mass, γ is solar altitude, and a, b, and c are empirical constants equal to 0.15, 3.885, and 1.253 respectively (Kasten, 1964, equation 22, page 7, and table V, page 8)—and its component in the plane of the slope accumulated. Totals were accumulated for slopes from −90° to +90° in 10-degree increments and slope directions of 0 to 90° of azimuth in 30-degree increments. The totals relative to a horizontal surface are presented in the figure.

The simulation model contains no modulation for atmospheric dust or for water vapor. These factors are assumed constant. This is a considerable simplification, but the clean, cold antarctic environment is probably



Yearly totals of solar radiation incident on slopes of various inclinations and azimuths at 77°30′S. (relative to a horizontal surface).

the closest approximation on earth to this model. The topographical modulation is quite specific to Meserve Glacier, but it is not a very significant source of error for many other localities. This work was supported by National Science Foundation grant GV-28804. Computer time was made available by the Instruction and Research Computer Center, The Ohio State University.

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Distribution of benthic foraminifera at Arthur Harbor, Anvers Island

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Primary works on the distribution of benthic foraminifera of the ocean around the Antarctic Peninsula have been concerned with shelf and deep water faunas (Heron-Allen and Earland, 1932; Earland, 1933, 1934, 1936; Herb, 1971; Echols, 1971) found at depths greater than 200 meters. During 1971-1972, the distribution of shallow water foraminiferans at depths of less than 60 meters was investigated in Arthur Harbor, adjacent to Palmer Station (fig. 1). This work is part of a study of the biology and ecology of shallow water foraminifera, supported by National Science Foundation grant GV-31162 (Lipps *et al.*, 1972). The samples were taken from aboard a small boat, with the use of a small mudgrab. They were stained with Rose Bengal to differentiate live and dead foraminiferans, and sieved over a 200-mesh sieve. The foraminiferans were picked wet. For the purposes of this paper, no distinction is made between dead and alive foraminiferans in relation to aspects of distribution.

Four basic assemblages were evident from the data (table) which appeared to be correlated with depth and relative exposure to wave action (fig. 1). Central Arthur Harbor, uniformly shallow (about 30 meters), had an assemblage of foraminifera dominated by *Hippocrepinella hirudinea* Heron-Allen and Earland. The relatively narrow inlet to the south of the station was dominated by *Trochammina malovensis* Heron-Allen and Earland, and *Psammosphaera fusca* Schultze. The deeper portions of the harbor, at its entrance, had a diverse fauna, with *Reophax dentaliniformis* Brady and *Cassidulina crassa* D'Orbigny as notable elements (fig. 2). The assemblage south of Bonaparte Point was dominated by *C. crassa* and by a planktonic foraminferid, *Globigerina* sp. Planktonic foraminifera were rare in the sediment within the harbor.

The living-dead ratios (as indicated by a positive-

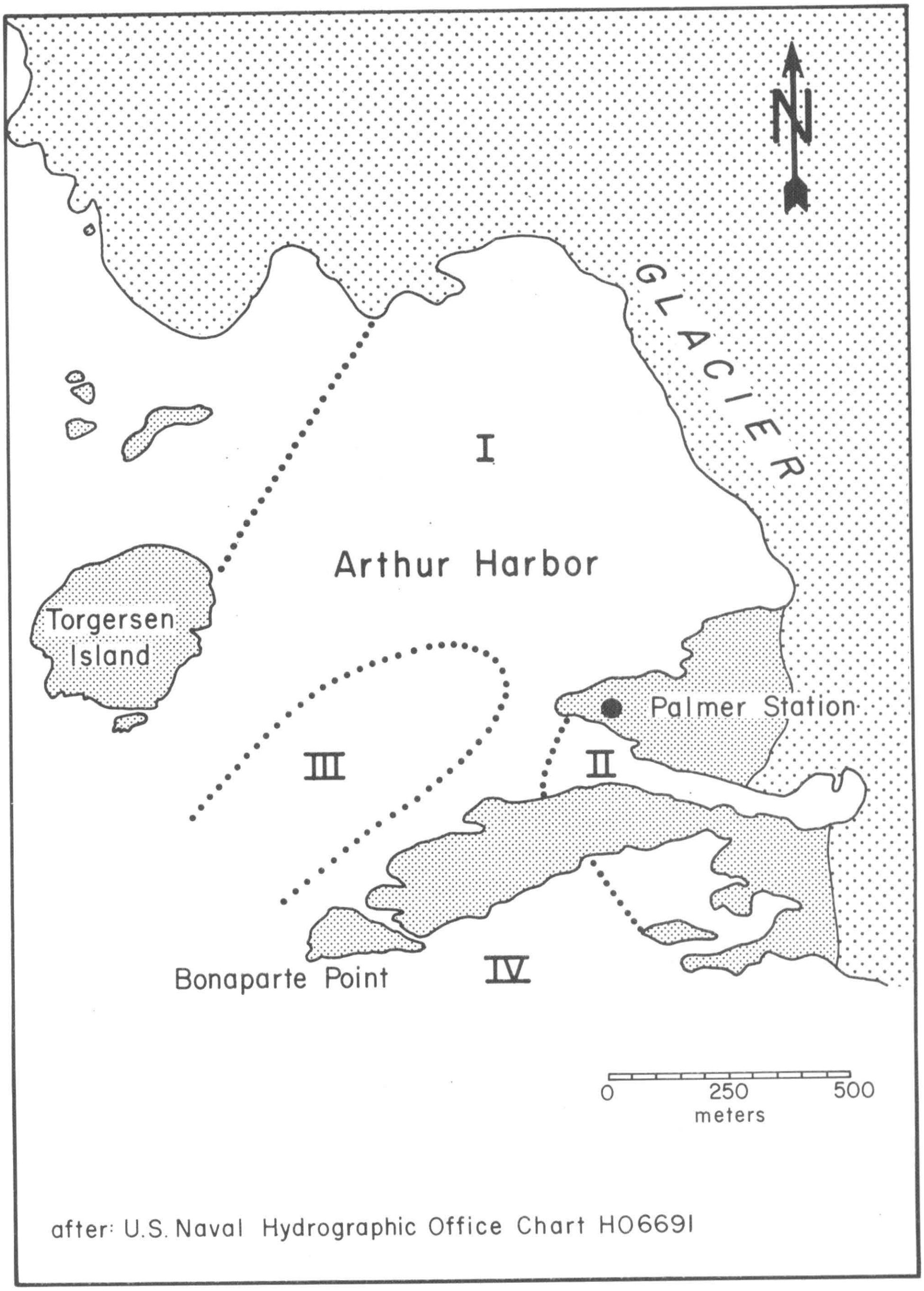

Figure 1. Approximate distribution of foraminiferal assemblages.

negative test in Rose Bengal) for most of the samples ranged from about 0.20 to 1.5, but an exception to this was the extreme rarity of live foraminifera in the inlet south of the station. Rose Bengal staining indicated that roughly 90 percent of all *R. dentaliniformis* and *H. hirudinea* appeared to be alive.

