U.S. ANTARCTIC RESEARCH PROGRAM

1975-1976

Planned Field Research Projects

ANTARCTIC PENINSULA

Scotia Arc-Antarctic Peninsula tectonics project, 1975-1976. Ian W. D. Dalziel, Lamont-Doherty Geological Observatory of Columbia University. Work will continue this field season to determine the structure and tectonic history of the Antarctic Peninsula, the Scotia Arc, and farsouthern South America as part of the Scotia Arc-Antarctic Peninsula tectonics project. The ultimate goals are to (1) understand the past interrelationships of Antarctica with adjacent continents and oceans basins, (2) understand the development of the Antarctic Peninsula and the Scotia Arc, and (3) evaluate this region for mineral resources, especially copper.

Cenozoic biostratigraphy of Seymour Island. David H. Elliot, The Ohio State University. The geology, stratigraphy, and paleontology of exposed raised continental shelf sediments on the Antarctic Peninsula, in the Scotia Arc, and in farsouthern South America will be investigated this austral summer. The ultimate goal is to evaluate the Antarctic Peninsula area's potential for petroleum and natural gas deposits.

Abundance, diversity, and trophic dynamics of antarctic benthic fishes and invertebrates. Hugh DeWitt, University of Maine, Orono. The abundance, biomass, and structure of antarctic benthic fish populations will be determined in selected areas during R/V Hero cruise 76-1 (mid-January to mid-March 1976). Feeding habits, digestion rates, and food consumption of selected fishes and echinoderms will also be studied to extend knowledge of the anatomy, taxonomy, and zoogeography of antarctic fishes, echinoderms, and certain coelenterates.

Metabolic studies of antarctic invertebrate fauna. Mary Alice McWhinnie, DePaul University. Our research during the 1975-1976 austral summer is divided into two categories: (1) initial studies of the biology and population dynamics of Euphausia superba, the predominant krill species in Bransfield Strait, and (2) further studies of the metabolic pathways of krill and other pelagic and selected benthic invertebrates. The first category will be undertaken from aboard R/V Hero, and the second will concentrate in the Palmer Station vicinity.

Crustaceous conglomerates. Robert H. Dott, University of Wisconsin, Madison. Crustaceous conglomerates will be investigated this austral summer to provide evidence about the beginnings of upheaval in the Andes Mountains.

Charadriiform bird adaptations to the Antarctic. David F. Parmelee, University of Minnesota, Minneapolis. At Palmer Station in 1974, many breeding adult and young skuas and terns, and also many young gulls, were banded and color-coded. Emphasis this season is on banding adult gulls and the remainder of the skua and tern populations. Observations of the ecology and breeding behavior of these marked birds will continue. Their movements in the Palmer area are being monitored year-round by graduate students. Depending on the availability of R/V Hero, periodic observations will be made in the Joubin Islands. Visited briefly during January 1974, the Joubin Islands have a number of interesting bird populations within 25 kilometers of Palmer. In addition to heretofore unreported tern colonies, several penguin colonies--including three penguin species that breed side-by-side--are present in the Joubin Islands.

Cardiovascular dynamics of antarctic homeotherms. David E. Murrish, Case Western Reserve University. Nesting antarctic birds often are exposed to long periods of direct solar radiation that may place great demands on their thermoregulatory mechanisms. Adult pygoscelid penguins, blue-eyed shags, and giant petrels occasionally pant, and their young pant vigorously when subjected to heat loads. Panting during heat stress has been shown to result in marked hypocapnia and alkalosis in bird blood. The acid-base balance of adults and young of these species during normothermic and hyperthermic conditions will be investigated. Oxygen capacity, oxygen dissociation curves, and Bohr effect will also be determined.

Austral spring pack ice studies of antarctic seals. Donald B. Siniff, University of Minnesota, Saint Paul. R/V Hero will be used during the early austral spring to study breeding behavior, local movements, and activity and distribution patterns of leopard and crabeater seals in unconsolidated pack ice near Palmer Station. A few seals will be temporarily immobilized for weighing, measuring, and tagging, and then will be released. Sonic and radio-frequency tags will be used to track seals through the pack ice and to provide continuous data on activity patterns.

Transfer of organochlorine pollutants to antarctic ecosystems. Robert W. Risebrough, University of California. Concentrations of organochlorine compounds in surface seawater will be determined during R/V Hero cruise 75-6 in October and November 1975.

