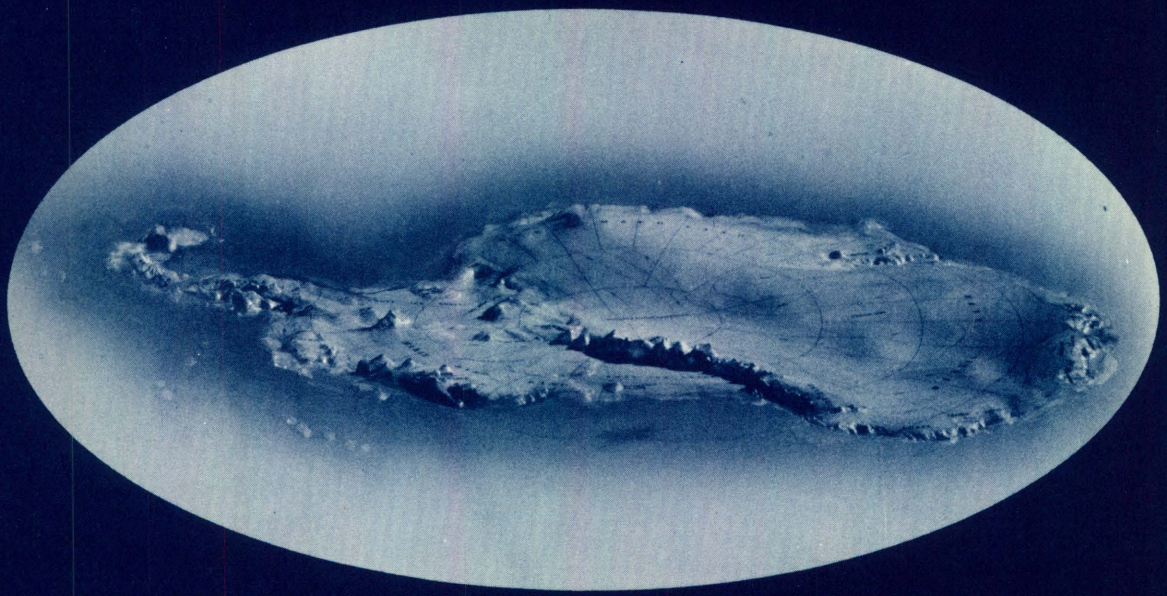
# Antarctic report

MAY 1965



U.S. ANTARCTIC RESEARCH PROGRAM

NATIONAL SCIENCE FOUNDATION

## CONTENTS



Communications regarding the Antarctic Report should be addressed to the Office of Antarctic Programs, National Science Foundation, Washington, D. C., 20550.

# RICHARD E. BYRD ANTARCTIC COMMISSION BILLS

## DR. LELAND J. HAWORTH TESTIFIES

As reported in the April issue of the Antarctic Report, hearings on the four commission bills began on April 12 in the Subcommittee on Territorial and Insular Affairs of the Committee on Interior and Insular Affairs. Testifying before the Subcommittee on May 6-7, Dr. Haworth, Director of the National Science Foundation, said, in part:

On May 1, 1965, the President announced the establishment of the Antarctic Policy Group, noted the success of international cooperation in Antarctica and called for the extension of such cooperation into other fields of international endeavors. His announcement coincides with the 10th anniversary of the establishment of the arrangements to mount one of the most purposeful large-scale efforts of exploration the United States has ever undertaken, the International Geophysical Year antarctic effort. As Director of the National Science Foundation and one of the three participants in the Antarctic Policy Group, I wish to describe to you something of our program.

The primary responsibility for policy concerning Antarctica resides in the three members of the Antarctic Policy Group, which consults as necessary with other agencies of the Government having antarctic interests. In this Group we formulate policy, determine objectives to implement this policy, and agree on long-range plans which conform with these objectives. This arrangement for policy development and review will permit the inclusion in the program on a relative priority basis of the activities of private citizens and organizations which are determined to be in the interest of the United States and compatible with operational capabilities. There is present in this arrangement also the means by which matters affecting the policies and objectives of the United States can be brought to the attention of the President.

Over the years the coordinating responsibility in managing antarctic affairs has worked out very well. The formalizing of an Antarctic Policy Group has sharpened up this coordinating responsibility. The presence of this Group now identifies the place to which those having an interest in Antarctica can turn. The composition of the Antarctic Policy Group puts at its immediate disposal the staffs and capabilities of the three agencies which in their own spheres are specially qualified to carry out these tasks.

The Federal agencies directing and conducting our antarctic program have achieved their present expertise through a process of growth and development over the past decade. The experience of the Foundation is illuminating. The very modest scientific effort in the Antarctic underwent a

great intensification in the International Geophysical Year, which was supported in the United States chiefly through Foundation funds. When, in 1958, the United States decided to continue a substantial scientific program in Antarctica, the National Science Foundation was designated by the President to fund and manage these activities, called the "U.S. Antarctic Research Program (USARP)." Thus the budget for the entire scientific program, including the scientific activities of other Government agencies, rests in the Foundation. In directing this program the Foundation recognizes that the United States has a long-term interest in Antarctica; consequently planning of the program content is predicated upon the assumption that it must serve as the basis for a continuing effort of many years' duration.

If we are to understand the role of Antarctica in our environment and to seek out the beneficial uses Antarctica may provide for mankind, we must encourage the application of a wide variety of talent and divergent points of view in its study. Thus the U.S. Antarctic Research Program provides a broad approach to the scientific exploration of Antarctica by incorporating the research interests of private institutions and Federal agencies alike. Furthermore, it amalgamates a spectrum of biological and physical sciences into a single integrated and coordinated program. It includes support of important related projects such as the analysis of data from scientific investigations, the publication of scientific results, and the retrieval and dissemination of this information. In addition, we are pursuing a long-range effort to map the continent. When necessity dictates, arrangements for specialized research facilities can be made. In fact, under the authority of the National Science Foundation it is possible to arrange for the conduct of any legitimate research activity which will extend our understanding of the continent, its surrounding regions, and their effect on the worldwide environment. All of this will serve to guide us to the ways to make Antarctica beneficial to mankind.

Long-range plans for U.S. antarctic efforts are developed in the following manner: The National Science Foundation in consultation with other interested agencies prepares a five-year projection of scientific program requirements. This projection is based upon the known research interests and capabilities of Federal agencies, of universities, and of other private organizations and is put together in full cognizance of overall U. S. national interests. The Five-Year Plan has annually been brought up to date by revisions which extend it an additional year. This Five-Year Plan is provided to the Department of State and the Department of Defense. The Department of Defense responds with a corresponding Five-Year Plan for logistic support requirements. The Department of State reviews these plans in the light of U. S. foreign policy objectives and provides guidance and suggested priorities. Obviously, it is necessary to reconcile differences which may occur such as the provision of logistic support capabilities for proposed future scientific programs. Therefore, in the preparation of the respective plans, close staff cooperation is maintained. Policy problems which may arise out of this planning procedure are resolved by the Antarctic

Policy Group.

The research interests of other Federal agencies are included in the National Science Foundation long-range U. S. scientific program projection. All of them are funded through the appropriation of the National Science Foundation, which transfers funds as needed. As a result, the following Federal agencies have or have had research programs which are in addition to those carried out by universities and other private research organizations:

Air Force Cambridge Research Laboratory
U.S. Coast and Geodetic Survey
U. S. Weather Bureau
National Bureau of Standards
U. S. Geological Survey
Bureau of Mines
U. S. Naval Oceanographic Office
U. S. Army Signal Corps
U. S. Army Corps of Engineers (Cold Regions Research & Engineering Laboratory)
Smithsonian Institution

The Foundation has also been working with NASA in the introduction of satellite data programs in Antarctica and in developmental aspects of NASA's Moon Program where Antarctica might provide certain test opportunities.

Supporting the policy review and promulgation process, there is continuous staff coordination to achieve immediate objectives. This coordination is primarily between the National Science Foundation and the Department of State, Department of Commerce, Department of Interior, and the Department of Defense, with other agencies included where they may have an interest. Particularly important in this process is the constant coordination between the Head, Office of Antarctic Programs in the Foundation and the Commander, Naval Support Force, Antarctica, to develop and implement the yearly program.

Six to nine months prior to each antarctic field season, the Foundation presents its scientific field requirements to the U.S. Naval Support Force, Antarctica, first in general terms and then in succeedingly more detailed form. In this process again the Foundation speaks to the Navy not only for the private research community but for Federal agency scientific groups with antarctic interests, thus providing the Naval Support Force with a coherent set of requirements and priorities. In this regard there was in January, 1965, a week's planning conference in New Zealand between the Commander, Naval Support Force, Antarctica, and his staff, and the Chief Scientist and the Program Director for Field Requirements and Coordination representing the Head, Office of Antarctic Programs of the Foundation. At this meeting the amalgamation of scientific program requirements and logistic support capabilities for the 1965-66 effort commenced, coordinating information from detailed plans.

The effectiveness of the planning and coordinating which exists is illustrated by some of the achievements of the last several years. In 1962 the U. S. established the Eights Station in the Ellsworth Highland to extend the U. S. network of stations for the first time since the close of the International Geophysical Year. At the same time, there was introduced into the program the first full-time antarctic research vessel, which has given the U. S. a unique capability to explore the very rich ocean regions surrounding Antarctica. The U. S. is the only country engaged in such a program of research and exploration of the Southern Oceans.