Although I did not see a precise boundary between the shallow assemblage of *H. hirudinea* and the deeper one of *R. dentaliniformis* and *C. crassa,* the fauna at 30 meters depth differs markedly from the fauna at 40 meters. Preliminary work suggests that this difference is not caused by differences in the physical characteristics of the sediments. In contrast, the faunal difference between Arthur Harbor and comparable depths south of Bonaparte Point appears to be caused by differences in wave exposure and sediment.

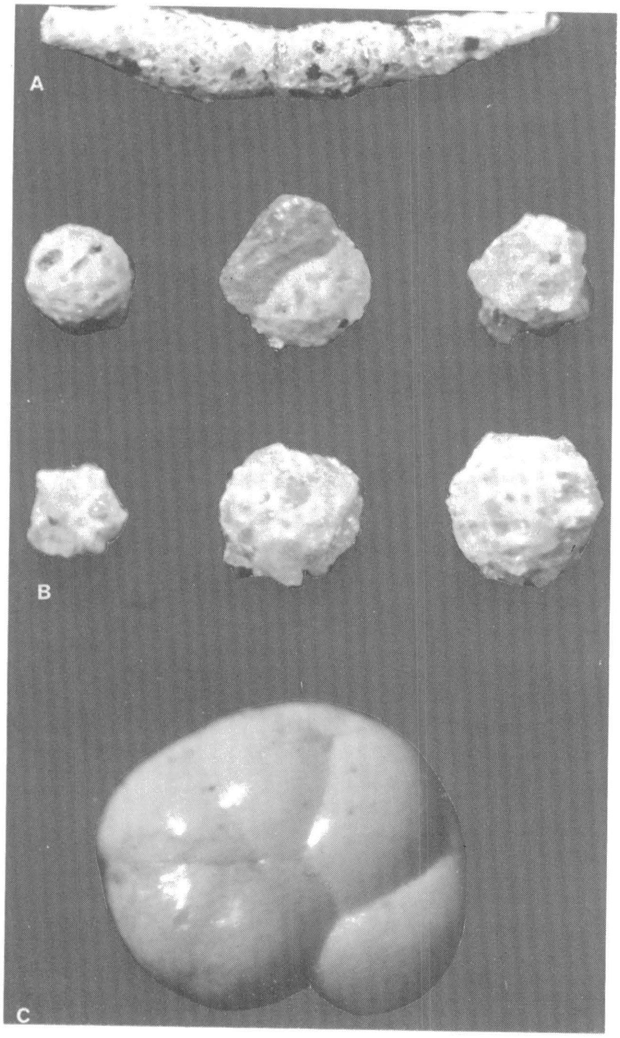

Figure 2. (a) *Reophax dentaliniformis* Brady (enlarged 62x). (b) *Psammosphaera fusca* Schultze (enlarged 62x). *Cassidulina crassa* D'Orbigney (enlarged 124x).

Preliminary faunal list and relative abundances of foraminifera in the assemblages of Arthur Harbor.

	I	II	III	IV
Astrorhiza triangularis Earland	1	0	0	0
Cassidulina crassa D'Orbigny	1	2	2	3
Cassidulioides parkeriana Brady	0	1	0	0
Cornuspira diffusa Heron-Allen & Earland	1	1	0	0
Ehrenbergina crassa Heron-Allen & Earland	1	0	1	0
Globigerina sp.	1	1	1	3
Gordiospira fragilis Heron-Allen & Earland	1	0	0	0
Haplophragmoides canariensis D'Orbigny	0	1	0	0
Hippocrepinella hirudinea Heron-Allen & Earland	3	1	0	0
Miliammina arenacea Chapman	0	1	0	0
Miliolina lucida Karrer	0	1	0	0
Nonion stelligerus D'Orbigny	1	0	0	0
Proteonina tubulata Rhumbler	1	0	0	0
Psammospheara fusca Schultze	0	3	2	1
Pyrgo depressa D'Orbigny	0	0	1	0
Pyrgo williamsoni Silvestri	0	0	1	0
Reophax dentaliniformis Brady	0	0	2	0
Reophax pulifer Brady	0	1	0	0
Reophax subfusiformis Earland	1	0	0	0
Trochammina intermedia Heron-Allen & Earland	0	1	1	1
Trochammina malovensis Heron-Allen & Earland	1	3	2	2
Uvigerina angulosa Williamson	0	1	0	0
Webbinella hemisphearica Jones, Parker & Brady	1	1	1	1

0-absent
1-rare
2-common
3-abundant

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Recent activities of the Committee on Polar Research

LOUIS DEGOES

Committee on Polar Research
National Academy of Sciences

The Committee on Polar Research (CPR), established in January 1958, advises on U.S. research programs in polar regions and represents the National Academy of Sciences in the affairs of the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions. Dr. James H. Zumberge is the U.S. delegate to SCAR. Also he chairs the CPR, which is supported by a grant from the National Science Foundation. The CPR held its 32nd meeting at the Academy on December 1 and 2, 1972, in Washington, D.C., and its 33rd meeting at Seattle, Washington, May 11 and 12, 1973. In addition, four panels and seven *ad hoc* groups met during the period covered by this report.

Altogether over 100 scientists serve on the CPR and its subgroups, each for 3-year terms; in early 1973, 30 new members were appointed to replace those whose terms had expired.

International activities. The 12th SCAR plenary session and associated meetings were held in Canberra, Australia, August 14 to 19, 1972. The results of the SCAR meetings were reported in the *Antarctic Journal* (March-April 1973).

In collaboration with the National Academy of Sciences Building Research Advisory Board, several CPR members participated in planning for the 2nd International Conference on Permafrost that was held in Yakutsk, U.S.S.R., on July 16 to 28, 1973. Dr. D. James Baker represented the CPR in discussions on polar research, held at the Academy with Dr. Pavel K. Sen'ko and Dr. Vladimir A. Shamont'yev of the Soviet Union. Dr. Jay T. Shurley participated as the U.S. member in the first meeting of the SCAR subcommittee on human biology and medicine and the SCAR Symposium on Human Biology and Medicine in the Antarctic. Both the meeting and the symposium were held at Scott Polar Research Institute, Cambridge, England, September 19 to 21, 1972. In September and October 1972 he also conferred with Soviet scientists, in Leningrad and Moscow, on plans for the 3rd Symposium on Antarctic Biology (to be held at the National Academy of Sciences, August 26 to 31, 1974). Mr. R. B. Southard, Jr., Dr. Sayed El-Sayed, and Dr. Donald B. Siniff presented papers on polar research at the 16th Committee on Space Research meeting, Konstanz, West Germany, May 23 to June 6, 1973.

