2003-2004 USAP Field Season

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Click on the station name below to retrieve a list of projects supported by that station.

	Austral Summer Season Openings		Austral Winter Season Opening	Estimated Population	
Station	**Operational**	**Science**		**Summer**	**Winter**
McMurdo	20 August 2003 (WinFly*)	01 September 2003 (mainbody)	23 February 2004	890 (weekly average) 2,900 (total)	187 (winter total)
South Pole	24 October 2003	30 October 2003	15 February 2004	232 (weekly average) 650 (total)	72 (winter total)
Palmer	27-September-2003	17 October 2003	8 April 2004	34-44 (weekly average) 75 (total)	40 (winter total)
Research Vessels	Year-round operations Vessel schedules on the Internet: http://www.polar.org/science/marine.			RV/IB NBP 39 science & staff 25 crew	RV LMG 32 science & staff 25 crew
	Field Camps				
	Air Support				

* A limited number of science projects deploy at WinFly.

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Every field season, the USAP sponsors a variety of technical events that are not scientific research projects but support one or more science projects.

NASA GSFC NAILS, MTRS1, MTRS2, and SPTR

Event #: T-008-M

Station: McMurdo

Work Site: McMurdo Station

Team Leader: Michael Comberiate

Affiliation: NASA Goddard Space Flight Center
Code 422
Building 16W, Room N066
Greenbelt, MD 20771
301.286.2165
mike.comberiate@gsfc.nasa.gov

http://www.gsfc.nasa.gov/

MTRS2. Photo courtesy of Seth White.

Project Description: NASA researchers will perform maintenance and upgrades to their systems during the Austral

2003-2004 summer season:

NAILS two-meter satellite tracking station on Ross Island:

- Perform system checkup, test and repair if necessary
- Examine spares, reorganize, and retrograde old equipment and equipment for Antarctic Museum display

MTRS1 and MTRS2 TDRS uplink station on Black Island:

- Perform system checkup, repair if necessary

The project team will work with a staff communications technician for reconfigurations and repairs. Except for AC power, heat, and internet support to the project team's equipment, normal operations will require no support from McMurdo station contractor support personnel. One communications technician will be needed in the vicinity of the equipment during launch support of NOAA 17 (launched in June 2002) and the DMSP satellite launch scheduled for October.

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ICDS Ice Core Drilling Services (ICDS)

Event #: T-150-M/S

Station: South Pole Station

Work Site: USGC observatory 8 kilometers from South Pole Station

Team Leader: Dr. Charles R. Bentley

Affiliation: University of Wisconsin Madison
Department of Geology and Geophysics
1215 W. Dayton Street
Madison, WI 53706
608.262.0693
bentley@geology.wisc.edu

http://www.ssec.wisc.edu/a3ri/icds/

Project Description: Supporting Rhett Butler's project, G-090-S, the South Pole-based project team will operate the ICDS 4-inch drill system to complete reaming out the last 12" diameter borehole to a depth of about 300 meters.

The ICDS team will commute eight kilometers out of South Pole station to the USGS observatory.

Team members will also inventory and maintain ICDS drills and supplies in McMurdo.

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Scripps AARC

Arctic and Antarctic Research Center at Scripps Institution of Oceanography (AARC), TeraScan project

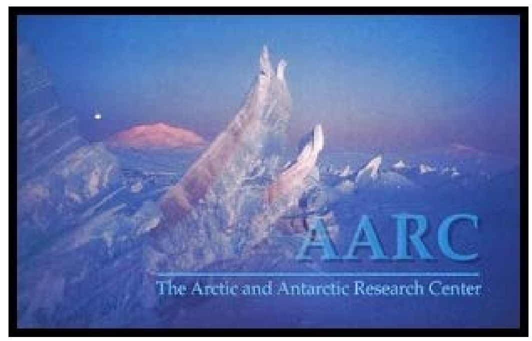
Event #: T-312-M/N/P

Station: McMurdo and Palmer Stations, RV/IB Nathaniel B. Palmer

Work Site: TeraScan computer installations

Team Leader: Dr. Dan Lubin

Affiliation: Scripps Institution of Oceanography
Arctic and Antarctic Research Center (AARC)
California Space Institute
9500 Gilman Drive, mail code 0214
La Jolla, CA 92093-0221
858.534.6369
dlubin@ucsd.edu
http://arcane.ucsd.edu



Project Description: The AARC is funded to archive and distribute all NOAA and DMSP (Defense Meteorological Satellite Program) data collected south of 60 degrees. The data from polar orbiting satellites are collected by ground stations at McMurdo and Palmer Stations aboard the RV/IB Nathaniel B. Palmer. It is distributed by ARCC to the scientific community and to support contractor meteorologists for forecasting.

No project team will be traveling to Antarctica this season. Support contractor technicians will collect data from each TeraScan-equipped station. Data collection is scheduled for the maximum coverage and quantity of NOAA and DMSP data for the McMurdo region on a year-round basis. Before sending the data out, ARCC personnel check it for quality by reading and processing random collected passes.