The U. S. also exercised its right of inspection under the Antarctic Treaty during the 1963-64 austral summer. I believe this is one of the most important actions that the U. S. has taken in connection with our national antarctic policy.

This season we established the new Palmer Station on Anvers Island off the Antarctic Peninsula, extending our capability into this area where our nation has not been represented since 1947. We hope, with the consent of Congress, to augment this program by constructing a wooden trawler to work in conjunction with this station in exploring both land and ocean areas of the Peninsula. We have also begun the exploration of the last unknown area of the continent--the region between the South Pole and Queen Maud Land. An oversnow traverse has carried a U. S. geophysical team into this new area which lies between areas previously explored by the British, the Belgians and the Soviets. We hope to establish a station for a year or so in the middle of this area while we conduct our exploration.

Finally, we are commencing a series of research projects which utilize satellite data. The United States has improved its network of useful stations by concentrating its efforts in those antarctic areas of greatest future interest to us. The strengthening of this network has not been the result of haphazard planning nor has it developed in the absence of interagency coordination.

Perhaps one of the most gratifying aspects of Antarctica is the spirit of international cooperation which exists in this region. The Antarctic Treaty assures the freedom of scientific investigation anywhere in the Treaty area for at least thirty years. While pursuing our own scientific interests over much of Antarctica, we have also cooperated with nearly every other country party to the Treaty in the carrying out of research programs. The Treaty has encouraged such cooperation and has insured that our scientists may have access to data and scientific results from areas of Antarctica being explored by other countries. We believe that the Treaty has provided to U. S. scientists a freedom of access to Antarctica and information about it that they might otherwise never have enjoyed. Furthermore, the provisions of the Treaty encourage the establishment of protective measures safeguarding for man's study and use the unique features of the antarctic environment. For example, the Foundation in cooperation with the Department of State, the Department of

Defense, with the advice of the Department of Interior and the Smithsonian Institution, is in the process of instituting procedures to insure that unnecessary harm is not caused to antarctic fauna and flora by our activities on the continent.

Considering that the continent of Antarctica covers an area as large as the United States and Western Europe combined, and that ten years ago we had hardly begun its systematic exploration, remarkable progress has been made. Never before in so short a time has man explored so large an area so thoroughly and with so few people. In fact, today we know more about certain facets of Antarctica and its environment than we do about large areas of Asia, Africa and South America.

Since 1957, fourteen major U. S. oversnow traverses have crisscrossed much of the interior of the continent. From these traverses, we can now sketch out the surface elevations, ice thicknesses, gravity and magnetic fields, the average annual temperature and the amounts of annual snowfall over nearly three-quarters of Antarctica. Although other countries, particularly the USSR, have also made notable journeys into the interior, the tracks of the U. S. traverses amount to nearly three times the combined accomplishments of all other nations. The vital facts gathered in this manner have laid the groundwork for other programs: the mapping, the geology and the rheology of the antarctic ice. This information has also made it possible, figuratively speaking, to lift off the ice cover of Antarctica and reveal the conformation of the sub-ice topography and the relationship one to another of the various geophysical provinces which comprise Antarctica. We now know how deceptive in appearance is the ice cover of Antarctica. For example, if ice were melted off West Antarctica, the area in which the U. S. has carried out the majority of its activities would be under water with the exception of the mountain ranges, which would form island arcs.

The knowledge gained from the traverses plus the reconnaissance aircraft flights has identified the ice-free and other areas of interest and the U. S. has proceeded with the mapping of these features. Aerial photographic coverage is now complete for many of the major mountain ranges and the areas along the coast of the Amundsen Sea. Considerable ground control has been established and accurate maps have been or are in the process of compilation. Future coverage will include the coasts of the Bellingshausen Sea, the southern areas of the Antarctic Peninsula, and the Queen Maud Land ranges along the coast facing Africa.

Simultaneously with the production of aerial photography and cartographic maps, teams of U. S. geologists from the U. S. Geological Survey, the University of Minnesota, Ohio State University and several other universities have ranged over the accessible ice-free mountains studying the rock formations. In one more season the reconnaissance geology of the major ranges of West Antarctica will be completed. Literally tons of rocks and fossils from which the ages and formations can be determined have been brought back to U. S. laboratories. With this history of the geological formations, the likely areas of value for minerals can be

further examined. With nearly 95% of the continent covered with ice, the isolated interior areas will never be as well-known geologically as the temperate latitude lands; nevertheless, the ice-free areas if brought together would be the size of some of our larger states, such as Colorado. So far no mineral deposits which are commercially significant today have been discovered. But the research which has been carried out will now make it possible to narrow down any likely possibilities.

United States glaciologists, from the traverse work and from detailed studies at the permanent stations and other local areas, have gained considerable knowledge in the movement of the ice. For example, they can judge from knowledge of the ice flow off the continent annually, the cooling effect that it has on the waters of the oceans. At present, we are well along on the development of a special drill that will penetrate to the deepest ice layers and reveal information on the internal temperatures and rate of heat flow near the bottom of the ice. From these, the fundamental behavior of ice flow can be deduced and predictions made on possible future slowing-down or speeding-up of the ice movement, with consequent changes in oceanic sea level. It is sufficient to bear in mind that 2% of the earth's water is locked up in Antarctica as salt-free ice. This is enough water, if the ice were melted, to raise the world ocean level 250 feet. The geology of Antarctica tells that it has not always been a frozen desert. Fossils and petrified trees indicate that the continent once had a very different and much warmer climate. It therefore is important for man to know what changes, if any, may be occurring in the antarctic ice cap.

Major efforts have gone into meteorology and the outer atmosphere studies. The continent is a tremendous heat sink and vast quantities of relatively warm air flow at high levels from the equator into the south polar regions. Antarctica is not, as had once been suspected, a breeding ground for polar storms. Instead, we know that these storms develop in the surrounding ocean areas where westerly winds prevail. A fuller understanding of the relation between these storms and the high gravity winds which sweep off the high plateau to the coastal areas remains an important problem to be studied.

As the south geomagnetic pole and auroral zone lie in Antarctica, many studies have been made of the charged particles that come in from the sun and are deviated along magnetic lines to the polar regions. Free from the interference of electrical noises, either man-made or due to electrical storms, the continent is a good area to monitor the electromagnetic signals that reveal the structure of the outer ionosphere and the potentials of long-range radio communication. The U. S. has been fortunate that its area of operations is magnetically conjugate to eastern Canada as this circumstance allows scope in studying radio propagation paths across the globe. Special long antennas have been installed over the inland ice to allow U. S. scientists to experiment with man-made, controlled, very-low-frequency radio signals.

By virtue of the high latitude location, satellite readout stations can

monitor polar satellites very efficiently, a few stations being able to read all of the satellite passes. Already the U. S. has meteorological, geodetic and orbiting-geophysical-observatories (OGO) satellite readout stations and our long-range plans call for still further installations as part of the networks.

Most of the living forms of Antarctica are either in the seas or along the coast, close to the water. We feel we have been very successful in exploring vast areas of waters north of the Antarctic with our research vessel. The Eltanin, which is operated for the Foundation by the Military Sea Transportation Service, is larger than most U. S. research vessels and accommodates more than 30 scientists from more than a dozen universities and Government agencies with many diverse programs of meteorology, ionospheric soundings, and physical, chemical and biological oceanography and submarine geology. In nearly three years of continual operations in the high latitudes of the Southern Hemisphere, thousands of miles of cruise tracks have been made in the areas of the South Pacific and between South America and Antarctica. The Eltanin has maintained a record of better than 290 days a year at sea and is the only research vessel which is today exploring these oceans on a full-time basis. Large ocean areas of high biological productivity lie near the Antarctic Convergence where the intermixing of cold waters from the continent and warm waters from the north bring up nutrients from the ocean floor. It was the richness of these oceans that brought our sailors first to Antarctica and led to the early exploration of the continent. It may be the marine resources of Antarctica that will again become Antarctica's chief benefit to mankind.

In developing an integrated scientific program in Antarctica, the Foundation is advised by the Committee on Polar Research of the National Academy of Sciences; the Chairman of this Committee is Dr. Laurence M. Gould, now at the University of Arizona. The Committee provides the Foundation with recommendations for long-range scientific objectives. The Academy Committee also represents the U. S. antarctic scientific community on the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU). It is through SCAR that international coordination of scientific programs is achieved. Dr. Gould is presently serving a three-year term as President of SCAR. The Foundation also receives advice from Government agencies with scientific bureaus which have an interest in Antarctica as well as from private research organizations through the normal means available to the Foundation.

There is a legitimate concern on the part of this Committee that information about Antarctica which is required for wise planning and informed implementation of projects in Antarctica shall be available to all those who may have an interest or responsibility in this area. It should be pointed out that the National Science Foundation was directed in 1960 to serve as a clearinghouse and source of information concerning Antarctica. Whereas it is considered undesirable to establish a central depository for all information dealing with Antarctica, a project that

would entail the disruption of a number of existing libraries and well established depositories of records and data, the National Science Foundation has during the last four years supported projects and activities which have made it possible for anyone interested in antarctic problems to locate information about Antarctica which may be required. In addition to maintaining a service designed to direct inquiries to appropriate sources, the Foundation has supported such projects as the preparation of an Antarctic Bibliography, the cataloguing of type and location of existing data, results and specimens worldwide, the summation of scientific knowledge of Antarctica in folio form, and other projects which insure that the contribution of U. S. scientists and those from other countries working in Antarctica are made available to other established information collecting and disseminating organizations. The Foundation supports the publication of information and scientific results derived from the research program including such publications as the Antarctic Research Series. The Foundation also supports the activities of polar research centers such as the Institute of Polar Studies at The Ohio State University, and the Geophysical and Polar Research Center of the University of Wisconsin.