SIPLE STATION

Active and passive probing of the magnetosphere. R. A. Helliwell, Stanford University. This is a continuing, year-round investigation of the magnetosphere's response to very low frequency (VLF) waves injected by the Siple Station transmitter. Specific areas of study include: wave-particle interactions in the premidnight sector and their relation to substorm activity, dependence of wave growth and emission generation on transmitter power, distribution in longitude and latitude of transmitter signal paths, use of the transmitter for study of magnetosphere direct lifetimes, and study of the effects of magnetic impulses on the transmitter signals. Passive VLF techniques will be used to study magnetospheric thermal plasma dynamics with emphasis on space-station measurements organized as cooperative components of the International Magnetospheric Study (IMS). Initial direction-finding measurements will be made as part of the multistation (IMS) studies near L=4. Further correlative studies of coupled magnetosphere-ionosphere processes near the plasmapause will be made with the special objective of identifying precipitation phenomena associated with controlled and natural VLF waves.

Conjugate micropulsation observations. Laurence J. Cahill, Jr., University of Minnesota, Minneapolis. High-permeability metal core search coil magnetometers will continue to collect year-round digital data on magnetic tape at Siple Station, at Roberval, Quebec (Canada), and aboard the Explorer 45 satellite. The data are being used to describe the state, the location, and the dynamics of the plasmapause region of the magnetosphere during magnetic storms, and to examine the relationship of micropulsations in the 10- to 10^{-2}-hertz frequency range to polar substorms. The high sampling rate (with resultant high resolution) and signal polarization measurements are used to study propagation characteristics. Time differences between signal arrival at conjugate points are used in conjunction with polarization measurements to deduce where and how signals originate and how the energy is dissipated. Simultaneous measurements at the conjugate points are analyzed to learn about the seasonal effect on micropulsation propagation, and signals recorded at either ground station are compared with similar measurements made aboard Explorer 45 to examine the effect of propagation along the field line. Analysis techniques include the use of power spectra, dynamic power spectra, and polarization hodograms in data interpretation.

Conjugate magnetic studies. Louis J. Lanzerotti, Bell Telephone Laboratories. A three-component fluxgate magnetometer will acquire year-round data at Siple Station diring 1975-76. These data will be used in correlation with data from four similar megnetometers spaced in a latitudinal array in the northern conjugate area at L=4.4, 4.0, 3.5, and 3.2, and with a fifth station mobile in longitude in the vicinity of L=3.5. The data will be used in extensive studies of seasonal effects on geomagnetic conjugacy, of seasonal effects of the ionosphere on the transmission of ultra low frequency waves from the magnetosphere to the ground, and of changes in conjugacy with magnetic disturbance conditions.

High latitude ionospheric absorption. Hugh J. A. Chivers, University of California, San Diego. During the 1975-1976 field season, 50-megahertz riometers and associated antennas will be installed at McMurdo, Siple, and South Pole stations. These instruments, which are in addition to the 30-megahertz riometers already in place at each location, will be used to measure ionospheric absorption caused by solar activity at different latitudes. Measurements also will be made at a conjugate location in Canada.

Very high frequency auroral radar. Ben B. Balsley, Environmental Research Laboratories, National Oceanic and Atmospheric Administration. A 50-megahertz auroral backscatter radar unit capable of semiautomatic operation will be installed at Siple Station this austral summer to enhance magnetosphere-ionosphere measurements being made at Siple and at its geomagnetic conjugate, Roberval, Quebec (Canada). This is the first time such equipment has been operated in this mode. After successful testing, the system will be used to obtain amplitude and spectral characteristics of the radar aurora in the southern auroral region.

AMUNDSEN-SCOTT SOUTH POLE STATION

Human adaptation to south polar stresses. Harold G. Muchmore, M.D., Oklahoma Medical Research Foundation. Dr. Muchmore and six assistants will continue year-round studies of immunologic changes in people who winter at Amundsen-Scott South Pole Station. Cellular immunity studies will be carried out on live leukocytes derived from peripheral blood. Lymphocytes will be processed for transformation studies, and T and B enumeration and neutrophil functions also will be studied. Specimens for immunoglobulins will be collected, and specimens for virus isolation will be obtained to isolate and identify the respiratory virus responsible for postpolar infections. These viruses will be utilized as reagents in the assay of immunity changes during isolation. Baseline data in these parameters from persons scheduled to spend the 1976 austral winter at the South Pole were gathered before they left for Antarctica. Radioactive material (tritium) will be used in these studies.

Meteorological observations at the South Pole. Werner Schwerdtfeger, University of Wisconsin, Madison. Assistance will be provided to the New Zealand National Weather Service, which during the 1975-76 austral summer will replace the U.S. National Weather Service (National Oceanic and Atmospheric Administration) in conducting year-round surface and upper-air weather observations at Amundsen-Scott South Pole Station.