Domestic activities. Highlights of the Committee's meeting at the Academy on December 1 and 2, 1972, were: a review of results of the 12th SCAR meetings in Melbourne and Canberra; consideration of a report by Mr. James Heg, of the National Science Foundation, on the 7th Antarctic Treaty Consultative Meeting, Wellington, New Zealand; discussion of a proposal by Dr. Thomas O. Jones, chairman of the Interagency Arctic Research Coordinating Committee (IARCC) for critical review of the IARCC 5-year plan for arctic research; consideration of a proposal by Mr. Philip M. Smith, of the National Science Foundation, for a review of the management of the Foundation's snow, ice, sediment and rock core program; a critical review of the status of the Ross Ice Shelf Project (RISP), Greenland Ice Sheet Program (GISP), and Dry Valley Drilling Project (DVDP). The Committee also called on Professor A. Lincoln Washburn to propose the composition and develop the charge of an *ad hoc* study group to prepare a report on permafrost research. Dr. Robert A. Helliwell was appointed vice chairman for the Antarctic, and Dr. Keith B. Mather was designated vice chairman for the Arctic. The Committee conditionally endorsed three studies that were prepared by its panels.

At the 33rd meeting of the Committee, in Seattle, Washington, May 11 and 12, 1973, the National Science Foundation's Office of Polar Programs gave a presentation on its domestic and international programs, resources, management, issues and problems, and identified areas where the CPR might be of help in the months ahead. Upon completion of its task, the RISP steering group was disbanded. The polar cores study was completed and a letter report issued to the National Science Foundation. Mr. Robert M. Dillon, executive director of the Building Research Advisory Board, reported on the status of U.S. planning for the 2nd International Permafrost Conference. He introduced three visiting Soviet scientists: Professor Pavel I. Melnikov and Dr. F. E. Are, director and assistant director, respectively, of the Permafrost Institute, Siberian Division of the Academy of Sciences of the U.S.S.R.; and Dr. Andre P. Kapitsa, president, Far East Research Center, Academy of Sciences of the U.S.S.R., Vladivostok. A discussion of permafrost research in both countries followed. The Committee was up-dated on SCAR activities, the International Biological Program's Tundra Biome Program, and Earth Resources Technology Satellite-1 imagery in polar regions. The Committee endorsed a resolution proposing that Amchitka Island be designated as a National Environmental Research Park, and a resolution by the glaciology panel on the disposal of high-level radioactive materials in polar ice sheets. Both resolutions were transmitted to the Academy for review and approval before going forward.

The panel on biological and medical sciences met at the University of Kentucky, Lexington, on October 19 and 20, 1972. They reviewed international collaboration on biological and medical research, preliminary plans for the 3rd SCAR Symposium on Antarctic Biology, and the status of support for antarctic biological and medical research. On February 9, 1973, a meeting of the U.S. Arrangements Committee for the 3rd SCAR Symposium was held at the National Science Foundation, to plan for local activities.

Two *ad hoc* working groups were formed to prepare the glaciology portion of a report requested by the National Science Foundation. The working group on antarctic sea ice met at the University of Washington, Seattle, July 24 to 27, 1972, to put together their contribution, while the working group on continental ice met October 26 and 27, 1972, at the University of Wisconsin, Middleton, to prepare their report. These documents were integrated into the glaciology panel's study which was subsequently endorsed by the CPR.

A meeting of the panel on glaciology was held at Seattle, Washington, May 8 and 9, 1973. Consideration was given to the proposal for disposal of radioactive materials in polar ice sheets. Other items reviewed and discussed were the status of glaciology programs: GISP, Arctic Ice Dynamics Joint Experiment (AIDJEX), International Antarctic Glaciology Program, Polar Experiment (POLEX), DVDP, West Antarctic Streamline Program (WASP), Antarctic Sea Ice Program (ASIP), Glaciology of the Antarctic Peninsula (GAP); plans for the 2nd International Permafrost Conference; status of the panel's report on recommendations for polar research; a review of the IARCC report. Resolutions were drawn up on disposal of radioactive materials and the geographic location for the RISP drill hole.

The *ad hoc* working group on antarctic oceanography met on July 20 and 21, 1972, in Boulder, Colorado, and again on September 20 to 22, 1972, in Washington, D.C., to draft their report in response to a National Science Foundation request. The document was made available for Academy review in February 1973.

The panel on upper atmospheric physics met on July 17 to 19, 1972, at Stanford University, to make writing assignments for the preparation of a detailed report on upper atmospheric physics research in Antarctica. A second meeting was held in San Francisco on December 4, 1972, to review the report and to make final changes. The document was endorsed by the Committee and it is being prepared for publication.

An *ad hoc* working group on the unmanned geophysical observatory (UGO) was established and was composed largely of representatives from interested panels. The group met in Boulder, Colorado, on September 18, 1972, to prepare a report on the application of the UGO to antarctic research programs. The published report is expected to be ready for issue in late 1973.

A meeting of the RISP steering group was held at the University of Nebraska, Lincoln, on September 22 and 23, 1972. The agenda for the meeting included reviews of related drilling projects such as DVDP, GISP, and WASP, the development of the RISP scientific plan, and fiscal matters. A second meeting was held at the National Academy of Sciences on February 10, 1973, to review the RISP science plan, to consider an environmental impact appraisal statement as recommended by SCAR, and to plan future RISP operations. The steering group concluded that its task largely was completed and proposed to the CPR that it be disbanded.

The joint review panel for AIDJEX held its third and final meeting in San Francisco, December 8, 1972. Dr. Norbert Untersteiner, AIDJEX coordinator, called on participants to report on the status of the project and to identify likely problem areas. The panel agreed that much progress had been made in sharpening the scientific and management foci of AIDJEX and that the experiment had achieved maturity. The panel noted the highly successful Symposium of Sea-Air Interaction in the Polar Regions, held during the fall American Geophysical Union meetings; over 50 papers were presented at 5 sessions.

In a letter from Dr. H. Guyford Stever, director of the National Science Foundation, to Dr. Handler, president of the Academy, it was proposed that a new POLEX panel be formed and be concerned with the implementation of the GARP objectives in the polar regions by developing close ties with AIDJEX and the U.S.S.R.-proposed POLEX. Accordingly, the AIDJEX panel was disbanded and some of its members were asked to serve on the new joint POLEX panel. A planning session was held on December 8, 1972, on determining how AIDJEX and POLEX might best contribute to GARP's objectives, especially as related to the first GARP Global Experiment and to climatic variation. Two working groups were appointed to deal with the first GARP objective of deterministic forecasting and the second GARP objective of climate and secular change.