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CTBT

Installation, operation and maintenance of a Comprehensive Test Ban Treaty (CTBT) class infrasound array in

Windless Bight, Antarctica

Event #: T-396-M

Station: McMurdo

Work Site: Windless Bight

Team Leader: Mr. Daniel L. Osborne

Affiliation: University of Alaska Fairbanks
Geophysical Institute
903 Koyukuk Avenue
P.O. Box 757320
Fairbanks, AK 99775-7320
907.474.7107
dosborne@gi.alaska.edu
http://www.gi.alaska.edu/~jvo/newinfrasound/...
infrasound/members.htm

Univ. of Alaska team servicing infrasound sensor in Windless Bight November, 2003

Project Description: This group operates and maintains a CTBT (Comprehensive Test Ban Treaty) infrasound array at Windless Bight, Ross Island.

Project team members will refuel and service the power system at the Windless Bight installation. Team members will establish a camp at the site and spend about two weeks in the field.

Data from the Windless Bight system is forwarded to the CTBT office in Vienna, as well as to the principal investigator's home institution where it will be made available for research into the natural infrasonic background.

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MGS NASA/McMurdo Ground Station (MGS)

Event #: T-927-M

Station: McMurdo

Work Site: McMurdo Station

Team Leader: Mr. Ken Griffin

Affiliation: Honeywell Technical Solutions, Inc.
NASA Wallops Flight Facility
Building E-106, Room 209
Wallops Island, VA 23337
757.824.2478
Ken.Griffin@csoconline.com
http://www.wff.nasa.gov/~code452/mcmurdo.html

Project Description: NASA's McMurdo Ground Station (MGS) performs critical support for countdown, liftoff and early-orbit phases of satellite launching operations. It also tracks a variety of in-orbit scientific (TRACE, FAST, WIRE, SWAS, GRACE 1 and 2, SAC-C, CHAMP, etc.) and mapping

(Radarsat, Lansat-7,QuikSCAT, ERS-2, etc.) satellites. MGS supplies real time data (downlink) and commanding (uplink) support to a variety of projects via NASA’s dedicated 128Kbit data line. Voice support is through a dedicated 16Kbit voice loop with Goddard Space Flight Center. Radarsat, ERS-2 SAR, and Taurus START 2 treaty compliance data will be shipped back to the U.S. for processing. If requested, MGS will uplink data through the MTRS-1 ground station located on Black Island, or MTRS-2 ground station located on Crater Hill through TDRSS (Telemetry and Data Relay Satellite System) to White Sands, New Mexico.

Each austral summer, project team members at McMurdo Station are responsible for the maintenance and operation of the ground station. This season the MGS team will relocate their equipment to the Joint Spacecraft Operations Center (JSOC).

In addition to relocating the equipment, upgrades may be performed on the system to include a RAID storage device, and system automation enhancements.

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2003-2004 USAP Field Season

Event Numbering System

All projects are identified by a unique event number. It comprises a prefix, a 3-digit number, and a suffix. The prefix is a letter that indicates the USAP program funding a project:

Prefix	USAP Program
A	Aeronomy & Astrophysics
B	Biology & Medicine
G	Geology & Geophysics
I	Glaciology
O	Oceans & Climate Systems
W	Artists & Writers
T	Technical Event

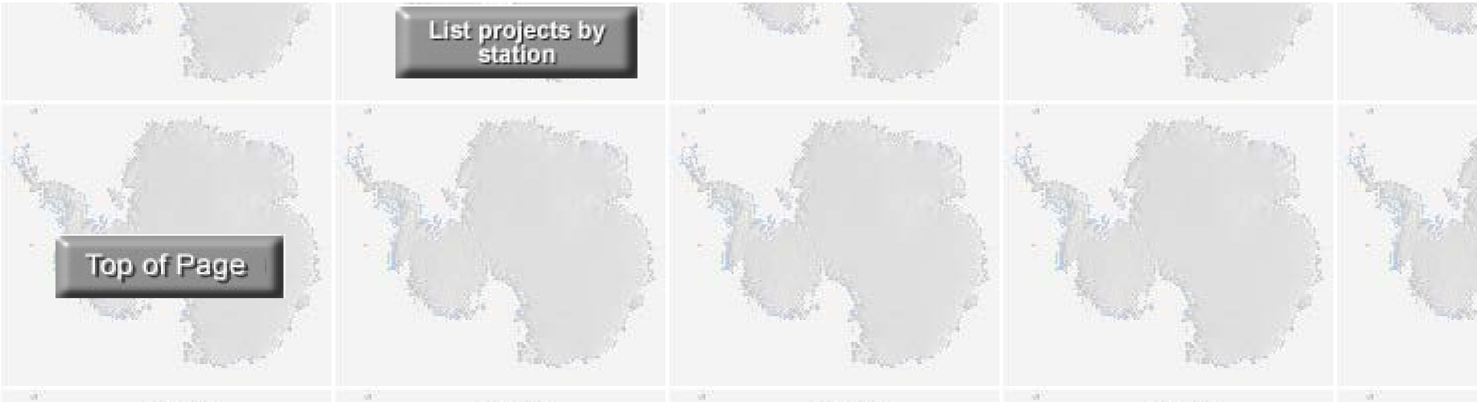
List projects by program

The 3-digit number provides the uniqueness for each event number. No two projects have the same number.

List projects by event number digits

The suffix represents the supporting station. If field work takes place at more than one location the event number carries more than one suffix separated by a slash.

Suffix	Supporting Station
M	McMurdo Station
P	Palmer Station
S	South Pole Station
L	R/V Laurence M. Gould
N	RV/IB Nathaniel B. Palmer
E	Special projects supported by the USAP. Examples include investigators working with other national antarctic programs, groups working on islands in the peninsula.