Size distribution of background aerosols determined from multi-spectral measurements of atmospheric transparency. Glenn E. Shaw, University of Alaska, Fairbanks. Physical and radiative properties of suspended particulates over Amundsen-Scott South Pole Station were studied during the austral summer of 1974-1975. Aerosols over the South Pole were distributed by size according to a Junge power law distribution function with a power law exponent equal to about 3.2. The albedo of single scattering is roughly 0.8, and the columnar mass loading during the clearest conditions is 0.02 grams per square meter. Calculations indicate that the aerosols result in a net heating of the earth-atmosphere system of 0.1°C. These values are thought to be typical of intervolcanic periods, and probably represent the minimum aerosol loading on the planet.

Antarctic aerosols. Austin Hogan, State University of New York, albany. During the 1975-1976 field season we will continue to study the climatology of surface aerosol concentrations. A more sensitive detector, which will allow more accurate determinations of the size and charge of aerosol concentrations, will be incorporated in this season's measuring system. Earlier experiments have shown that near-surface antarctic air is generally isolated from air only a few

meters aloft; this is created by a strong near-surface thermal inversion. Attempts will be made to determine aerosol concentration variations across this inversion by using tethered balloons. The layer above the surface inversion is almost always saturated with ice, but ice crystals do not always precipitate. Several seeding experiments are planned to continue studies of ice-nucleating mechanisms in this layer.

Analysis of antarctic halocarbons. R. A. Rasmussen, Washington State University, Pullman. Enriched concentrations of halocarbons and other trace gases in snow will be quantified this austral summer field season at the South Pole to help establish a polar halocarbon concentration profile. Types of halocarbons present, which are being removed, and the rate of removal also will be determined. Air samples will also be collected. A primary question related to this research is how the polar atmosphere removes trace gases, especially chlorofluorocarbons, from the global atmosphere. Current theories indicate that these trace gases may be depleting earth's protective ozone shield.

Atmospheric trace metals and halogens. William Zoller, University of Maryland, College Park. An aerosol chemistry sampling program will continue this austral summer at Amundsen-Scott South Pole Station. The program includes collection and chemical analysis of atmospheric ice crystals and bulk particulate matter. Surface ice and snow samples also will be collected for chemical analysis and comparison with atmospheric samples to evaluate the importance of the polar ice cap as a thermal trap for particulate and gaseous materials. A clean air facility will be established about 5 kilometers east of South Pole Station. A temporary structure also will be assembled to provide more space for field experiments.

Ice crystal precipitation in the antarctic atmosphere. Takeshi Ohtake, University of Alaska, Fairbanks. Study of ice crystals precipitating from cloudless atmosphere at Amundsen-Scott South Pole Station will continue. This research includes (1) observation of ice crystal precipitation such as vertical differences in concentration, size, and shape of crystals as compared to other meteorological factors, (2) study of formation mechanisms such a nucleation and moisture, and (3) assessment of the effect of ice crystal precipitation on climate. Pressure, temperature, and humidity in the lowest 1,000 meters will be measured using an instrument package lifted by a tethered balloon and a kite. Observations of ice crystal formation in the Arctic will be compared with those at the South Pole to clarify ice crystal precipitation mechanisms.

Origin of atmospheric ice crystals. Vernon N. Smiley, University of Nevada, Reno. Ice crystals in the atmosphere above Amundsen-Scott South Pole Station will be measured this austral summer field season. This research will involve Lidar measurements to obtain verticle profiles of backscatter intensity, and concurrent surface observations with a replicator to measure crystal size and size distribution, and crystal habits. The measurements will be integrated with radiosonde data for such factors as temperature and humidity versus altitude. The results will be used to determine the heights at which crystals form, the vertical structure of the "crystal cloud," and the dependence of these qualities on environmental conditions.

Geophysical monitoring for climatic change. Kirby Hanson, Air Resources Laboratory, National Oceanic and Atmospheric Administration. The principle objectives of geophysical monitoring for climatic change are to determine background levels of trace gases and aerosol particles in the atmosphere, to record their rate of change, and to assess the effects these constituents may have on climate. These long-term measurements will continue at Amundsen-Scott South Pole Station as one of six planned clean air monitoring observatories of the National Oceanic and Atmospheric Administration (NOAA). Measurements will be made of carbon dioxide levels (to determine the rate of increase resulting from combustion of fossil fuels , biotic uptake, etc.), surface and total ozone shifts in the maximum and minimum concentrations of these gases), Aitken nuclei and other aerosols (to establish baseline values for turbidity and global pollution), and solar radiation (to obtain irradiance data in several broad bands). Fluorocarbon flask samples will be taken and compared with other on-station monitoring systems. On-site personnel will assist in making measurements for other NOAA and National Science Foundation-funded programs.