The first full meeting of the POLEX panel was held at the National Center for Atmospheric Research, Boulder, Colorado, June 8 and 9, 1973. Space satellite imaging programs were reviewed and Canada's participation in POLEX was discussed. Five working groups were established to draft elements of the U.S. portion of an international POLEX program: (1) numerical modeling experiments (Dr. W. L. Gates, convener); (2) physical processes in the atmosphere and at the boundary layer (Dr. N. Untersteiner, convener); (3) heat balance of the polar oceans (Dr. D. J. Baker, convener); (4) polar climatology record (Dr. W. J. Campbell, convener); (5) meteorological observations in the polar regions to satisfy the first GARP objective (Dr. W. W. Kellogg, convener).

The panel on geology and solid earth geophysics met on November 16 and 17, 1972, at the University of Wisconsin, Madison, to prepare their report on antarctic research.

As a result of the IARCC request for the CPR to review its 5-year plan for arctic research, an organizational meeting of an advisory group was held in Seattle, Washington, on May 10, 1973, to establish guidelines, assignments, and schedules for the task.

The first meeting of the permafrost study group was held in Seattle, Washington, on June 12 and 13, 1973. The study group will conduct a broad review of permafrost research, evaluate its adequacy, and identify scientific problems and areas that deserve attention. A work plan and schedule was developed; a final report is expected by the end of 1973.

Antarctic Map Folio Series

VIVIAN C. BUSHNELL

Research Publications
American Geographical Society

Of the 19 folios planned for the *Antarctic Map Folio Series,* 17 have been published. Folio 17, "Marine sediments of the southern oceans," appeared in June and was described in the May-June 1973 *Antarctic Journal* (p. 143).

Work on Folio 18, "Antarctic mammals," is in progress. The folio will include maps and statistical graphs on whales and whaling, contributed by W. H. Dawbin, S. G. Brown, and the Scott Polar Research Institute, with a discussion of whale distribution, by N. A. Mackintosh. A number of seal distribution maps have been compiled by Albert Erickson and his colleagues, using data from the literature and from recent seal-population studies carried out under National Science Foundation grants to the University of Minnesota. Robert L. Brownell, Jr. contributed distributional maps and a discussion of dolphins and other smaller antarctic Odontocetes. Folio 18 is scheduled to be published by mid-1974.

Folio 19, devoted to the history of exploration and scientific investigation in the Antarctic, tentatively is scheduled to appear in 1975. It will include material compiled primarily by the staff of the American Geographical Society, with an introductory text by Henry M. Dater. For many years he was Chief of the History and Research Division, U.S. Naval Support Force, Antarctica.

Antarctic geographic nomenclature

FRED G. ALBERTS

Geographic Names Division
Defense Mapping Agency Topographic Center

Approval was given last year to antarctic geographic names that had been applied by expeditions of Australia, New Zealand, Norway, the Soviet Union, the United Kingdom, and the United States. Physical features to which the names were applied were researched in the Geographic Names Division (GND), Defense Mapping Agency Topographic Center, to establish the facts of discovery, mapping and initial naming, the appropriateness of a given name, and the extent to which usage may have become established. Official standardizing actions were taken by the Board on Geographic Names and the Secretary of the Interior, on the basis of information developed by the GND research and upon recommendations of the Advisory Committee on Antarctic Names (ACAN).

Problems ranged from determining proper application of names to choosing between multiple names for a feature or alternative generic terms. Avoided were unduly long names, names suggested for ephemeral or transitional ice features, and names identical to those already in use. Several cases in which expeditions had applied different names to the same feature were resolved by ACAN through consultation and correspondence with name authorities of other countries.

The GND continued to be a clearing house for antarctic names information, responding to hundreds of inquiries and editing charts, reports, and other materials submitted for verification of spelling and application of names. Research leading to development of original names for new U.S. Geological Survey maps of the Hobbs and Ruppert Coasts of Marie Byrd Land was undertaken. To date, names have been provided for 81 new shaded relief maps in the U.S. Geological Survey 1:250,000 scale *Antarctica Reconnaissance Series,* and 6 in the U.S. Geological Survey 1:500,000 scale *Sketch Map Series.*

ACAN membership underwent uncommon change during the year with the resignations of Kenneth J. Bertrand, member since 1947 and chairman since 1962, and Herman R. Friis, member since 1957. The Secretary of the Interior appointed Walter R. Seelig, Commander Kelsey B. Goodman, U.S. Navy, and Morton J. Rubin, as new members of the Committee. They join the current chairman, Henry M. Dater, and Albert P. Crary. Meredith F. Burrill, executive secretary of the Board on Geographic Names and long affiliated with ACAN work, retired and was succeeded by Richard R. Randall.

The computerized polar bibliographic data base at the Library of Congress

GEZA T. THURONYI

Science and Technology Division
Library of Congress

The *Antarctic Bibliography* (AB) now is being produced entirely from a computerized bibliographic data base. Production of 3x5-inch cards has been discontinued and current-awareness service is provided through a monthly bulletin, *Current Antarctic Literature* (CAL). Each issue of this bulletin contains 100 to 150 bibliographic citations with abstracts, arranged in 13 subject categories as in the AB. Author and subject indexes are provided periodically (two have been issued, covering CAL numbers 1 to 5 and 6 to 10, respectively; in the future they may be quarterly, each covering three issues).

The 1,444 citations and abstracts contained in CAL numbers 1 to 10 (September 1972 to June 1973), together with 800 items issued earlier, in card form, will constitute Volume 6 of the AB. This represents a departure from the earlier practice of publishing a new volume whenever there were 2,000 completed abstracts. In the future, the AB will be published annually, with individual volumes containing a variable number of abstracts.

Mechanization of the AB has made it possible to conserve on some expenditures, by closer coordination with the *Bibliography on Cold Regions Science and Technology* (also prepared by staff of the Cold Regions Bibliography Project). The two bibliographies are produced from a single bibliographic data base, thus avoiding duplication of effort. When a record is entered into the data base, a "pertinency code" is affixed to indicate the bibliography for which the record is to be used ("a" for *Antarctic Bibliography,* "c" for *Cold Regions Bibliography,* or "b" for both). But the use of a common data base also created a need for a rather complicated numbering system, in order to keep the two bibliographies' specific numbering sequences intact without gaps. Under this system, the document number and the bibliographic reference number not always are identical, making data control more cumbersome. This same numbering system also was extended to the microfiches that are prepared for each cited document, thus eliminating duplication in this area, too.

In addition to entering current items into the data base, items previously issued are being keyboarded to make them machine-readable. Thus, the first 800 items of Volume 6 of the AB—originally typed and circulated in card form—have been re-keyboarded and entered into the mechanized data base to make them amenable to the volume's mechanized production. Another retrospective conversion effort is aimed at the 10,000 items published in volumes 1 to 5 of the AB, some 6,000 of which already have been rekeyboarded (without abstracts, however). These will be used primarily for producing cumulative indexes, but also can serve for retrieval purposes.

A new development in the continuing expansion of the project's computer capabilities has been the installation of an on-line video display terminal on the Science and Technology Division's premises. This device, with its limited search capability, provides direct access to the current bibliographic data base. While it cannot be used to input or modify data, it can display data and produce hard copy on a small printer. When used to its full potential, this installation should help to eliminate the handling of voluminous printouts, facilitate checking for duplication, and permit quick subject searches or other retrieval runs.