It should be pointed out that the miles of traverses, the tons of rich samples or barrels of fish specimens have a value that goes much beyond their individual import. A program of basic research for Antarctica seeks to relate its particular physical characteristics to the laws of nature as we now understand them. It provides a unique opportunity to extend our understanding of how nature works, for Antarctica is a natural laboratory of extreme conditions not found anywhere else on the surface of the earth. Here we have life surviving and evolving at the limits of endurance. We have a Pleistocene condition similar to that which covered parts of the Northern Hemisphere thousands of years ago. We have physical forces of the greatest magnitude at work in the atmosphere and the oceans around Antarctica. Eight years of research have told us that Antarctica has a profound effect upon the world as we know it, and our research work there may provide solutions to some of the great questions about our environment that remain unanswered today.

The understanding that comes from basic research is the first necessary step to the practical utilization of what nature has provided man. The National Science Foundation realizes in its direction of the U. S. Antarctic Research Program the possibility that from research in Antarctica will come our knowledge of practical benefits for mankind. We realize that geologic and geophysical studies will narrow down possible areas of mineral potential. Our research on marine fauna and flora will serve to define the reserves of food for man in the oceans and how we can best use them. Our radio sciences experiments may aid satellite communications. But, we should not justify our basic research solely by the presence or possibility of such specific practical uses. The general understanding developed, and its relationship to the earth as a whole are equally important.

We must not discount either the fact that the antarctic experience has

great educational value. Antarctica, because of its harshness, reduces human activity to simple functions and it teaches the individual scientists initiative, ingenuity and perseverance. Furthermore, it provides opportunity for original work to the student as well as to the veteran researcher. Today, our scientific manpower in the United States is stretched very thin. We encourage students to seek their advanced academic degrees on antarctic problems because there is a real opportunity for them to do original research and because we believe it is in the interest of the United States to increase the number of research scientists with polar experience. Today some of our most promising geophysical and biological research is being pursued by young men who began as students eight years ago in Antarctica and are now well launched in the scientific community.

It is our intention to see to it that the Foundation continues to pursue an active and dynamic research program in Antarctica. This program will continue to serve as broad a variety of Federal and private research interests as possible. I am confident that the results will benefit science and mankind and that the program will carry forward the interests of the United States in Antarctica. Today, we are better represented on the continent than at any time in our long history of exploration. Never before have we enjoyed the flexibility of movement or variety of ways to pursue our exploration. We have maintained the tradition of leadership which our country has enjoyed and successfully used it to encourage peaceful international cooperation in Antarctica. The knowledge and understanding which we are gaining, I am confident, will benefit this nation and repay the investment of dollars and hard work that we have made.

[At the request of the Chairman, the Honorable Leo W. O'Brien, Dr. Haworth subsequently submitted the following supplementary statement]:

In Bureau of the Budget Circular A-51, which formalized responsibilities for the antarctic program within Government agencies, the National Science Foundation was assigned, as part of its functions, the task of serving as "the clearinghouse and source of information regarding the existence and location of antarctic records, files, documents, and maps within the various executive agencies and nongovernmental organizations." Such a clearinghouse has been operated in the National Science Foundation since 1962.

Among the tools employed in the acquisition and dissemination of current antarctic information (including science, logistics, exploration, political geography, etc.) is the Antarctic Bibliography, prepared under National Science Foundation funds at the Science and Technology Division of the Library of Congress. This Bibliography is issued on standard 3 x 5 library cards containing informative abstracts and a subject index, plus indexes to the geographic area, station, or both where the work was performed, author and co-authors, grantee institution and, in some cases, the expedition.

The Antarctic Bibliography cards are available to universities, Government agencies, and other organizations in the United States with a bona fide interest in Antarctica. Sets are being sent abroad to the agency or organization in each country with which the National Science Foundation regularly exchanges publications on Antarctica. However, the number of cards issued to date makes it cumbersome to handle except at libraries. Therefore, cumulative volumes will be issued periodically, each containing 2,000 abstracts with indexes. Volume 1 will be available this spring. In order to assure the permanent conservation of the antarctic records, every document abstracted for the Antarctic Bibliography is microfilmed in toto at the Library of Congress.

Information on current scientific activities in Antarctica is provided in the Antarctic Report. This multilithed report, issued monthly by the National Science Foundation, is a continuation of the Antarctic Status Report, begun in 1959. Containing brief articles and items of general interest, in addition to the progress reports of field work, the Antarctic Report provides a means of direct communication among the various elements of the U. S. Antarctic Research Program and other agencies and individuals, national and foreign, concerned with antarctic research.

Biologists and geologists who have collected specimens in the Antarctic, or who wish to obtain information on antarctic specimens available in the United States, have at their disposal the central records of antarctic specimen collections maintained with National Science Foundation funds at the Smithsonian Oceanographic Sorting Center. These files include, in addition to complete records of antarctic specimens in the U.S. National Museum, all available data on antarctic collections deposited with, or under study at museums and universities throughout the country. The task of indexing, sorting, copying, and distributing the bottom photographs obtained in antarctic seas by the National Science Foundation's research vessel, the USNS Eltanin, is carried out also by the Smithsonian Oceanographic Sorting Center as part of the Antarctic Specimen Records Project. A data processing system is being devised for the antarctic specimen records that is compatible with the systems used by the National Oceanographic Data Center and other Government offices.

In close coordination with the Antarctic Specimen Records Project, a sorting operation of USARP specimen collections is being carried out at the Smithsonian Oceanographic Sorting Center with Foundation support. This arrangement is particularly useful and economical for sorting and distributing large collections of antarctic materials such as the marine biological collections obtained aboard the USNS Eltanin.

During the first year of operation of this project, nearly two million antarctic specimens were sorted by the Smithsonian Oceanographic Sorting Center, principally materials from the USNS Eltanin but also 11 other benthic collections and a special collection of 30,000 biological specimens obtained in 1963 during a survey of potential sites for Palmer Station in the Antarctic Peninsula.

In order to insure that specimen collections made with Government funds are not thoughtlessly disposed of or otherwise lost upon completion of a research project, the Foundation has made their preservation a condition of the research grant. Each grantee is required to provide NSF with a general description of any biological or geological materials obtained by any members of his field party and to inform the Foundation of any dispositions made of these collections and the pertinent field data. The Foundation reserves the right to direct the eventual disposition of all collections and field data. As a general rule, it will permit title to collections and field data to vest in grantee institutions where adequate facilities for collections and public accessibility for study purposes are guaranteed; however, the grantee institution is required, as a condition of the grant to forward a representative set of the collections to the U. S. National Museum.

The Eltanin's program of sampling the antarctic seas includes continuous coring of the bottom sediments. During the next decade this operation may be expected to produce close to 40,000 feet of bottom cores, which must be preserved for study by contemporary scientists and future generations. Under grant from the National Science Foundation, construction is expected to begin soon on a 9300 square foot core storage facility at Florida State University, where the cores will be kept under controlled temperature and humidity conditions. From there, sections of the cores will be made available on request for study by specialists throughout the country.

To represent the national effort in international polar research, to provide a representative medium for national antarctic scientific efforts, and to accommodate monographic or fuller treatments, the Antarctic Research Series has been created. Published by the American Geophysical Union with the aid of a grant from the National Science Foundation and under the supervision of a Board of Associate Editors, four volumes have appeared to date in this Series. Volume 1 was entitled Biology of the Antarctic Seas, Volume 2, Antarctic Snow and Ice Studies, Volume 3, Polychaeta Errantia of Antarctica, and Volume 4, Geomagnetism and Aeronomy. Volumes on geology, glaciology, meteorology, and pedology will appear in the Series.

In order to summarize the present knowledge of the Antarctic, a project entitled the Antarctic Map Folio Series has been instituted at the American Geographical Society with funds provided by the National Science Foundation. This Series is to contain some 20 folios prepared by more than 50 contemporary experts in the various scientific disciplines. In addition to serving as a general reference source for antarctic information, the Series is intended to be a working tool for scientists carrying on continued studies or initiating new research in the Antarctic.

The production of maps represents an important facet of the U. S. Antarctic Research Program. The antarctic aerial photography and map library is located at the Branch of Special Maps of the U. S. Geological

Survey, where prints and negatives of aerial photography flown for mapping and for other special purposes are filed. Included in the latter category is low-altitude photography of penguin rookeries, special areas of geological interest, etc. Maps and charts produced as part of the U. S. mapping program in Antarctica, special large scale maps, and maps received from foreign countries through the Scientific Committee on Antarctic Research are on file in this library.

Like the exchange of scientists between national expeditions in Antarctica, the exchange of publications with foreign agencies engaged in antarctic research contributes significantly to the current awareness of operations and results of research by other nations, vital in the efficient conduct of a national program operating with limited funds. The National Science Foundation carries out an active publications exchange program with the eleven foreign countries most active in antarctic research.