List projects by station

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United States Antarctic Program

2003-2004 Projects

Website	PI Last Name	PI First Name	Event Number	Project Title
Go	Ainley	David	B-031-M	Geographic structure of Adelie penguin populations: Demography of population expansion
Go	Amsler	Charles	B-022-L/P	The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula
Go	Anandakrishnan	Sridhar	I-205-M	Tidal modulation of ice stream flow
Go	Bieber	John	A-120-M/S	Spaceship Earth: Probing the solar wind with cosmic rays
Go	Binns	Walter	A-149-M	Trans-Iron Galactic Element Recorder (TIGER) / ANITA-lite
Go	Bowser	Samuel	B-015-M	Remotely operable micro-environmental observatory for antarctic marine biology research
Go	Caldwell	Douglas	A-103-S	A search for extrasolar planets from the South Pole
Go	Carlstrom	John	A-373-S	Degree Angular Scale Interferometer (DASI)
Go	Chereskin	Teresa	O-317-L	Shipboard acoustic Doppler current profiling aboard the research vessel Laurence M. Gould
Go	Conway	Howard	I-209-M	Western divide WAISCORES site selection
Go	Conway	Howard	I-210-M	Glacial history of Ridge AB
Go	DiTullio	Giacomo	B-272-M	Iron and light effects on Phaeocystis antarctica isolates from the Ross Sea
Go	Doran	Peter	B-426-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Ducklow	Hugh	B-045-L/P	Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

Go	Ejiri	Masaki	A-117-S	All-Sky imager at South Pole
Go	Emslie	Steven	B-034-M	Occupation history and diet of Adélie penguins in the Ross Sea region
Go	Engebretson	Mark	A-102-M/S	Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites
Go	Firing	Eric	O-315-N	Shipboard acoustic Doppler current profiling aboard the research vessel Nathaniel B. Palmer
Go	Fountain	Andrew	B-425-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Gaisser	Thomas	A-109-S	South Pole Air Shower Experiment - SPASE 2
Go	Gargett	Ann	B-208-N	Interactive effects of UV and Vertical mixing on phytoplankton and bacterioplankton in the Ross Sea
Go	Garrott	Robert	B-009-M	Patterns and processes: Dynamics of the Erebus Bay Weddell seal population
Go	Gordon	Arnold	O-215-N	ANSLOPE: Cross slope exchanges at the antarctic slope front
Go	Halzen	Francis	A-333-S	IceCube
Go	Hansen	Anthony	O-314-M	Solar/wind powered instrumentation module development for polar environmental research
Go	Harvey	Ralph	G-058-M	The Antarctic Search for Meteorites (ANSMET)
Go	Hofmann	Dave	O-257-S	South Pole monitoring for climatic change: U.S. Department of Commerce NOAA Climate Monitoring and Diagnostic Laboratory
Go	Hofmann	David	O-264-P	Collection of atmospheric air for the NOAA/CMDL worldwide flask sampling network
Go	Holzapfel	William	A-378-S	High-resolution obervations of the cosmic microwave background (CMB) with ACBAR
Go	Inan	Umran	A-108-S	A very-low-frequency (VLF) beacon transmitter at South Pole (2001-2004)

Go	Inan	Umran	A-306-P	Global thunderstorm activity and its effects on the radiation belts and the lower ionosphere
Go	Jeffrey	Wade	B-200-N	POTATOE: Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects (MOAT)
Go	Johns	Bjorn	G-295-M	University NAVSTAR Consortium (UNAVCO) GPS survey support
Go	Keeling	Ralph	O-204-P/S	A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems
Go	Kennicutt, II	Mahlon	B-518-M	Spatial and temporal scales of human disturbance
Go	Kieber	David	B-266-N	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea
Go	Kiene	Ronald	B-002-N	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea, Antarctica
Go	Kim	Stacy	B-010-M	Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic
Go	Kreutz	Karl	I-191-M	Dry Valleys Late Holocene climate variability
Go	Kvitek	Rikk	B-320-E	Victoria Land latitudinal gradient project: Benthic marine habitat characterization
Go	Kyle	Philip	G-081-M	Mount Erebus Volcano Observatory and Laboratory (MEVOL)
Go	LaBelle	James	A-128-S	A versatile electromagnetic waveform receiver for South Pole Station
Go	Lange	Andrew	A-033-S	Background Imaging of Cosmic Extragalactic Polarization (BICEP): An experimental probe of inflation
Go	Lyons	W. Berry	B-420-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	MacAyeal	Douglas	I-190-M	Collaborative research of Earth's largest icebergs
Go	Marsh	Adam	B-029-M	Genomic networks for cold-adaptation in embryos of polar marine invertebrates