Atmospheric processes and energy transfers at the South Pole. John J. Carroll, III, and Kinsell Coulson, University of California, Davis. This project's primary objective is to determine the energy balance of the Antarctic and its effect on large-scale atmospheric circulation in the Southern Hemisphere. The South Pole region, where our present work is concentrated, is representative of a large portion of the continent's interior; energy balance measurements (radiation, sensible and latent heat, storage in the snow pack, etc.) at this location are similarly representative of the energy regime of a wide area. We anticipate that these data from the interior, in combination with future data from coastal areas and from satellite measurements of radiation, will provide a reasonably reliable assessment of the overall energy balance in high southern latitudes and will help to understand global weather and climate. A second objective is to use measurements of light polarization and intensity in a sunlit sky as indicators of dust, haze, and other particles in the

antarctic atmosphere. Not only do such particulates influence the system's radiative energy balance, but they also are an index of airmass history in the recent past.

Atmospheric acoustic echo-sounding. Freeman Hall, Environmental Research Laboratories, National Oceanic and Atmospheric Administration. An acoustic echo-sounder used during the 1974-1975 season will be modified this season by adding a passive receiving antenna for bistatic investigations of the planetary boundary layer. The combined monostatic and bistatic system will provide independent measurements of temperature and velocity structure functions to heights of 600 meters. A data-averaging and logging interface will record digital data on a computerized magnetic tape system for later evaluation. Facsimile records also will be made for both backscatter and bistatic acoustic returns to provide high spatial and temporal resolution of turbulent structure in the planetary boundary layer. These data will lead to a better understanding of the origin and maintenance of the turbulent, surface-based inversion over the antarctic plateau.

A study of midday auroras. Syun-Ichi Akasofu, University of Alaska, College. During the 1976 austral winter, a 35-milimeter all-sky camera will be operated at Amundsen-Scott South Pole Station, and a 16-millimeter all-sky cameral will be operated at Siple Station. The data will be searched for correlations of auroral substorm activity and interplanetary magnetic field variations and substorm precurser clues. The South Pole is a unique location from which to observe dayside aurora; its location also enables visual detection of auroras over periods of several days when the sky is cloudless, which is a normal condition. In concert with simultaneous ISIS satellite data, past observations from the South Pole have shown that middal auroras occur directly under the cusp precipitation region. The Siple instrument is providing visual information about ionosphere dynamics at subauroral zone latitudes. In conjunction with simultaneous magnetospheric research at Siple, our data will be used to investigate how the magnetosphere and ionosphere interact and how energy is transferred from the magnetosphere to the ionosphere in its transit from the sun to the earth. An attempt will be made to relate the behavior of midday and midnight auroras and to delineate the different responses of midday and midnight auroras to changes in the interplanetary magnetic fields.

Doppler research in Antarctica. William R. MacDonald, U.S. Geological Survey, Reston, Virginia. This program continues several years of work to obtain data on (a) ionospheric and tropospheric effects of radio propagation, (b) ice sheet movements, and (c) polar motion and earth's spin axis. A fixed satellite tracking facility is maintained year-round at Amundsen-Scott South Pole Station; this and another tracking facility at McMurdo Station serve as master translocators for roving

backpack satellite tracking receivers called geoceivers. Geoceivers are used to obtain accurate positioning data for mapping projects, for traverse activities, and for glaciological studies.

Geoceivers will be used this season to establish accurate positions of study sites that were established on the Ross Ice Shelf during the 1974-1975 field season. Geoceivers will also be used in a cooperative program with the British Antarctic Survey to establish accurate controls for positioning satellite (ERTS/LANDSAT) imagery of the Ellsworth Mountains. Plans are to establish refined doppler-derived positions on preselected points that can be identified on the satellite imagery. Logistics support for the Ellsworth Mountains effort will be provided by a British Antarctic Survey Twin Otter airplane.

The two-person winter U.S. Geological Survey team at South Pole Station also will operate telemetry equipment for the National Aeronautics and Space Administration's Dual Air Density Explorer satellite program, and will assist in a seismological monitoring program of the Office of Earthquake Studies, U.S. Geological Survey.

Earth tides and earth's free vibrations. Louis B. Slichter, University of California, Los Angeles. Long-period tides, and earth's free vibrations excited by large earthquakes (should ones of sufficient energy, magnitude 8 or more, occur), will continue to be observed year-round at Amundsen-Scott South Pole Station. The near-absence of daily and semidaily tides at the South Pole makes this a unique site from which to observe weak gravity signals with precision. Highest precision is needed for observations of two quantities not yet measured: (1) phase lag and Q of the fortnightly tide, and (2) period of the solid-body vibration of earth's inner core, if and when it is displaced form its central position by a large earthquake or by random motions of the outer core fluid.