While helped by increasingly sophisticated computer methods in the processing and publishing stages, the AB project staff still faces the task of locating pertinent material which, as of now, must be done by conventional methods. In addition to the resources of the Library of Congress, and other libraries, great reliance is placed on material sent directly to the project by authors and publishers. By sending their publications (Cold Regions Bibliography Project, Library of Congress, Science and Technology Division, Washington, D.C. 20540), producers of literature insure prompt bibliographic coverage of their work.

Antarctic Research Series

STEPHEN F. SOUSK

American Geophysical Union

The *Antarctic Research Series* of the American Geophysical Union was initiated in 1963, with grant assistance from the National Science Foundation. The *Series* provides a publishing medium for papers and monographs based on antarctic research that otherwise might not be published. The original research papers published in those volumes are directed not only to scientists actively engaged in the same field, but also to graduate students and to scientists in closely related fields.

The most recent book, Volume 20, is *Antarctic Terrestrial Biology.* This volume, 322 pages, $30.00, contains 13 original papers on terrestrial biological research and initiates a companion to the 4 volumes of *Biology of the Antarctic Seas.* The articles range in subject matter from the limnology, physiology, and ecology of aquatic systems, to the taxonomy of freshwater algae, lichens, mosses, fungi, protozoa, and land arthropods of Antarctica. Although this volume includes reports on systematics and ecologic research, the longer papers point to the new trend in field biological research, toward reliance on sophisticated instrumentation and *in situ* experimentation. The three papers on antarctic freshwater lakes reveal an unsuspected variety in these aquatic systems. Lichens and mosses are identified as the two major elements of antarctic vegetation in the four papers discussing their photosynthesis, metabolism, and physiology. The description of a basidiomycete new to Antarctica is of interest because the larger fungi are rare to the Antarctic. The volume concludes with a report on the subantarctic vegetation of the Magellanic region that contributes to an understanding of the relationship of Antarctica to southern land masses.

Since mid-1971, five other volumes have been published. These volumes include:

Volume 15, *Antarctic Oceanology I,* 343 p., $22, includes studies of the characteristics and circulation of the water masses, of the topography, magnetics and seismicity of the sea floor, and of the sediments and their constituents and chemistry.

Volume 16, *Antarctic Snow and Ice Studies II,* 412 p., $24.50, centers primarily on the glaciological results from U.S. traverses in the Antarctic.

Volume 17, *Biology of the Antarctic Seas IV,* 362 p.,

$30, includes a collection of original studies on field research in antarctic waters, dealing mainly with the systematics, ecology, and distribution of phytoplankton and zooplankton.

Volume 18, *Antarctic Pinnipedia,* 226 p., $25, focuses on recent investigations on seals.

Volume 19, *Antarctic Oceanology II: The Australian-New Zealand Sector,* 364 p., $32, studies the ocean south of Australia and New Zealand from the perspectives of physical oceanography, marine geophysics, and marine sediments. Presented are comprehensive examinations of the waters, the sea floor and underlying crust, and the evolutionary history of this ocean.

Additional volumes in press include ones on brachiopods and human adaptability, and a bird handbook.

Volumes 2 to 20 of the *Series* (see *Antarctic Journal,* III(5): 211; IV(5): 236; V(5): 201; VII(5): 215) still are available from the American Geophysical Union, 1707 L Street, N.W., Washington, D.C. 20036. A substantial discount on complete sets is available to those who enter a standing order for the series. Volumes 1 and 6 are out of print but are available from University Microfilms, Ann Arbor, Michigan 48106.

This work is partially supported by National Science Foundation grant GV-55.

Translation of the *Soviet Antarctic Expedition Information Bulletin*

STEPHEN F. SOUSK

American Geophysical Union

Volume 8 of the translation of the *Soviet Antarctic Expedition Information Bulletin* has been partially completed; numbers 79-85 have been released. The complete volume will consist of bulletins 79-90. Commencing with Volume 8, each bulletin is being published as a separate issue. The series continues to be a primary source of narrative information on Soviet activities in the Antarctic. The translation series is partially supported by National Science Foundation grant GV-32923.

Back volumes are available from the American Geophysical Union. These include Volumes 1 to 3, published by Elsevier Publishing Company (Amsterdam), in book form, and Volumes 4 to 7, published by the American Geophysical Union (see *Antarctic Journal,* VII(5): 215). The current subscription rate for 12 issues is $50. Prospective subscribers are invited to contact the American Geophysical Union, 1707 L Street, N.W., Washington, D.C. 20036.

Polar specimens at the Smithsonian Oceanographic Sorting Center

B. J. LANDRUM

Smithsonian Oceanographic Sorting Center

Since 1963 the Smithsonian Oceanographic Sorting Center has had a significant role in furthering knowledge of antarctic biology, particularly that of marine organisms. It has provided scientific services related to the preservation and study of specimens by systematists throughout the world to whom sorted taxonomic groups are regularly distributed. Over 5,067,248 sorted specimens have been sent to about 140 specialists in the past 9½ years. The samples represent most of the biological collections made from aboard the USNS *Eltanin* in about three-fourths of the oceanic areas surrounding Antarctica.

Work on antarctic collections recently expanded to include arctic specimens. In 1971-1972 the center received over 6,000 arctic samples taken in the 1950s by staff of the University of Southern California under a program sponsored by the U.S. Navy Oceanographic Office. The arctic collection is being processed for distribution to interested specialists. Future expansion of U.S. interest in arctic regions and its biota should augment these earlier collections' value. Over 3,000 samples containing more than 8,000,000 specimens have been sorted. The collection and sorting data are stored in the polar data bases maintained at the Smithsonian Oceanographic Sorting Center.

Specimens collected during RV *Hero* cruises also are being processed. Sorting of benthic invertebrates collected by Smithsonian Oceanographic Sorting Center staff aboard Cruise 72-1 is nearly complete. Last winter, two Sorting Center technicians aided personnel of the University of Maine and collected 200 additional samples specifically for other systemists who receive collections through the Sorting Center.

We are reviewing taxonomic groups whose availability may be unknown to potential researchers. Schools, museums, and individual systematists will be notified of such collections, to facilitate further research. Particular efforts are being made to attract students and other new investigators to the study of polar collections. Likewise we are planning to explore ways to more definitively sort some more complex taxonomic groups, particularly those that are ecologically vital (e.g. copepods) and may have received relatively little study because of the difficulties of accurately identifying lower taxa (i.e. families).

The USNS *Eltanin* rock collection has been at the Sorting Center for several years. The collection recently was transferred to Florida State University for storage and distribution (Schmid, 1973). The ocean bottom photograph collection remains at the Sorting Center. During 1972 about 7,500 black-and-white prints were distributed to investigators. Most prints are made at the Sorting Center's new photographic laboratory. Reliance on commercial processors has been eliminated and efficiency in meeting requests has improved.