Go	Martinson	Douglas	B-021-L	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
Go	Mayewski	Paul	I-153-M	A science management office for the United States component of the International Trans Antarctic Scientific Expedition (ITASE) -- South Pole to Northern Victoria Land
Go	McKnight	Diane	B-421-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Mitchell	B. Greg	B-228-L	Plankton community structure and iron distribution in the southern Drake Passage
Go	Morse	Robert	A-130-S	Antarctic Muon And Neutrino Detector Array (AMANDA)
Go	Müller	Dietrich	A-125-M	Tracer-Lite II: Transition Radiation Array for Cosmic Energetic Radiation, a balloon borne instrument
Go	Neale	Patrick	B-203-N	Interactive effects of UV radiation and vertical mixing on phytoplankton and bacterioplankton in the Ross Sea
Go	Novak	Giles	A-376-S	Mapping galactic magnetic fields with SPARO
Go	Priscu	John	B-195-M	Microbial diversity and function in the permanently ice-covered lakes of the McMurdo Dry Valleys
Go	Priscu	John	B-422-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Quetin	Langdon	B-028-L/P	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
Go	Retallack	Gregory	G-299-M	Permian-Triassic mass extinction in Antarctica
Go	Rosenberg	Theodore	A-111-M/S	Riometry in Antarctica and conjugate region
Go	Rosenberg	Theodore	A-112-M	Polar Experiment Network for Geophysical Upper-Atmospheric Investigations (PENGUIN)

Go	Scambos	Theodore	I-186-M	Characteristics of snow megadunes and their potential effects on ice core interpretation
Go	Severinghaus	Jeffrey	I-184-M	How thick is the convective zone?: A study of firn air in the megadunes near Vostok
Go	Sivjee	Gulamabas	A-129-S	Effects of enhanced solar disturbances during the 2000-2002 solar-max period on the antarctic mesosphere-lower-thermosphere (MLT) and F regions composition, thermodynamics and dynamics
Go	Smith	David	A-144-E/M	Development and test flight of a small, automated balloon payload for observations of terrestrial x-rays
Go	Smith	Raymond	B-032-L/P	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
Go	Smith	Walker	B-047-M	Interannual variability in the Antarctic-Ross Sea (IVARS): Nutrients and seasonal production
Go	Sowers	Todd	I-177-M	Refining a 500-thousand-year climate record from the Mt. Moulton blue ice field in West Antarctica
Go	Sprintall	Janet	O-260-L	The Drake Passage high density XBT/XCTD program
Go	Stacey	Gordon	A-377-S	Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on AST/RO
Go	Stark	Antony	A-371-S	Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)
Go	Stearns	Charles	O-202-M/P/S	Antarctic Meteorological Research Center (AMRC) (2002-2005)
Go	Stearns	Charles	O-283-M/P/S	Antarctic Automatic Weather Station Program (AWS): 2001-2004
Go	Steffen	Konrad	O-309-L	AMSR sea ice validation during the R/V Laurence M. Gould's traverse to Antarctica
Go	Stepp	William	A-145-M	Long Duration Balloon Program (LDB)
Go	Stock	Joann	G-071-N	Improved Cenozoic plate reconstructions of the circum-Antarctic Region

Go	Vernet	Maria	B-016-L/P	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
Go	Virginia	Ross	B-423-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Wall	Diana	B-424-M	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
Go	Wiens	Douglas	G-089-M	A broadband seismic experiment to investigate deep continental structure across the east-west Antarctic boundary
Go	Wilson	Terry	G-079-M	Transantarctic Mountains deformation network: GPS measurements of neotectonic motion in the antarctic interior
Go	Zhou	Meng	B-248-L	Plankton community structure and iron distribution in the southern Drake Passage

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NSF Contact:

Environmental Officer
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

The Antarctic Conservation Act (ACA) was made U.S. law in 1978 and was amended by the Antarctic Science, Tourism, and Conservation Act of 1996. The ACA is intended to conserve and protect the native mammals, birds, and plants of Antarctica and the ecosystem. It is broadly applied to U.S. citizens and other participants in U.S. government activities south of 60 degrees south latitude. It regulates ordinary on-ice activities and provides a permit system that allows while carefully restricting certain otherwise prohibited activities for worthwhile purposes. It empowers enforcement officers and prescribes serious penalties for violations.

In 1991, the United States along with the other treaty nations adopted the Protocol on Environmental Protection and its five annexes that outline a comprehensive protection system for the antarctic environment. Together, the ACA and the Protocol formalizes America's commitment to protect the environment of the southernmost continent and its dependent and associated ecosystems. Together, the United States and other treaty nations are committed to preserving the region as a natural reserve devoted to peace and science.

Specific provisions for environmental protection include regulating the introduction of nonindigenous species, prohibiting casual interference with flora and fauna, and managing pollutants. Particularly sensitive regions have been designated ASPAs (Antarctic Specially Protected Areas) and permits are required to enter them. Each five years, NSF's support contractor must apply for and be issued a Master Permit which establishes requirements for managing pollutants and wastes including removal and recycling or proper disposal in the United States of most wastes and excess materials generated by the program.

Recognizing that worthwhile scientific research and related logistic support can have effects on the Antarctic environment, the Antarctic Treaty Consultative Parties adopted recommendations on environmental monitoring in Antarctica with two important goals: To detect any unforeseen effects, and to verify the actual impact and scope of those effects that were anticipated. The Protocol on Environmental Protection to the Antarctic Treaty also requires that environmental impacts be monitored. The U.S. Antarctic Program (USAP) is developing an Environmental Monitoring Program designed to detect and measure any impacts from science and operations at its research stations in Antarctica. Only with a sustained and coherent monitoring program can a reliable basis for sound environmental management decisions and possible improvements be established. Data obtained from the monitoring program will be used to document baseline conditions, verify operational impact, and monitor activities undertaken to recover from accidental impacts to the environment.