Russian activities in Antarctica are reported regularly in the Information Bulletin of the Soviet Antarctic Expedition, which, in turn, is being translated into English by the American Geophysical Union under grant from the National Science Foundation. Of the 48 original issues, 44 have been translated. The first 30 issues were published in three volumes, each containing ten Bulletins; subsequent translations have been published in single issues of two Bulletins each. Translations of other foreign materials are being prepared and issued as feasible, using excess foreign currencies available to the U. S. Government in Israel.

In order to assure maximum availability of reports on antarctic research, the National Science Foundation deposits a copy of each such report prepared with Government funds, with the Clearinghouse for Federal Scientific and Technical Information of the U.S. Department of Commerce. This agency, in turn, announces the reports' availability in its publication, U.S. Government Research Reports, and reproduces copies on request. The Foundation furthermore encourages its grantees for antarctic research to report their current activities to the Science Information Exchange, where all available data on non-classified Government-sponsored research are kept on file.

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## TRAGEDY AT BYRD STATION

On May 8 shortly after 1:00 a.m. at Byrd Station, Carl R. Disch, ionospheric physicist for the National Bureau of Standards, was reported missing after he had left the radio noise building in a severe storm to walk to the main station complex, 7,000 feet away. Disch apparently failed to make contact with the handline between the radio noise installation and Byrd Station, as a search of the vicinity of the radio noise building disclosed footprints, assumed to be his, leading to the southwest end of the runway. Here the tracks were lost because of blowing

snow, and it was not until the morning of May 9 that a party could continue tracking. In the meantime the immediate station area, supply line, and dump were investigated. When the tracks were lost a second time a major search effort, including vehicles, a sled-mounted hut and a supply of food and fuel, proceeded to the point where the tracks were last seen and continued southward for 13 miles from the station on the 10th and 11th, making perpendicular sweeps to the east and west, with no success. In the station area the search continued and a party visited the old Byrd Station six miles away. Repeated attempts were made to reach the long-wire antenna site eleven miles to the northwest, although this direction was contrary to the direction of the footprints and almost into the wind, making it a highly unlikely one for Disch to have taken.

Throughout this period, there were intermittent storms with winds up to 45 knots and visibility reduced to zero by heavy blowing snow, seasonal darkness, and overcast. At one point the temperature dropped to -79°F., seriously interfering with the movement of men and vehicles. The station complement utilized the brief twilight at midday and the light of the full moon whenever possible to advance the search efforts.

A memorial service for Carl Disch was held in his hometown of Monroe, Wisconsin on May 14, attended by Dr. T. O. Jones, Head of the Office of Antarctic Programs, and Mr. Stephen S. Barnes from the Central Radio Propagation Laboratory, National Bureau of Standards. Further search is planned for the return of daylight in the spring.

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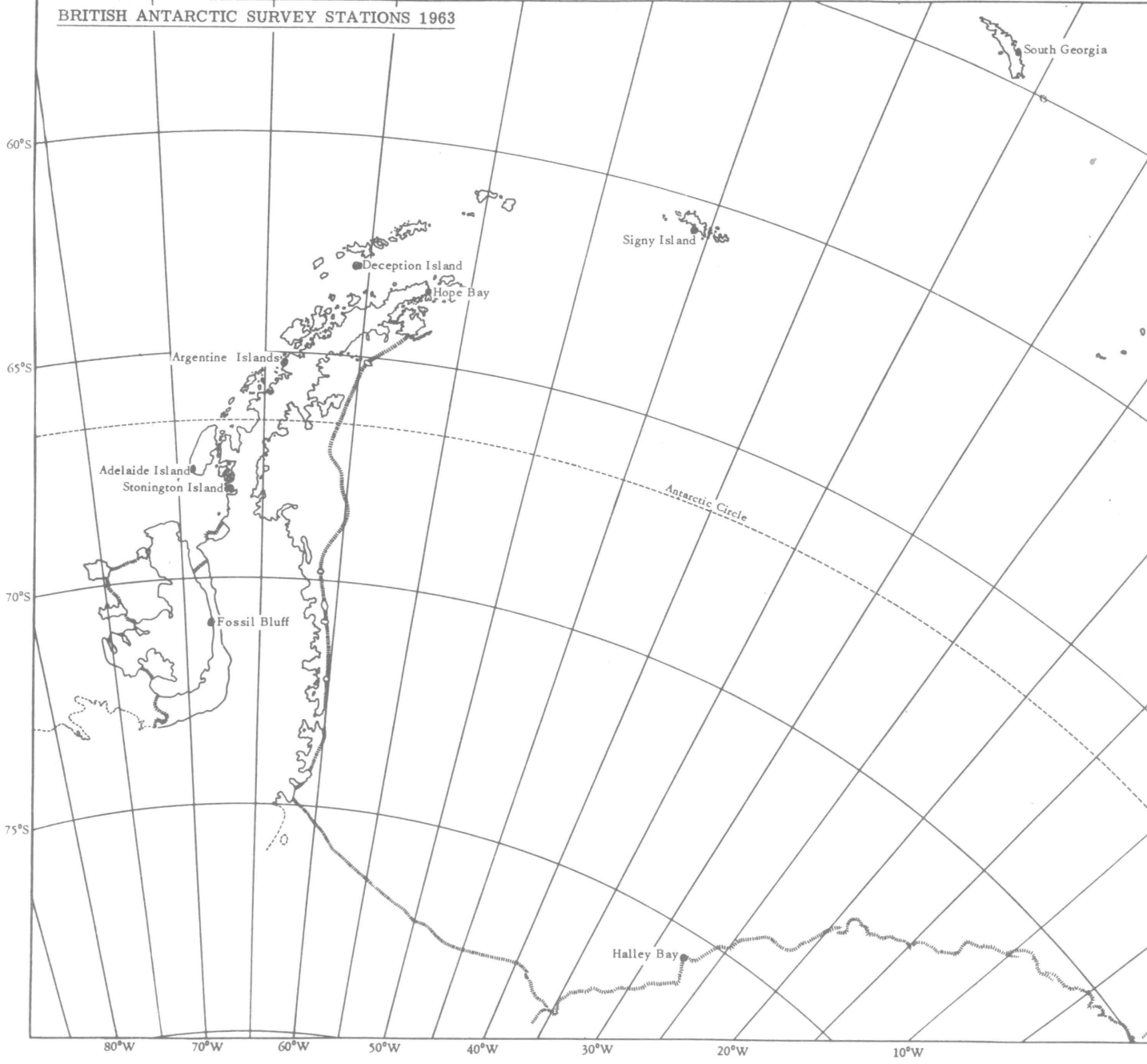
## ACTIVITIES OF OTHER NATIONS

### UNITED KINGDOM

Stations scheduled to be occupied during 1965 are shown in the attached map. According to information provided in SCAR Report No. 6, published August 1964, the following activities were tentatively planned:

| Base | Location | Personnel | Activities Planned |
|---|---|---|---|
| B | Deception Island | 11 | Surface meteorology, visual aurora, Air Base |
| E | Stonington Island | 20 | Visual aurora, survey, geology |
| F | Argentine Islands | 16 | Surface and upper-air meteorology, solar radiation, ozone studies, geomagnetism, visual aurora, ionosphere and whistlers, seismology, tides, vegetation studies |
| H | Signy Island | 12 | Surface meteorology, visual aurora, soil science, plant ecology, limnology, marine biology, invertebrate zoology, bird behavior |




[From: The Royal Society, U. K. National Report No. 6 to SCAR]

| Base | Location | Personnel | Activities Planned |
|---|---|---|---|
| | | | studies, routine bird-banding and seal tagging |
| KG | Fossil Bluff | - | Surface meteorology, survey, geology (summer occupation - manned from Base E or T) |
| T | Adelaide Island | 11 | Surface meteorology, visual aurora, survey, geology |
| Z | Halley Bay | 30 | Surface and upper-air meteorology, solar radiation, ozone studies, geomagnetism, magnetic survey, visual, photographic and radar auroral studies, ionosphere, glaciology, survey, geology, physiology |
| SG | South Georgia | 7 | Surface meteorology at King Edward Point; normal program for control of elephant seal industry, studies on fur seals |

BIOLOGY AND MEDICINE

Botany: At Bases F and H and in other areas, field studies on Deschampsia antarctica and Colobanthus crassifolium will continue, and parallel work on these species in cultivation will be carried out in the U. K. At Base H, a new program of research on bryophyte ecology will begin. Research on the maturation cycle and general fruiting behavior of selected mosses will be continued in the 1964-65 summer at various bases. At Base F, a primary survey of vegetation will be concluded. General collections will be made in the Tottanfjella.

Limnology: Research on the composition of freshwaters, and annual variation in ion concentrations will begin at Base H.

Mammalogy: At Base H, the tagging of Weddell and elephant seals will continue; breeding distribution and success will be recorded. At South Georgia, research on fur seals and elephant seals will continue. Census information on seal density in pack ice will be gathered wherever possible.

Marine Biology: At Base H, sub-littoral ecological surveys will continue, and a detailed survey of a large, land-locked, tidal lagoon will be studied. Detailed research on sub-littoral marine algae will be carried out during the 1964-65 summer. Observations on the limpet Patinigera polaris will continue and research on fishes, especially Notothenia spp., will be initiated.

Medical research: At Base E, studies of the energy expenditure on specific tasks, with special reference to sledging, will continue.

Microbiology: At Base H, microbiological and mycological studies of soil

will be concluded.

Ornithology: At Base H, research on the brown skua will continue. A new program of penguin embryology will begin. At Base B, a study will be made of the antarctic tern (Sterna vittata). At B, H and other bases, routine bird-banding will continue. At all bases, census data on breeding birds will be collected and selected populations and nests will be marked.