Reference

Schmid, Elaine. 1973. Dredge samples from the southern oceans. *Antarctic Journal of the U.S.*, VIII(6): 357.

Dearborn, J. H., A. John Jordan, Stephen M. Fried, Harold T. King, and John E. Miller, 1973. Ecological studies of echinoderms and general marine collecting along the Antarctic Peninsula. *Antarctic Journal of the U.S.*, VIII(4): 206-208.

Antarctic Marine Geology Research Facility, 1972-1973

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Activities of the Antarctic Marine Geology Research Facility and Core Library, Florida State University, during the past year included the receipt and initial processing of 89 piston cores (578 meters), and 86 trigger and phleger cores (33 meters). These were retrieved from the southern ocean aboard USNS *Eltanin* Cruises 52-55, and brought the total of *Eltanin* piston cores to 1,133. An approximately equal number of trigger and phleger cores are part of the permanent collection of materials housed at the Antarctic Core Library. The total length of cored sediment from the 55 *Eltanin* cruises is near 8 kilometers (table). From these materials more than 8,000 samples have been distributed during the past year to numerous investigators from several countries. In all, more than 100,000 samples have been borrowed from the *Eltanin* collection.

Perhaps the highlight of the year's shipboard retrieval operation was the recovery of Cretaceous sediment from the Kerguelen Plateau, aboard *Eltanin* Cruise 54 (Kaharoeddin *et al.*, 1973). This is significant because these are the oldest sediments thus far obtained by the *Eltanin* in the southern ocean. Research is in progress to learn the geological implications of this discovery as they relate to the paleohistory of the Indian Ocean.

A major acquisition of the Florida State University antarctic collection was the transfer from the Smithsonian Oceanographic Sorting Center in June 1973 of more than 9,000 lbs. of rock samples collected in the southern ocean by dredges, trawls and grab sampling aboard the research vessels *Eltanin, Vema, Hero,* and *Anton Brun.* Most of these samples had been sent to the Smithsonian Oceanographic Sorting Center during 1969 and 1970, for cataloging and lithologic classification (Simkin, 1969, 1971). A staff member of the Sorting Center accompanied the return of the samples, and assisted in the final cataloging procedures. The collection is available to antarctic investigators. Forthcoming is a descriptive catalog and inventory listing of whole rock samples and thin sections that comprise this collection.

Also among the year's activities was the compilation, publication and distribution of the fourth volume of *Eltanin* core descriptions (Frakes, 1973). Together with the supplemental issue of descriptions of materials taken aboard Cruise 55, it completes the routine descriptive data. In progress is an attempt to further the usefulness of the core descriptions by establishing a southern high latitude biostratigraphy, based on diatoms, that spans inclusively the interval from Recent through Eocene (McCollum, 1972, 1973). This is intended to aid the sampling of *Eltanin* materials for reliably dated samples within a particular sub-surface horizon of interest.

Post-*Eltanin* activity in antarctic marine geological investigations during the past year was represented by three scientists from the Antarctic Marine Geology Research Facility who were aboard the *Glomar Challenger*'s initial cruise into antarctic waters (Hayes *et al.*, 1973).

References

Cassidy, Dennis S., and G. W. DeVore. 1973. Antarctic Marine Geology Research Facility and Core Library. *Antarctic Journal of the U.S.*, VIII,(3): 120-128.

Frakes, Lawrence A. 1973. USNS *Eltanin* sediment descriptions, Cruises 4-54. *Sedimentology Research Laboratory, Department of Geology, Florida State University. Contribution*, 37. 259 p.

Hayes, Dennis E., L. A. Frakes, P. Barrett, D. A. Burns, P. Chen, A. B. Ford, A. G. Kaneps, E. M. Kemp, D. W. McCollum, D. J. W. Piper, R. E. Wall, and P. N. Webb. 1973. Leg 28, deep sea drilling in the southern ocean. *Geotimés*, 18(6): 19-24. *Also see:* Deep sea drilling in the southern ocean, 1972-1973. *Antarctic Journal of the U.S.*, VIII(4): 169-170.

Kaharoeddin, F. Amrisar, F. M. Weaver, and S. W. Wise. 1973. Cretaceous and Paleogene cores from the Kerguelen Plateau, southern ocean. *Antarctic Journal of the U.S.*, VIII(5): 297-298.

Eltanin core inventory [1].

Cruise	Number piston cores	Core lengths (centimeters)			
		Longest	Average	Total	Cumulative
1—50	1,044	2,642	678.0	707,847	707,847
52	12	565	392.2	4,706	712,553
53	26	1,793	826.3	21,485	734,038
54	15	1,196	548.1	8,221	742,259
55	36	1,118	650.3	23,409	765,668
1—55 [2]	1,133 [3]	2,642 [4]	675.8	765,668	765,668

[1] Not included in this listing are 80 piston cores from Cruises 39, 43, and 45, totaling 738 meters in length, sent to University of Southern California.

[2] No cores were taken aboard Cruises 28, 29, 30, 31, 40, 41, 46, 47A, and 51.

[3] This total previously has been reported (Cassidy and DeVore, 1973) as 1,139. The apparent discrepancy was the result of Cruise 55 cores not having been received at the Antarctic Marine Geology Research Facility by the time the manuscript was prepared, making it necessary to rely on incomplete data.

[4] Piston core E 13-17, 65°41.0′ S. 124°06.8′ W., 2,583 fathoms.

McCollum, David W. 1972. Neogene genus *Trinacria* as a stratigraphic marker in southern ocean sediments. *Antarctic Journal of the U.S.*, VII(5): 198-199.
McCollum, David W. 1973. The genus *Denticula* Kütz in southern ocean sediments. *Antarctic Journal of the U.S.*, VIII (5): 293.
Simkin, Tom. 1969. Rock samples from the antarctic seas. *Antarctic Journal of the U.S.*, IV(5): 235.
Simkin, Tom. 1971. Rocks from the antarctic seas. *Antarctic Journal of the U.S.*, VI(6): 251.

Dredge samples from the southern ocean

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Smithsonian Institution

USNS *Eltanin*'s 55 cruises in the southern ocean between 1962 and 1972 gathered valuable information for all scientific fields. The geology program resulted in the collection of over 9,000 pounds of rocks, most of which were dredged from the ocean. Principal collectors of these samples were representatives from Florida State University, Tallahassee, where the rocks originally were housed. During 1969 and 1970 the rocks were transferred to the Smithsonian Institution Oceanographic Sorting Center, to be inventoried, described, and cataloged. In June 1973 these well-travelled rocks were transferred to the Antarctic Marine Geology Research Facility, Florida State University.