Environmental, Health and Safety (EHS) initiatives for the United States Antarctic Program were established in 1987 by a safety review panel appointed by the director of the NSF. The goals of the initiatives are to clean up debris from past activities, improve the health and safety of all USAP participants, and minimize the environmental impact of on-ice activities. The initiatives are consistent with US environmental protection regulations (45CFR670-672).

Historically, the USAP has recycled 60-70 percent of all the waste generated on stations. The remainder is incinerated, treated, or removed to landfills in the United States. Last season, 1.9 million kilograms of recyclables, waste, and equipment were removed from USAP stations and field camps. The preferred waste management strategy is pollution prevention and the EHS initiatives waste minimization program has reduced waste by about 9 percent annually since 1994.

The initiatives also include an environmental impact assessment program. All on-ice activities, research or otherwise, which are expected to have a minor or transitory environmental impact are documented to help identify alternatives and mitigate potential impacts. This program is designed to ensure that environmental considerations are taken into account in the planning of all activities with the aim of preventing adverse impacts. Each season, audits are conducted to ensure that research activities comply with environmental impact assessment requirements.

A comprehensive plan to educate science parties about the Antarctic Conservation Act (ACA) and other environmental practices has been developed to support the USAP. Waste management education and training is provided at each major station and for personnel deploying to the field. Specialized environmental information and training is provided for the wide variety of environments and situations encountered within the USAP, both before and during the field season. For example, all participants entering the McMurdo Dry Valleys are trained to work in an area with its unique environmental sensitivities.

Antarctica's remote location and extreme environment, combined with limited medical services, make safety a top priority for all people working within the USAP. The USAP integrates health and safety requirements and awareness into every activity at every site. A comprehensive field safety training program has been implemented to ensure participants know what to expect, and how to survive in a variety of field situations. On station, RPSC invites all USAP participants to take part in specific safety training, safety evaluations and work place inspections to become more proactive in safety as opposed to reactive. With the addition of new safety multi-media and presentations at each of the stations, USAP participants can check out videos and safety information to round out their knowledge or to learn new techniques in preventing personal injuries. USAP participants are ultimately responsible for their behaviors and contributions to the Safety and Health Program. RPSC Safety and Health Professionals & Management are a dedicated safety resource to the USAP who can and should be used by all program participants.

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Principal Investigators

PI Last Name	PI First Name	NSF/OPP Award #	Project Title	Event #
Ainley	David	01-25608	Geographic structure of Adelie penguin populations: Demography of population expansion	B-031-M
Amsler	Charles	01-25181	The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula	B-022-L/P
Anandakrishnan	Sridhar	02-29629	Tidal modulation of ice stream flow	I-205-M
Armstrong	Jennifer	.	Ice Through the Ages: A nonfiction young adult book	W-219-M/S
Ashworth	Allan	02-30696	Terrestrial paleoecology and sedimentary environment of the Meyer Desert Formation, Beardmore Glacier, Transantarctic Mountains	G-294-M
Avery	Susan	ATM 00-00957	Dynamics of the antarctic mesosphere-lower-thermosphere (MLT) region using ground-based radar and TIMED instrumentation	A-284-S
Babcock	Loren	02-29757	Paleobiology and taphonomy of exceptionally preserved fossils from Jurassic Lacustrine deposits, Beardmore Glacier area and southern Victoria Land, Antarctica	G-297-M
Baskin	Yvonne	.	Soil biodiversity book	W-220-M
Bieber	John	00-00315	Spaceship Earth: Probing the solar wind with cosmic rays	A-120-M/S
Binns	Walter	NSF/NASA agreement	Trans-Iron Galactic Element Recorder (TIGER) / ANITA-lite	A-149-M
Blake	Daniel	99-08856	Global climate change and the evolutionary ecology of antarctic mollusks in the Late Eocene	G-065-E
Blanchette	Robert	02-29570	Investigations on deterioration in the historic huts of Antarctica	B-038-E/M
Bledsoe	Lucy	.	Palmer Station children's novel	W-218-P
Bowser	Samuel	02-16043	Remotely operable micro-environmental observatory for antarctic marine biology research	B-015-M
Butler	Rhett	EAR 00-04370	IRIS - Global Seismograph Station at South Pole	G-090-P/S
Caldwell	Douglas	01-26313	A search for extrasolar planets from the South Pole	A-103-S
Carlstrom	John	00-94541	Degree Angular Scale Interferometer (DASI)	A-373-S
Carlstrom	John	01-30612	South Pole observations to test cosmological models	A-379-S
Case	Judd	00-03844	Evolution and biogeography of Late Cretaceous vertebrates from the James Ross Basin, Antarctic Peninsula	G-061-E
Chereskin	Teresa	98-16226	Shipboard acoustic Doppler current profiling aboard the research vessel Laurence M. Gould	O-317-L
				W-223-