CARTOGRAPHY

Base KG Extension of the tellurometer/theodolite traverse of George VI Sound northwards from Fossil Bluff during the summer months.

Base E Reconnaissance and survey of the central plateau of the Antarctic Peninsula between 70° and 72°S.

Base Z Continuation of the survey of Tottanfjella.

Summer work: A reconnaissance will be made of the coastal area from Cape Legoupil (63°20'S) to Sterneck Island (64°11'S) in preparation for the completion of the systematic survey of this part of the Antarctic Peninsula within the next few seasons.

EARTH SCIENCES

Geology: Continuation of detailed geological survey programs on the east coast of Graham Land, in Alexander Island and southwest Graham Land. Extension of mapping in Tottanfjella from Base Z.

Glaciology: A program similar to that of 1964 will continue at Base Z.

Soil science: At Base H, a new program will begin on the effect of frost in releasing nutrients in the soil.

METEOROLOGY

Bases B, H, T and South Georgia will carry out full surface observational programs and the programs at Bases F and Z will continue. Precipitation samples for isotope and fallout analysis will be collected at Bases F and Z.

OCEANOGRAPHY

Sea ice recording to continue at all bases and ships. Tide recording to continue at Base F. Hydrographic surveys of the Signy and Argentine Islands areas.

Seaborne Geophysical Surveys: Seismic refraction survey in Bransfield Strait and across Scotia Ridge between the South Shetland and South Orkney Islands. Magnetic survey of selected areas.

UPPER ATMOSPHERE PHYSICS

Aurora: At Bases B, E, F, H and T, visual observations of aurora will be made at three-hourly intervals. At Base Z, the visual observations every quarter-hour will continue. A SCAR 35 mm. all-sky camera is scheduled to be installed for the IQSY program. The 16 mm. all-sky camera will then be used for special studies with color film. It is also expected that an auroral filter photometer will be available. During equinoctial periods, parallactic photography of the aurora between Base Z and an out-station on the ice cap will be attempted. The radar auroral program will continue.

Geomagnetism: Station programs at Bases F and Z will continue, with the addition of proton vector magnetometers for absolute measurements of the elements F, H and Z. Repeat stations at Stanley and Grytviken will be reoccupied. The field survey of the vertical component in the neighborhood of Base Z will be repeated.

Ionospheric studies: Base F: Ionospheric soundings and whistler recordings will continue, vertical incidence soundings being made 1/4 hourly on RWDs and SWIs.

Base Z: In addition to the regular ionospheric soundings, hourly measurements will be made of drifts with Cavendish Laboratory type, Morley & Dukes Mk II equipment (six aerials/frequency band available) on two of the three frequency bands (1, 2.2 or 4.0 Mc./s.), when possible; hourly measurements of absorption by method A1 using DSIR pulse absorption equipment on 1.0, 2.2 and 4.0 Mc./s.; continuous recordings of ionospheric absorption by method A2 using EMI Products Model 123D Riometer over the frequency range 10 to 50 Mc./s.; continuous reception of forward scatter signals from the U.S. South Pole Station using U.S.-type receiving equipment for studies of the intensity and duration of events, particularly PCAs; measurement of drift of large-scale ionospheric irregularities.

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## PUBLICATIONS

The following publications received at the Office of Antarctic Programs during May pertain to work supported in whole or in part by the National Science Foundation under the U. S. Antarctic Research Program.

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KOOYMAN, GERALD L., Univ. of Arizona. Techniques used in measuring diving capacities of Weddell seals. (Polar record, Jan. 1965. vol. 12, no. 79, p. 391-94.)

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* Copies may be obtained from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, 22151.

NOTE: In general, material included in the Field Report is summarized from regular reports by personnel of Federal agencies, universities and institutions carrying out scientific research in the Antarctic under National Science Foundation grants and with logistic support by the U.S. Navy. In order to ensure that the work of the individual scientists and their institutions is clearly understood, it is requested that prior to using any of this material for public dissemination, such use be discussed with the Office of Antarctic Programs in the National Science Foundation or with the originators of the research as named.

## GENERAL

Byrd Station: Record low temperatures combined with the usual Byrd wind produced chill factors as low as -83.3°C. (-118°F.).

Eights Station: A second outdoor light was installed to aid station refueling and as a general safety precaution. The Wonder Arch over the main station was almost completely covered by drifting snow at the end of the month. The station power was shut down several times for minor repairs. The ham radio continued operation in the 7 Mc./s. band, but reception was poor.

USNS Eltanin: Thirty-six stations were occupied on Cruise 17 along the 135°W. and 95°W. meridians and along the ice front between them at about 68°S. latitude. En route to Valparaiso, some special studies were made of the continental shelf and slope off Valdivia, Chile, near 39°S. 74°W.

Near 54°S. 135°W. the track was altered from the planned cruise to obtain additional bathymetric data on the fracture zone that crosses the South Pacific Rise. This zone is now known to continue east towards the Drake Passage, and considerable bottom relief was noted along the 95°W. meridian over about two degrees of latitude.

Although the cruise was not as rough as had been anticipated for this time of year, the weather was quite cloudy and there was considerable snow. During the work along the 68°S. latitude line, the temperature remained close to 0°C.

McMurdo Station: The sled runner ends on the movable fish houses were fitted with metal caps and major repairs were completed on Warehouse 73.

All of the operating vehicles received maintenance checks and the arch welder was given a complete overhaul. Painting of the sub-ice chamber and the Biolab workshop area was completed and the distilled water room was refurbished. Fluorescent lights were installed in the wet lab and the workshop area.

Palmer Station: The average temperature was just below 0°C. and rain fell on the 17th. The remote measurements were accomplished with a minimum of difficulty and comparison of data with station measurements revealed no unexpected anomalies. Ice at sea was limited to some light debris and a few large bergs.

The surface of the icecap was hard and often slippery. There were ten days with fog and 21 days in which air operations could have been conducted. At the end of the month, the maximum useable daylight was down to about four hours per day.

South Pole Station: Operations normal.

## BIOLOGY

### McMurdo Station

Biolab, Stanford University: Much time was spent in devising and building an aquarium system for the wet lab facilities. Eight 50-gallon aquaria have been remodeled to accommodate plexiglass cooling inserts which receive antifreeze from a storage tank. The antifreeze is cooled by pumping it through a radiator located outside the wet lab with antifreeze temperature regulated by a thermoregulator in conjunction with an electronic relay which activates a pump. Aquaria have independent temperature control through the use of thermoregulators and relays which activate solenoid valves for each aquarium. The temperature can be controlled to about 0.05°C.

Fish Metabolism and Growth, Stanford University: Aquaria are presently being used to acclimate fishes at several temperatures warmer than the environmental, for tissue metabolism and osmoregulation studies of McMurdo Sound fishes. Total nitrogen and non-protein nitrogen levels in blood serum were determined in order to establish a reference for future studies involving non-protein nitrogen changes correlated with temperature elevation in Trematomus fishes. Tissue metabolism studies were continued, including studies of the metabolic pathways active in the tissue.

### USNS Eltanin

Plankton Program, Columbia University, Lamont Geological Observatory: A total of 34 plankton stations were made, resulting in 281 plankton samples, viz.:

| Gear | No. of Samples |
|---|---|
| Multiple Plankton Sampler (MPS) | 84 |
| Bathypelagic Sampler 1 (BPS-1) | 25 |
| Bathypelagic Sampler 2 (BPS-2) | 23 |
| Microplankton Net | 29 |
| 1/2 m. square Frame | 70 |
| .8 millipore filter & 2 μ permionics glass sleeves (nannoplankton collections) | 50 |

Cursory examination of the contents of samples at complete stations shows that above the Antarctic Convergence, Foraminifera (Globergerinidae) were quite common in the upper layers at all times but were rarely found below the 250 m. level. Above the Antarctic Convergence, G. bulloides was the dominant species; below the Antarctic Convergence this species was replaced by G. quiqueloba and G. pachyderma. There was a greater variety of species in the colder antarctic waters but at a point below 66°S. these became smaller and were caught only with a #20 mesh net. Pteropods above the Antarctic Convergence were represented by the dominant species Limicina retroversa; south of the Convergence, L. helcinia predominated. Limicina was usually present above the 500 m. level, and more abundant on the surface late at night. Ostracods were most abundant north of the Antarctic Convergence at all depths. Pteropods and ostracods appear to undergo vertical migration and are more common near the surface at night.

Comparative Physiology Program, De Paul University: The scantiness of pelagic crustacea, and particularly of Euphausia superba, gave interesting information on the distribution of krill in the Pacific Ocean during the austral winter. A number of species of amphipods, which were consistently encountered, were substituted for the experimental work designed for krill. The definition of the characteristic alkaline phosphatase has been determined for four different species of crustacea. An essentially complete study on calcium and strontium uptake, residence time and turnover rate, was carried on with two species of amphipods. This study has led to rather excellent knowledge of mineral accumulation in the least calcified crustacea, which constitute a significant component in the food chain. Limited but useful data were obtained from the more northern Euphausia triacantha.