Cataloging of the *Eltanin* rock specimens is complete and a list of available material is scheduled for publication. The list will include sample number, and latitude, longitude, and depth at which the samples were collected. The published data, however, only will be a small portion of the flexible, computer-based, cataloging system; additional information about the rocks will be available upon request. Data for most samples are: type of collecting equipment used (i.e. Blake trawl, Campbell grab, etc.); approximate lithologic proportions of the sample; type of topography at the sampling location; provenance of the sample; deep sea photographs. From the entire dredge (or sample), individual rocks were selected, thin-sectioned, and petrographically described. All data is cross-indexed and therefore it is possible to locate samples of a specific type.

In order to fulfill an even greater portion of the researcher's need, plans are being made to increase the amount of available data. It is hoped that a complete petrographic description of the *Eltanin* rocks soon will be published. Future plans include cataloging samples, also in our collection, taken from aboard the RV *Vema*, *Hero*, and *Anton Brun*.

This collection and its attendant data are available to researchers, many of whom rarely have opportunities to collect oceanic rock specimens. We hope that the geologic community will utilize the collection's potential. Inquiries may be addressed to: Curator, Antarctic Marine Geology Research Facility, Geology Department, Florida State University, Tallahassee, Florida 32306.

News and notes

New airplane begins antarctic duty

One of three new National Science Foundation-purchased LC-130Rs commenced antarctic service in late October. The ski-equipped craft joined two older LC-130Fs that carried the burden of the U.S. Antarctic Research Program's on-ice flight operations during the opening weeks of the 1973-1974 austral summer.

The new airplane (no. 159129) and its sister ships (no. 159130, expected to be delivered in late November, and no. 159131, to be delivered following the austral summer) were purchased by the National Science Foundation under a $19.74 million appropriation by Congress in fiscal 1973. The U.S. Navy's Antarctic Development Squadron Six operates and maintains the new airplanes.

Built by the Lockheed-Georgia Co., the planes have a maximum payload, on a flight of 1,000 miles, of about 33,000 pounds. The older LC-130Fs have a maximum payload of about 23,000 pounds and a smaller flight range than the LC-130Rs. The LC-130R also has modernized avionics and increased ability to accommodate scientific instrumentation. No. 159129 first flew October 9 and 13 for testing before government acceptance.

Antarctic International Memorial Service

Officials of the United States, New Zealand, and the City of Christchurch (N.Z.), members of both countries' antarctic research programs, and others gathered October 7 at Christchurch for an Antarctic International Memorial Service. Most of the U.S. participants in the service were enroute to Antarctica from Christchurch, the location of the U.S. Antarctic Research Program's forward staging facilities.

The program was held at the Christchurch Cathedral and honored the 41 U.S. and N.Z. citizens who died in Antarctica between 1946 and 1971. After readings and hymns, the participants adjourned to the Christchurch Cathedral Square for the dedication of seven trees that are gifts of the United States. A plaque, placed on the outside of the cathedral, also was dedicated. The plaque reads: "In memory of those who have given their lives in Antarctica. Their dedication to peaceful scientific research will not be forgotten."

Soviet literature in translation

Water Circulation in the Arctic Basin, edited by A. F. Treshnikov, has been published for the National Science Foundation under the Special Foreign Currency Program. The 145-page volume's first chapter, structure of water masses and water circulation in the Arctic Basin, was written by Professor Treshnikov. Chapters II-IV (physical concepts of hydrodynamic models of ocean currents, hydrodynamic models of steady-state thermohaline water circulation in the Arctic Basin, and formation of ice cover of equilibrium thickness and surface layer of water in the Arctic Basin) were written by G. I. Baranov. The authors jointly wrote portions of chapter III. The volume, number TT 72-50088, may be purchased from the National Technical Information Service, Springfield, Virginia 22151, for $3 hardcopy and $1.45 microfiche.

SAE Information Bulletin Volume 8, Issue 7, published

Soviet Antarctic Expedition Information Bulletin number 85 (1973) has been translated into English and published under a grant from the National Science Foundation. The issue contains 14 scientific papers and 2 reviews, as well as a section on foreign press coverage of antarctic research. Copies may be ordered from the American Geophysical Union, 1707 L Street, N.W., Washington, D.C. 20036. Issue 7 costs $7.50.

Third SCAR/IUBS Symposium on Antarctic Biology

The Third Symposium on Antarctic Biology, sponsored by the Scientific Committee on Antarctic Research (SCAR) and the International Union of Biological Sciences (IUBS), is scheduled for August 26 to 31, 1974, at the National Academy of Sciences, Washington, D.C. The symposium's theme will be adaptations within antarctic ecosystems. Topics will include the structure and function of marine ecosystems, the structure and function of freshwater and terrestrial ecosystems, the development and evolution of antarctic ecosystems, and ecosystem evaluation, modeling, monitoring, and management.

The first SCAR/IUBS symposium in Paris, France, in 1962, covered microbiology through plant and animal biogeography, ecology, and physiology, including human physiology and psychology. The second SCAR/IUBS symposium was on antarctic ecology: past environments, marine ecosystems, plankton and its pelagic consumer, the pelagic resources of the southern ocean, marine benthos, the biology of seals, adaptation in seals, ecology of antarctic birds, freshwater ecosystems, soils, vegetation, terrestrial fauna, and conservation.

The third symposium's theme is designed to reflect current emphases in antarctic biological research. It is being organized by the Committee on Polar Research (CPR), National Academy of Sciences. The CPR panel on biological and medical sciences is the symposium's U.S. steering group: Professor William S. Benninghoff (chairman), and Drs. Maxwell E. Britton, Sayed Z. El-Sayed, Robert W. Elsner, E. K. Eric Gunderson, John W. Marr, Mary A. McWhinnie, Bruce C. Parker, George W. Rogers, Jay T. Shurley, and Donald B. Siniff. Further information is available from the Committee on Polar Research, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

SCAR working group elects new officers

The Scientific Committee on Antarctic Research (SCAR) working group on geology, meeting in Canberra, Australia, in late August, elected Dr. Campbell Craddock, chairman, Dr. R. Ian McLeod, secretary. Dr. Craddock is professor of geology, Department of Geology and Geophysics, University of Wisconsin, Madison. Dr. McLeod is associated with the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development, Canberra. The working group's former chairman was Dr. R. W. Willett, of New Zealand, and its secretary was Dr. R. J. Adie, of the United Kingdom.

New U.S. Navy assistant secretary (R & D)

Dr. David S. Potter, formerly director of research at the Detroit Diesel Allison Division of the General Motors Corporation, is the U.S. Navy's new assistant secretary (research and development). He is a member of several professional societies and serves on a number of boards and committees, including the advisory committee for planning and institutional affairs, National Science Foundation. Dr. Potter holds a Ph.D. degree in physics from the University of Washington.