Cokinos	Christopher	.	The fallen sky: Eccentrics and scientists in pursuit of shooting stars	M
Connell	Laurie	01-25611	Yeasts in the antarctic Dry Valleys: Biological role, distribution, and evolution	B-019-M
Conrad	Lawrence (Larry)	.	Field guide to antarctic features: McMurdo Sound region	W-224-M
Conway	Howard	00-87345	Western divide WAISCORES site selection	I-209-M
Conway	Howard	00-87144	Glacial history of Ridge AB	I-210-M
Cuffey	Kurt	01-25579	Dynamics and climatic response of the Taylor Glacier system.	I-161-M
Dalziel	Ian	00-03619	A GPS network to determine crustal motions in the bedrock of the West Antarctic Ice Sheet (WAIS)	G-087-M
Day	Thomas	02-30579	Response of terrestrial ecosystems along the Antarctic Peninsula to a changing climate	B-003-P
DeVries	Arthur	02-31006	Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution	B-005-M
Deshler	Terry	02-30424	Measurements addressing quantitative ozone loss, polar stratospheric cloud nucleation, and large polar stratospheric particles during austral winter and spring	A-131-M
Detrich	William	01-32032	ICEFISH 2003: International collaborative expedition to collect and study fish indigenous to sub-antarctic habitats	B-039-N
DiTullio	Giacomo	02-30513	Iron and light effects on Phaeocystis antarctica isolates from the Ross Sea	B-272-M
Doran	Peter	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-426-M
Ducklow	Hugh	02-17282	Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-045-L/P
Dye	Timothy	01-25893	Culture and health in Antarctica	B-027-M
Eicken	Hajo	01-26007	Measurements and improved parameterizations of the thermal conductivity and heat flow through first-year sea ice	O-253-M
Eisele	Fred	02-30246	Antarctic Troposphere Chemistry Investigation (ANTCI)	O-176-M/S
Ejiri	Masaki	U.S./Japan agreement	All-Sky imager at South Pole	A-117-S
Emslie	Steven	01-25098	Occupation history and diet of Adélie penguins in the Ross Sea region	B-034-M
Engebretson	Mark	02-33169	Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites	A-102-M/S
Firing	Eric	98-16226	Shipboard acoustic Doppler current profiling aboard the research vessel Nathaniel B. Palmer	O-315-N
Fountain	Andrew	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-425-M
Fraser	William	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-013-L/P
			Monitoring the human impact and environmental variability on	

Fraser	William	01-30525	Adelie Penguins at Palmer Station	B-198-P
Fraser-Smith	Antony	01-38126	The Operation of an ELF/VLF Radiometer at Arrival Heights, Antarctica	A-100-M
Frazer	Thomas	03-36469 SGER	Complex pelagic interactions in the Southern Ocean: Deciphering the antarctic paradox	B-212-E
Gaisser	Thomas	99-80801	South Pole Air Shower Experiment - SPASE 2	A-109-S
Gargett	Ann	01-25818	Interactive effects of UV and Vertical mixing on phytoplankton and bacterioplankton in the Ross Sea	B-208-N
Garrott	Robert	02-25110	Patterns and processes: Dynamics of the Erebus Bay Weddell seal population	B-009-M
Gast	Rebecca	01-25833	Comparative and quantitative studies of protistan molecular ecology and physiology in coastal antarctic waters	B-207-N
Goes	Joaquim	01-26150	Ultraviolet-radiation-induced changes in the patterns of production and composition of biochemical compounds antarctic marine phytoplankton	B-206-N
Goodge	John	02-30280	Geophysical mapping of the east antarctic shield adjacent to the Transantarctic Mountains	G-291-M
Gordon	Arnold	01-25172	ANSLOPE: Cross slope exchanges at the antarctic slope front	O-215-N
Grew	Edward	02-28842	Boron in antarctic granulite-facies rocks: Under what conditions is boron retained in the middle crust?	G-067-E
Hall	Brenda	01-24014	Millennial-scale fluctuations of Dry Valleys lakes: A test of Implications for regional climate variability and the interhemispheric (a)synchrony of climate change	I-196-M
Halzen	Francis	02-36449, 03-31873	IceCube	A-333-S
Hamilton	Gordon	02-29245	Glaciology of blue ice areas in Antarctica	I-178-M
Hammer	William	02-29698	Vertebrate Paleontology of the Triassic to Jurassic sedimentary sequence in the Beardmore Glacier area of Antarctica	G-298-M
Hansen	Anthony	DBI 01-19793	Solar/wind powered instrumentation module development for polar environmental research	O-314-M
Harvey	Ralph	99-80452	The Antarctic Search for Meteorites (ANSMET)	G-058-M
Hernandez	Gonzalo	02-29251	Austral high-latitude atmospheric dynamics	A-110-M/S
Hildebrand	John	99-10007	Mysticete whale acoustic census in the GLOBEC west antarctic project area	B-239-L
Hofmann	Dave	NOAA/NSF agreement	South Pole monitoring for climatic change: U.S. Department of Commerce NOAA Climate Monitoring and Diagnostic Laboratory	O-257-S
Hofmann	David	NOAA/NSF agreement	Collection of atmospheric air for the NOAA/CMDL worldwide flask sampling network	O-264-P
Holzapfel	William	02-32009	High-resolution obervations of the cosmic microwave background (CMB) with ACBAR	A-378-S
Hunt	George	02–34570 SGER	Food web structure across a large-scale ocean productivity gradient: Top predator assemblages in the southern Indian Ocean	B-025-E
Inan	Umran	00-93381	A very-low-frequency (VLF) beacon transmitter at South Pole (2001-2004)	A-108-S
Inan	Umran	02-33955	Global thunderstorm activity and its effects on the radiation belts and the lower ionosphere	A-306-P