Dual Air Density Explorer satellite program. Kenneth McDonald, Goddard Space Flight Center, National Aeronautics and Space Administration. Three persons will install a commmand and data acquisition facility at Amundsen-Scott South Pole Station this field season for the National Aeronautics and Space Administration's (NASA) Dual Air Density twin satellite experiment. Two Explorer satellites will be launched by a single Scout rocket late in 1975, and are expected to remain in about the same orbit throughout the 2-year mission. Each satellite is drag sensitive and uses a mass spectrometer as part of a unique system that is insensitive to orientation, is highly sensitive to the upper atmosphere, and is capable of in-flight calibration. Comparison of measurements from the two satellites should reveal the atmosphere's vertical structure on a global scale from altitudes of 350 to 1,500 kilometers. Comparisons then can be made between satellite measurements and coordinated vertical probe measurements from various launch sites.

ROSS ICE SHELF

Surface glaciology of the Ross Ice Shelf. R. H. Thomas, The University of Nebraska, Lincoln. This project's objectives are to estimate the mass balance of the Ross Ice Shelf, to deduce bottom melting and freezing rates, to investigate shelf dynamics, and to calculate particle paths for any flow line through the shelf. Strain networks planted on the Ross Ice Shelf during the 1974-1975 field season will be remeasured this field season to give ice strain rates at 50 kilometer intervals. Geoceiver positioning will be provided by the U.S. Geological Survey.

Shallow ice core drilling. Chester C. Langway, Jr., State University of New York, Buffalo. We will retrieve 100 meter ice cores this field season from Roosevelt Island and from Siple Station. The cores later will be subjected to physical and chemical analyses for climatic studies. Pit samples for chemical and accumulation data will be obtained adjacent to drill sites.

Quantitative paleoclimatic analysis of Ross Sea continental shelf sediments. Thomas B. Kellogg, University of Maine, Orono. Recent studies of the Ross Sea in West Antarctica have produced evidence suggesting that the Ross Ice Sheet is inherently unstable. To test this and other hypotheses, a study of the dynamic history of the Ross Ice Sheet will be made by quantitative sedimentologic and micropaleontologic analyses of core material from the Ross Sea, Ross Ice Shelf Project, Dry Valley Drilling Project, and Deep Sea Drilling Project drill core material will be used. Our goals are (1) to determine the chronology, the duration, and the extent of past fluctuations of the Ross Ice Sheet/Shelf system; (2) to provide a stratigraphic link between sediments of the subantarctic southern ocean and the glacial stratigraphy of the Transantarctic Mountains; (3) to determine the relationship between documented glacial events in the Antarctic and climatic events documented for the rest of the world.

SOUTHERN VICTORIA LAND

Late Cenozoic glacial history of East Antarctica. George H. Denton, University of Maine, Orono. Field work since 1957 suggests that the Ross Sea, and probably the Weddell Sea, were filled to a large extent with grounded glacial ice at the maximum of the last glaciation. This sheet represented an extension of west antarctic ice, fed also by outlet glaciers from East Antarctica, onto adjacent continental shelves. Carbon-14 dates indicate that ice recession began before 10,000 years ago and has continued even through the last several thousand years, leading to speculation about the possibility of continued recession and concordant changes in sea level. This season we will (1) obtain carbon-14 dates on raised marine sediments in the McMurdo region, (2) map glacial deposits in Ferrar Valley and elsewhere in the McMurdo region, and (3) examine nunataks behind Taylor and Wright valleys.

Freshwater and terrestrial ecosystem modeling at Lake Bonney. Bruce C. Parker, Virginia Polytechnic Institute and State University. Last year's effort will be extended this austral summer, with special emphasis on specific needs for the Lake Bonney model. Carbon-14 primary productivity measurements will be used to identify limiting and toxic factors in the lake. Organic matter concentrations will be identified, and photorespiration studies will be done.

Dry Valley Drilling Project, 1975-1976. Lyle D. McGinnis, Northern Illinois University, DeKalb. A late-winter breakout of the McMurdo Sound sea ice in 1974 forced postponement of Dry Valley Drilling Project (DVDP) plans to retrieve core from beneath the sound itself. Using the McMurdo Sound ice as a platform for the drill rig and associated equipment, this final DVDP objective will be attempted once again in the 1975-1976 field season. Drill personnel and most other technical assistants will be provided by New Zealand. Primary logistics support and housing at McMurdo will be furnished by the United States, with Japan participating in various DVDP-related investigations at McMurdo Station's Thiel Earth Sciences Laboratory. Core retrieved late in the 1974-1975 field season, plus that from the current season, will be shipped to the United States for continuing analysis at home institutions. Electrical and gamma logging of DVDP areas and drill holes also will be done this season.