The amphipods used in these studies proved too small for injection with radioactive carbon-labeled carbohydrates. Instead, $C^{14}$-acetate and $C^{14}$-alanine were added to the environmental sea water. These studies demonstrated that the crustaceans are capable of absorbing dissolved organic nutrients from their environment. The significant uptake of environmentally occurring organic compounds which are not only oxidized but are also incorporated into tissue lipid, glycogen, exoskeleton and the non-lipid, non-glycogen fraction (protein and/or amino acids) was determined with the Warburg equipment aboard the Eltanin. Tunicate protochordates (Salp) were collected in the deep scattering layer and preserved for shipment to De Paul for laboratory study of absolute

vanadium content by neutron activation in an atomic pile, and for information on their capacity to accumulate vanadium. "Dried" sea water was also collected for exposure to neutron activation, to determine its vanadium content.

Smithsonian Oceanographic Sorting Center Program, Smithsonian Institution: A total of 86 bathypelagic and benthonic samples were made during 36 Eltanin stations, viz.:

| Gear | No. of Samples |
|---|---|
| Isaacs-Kidd Midwater Trawl (3m) | 34 |
| Isaacs-Kidd Midwater Trawl (1m) | 21 |
| Menzies Trawl | 8 |
| Blake Trawl (5 ft.) | 10 |
| Blake Trawl (10 ft.) | 1 |
| Miscellaneous hauls | 12 |

The SOSC program cooperated with the Plankton Program and the Comparative Physiology Program by providing assistance in collecting activities and by sorting and preserving biological and geological specimens.

Palmer Station

Entomology, Bernice P. Bishop Museum: Microclimatic observations continued on a routine basis. Soil temperatures were fairly uniform, with the average approximately 0°C. and maximum fluctuation to 6°C. The arthropods remain inactive. Wintering aggregations of one species of mite, believed to be rare, were observed. Extraction and analysis of core samples are continuing. Various aspects of the biology of several species including life histories and temperature, humidity, and food preference are underway. The number of birds and seals remained steady except for the addition of a few crabeater seals.

GLACIOLOGY

Palmer Station

Ohio State University: For the ice movement survey, eighteen points on a profile six miles inland and approximately one mile wide, have now been fixed. Six of these are associated with the terminal zone between Norsel and Bonaparte Points, and 12 are on the profile beyond the crevassed zone. Small strain networks associated with the crests and troughs of waves were established on the main profile. Remeasurements of the snow stakes indicate negligible accumulation in most areas. There has been some lowering of the surface due to settling.

Preliminary astronomical observations for movement measurements were

begun on May 29. The planned observation program of 24 star passages had to be abandoned due to poor weather conditions.

## METEOROLOGY

### Byrd Station

U.S. Weather Bureau: The low for the month was -61.7°C. (-79°F.), which is 5.5°C. (10°F.) below the previous record for May. The average temperature, -37.9°C. (-36.3°F.), was 1.7°C. (3°F.) lower than the previous record average low for May, set in 1962.

The snow stakes indicated an accumulation of +0.8 cm. during May. There were 22 clear days, which is a record for the station.

The level of maximum ozone concentration descended from 55 mb. in April to 87 mb., where the maximum partial ozone pressure was 176 nanobars. There was still a secondary maximum at 55 mb. and another at 130 mb. Surface ozone increased steadily from the April level; by the 29th, the day of maximum concentration, the Regener instrument indicated 3.35 pphmv and the Mast instrument, 3.00 pphmv.

The surface and upper air radiation programs functioned well. The radiometersondes reached exceptionally high altitudes for this time of the year, probably owing to the special conditioning of the Darex balloons.

### Eights Station

U.S. Weather Bureau: Even though the pressure was generally higher, there were more storms than in May of either of the previous two years. The storms from the north brought the most violent winds, but the storms with southerly winds produced the greatest static electricity buildup. New records for May include the highest temperature, -8.3°C. (+17°F.), the highest monthly average temperature, -32.2°C. (-26°F.), and the highest monthly average station pressure, 26.964 in. Although the sun altitudes were favorable for viewing noctilucent clouds, none were seen.

The daily mean values of surface ozone ranged from 2.51 to 1.66 pphmv with the highest value recorded on May 1 during a period of gusty, southerly winds. Some data were lost on the 23rd when a chart roll jammed, and there was occasionally slight interference from the pulsations of the ionosounder. Otherwise, the equipment operated normally.

The atmospheric electricity instrument operated normally, although sudden station power surges caused frequent lowering of the probe current and the instrument had to be zeroed frequently. Probe cap plugging during storm periods caused some loss of data.

Data from the previous month were used in a correlation study of atmospheric potential gradient and surface ozone. It appears that the peak of the surface ozone value occurs several hours after the positive potential gradient reaches its peak.

USNS Eltanin

U.S. Weather Bureau: Fifty-two balloon flights were made for radiosonde and Rawinsonde observations. The average altitude for radiosondes was 25,270 m., with a maximum of 34,280 m. Forty-six of the flights terminated in bursting balloons. Thirteen attempted releases were unsuccessful. The average altitude for the Rawinsonde observations was 17,655 m. with a maximum of 27,850 m. The average altitude was lowered by the number of flights that had to be terminated because of interference by icebergs on the radar screen.

Seven ozone flights were made and six of these tracked to bursting at an average altitude of 31,117 m. One flight terminated near 16,000 m. due to a faulty instrument. Standard surface observations were made throughout the cruise and 16 samples of carbon dioxide were taken at eight stations for the Scripps Institution of Oceanography.

A daily weather map was prepared from the available data and a 24-hour forecast was issued. The facsimile equipment was moved from the chart room to the amateur radio room in time to copy the daily surface analysis from Buenos Aires near the end of the cruise.

South Pole Station

U.S. Weather Bureau: The use of a plasticizer with the Darex balloons improved their cold inflation behavior and resulted in an increase in bursting height. The launching difficulties have been resolved by installing an additional launch platform downwind from the obstructions, and by modifying the launch technique.

OCEANOGRAPHY

USNS Eltanin

Bottom Photography, Alpine Geophysical Associates, Inc.: A total of 50 camera stations were taken, 34 at the main stations and 16 off the coast of Valdivia, Chile. At the 34 main stations both black and white and color film were used. The only modification made to the camera was the addition of a light-shield above the uppermost light on the camera. This light had been added during the previous cruise to increase the exposure for the color film, but its proximity to the camera lens caused some diffused light. Color film was not used on the 16 special stations near Chile. Considerable animal life was noted in these shallow stations, particularly fish, crab, and shrimp.

Physical Oceanography, Columbia University, Lamont Geological

Observatory: Standard hydrographic stations, consisting of one deep and one shallow cast, were taken about every degree of latitude on the two north-south legs of the cruise, while along the east-west line near the ice front, the spacing between stations was doubled. Special efforts were made to sample the bottom five meters of water with a specially rigged Nansen bottle. These efforts met with some difficulties, but after subsequent changes in equipment some successful samples were obtained. The hydro T-grad, giving continuous temperature readings, was used on all stations during the first part of the cruise, but was then lost after hitting the bottom.

About 800 bathythermograph lowerings were made at spacings about 10 miles on a north-south track and 15-20 miles otherwise. A new BT unit which has a more open scale, with calibration lines at every 2°C., was used for about 100 lowerings before the pressure element failed. Continuous recordings were made of the surface temperature and about 600 surface salinity samples were taken.

Ten large sub-surface samples were collected for C-14, Sr-90, Cs-137 and H-3 isotope studies, but late in the cruise it was found that the plastic liners were broken in nine cases. Owing to the poor condition of the barrels, some of the sampling program may be jeopardized.

Water masses were sampled for calcium content every other degree along 95°W. longitude at seven different depths for Dr. Olausson of the University of Göteborg, Sweden. The analysis was conducted aboard the ship.

Entomology, Bernice P. Bishop Museum (Collections by Chilean Guest Scientist): The insect nets were flown about 90% of the time since weather conditions were generally good. The nets were changed every other day and the collected material bottled and packed for shipment. No obvious insects or insect fragments were noted.

Marine Geology, Florida State University: Thirty-three piston cores were taken with an average length of about 9.7 m. (32 ft.). The longest core measured 22.6 m. (74 ft.). For the first time on the Eltanin, five-pipe cores were attempted. Although no extra-long cores were obtained, a method was successfully developed for handling this length of pipe, 33.3 m. (109 ft.). An unusual white calcium carbonate mud of clay size distribution with only about 5% diatom impurities was found in the piston core near 58°S. 95°W. The rock dredge was used several times on the Pacific Ridge, but only on three attempts were rocks returned and these appear to be ice erratics. This dredge was lost on the last attempt. Some problems were encountered with flaws in the plastic liners, and there was considerable bending of pipe caused by the addition of the heat flow experiment.

Four general sedimentary zones were noted on the cruise, the boundaries extending east and west. Near the Ridge, calcareous ooze, composed of foraminifera, was found at depths of 2100 fathoms or less. South of

this, a zone of diatom ooze was found, followed by a zone in which clay predominated. Near the Continent, interbedded clays, sands and silts were encountered, probably representing sediments deposited by submarine landslides or turbidity flow.

Submarine Geophysics, Columbia University, Lamont Geological Observatory: (A) Seismic Profiling. Continued development of equipment took place on Cruise 17. The sparker sound source was quite reliable and trouble-free, and was generally fired at eight-second intervals. The air gun was also used quite extensively, firing with a nine-second interval. The Teflon rings in the air gun lasted only about eight hours and required about 1/2 hour to replace. Some trouble was experienced with the air gun valve in the colder water and with the valve removed, the firing interval increased to 45 sec. Considerable work was done on the recording hydrophones to reduce the noise level, which depends to a great extent on the ship's speed.