Jeffrey	Wade	01-27022	POTATOE: Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects (MOAT)	B-200-N
Johns	Bjorn	EAR 99-03413	University NAVSTAR Consortium (UNAVCO) GPS survey support	G-295-M
Keeling	Ralph	ATM 00-00923	A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems	O-204-P/S
Kemerait	Robert	NSF/OPP-DoD MOA	Dry Valley seismic project	G-078-M
Kennicutt, II	Mahlon	SGER	Spatial and temporal scales of human disturbance	B-518-M
Kieber	David	02-30499	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea	B-266-N
Kiene	Ronald	02-30497	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea, Antarctica	B-002-N
Kim	Stacy	01-26319	Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic	B-010-M
Kreutz	Karl	02-28052	Dry Valleys Late Holocene climate variability	I-191-M
Kvitek	Rikk	02-29991	Victoria Land latitudinal gradient project: Benthic marine habitat characterization	B-320-E
Kyle	Philip	02-29305	Mount Erebus Volcano Observatory and Laboratory (MEVOL)	G-081-M
LaBelle	James	00-90545	A versatile electromagnetic waveform receiver for South Pole Station	A-128-S
Lange	Andrew	02-30438	Background Imaging of Cosmic Extragalactic Polarization (BICEP): An experimental probe of inflation	A-033-S
Larson	Edward	.	History of science in Antarctica	W-221-M
Lessard	Marc	01-32576	Measurement and analysis of extremely-low-frequency (ELF) waves at South Pole Station	A-136-S
Luyendyk	Bruce	00-88143	Antarctic cretaceous-Cenozoic climate, glaciation, and tectonics: Site surveys for drilling from the edge of the Ross Ice Shelf	G-152-N
Lyons	W. Berry	02-29836	Soil biodiversity and response to climate change: A regional comparison of Cape Hallett and Taylor Valley	B-259-M
Lyons	W. Berry	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-420-M
MacAyeal	Douglas	02-29546	Collaborative research of Earth's largest icebergs	I-190-M
Marsh	Adam	02-38281	Genomic networks for cold-adaptation in embryos of polar marine invertebrates	B-029-M
Martinson	Douglas	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-021-L
Mayewski	Paul	02-29573	A science management office for the United States component of the International Trans Antarctic Scientific Expedition (ITASE) -- South Pole to Northern Victoria Land	I-153-M
McKnight	Diane	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-421-M
Measures	Christopher	02–30445	Plankton community structure and iron distribution in the southern	B-225-L

			Drake Passage	
Mende	Stephen	02-30428	Dayside auroral imaging at South Pole	A-104-S
Miller	Molly	01-26146	Late Paleozoic-Mesozoic fauna, environment, climate, and basinal history: Beardmore Glacier area, Tranantarctic Mountains	G-094-M
Mitchell	B. Greg	02-30445	Plankton community structure and iron distribution in the southern Drake Passage	B-228-L
Morse	Robert	99-80474	Antarctic Muon And Neutrino Detector Array (AMANDA)	A-130-S
Mullins	Jerry	02-33246	Geodesy and geospatial program	G-052-M/P/S
Murcray	Frank	02-30370	Infrared measurements of atmospheric composition over Antarctica	A-255-M/S
Müller	Dietrich	NSF/NASA agreement	Tracer-Lite II: Transition Radiation Array for Cosmic Energetic Radiation, a balloon borne instrument	A-125-M
Naveen	Ron	02-30069	Long-term data collection at select Antarctic Peninsula visitor sites	B-086-E
Neale	Patrick	01-27037	Interactive effects of UV radiation and vertical mixing on phytoplankton and bacterioplankton in the Ross Sea	B-203-N
Nevitt	Gabrielle	02-29775	The development of olfactory foraging strategies in antarctic procellariiform seabirds	B-035-E
Novak	Giles	01-30389	Mapping galactic magnetic fields with SPARO	A-376-S
Palinkas	Lawrence	00-90343	Prevention of environment-induced decrements in mood and cognitive performance	B-321-M/S
Petzel	David	02-29462	Drinking and sodium/potasium-ATPase alpha-subunit isoform expression in antarctic fish	B-012-M
Ponganis	Paul	02-29638	Diving physiology and behavior of emperor penguins	B-197-M
Priscu	John	MCB 02-37335	Microbial diversity and function in the permanently ice-covered lakes of the McMurdo Dry Valleys	B-195-M
Priscu	John	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-422-M
Quetin	Langdon	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-028-L/P
Renne	Paul	01-25194	Calibration of cosmogenic argon production rates in Antarctica	G-064-M
Retallack	Gregory	02-30086	Permian-Triassic mass extinction in Antarctica	G-299-M
Rosenberg	Theodore	00-03881	Riometry in Antarctica and conjugate region	A-111-M/S
Rosenberg	Theodore	03-34467	Polar Experiment Network for Geophysical Upper-Atmospheric Investigations (PENGUIN)	A-112-M
Sanderson	Colin	MOU with DOE	Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab	O-275-P/S
Scambos	Theodore	01-25570	Characteristics of snow megadunes and their potential effects on ice core interpretation	I-186-M
Severinghaus	Jeffrey	02-30452	How thick is the convective zone?: A study of firn air in the megadunes near Vostok	I-184-M
			Effects of enhanced solar disturbances during the 2000-2002 solar-	