Borehole geology and volcanic petrology of the McMurdo area. Samuel B. Treves, University of Nebraska, Lincoln. During the 1975-1976 austral summer, Dry Valley Drilling Project (DVDP) cores will be logged, and any volcanic or basement rocks will be studied petrographically to investigate sequential relations. The DVDP cores are important in understanding the geologic history of the McMurdo area and the Southern Hemisphere. Study of the ash layers in the Erebus Ice Tongue and other outlet glaciers will continue, as will surveillance of Mount Erebus' volcanic activity.

Late Cenozoic biostratigraphy of Antarctica. Peter Webb, Northern Illinois University, DeKalb. On-site curation and logging of Dry Valley Project (DVDP) sedimentary cores will be done this austral summer. Micropaleontological control also will be maintained during drilling and retrieval of cores. All materials will be prepared for cold storage and shipping to Florida State University, Tallahassee.

Geothermal studies in the dry valleys. Edward R. Decker, The University of Wyoming, Laramie. Subsurface temperatures will be measured this austral summer in previous and new holes drilled by the Dry Valley Drilling Project. These measurements will use cables and electrical-resistance thermometers during and after drilling. Other field work will include collecting core samples for radioactivity measurements (uranium, thorium, and potassium), and the thermal properties of the rocks penetrated. Radioactivity and other thermal measurements will be made at the University of Wyoming. These studies will provide new data on permafrost thickness, recent climate changes, heat flow, and very deep subsurface temperatures near McMurdo Station and the dry valleys of southern Victoria Land. More knowledge of these phenomena may lead to thermal explanations for glaciation and other aspects (young volcanism, and uplift) of this portion of Antarctica's geologic history.

Suprapermafrost groundwater flow systems in ice-free valleys of the McMurdo Sound region. Keros Cartwright, Illinois State Geological Survey. Hydrogeologic investigations during the past two austral summers will continue this field season with work in Wright and Taylor valleys, southern Victoria Land. Particular emphasis will be placed on studying groundwater above frozen ground. Detailed investigations are planned for Wright Valley, from Lake Vanda west to the Labyrinth. Suprapermafrost groundwater samples will be chemically analyzed, and their physical

properties will be measured. This information, combined with a concurrent study of the characteristics of surface materials in the area, should lead to an understanding of the mass balance and chemical characteristics of lake, pond, and soil waters. Water sampling at Don Juan and Don Quixote ponds and monitoring of piezometer nets established there in 1974-1975 will continue, as will detailed downhole studies in Dry Valley Drilling Project hole 13.

Dry Valley Drilling Project environmental monitoring. Bruce C. Parker, Virginia Polytechnic Institute and State University. This final austral summer of monitoring will include a predrilling examination of the drill site, inspection during drilling operations, and a postdrilling audit.

CAPE CROZIER, ROSS ISLAND

Adelie penguin behavior. David G. Ainley, Point Reyes Bird Observatory. This study of Adelie penguin population biology is nearing completion. Groundwork was laid at Cape Crozier through the banding of 5,000 chicks annually from 1961-1962 through 1969-1970. During the 1968-1969, 1969-1970, and 1974-1975 seasons, many data were collected on these known-age birds. During the 1975-1976 field season at Cape Crozier, gaps in the data will be filled by concentrating efforts and observations on the oldest individuals: the 9 through 14-year-olds. We will be especially interested in the incidence of breeding in the oldest birds, and in determining what mortality occurred among older individuals during the past austral winter. Final analysis will provide a description of the longevity, productivity, mortality, and other demographic factors for the ecologically important Adelie penguin.

MCMURDO STATION AND VICINITY

Status and population dynamics of antarctic seals. Donald B. Siniff, University of Minnesota, Saint Paul. We will concentrate our efforts this austral summer in the Ross Island area: at Hutton Cliffs and at a remote colony approximately 8 kilometers off the coast. We also will continue the census and tagging efforts of the past 5 years. Pupping success will be monitored, and we will continue to collect data on the pupping history of individual famales at Hutton Cliffs and to measure and weigh individuals at Hutton Cliffs to correlate female condition with pup growth rate and reproductive success. At remote colonies we will study female response to density manipulation, and an attempt will be made to interpret effects of density on growth and reproductive history. Work at the remote colonies will primarily replicate that of the 1974-1975 field season. We also hope to study vocalization patterns.