The sparker was very effective for work on the Pacific Rise and on the Shelf areas, but neither the sparker nor the air gun gave sufficient energy to penetrate the thick sediments in the basins. The air gun, with an output of lower frequencies, is perhaps an improvement over the sparker when deep penetration is required.

(B). Magnetometer. The magnetometer operation was quite successful. Variations in intensity were charted over seamounts, trenches and basins, with only 19 hours of data missing on the cruise. The program utilizes a Varian direct-reading proton unit which was towed about 700 ft. astern. The readout, in gammas, is presented visually and graphically on an analog recorder.

Just before Cruise 17 started, a data acquisition system was installed for recording the magnetic information on IBM punched tape. This system was out of operation between March 24 and April 23 due to trouble in the digital clock, but was finally repaired by constructing a new input amplifier. Near the end of the cruise, the digital clock circuit was rewired to pulse the magnetometer every 10 seconds, while continuing to activate the tape punch once a minute. On April 23 the magnetometer cable was cut by entanglement with one of the trawls, but was soon replaced by a spare cable while the damaged unit was repaired.

(C) Heat Flow Program. Attempts to obtain heat flow from the area of the Pacific Rise were generally unsuccessful due to the small penetration of the corer into the hard bottom material. Three successful heat flow measurements gave values from 1/6 to 1.6 microcalories/$cm^2$./sec. This program was discontinued during the latter part of the cruise due to malfunction of the T-grad pressure system.

SEISMOLOGY

Byrd Station

U.S. Coast & Geodetic Survey: The equipment worked well with only a few minor repair problems.

South Pole Station

U.S. Coast & Geodetic Survey: The timer on all seismometers was adjusted to within 5%. The frequency standard was still erratic at times but there were no other problems.

UPPER ATMOSPHERE PHYSICS

Byrd Station

Aurora and Airglow, Arctic Institute of North America: There was trouble with the shutter of the 16 mm. all-sky camera and with the K-100 release lever during most of the month. A freer action of the ASC shutter was eventually attained by bending the frame which holds the solenoid. There were also some difficulties with frosting on the viewing plug in the hemispherical mirror, and the 35 mm. all-sky camera was shut down during the last few days of the month in order to make corrections in the programmer and the 50 cps. frequency standard. The frosting problem was reduced with stopcock grease placed around the sealing ring of the dome.

The patrol spectrograph operated well and film development was up-to-date at the end of the month.

Forward Scatter, National Bureau of Standards: Operations were smooth. Routine checks and adjustments were made on the equipment.

Geomagnetism, U.S. Coast & Geodetic Survey: Tests for temperature compensation and orientation of the normal magnetograph variometers were performed. A gradual, unexplained base line shift of 20 g. occurred between the 8th and the 20th.

It was a generally quiet month, with the exception of an unusually sharp bay in all three components between 2200 and 2300 GMT. on the 8th. The bay lasted about 20 minutes, was negative on the horizontal trace, and positive on the declination and vertical traces. The maximum effect occurred in the horizontal trace where the magnitude of the bay amounted to 600 g.

Some local disturbances resulted from the repositioning of the Fenwal thermoswitches in the Variations room. Ten sets of absolutes were taken with the following average results:

| | |
|---|---|
| declination | $70^{\circ}26.3'$ |
| horizontal field | 16,304 g. |
| vertical field | 57,757 g. |

There were Sudden Storm Commencements at 030109, 180326, and 190352.

Ionospheric Absorption and Micropulsations, National Bureau of Standards: With the exception of three hours of data which were lost while the time constant circuit was being repaired, riometer data were complete for the entire month. Hiss films were also complete as were the VLF records, less 40 hours.

The micropulsation records were disturbed by noise on all three antenna loops and some data were lost while attempting to repair the preamplifier. At the end of the month, the north-south and east-west loops were operating normally, but the vertical loop was still experiencing a high noise level.

Ionospheric Soundings, National Bureau of Standards: Film jamming resulted in some data losses.

VLF and ELF, Stanford University and Pacific Naval Laboratory: All systems operated well, making more time available for data reduction. The station averaged almost one satellite recording per day and excellent data were obtained from both Alouette I and the sounder. The topside ionograms are quite different from those obtained at lower latitudes.

Low magnetic activity resulted in very little VLF activity, but the whistler count continued to increase. FM multiplex tapes were made during active periods for correlation studies between VLF, ELF, ULF and ionospheric absorption.

The most disturbed period was from the 7th to the 12th and auroral hiss was detected at 40 Kc./s. on the 18th. The two NBS phase receivers were retuned every four days to aid in the multiple frequency propagation experiments being conducted from Hawaii. Records on the 30th showed that the solar eclipse had only minor effect on the amplitude and phase of signals from the Navy transmitters.

Eights Station

Aurora and Airglow, Arctic Institute of North America: There were no problems with the patrol spectrograph and only minor freeze-up problems (caused by a defective thermostat) with the all-sky camera. The scarcity of good weather continues to limit the operation of the NBS photometer. No visual auroral activity was observed, but films from the patrol spectrograph indicate that there was activity on the overcast night of the 5th. The frosting of the dome continues to be a problem.

Geomagnetism, U.S. Coast & Geodetic Survey: A base line shift occurred on May 1 when the damping cup had to be lowered in order to release the declination magnet which had frozen to it. The normal drum stopped temporarily on May 10. The last spare gold fiber was installed in the magnetometer; if this fiber should break, the declinations will be measured with the quartz horizontal magnetometer. The vertical scale values appear to be gradually and inexplicably increasing.

Sixteen sets of absolutes gave the following averages:

| | |
|---|---|
| declination | 32°39.2' |
| horizontal field | 21,041 g. |
| vertical field | 48,261 g. |

There were Sudden Storm Commencements at 030110, 160306, and 260123. Unusual activity was detected at 050125 and 082212 GMT.

Ionospheric Absorption, National Bureau of Standards: The only major absorption events were observed early in the month, 1.6 db. on the 5th being the largest. This event coincided with aurora and other ionospheric activity. The monthly impedance check was made on the 1st.

Ionospheric Soundings, National Bureau of Standards: The equipment worked well with the exception of sticking of the sweep relay and some film jamming on the 9th and 10th. Power failure resulted in six additional hours of missing data. The ionograms are being scaled for foF2, MUF2, Fmin and Es.

Micropulsations, National Bureau of Standards: The major difficulties this month were caused by electronic noise in the preamplifiers. There was a large disturbance on the 5th which was accompanied by aurora. Disturbed conditions occurred also on the 2nd, 8th, 16th, and 18th. Time checks were made with NSS in the absence of good WWV signals.

VLF, National Bureau of Standards: Hiss was recorded during most of the month; periodic emissions accompanied the hiss on the 11th, 12th, 15th, and 26th.

VLF and ELF, Stanford University and Pacific Naval Laboratory: The whistler activity gradually increased. A maximum rate of six per second was recorded on the 12th. Emission activity reached a high level on the 5th, 6th, 10th, 13th and 16th. Some special tapes were made which contain long-term periodics, multiphase emissions, whistler and hiss interactions, large-scale VLF absorption and the usual chorus and triggered emissions.

An unknown discrete emission which has the spectral characteristics of a wolf whistle was detected. It is not a precursory whistler pair and about half the time it is triggered by a strong whistler.

Large-scale VLF absorption events were noted on the 5th, 6th, and 10th, the event of the 5th following strong riometer absorption by about 12 hours. The first 40-Kc./s. event of the year occurred at 100450 GMT. There were power failures on the 8th, 17th, and 24th, but the only real data loss was on the 8th when the power drop occurred virtually simultaneously with the appearance of aurora and related activity.

WWV is seldom received now and NSS is being used for clock accuracy checks. Work is progressing on the revision of the whistler manual.

USNS Eltanin

Radioscience, Stanford University: The VLF program was carried out routinely during the cruise. Whistler activity was low at the beginning, but later increased, due perhaps to increased thunderstorm activity in the Northern Hemisphere during April and May. Very few VLF emissions were received, except for a noticeable one on April 18 at 1600 to 1700 GMT. when whistlers, echoes, risers triggered by emission, and risers triggered by whistlers were noted. Strong echo activity was received near the conjugate area of NPG.

Continuous recordings were taken to coincide with the orbital passes of the OGO-A satellite.

Cosmic Radiation, Bartol Research Foundation (Stanford University Observer): Although some equipment difficulties were encountered with the meson telescope, these generally effected only one of two channels at a time so that, summa summarum, very little total data loss resulted. There were good indications of increase in the count rates in the southern parts of the cruise.

During the port period prior to Cruise 17, the meson telescope room was painted and a tile floor installed.

Radio Noise, National Bureau of Standards: Local interference continued to trouble this program and only an estimated 60% of the data appeared reliable. There were some noticeable changes in signal level with geographic location. This program was terminated at the end of the cruise.

McMurdo Station

Cosmic Rays, Bartol Research Foundation: The meson telescope and neutron monitor operated normally.

Forward Scatter, National Bureau of Standards (Bartol Research Foundation Observer): The Byrd-McMurdo and McMurdo-Vostok links operated normally. The general laboratory cleanup continued.

Ionospheric Absorption, Douglas Aircraft Company: A new furnace was installed after the old one failed. In the interim, the hut temperature dropped to -12.2°C. (10°F.), causing damage to several transistors.