Willis L. Tressler dies

Dr. Willis L. Tressler died September 9 following a brief hospitalization at Denver, Colorado. He was 69. Dr. Tressler and his wife, Mrs. Eleanor C., had lived in Grand Lake, Colorado, since his retirement in 1965 from the U.S. Naval Oceanographic Office, Suitland, Maryland.

As an oceanographer, Dr. Tressler participated in several U.S. antarctic expeditions. He accompanied the 1954-1955 U.S. Navy Antarctic Expedition and Operation Deep Freeze in 1956-1957. In 1958-1959, during the International Geophysical Year, he was science leader at Wilkes Station. Also he participated in the U.S. Antarctic Research Program, at McMurdo Sound, from 1959 to 1961. Earlier, in 1954, Dr. Tressler was with the Canada-U.S. Expedition to the Beaufort Sea, in the Arctic.

Born in Madison, Wisconsin, Dr. Tressler attended Colorado College and received the B.A., M.A., and Ph.D. degrees from the University of Wisconsin. He was a professor at the University of Buffalo, New York, from 1930 to 1940, and at the University of Maryland from 1940 to 1946. During World War II he was granted leave to serve with the Office of Strategic Services, and following the war he was with the newly formed Central Intelligence Agency. He joined the U.S. Naval Oceanographic Office in 1950 and, in 1962-1963, was its director of education and training.

Dr. Tressler's scientific research resulted in the publication of numerous technical articles and papers, including studies of tropical lakes in the Philippines, plankton of the Chesapeake Bay, the ecology and taxonomy of marine and freshwater ostracoda, and the limnology of Wisconsin and New York. In Antarctica, he studied tidal currents by using motion picture photography of ice movement at Wilkes Station, and marine bottom productivity and seasonal changes in McMurdo Sound.

Correction

Portions of "Leopard seal study at Palmer Station," on pages 196 and 197 of the July-August 1973 issue (VIII: 4) were omitted inadvertently. Additional authors are R. Reichle (University of Minnesota), J. Schmidt, B. Goforth, and D. Müller-Schwarze (Utah State University Ecology Center). The last paragraph should read, "This work was supported by National Science Foundation grants GV-24327 to the University of Minnesota and GV-33215 to Utah State University." The reference list should read:

Müller-Schwarze, D., and C. Müller-Schwarze. In press. Relations between leopard seals and Adélie penguins. *Symposium on the Biology of the Seal, Guelph, Ontario, Canada, August 1972.*

Müller-Schwarze, D., and C. Müller-Schwarze. In press. A survey of 24 rookeries of pygoscelid penguins in the Antarctic Peninsula region. In: *The Biology of Penguins* (B. Stonehouse, ed.). London, Macmillan.

Winter flights to McMurdo Station begin new field season

On September 2, after a journey that began August 26 at Quonset Point, Rhode Island, and a 2-day stopover in Christchurch, N.Z., two LC-130F Hercules landed in early daylight at Williams Field, on the Ross Ice Shelf near McMurdo Station. After unloading passengers and cargo, the airplanes returned to Christchurch for a second trip across the southern Pacific and the Ross Sea, arriving at Williams Field on September 5.

About 50 scientists and U.S. Navy and civilian support personnel, and about 8 tons of cargo (including mail and fresh provisions) were airlifted on the first flights of the 1973-1974 season of U.S. scientific research in Antarctica. Nicknamed "Winfly" (winter fly-in), the flights permitted early starts on three scientific endeavors: the Dry Valley Drilling Project (DVDP), modeling of freshwater and terrestrial ecosystems, and physiology and biochemistry of freezing resistance in antarctic fishes.*

Preparations for the new season began months before Winfly. U.S. Navy and civilian support personnel at McMurdo traversed McMurdo Sound in late August to preposition 28,000 pounds of equipment, provisions, and fuel at Marble Point. The materials are to be used in conjunction with the DVDP as well as other projects that are centered in the dry valleys. Most pre-Winfly preparations at McMurdo, as well as at other U.S. stations, involved supply inventories and the readying of buildings and equipment.

Thermocouples were emplaced in DVDP hole 2 at McMurdo Station, after opening and redrilling to 133 meters in mid-September. Then drilling began at hole 3, also at McMurdo Station, and by the end of September 255 meters of continuous core had been recovered. A roller bearing assembly breakdown in the drill rig forced a several-day delay in drilling operations while a replacement part was obtained. Diesel fuel is being used as a recirculating medium at hole 3, instead of calcium chloride brine, in part to minimize ice melting in the drill hole as the equipment penetrates the permafrost. Early reports indicated a 25 percent greater penetration rate than that achieved at holes 1 and 2 last January, and recovered drill cores from hole 3 suggest a good possibility of encountering marine sediments.

Two members of an ecosystems modeling team from Virginia Polytechnic Institute and State University spent September and much of October inventorying equipment and supplies for use in the freshwater and terrestrial ecosystem modeling project's second year at Lake Bonney, in Taylor Valley. They also readied cargo for helicopter transport to the Lake Bonney hut. The project's first team, consisting of nine persons, was expected to arrive at McMurdo by the end of October.

The first week of work in the University of California, San Diego, project on the physiology and biochemistry of freezing resistance in antarctic fishes was spent constructing an insulated subfloor and insulated side and end walls in a Jamesway hut that had been built for the team during the winter. The hut, near McMurdo Station, is used as a running seawater laboratory where live fishes are kept in saltwater tanks. A fishing station was established 4 kilometers west of McMurdo. Weighing, tagging, and measuring of collected specimens began, and several were sent to the Jamesway aquarium for further experimentation and study.

Early inspection of Williams Field revealed greater snow burial of buildings than during any of the last 5 years. The structures were cleared of snow and the field made ready for the anticipated 32 C-141A and other flight arrivals during 1973-1974.

On October 9 the first C-141A Starlifter, from the 438th Military Airlift Wing, McGuire Air Force Base, New Jersey, landed at McMurdo. The flight marked the opening of the 1973-1974 austral summer season. In the first weeks of October, at least 191 passengers and 29,000 pounds of cargo were transported from Christchurch to Williams Field. In addition to three U.S. Air Force C-141A flights that transported scientists, personnel, and priority cargo from Stateside to Christchurch and to Williams Field, two chartered DC-8s deployed 313 passengers to Christchurch during early to mid-October. Other priority cargo weighing just over 673 long tons, to be airlifted from New Zealand to McMurdo, departed from Davisville, Rhode Island, on September 1 aboard the USNS *Private John R. Towle*.

The National Science Foundation-owned and civilian-operated research trawler *Hero* continued to be plagued in September and October with mechanical difficulties stemming from the scheduled overhaul of its main engines and generators that began last June. Originally the ship was to return to sea on July 23. Two of its cruises were cancelled because of the delays. The last cruise in 1973—numbered 73-3—was scheduled to debark by the end of October for study of crabeater seals along the Antarctic Peninsula.

* Each project planned for the 1973-1974 season is described on pages 314-324 of the September-October 1973 *Antarctic Journal.*

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