Thermo- and osmoregulatory responses in Adelie penguins. H. T. Hammel, Scripps Institution of Oceanography, University of California, San Diego. About 80 Adelie and 20 emperor penguins will be collected from the McMurdo Sound ice edge this austral summer. If possible, 15 Adelie breeding pairs will be taken from Cape Bird. The penguins will be sent to Sea World, San Diego, California, to serve as a stock colony. Experimental penguins will be drawn from the stock colony to be kept in a small penguinarium in the Physiological Research Laboratory, Scripps Institution of Oceanography. These birds will be implanted with thermodes and osmodes astraddle the rostral brainstem. Increased oxygen consumption by shivering, evaporative water loss by panting, water intake, and salt gland secretion will be investigated in response to thermal and osmotic stimulation of the rostral brainstem. Brainstem heating and cooling also will be conducted in conjunction with spinal cord heating and cooling by a thermode in the spinal canal and by heating and cooling the body core with a gastric thermode. Physiological research will not be conducted at McMurdo Station.

Benthic communities of McMurdo Sound. Paul K. Dayton, Scripps Institution of Oceanography, University of California, San Diego. During the 1974-1975 summer, this project will expand on several ongoing studies. The following will be investigated: (1) benthic primary productivity, using carbon-14 analysis;

(2) competitive dominance of the sponge Mycale acerata; (3) feeding selectivity of the asteroid Perknaster fuscus antarcticus; (4) reproductive, growth, and defense strategies of selected sponges; (5) settling ecology, habitat selectivity, and behavior of invertebrate larvae; (6) Odontaster validus' hypothesized key role in community organization; (7) dynamics and interactions in a community encrusted on cages along a rocky underwater cliff; (8) population increases in Homaxinella sp.; (9) soft-bottom community in New Harbor; (1) ophiuroid soft-bottom foraging; (11) decomposition and benthic implications of large pieces of carrion. We also will continue to monitor the 60 cages and controls established in McMurdo Sound when the project began in 1967. Soft-bottom sediments will be collected from aboard a U.S. Coast Guard icebreaker in the Pennell Bank area and along the eastern part of the Ross Ice Shelf.

Role of glycoprotein antifreezes in the survival of fishes inhabiting ice-laden seawater. Arthur L. DeVries, Scripps Institution of Oceanography, University of California, San Diego. McMurdo Sound waters are near freezing and are laden with ice for most of the year. Most of the world's fishes would quickly freeze to death in this environment. Antarctic fishes live in this icy environment and apparently do not freeze. Their body fluids are fortified with glycoproteins that possess antifreeze properties. This austral summer season's activities will center on how these antifreezes afford protection to the various fishes of McMurdo Sound. Blood samples will be collected from the large antarctic cod, Dissostichus mawsoni (160 centimeters long and 45 kilograms in weight), from which glycoproteins will be purified. We will study how and where these glycoproteins are synthesized, and how they prevent ice from propagating across the body wall. The latter experiment will be done by transfusing the black cod, Notothenia angustata, with antifreeze and determining the effect on its survival. This black cod, which belongs to the antarctic cod family, is one of few members that lacks antifreeze compounds. For comparative purposes, Notothenia fish will be collected from aboard a U.S. Coast Guard icebreaker in the Balleny and Scott Islands area (this is the only place where these fish are found).

Antarctic atmospheric infrasound. Charles R. Wilson, University of Alaska, Fairbanks. Observations of auroral infrasonic waves (AIW) from subauroral zone (65°) stations indicate that AIW result only from poleward--not from equatorward--motion of auroral forms. To

understand which AIW theory is most nearly correct, measurements will be made to determine whether they asymmetry is a source effect or a propagation effect. To do this, it is necessary to determine how convection in the polar cap ionosphere affects AIW propagation; this determination can only be made from observations within a polar cap. A three-microphone array (which later will be increased to four, enclosing a 40-square-kilometer area to provide redundancy) will be established at Windless Bight, near Scott Base (New Zealand). This is an excellent site for observing AIW, since it is a high geomagnetic latitude (=79 S), and it is free of katabatic winds that can conceal an AIW signal in the wind "noise.' Data from the microphones will be stored in digital form at Scott Base on Estraline-Angus chart recorders and on slow-speed magnetic tape. Data will be correlated with riometer, magnetometer, and all-sky camera data.