Geodetic Satellite Observations, New Mexico State University: Doppler data were recorded on 913 passes of four satellites. Strip chart recordings were made of first-order refraction errors, corrected

Doppler frequency, signal strength, and VLF phase differences. Installation and procedures are continually being refined.

South Pole Station

Aurora and Airglow, Arctic Institute of North America: The equipment operated well and film development is up-to-date.

Cosmic Rays, Bartol Research Foundation: The equipment operated normally and much time was invested in building improvements. Some overhead shelves were built to increase the storage space and fans were emplaced to cool the neutron monitor racks. The wiring was reworked and improved and a working space constructed. The spare parts were organized and relocated. Data processing is up-to-date.

Forward Scatter, National Bureau of Standards: The receiver for the Byrd-South Pole link and the transmitter for the South Pole-Halley Bay link operated well, but there was occasional interference from the base teletype. Processing of the Byrd-South Pole data is up-to-date.

Geomagnetism, U.S. Coast & Geodetic Survey: An intercom was installed in the Absolutes building. It is unplugged while absolute measurements are being made. Releveling of the variometer on May 31 improved the trace and caused a base line shift from 55743 g. to approximately 55786 g. Sixteen sets of absolutes resulted in the following averages:

| | |
|---|---|
| declination | 27°28.6' |
| horizontal field | 15,843 g. |
| vertical field | 56,523 g. |

There were unusual, rapid pulsations on all elements on the 17th from approximately 0930 to 1800 GMT.

Ionospheric Absorption, National Bureau of Standards: The riometer performance deteriorated by mid-month when calibration values became incorrect. The control units were realigned and the output values now appear normal.

Ionospheric Soundings, National Bureau of Standards: The ionosonde program functioned well but the ionograms continued to be irregular, spread, and often difficult to interpret.

VLF, Stanford University: The antenna preamplifier was replaced and operation was satisfactory for two days, after which the hum level again increased and eventually obliterated the VLF signals. The unit was shut down for further troubleshooting.

FOREIGN SCIENTISTS AT U. S. STATIONS

At McMurdo, Dr. Igor' A. Zotikov continued his study of sea ice growth with the implanting of 12 thermistors in the ice. Leads were run from the thermistors to a fish house several meters away and the temperature measurements were begun.

## U. S. SCIENTISTS AT FOREIGN STATIONS

Mr. George H. Meyer at Mirnyy Station reported continuous storm activity with little possibility for outside work.

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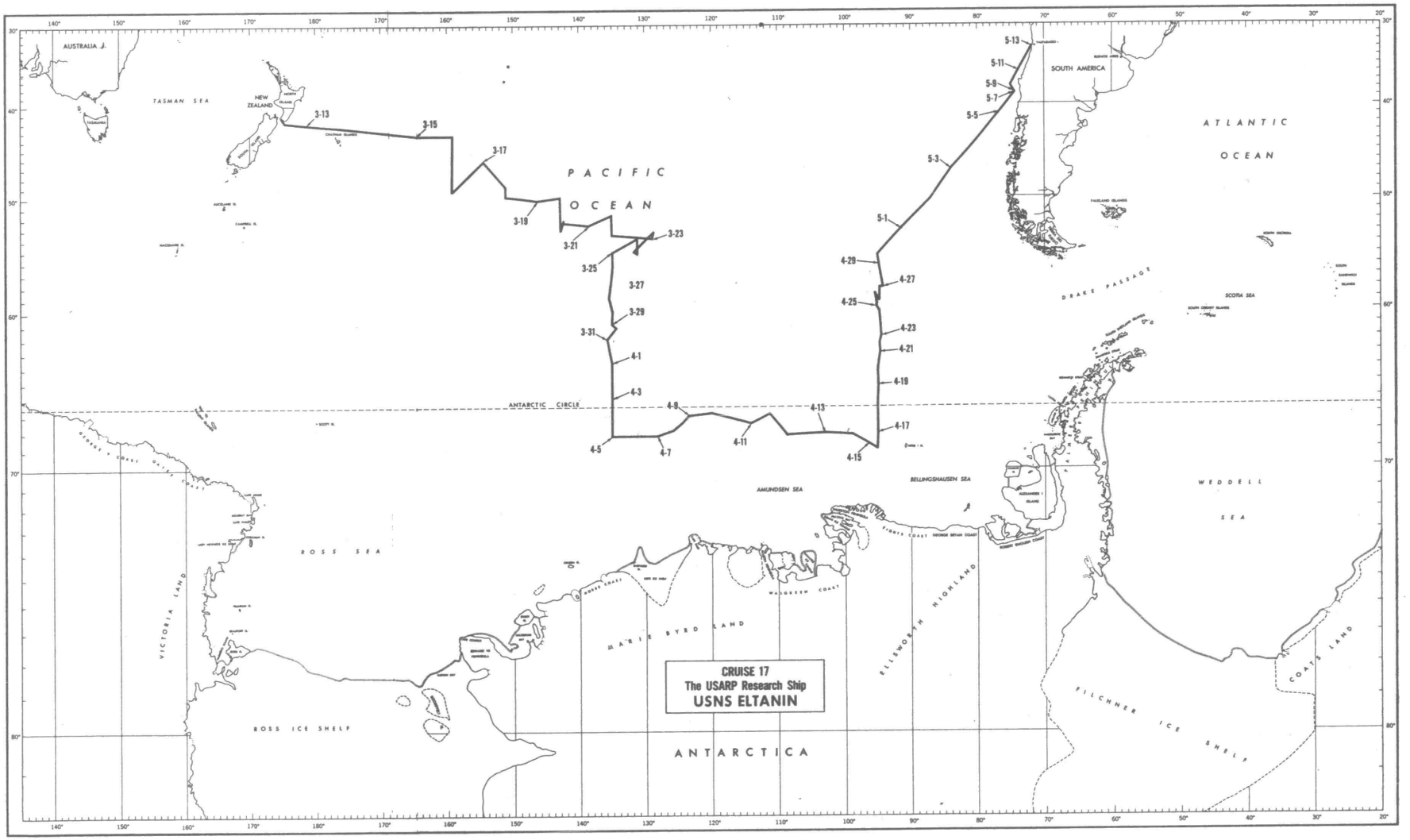
SUMMARY OF METEOROLOGICAL OBSERVATIONS - MAY 1965

| | Byrd | Eights | McMurdo | So. Pole | Palme |
|---|---|---|---|---|---|
| Temperature, °C. | | | | | |
| Average | -37.9 | -32.2 | -29.1 | -56.31 | -2.5 |
| Highest | -18.9/14# | - 8.3/14# | - 8.9/28# | -43.56 | 5.3/ |
| Lowest | -61.7/19# | -47.2/11# | -44.4/23# | -68.1/3# | -9.4/ |
| Station Pressure (Inches) | | | | | |
| Average | 23.892 | 27.964 | 29.215 | 20.163 | 29.18 |
| Highest | 24.47/2# | - - - | - - - | 20.735/26# | 29.9? |
| Lowest | 23.29/16# | - - - | - - - | 19.600/16# | 28.45 |
| Precipitation (Inches) | .04 | 0.94 | 0.1 | Trace | .50 |
| Snowfall (Inches) | 0.6 | 18.4 | 1.0 | Trace | 1.5 ( |
| Wind | | | | | |
| Prevailing Direction | N | S | NE | NNE** | NNE |
| Average speed (Knots) | 17.0 | 8.7 | 14.0 | 13.0 | 5.97 |
| Fastest mile (MPH) | 47/NNE/13# | 62/NNW/13# | - - - | 32/21# | - - - |
| Peak gust (Knots) | - - - | 58/NNW/13# | 55/28# | - - - | 37/-/ |
| Average Sky Cover | 3.0 | 7.6 | 3.7 | 2.0 | 7.0 |
| No. clear days | 22 | 4 | 18 | 24 | 3 |
| No. partly cloudy | 5 | 7 | 10 | 4 | 15 |
| No. cloudy days | 4 | 20 | 3 | 3 | 13 |
| No. days with visibility less than 1/4 mile | 21 | 12 | 1 | 0 | 5 |
| No. Radiosondes | 31 | - - - | 30 | 25 | - - - |
| Avg. height of Radiosondes (m) | 26,092 | - - - | 20,234 | 19,604 | - - - |
| No. Ozonesondes | 4 | - - - | - - - | 4 | - - - |
| Avg. height of Ozonesondes (m) | 28,896 | - - - | - - - | 24,351 | - - - |
| No. Radiometersondes | 27 | - - - | - - - | - - - | - - - |
| Avg. height of Radiometersondes (m) | 2,576 | - - - | - - - | - - - | - - - |

All figures above have been taken from radio messages and are unconfirmed
* Sea-level pressure
** North defined along 0° Greenwich # Date of occurrence


AUSTRALIA
TASMAN SEA
NEW ZEALAND
PACIFIC OCEAN
SOUTH AMERICA
ATLANTIC OCEAN
DRAKE PASSAGE
SCOTIA SEA
ANTARCTIC CIRCLE
AMUNDSEN SEA
BELLINGSHAUSEN SEA
WEDDELL SEA
ROSS SEA
VICTORIA LAND
MARIE BYRD LAND
ELLSWORTH HIGHLAND
COATS LAND
ROSS ICE SHELF
FILCHNER ICE SHELF
ANTARCTICA
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5-13
CRUISE 17
The USARP Research Ship
USNS ELTANIN