Cosmic ray intensity measurements. Martin A. Pomerantz, Bartol Research Foundation of the Franklin Institute. Cosmic ray observations at McMurdo Station are essential to continuing investigations of electromagnetic conditions in interplanetary space and of solar phenomena. In these studies of space "weather," utilizing cosmic rays as diagnostic tools, earth serves as a spin-stabilized "spacecraft" with multiple sensors for observing cosmic ray intensity modulations and anisotropies. A new 10-metric-ton cosmic ray detector with statistical precision exceeding that of any on earth will be shipped on USNS Towle to McMurdo this austral summer. It will be installed at Amundsen-Scott South Pole Station a year later, just before the maximum period of the current sunspot cycle when events of special interest, particularly the production of solar cosmic rays, will occur in profusion.

Submicron particulates in the antarctic stratosphere. David J. Hofmann, University of Wyoming, Laramie. Four balloon-borne soundings to measure aerosol particles and gas samples in the polar stratosphere will be made in January 1976 from McMurdo and Amundsen-Scott South Pole stations. Gas samples will be retrieved from two flights at McMurdo, and particles will be counted in two flights at the South Pole. Following recovery, gas samples will be analyzed by the National Oceanic and Atmospheric Administration. These measurements are aimed at studying how chlorine atoms may possibly reduce earth's stratospheric ozone shield by catalytic destruction of ozone molecules.

Geodetic and upper atmosphere satellite studies. Arnold J. Tucker, The University of Texas, Austin. Satellite tracking station 019, McMurdo Station, is part of the year-round National Geodetic Satellite Program. This station is equipped to measure the doppler shift of continuous wave signals transmitted from artificial earth satellites. Data collected at this station are used to determine a set of orbital parameters that describe satellite motions. Earth's gravitational field and atmospheric drag affect satellite motion and make it deviate from the trajectory described by this set of orbital parameters. Tracking satellites in this manner may lead to a better understanding of earth's gravitational field and ionospheric effects.

Artist program. Eliot Porter, Santa Fe, New Mexico. A project begun in the 1974-1975 season will be completed. Flora, fauna, and other features of Antarctica will be photographed and documented.

REMOTE PROJECTS

Weddell Sea oceanographic investigation. Theodore D. Foster, Scripps Institution of Oceanography, University of California, San Diego. As a continuation of the International Weddell Sea Oceanographic Expedition, a physical oceanographic investigation of the western Weddell Sea will be carried out this field season. Hydrographic casts and continuous measurements of salinity, temperature, and depth will be made. Three current meters moored in the northern Weddell Sea in February 1975 will be retrieved. This work is to further our understanding of the formation of Antarctic Bottom Water.

Circumantarctic biological survey. Sayed Z. El-Sayed, Texas A&M University. This austral summer we plan to investigate the biology of the southwestern Indian Ocean in collaboration with French scientists aboard Marion Dufresne cruise 8, which is under the auspices of the Territorie des Terres Australes et Antarctique Francaises. Marion Dufresne cruise 8 is expected to complete the circumantarctic biological survey began by USNS Eltanin in 1962. Biological productivity of the southern ocean, from Madagascar to the Crozet Plateau south to the antarctic pack ice, will be assessed; nutrient chemistry of the water column will also be studied in conjunction with phytoplankton studies.

Stock assessment of antarctic Minke whales. Robert L. Brownell, Jr., National Museum of Natural History, Smithsonian Institution. This collaborative and cooperative study by Argentina, Brazil, Canada, Japan, and the United States, took place in Seotember 1975. R/V Hero was used to collect data on the distribution, stock identification and stock size of Minke whales in the western South Atlantic. These data are needed to formulate rational international conservation and management regulations for Minke whale stocks in the South Atlantic as well as for other antarctic Minke whale stocks. Minke whales in the Southern Hemisphere represent the last important, renewable whale resource in the Antarctic still at or near its initial population size. Full-scale pelagic catches, however, have begun in the Antarctic, totaling approximately 20,000 between 1972 and 1975. Shore whaling from Brazil between 1966 and 1973 has taken another 5,000. There is need, therefore, to obtain population data before the stocks are further perturbed by whaling.

INTERNATIONAL COOPERATION

In addition to the Dry Valley Drilling Project and several other projects described above, six 1975-1976 antarctic programs will involve U.S.-foreign nation interactions in personnel and support services. Projects in this category, most receiving U.S. logistics support, are listed below.

International Antarctic Glaciological Project (McMurdo Station). Jean Vaugelade, Expeditions Polaires Francaises.

Glaciological and geomorphological studies in the dry valleys of southern Victoria Land (McMurdo Station). Sergei Miagkov, Moscow State University.

Japan visiting scientist program (McMurdo Station). Takeshi Nagata, Japan Institute of Polar Research.

British Antarctic Survey doppler project (Palmer Station). W. R. Piggott, British Antarctic Survey.

Meteorological observations (Amundsen-Scott South Pole Station). John DeLisle, N.Z. National Weather Service.