Sivjee	Gulamabas	99-09339	max period on the antarctic mesosphere-lower-thermosphere (MLT) and F regions composition, thermodynamics and dynamics	A-129-S
Smith	David	ATM 02-33370	Development and test flight of a small, automated balloon payload for observations of terrestrial x-rays	A-144-E/M
Smith	Raymond	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-032-L/P
Smith	Walker	00-87401	Interannual variability in the Antarctic-Ross Sea (IVARS): Nutrients and seasonal production	B-047-M
Sowers	Todd	02-30021	Refining a 500-thousand-year climate record from the Mt. Moulton blue ice field in West Antarctica	I-177-M
Sprintall	Janet	00-03618	The Drake Passage high density XBT/XCTD program	O-260-L
Stacey	Gordon	00-94605	Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on AST/RO	A-377-S
Stark	Antony	01-26090	Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)	A-371-S
Stearns	Charles	01-26262	Antarctic Meteorological Research Center (AMRC) (2002-2005)	O-202-M/P/S
Stearns	Charles	00-88058	Antarctic Automatic Weather Station Program (AWS): 2001-2004	O-283-M/P/S
Steffen	Konrad	NASA award	AMSR sea ice validation during the R/V Laurence M. Gould's traverse to Antarctica	O-309-L
Stepp	William	NSF/NASA agreement	Long Duration Balloon Program (LDB)	A-145-M
Stock	Joann	01-26334	Improved Cenozoic plate reconstructions of the circum-Antarctic Region	G-071-N
Stone	John	02-29314	Late Quaternary history of Reedy Glacier	I-175-M/S
Takahashi	Taro	00-03609	Mesoscale, seasonal and inter-annual variability of surface water CO2 in the Drake Passage	O-214-L
Tauxe	Lisa	02-29403	Geomagnetic field as recorded in the Mount Erebus Volcanic Province: Key to field structure at high southern latitudes	G-182-M
Taylor	Edith	01-26230	Permian and Triassic floras from the Beardmore Glacier region: Icehouse to greenhouse?	G-095-M
Taylor	Edith	02-29877	Shackleton Glacier area: Evolution of vegetation during the Triassic	G-293-M
Thiemens	Mark	01-25761	South Pole Atmospheric Nitrate Isotopic Analysis (SPANIA)	I-165-M/S
Trivelpiece	Wayne	01-25985	Foraging behavior and demography of Pygoscelis penguins	B-040-E
Uhle	Maria	02-30237	Biogeochemistry of Victoria Land coastal ponds: Role in terrestrial ecosystem organic carbon dynamics and structure	B-011-M
Veit	Richard	99-83751	Dynamics of predator-prey behavior in the Antarctic Ocean	B-023-L
Vernet	Maria	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-016-L/P
Virginia	Ross	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-423-M
		NASA	Validation of the Atmospheric Infrared Sounder (AIRS) over the	O-213-

Walden	Von	award	Antarctic Plateau	M
Wall	Diana	98-10219	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	B-424-M
Warren	Stephen	00-03826	Solar radiation processes on the East Antarctic Plateau	O-201-M
Wiens	Douglas	99-09603	A broadband seismic experiment to investigate deep continental structure across the east-west Antarctic boundary	G-089-M
Wilson	Terry	02-30285	Transantarctic Mountains deformation network: GPS measurements of neotectonic motion in the antarctic interior	G-079-M
Wilson	Terry	01-25624	Neotectonic structure of Terror Rift, Western Ross Sea	G-099-N
Yen	Jeannette	03-24539	Dynamic similarity or size proportionality?: Adaptations of a polar copepod	B-285-E/L
Zhou	Meng	02-29966	Plankton community structure and iron distribution in the southern Drake Passage	B-248-L

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USAP Programs in Antarctica

Aeronomy & Astrophysics	Dr. Vladimir Papitashvili Program Manager
Biology & Medicine	Dr. Polly Penhale Program Manager
Geology & Geophysics	Dr. Rama K. Kotra Program Manager
Glaciology	Dr. Julie Palais Program Manager
Oceans & Climate	Dr. Bernhard Lettau Program Manager
Artists & Writers	Mr. Guy Guthridge Program Manager

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Institution	PI Last Name	PI First Name	NSF/OPP Award #	Event #
Alabama Birmingham, University of	Amsler	Charles	01-25181	B-022-L/P
Alaska Fairbanks, University of	Eicken	Hajo	01-26007	O-253-M
Arizona State University Tempe	Day	Thomas	02-30579	B-003-P
Augsburg College	Engebretson	Mark	02-33169	A-102-M/S
Augustana College	Hammer	William	02-29698	G-298-M
Berkeley Geochronology Center	Renne	Paul	01-25194	G-064-M
Bigelow Marine Laboratory	Goes	Joaquim	01-26150	B-206-N
California Berkeley, University of	Cuffey	Kurt	01-25579	I-161-M
California Berkeley, University of	Holzapfel	William	02-32009	A-378-S
California Berkeley, University of	Mende	Stephen	02-30428	A-104-S
California Davis, University of	Nevitt	Gabrielle	02-29775	B-035-E
California Institute of Technology	Lange	Andrew	02-30438	A-033-S
California Institute of Technology	Stock	Joann	01-26334	G-071-N
California Irvine, University of	Hunt	George	02–34570 SGER	B-025-E
California San Diego, University of	Chereskin	Teresa	98-16226	O-317-L
California San Diego, University of	Keeling	Ralph	ATM 00-00923	O-204-P/S
California San Diego, University of	Palinkas	Lawrence	00-90343	B-321-M/S
California San Diego, University of	Sprintall	Janet	00-03618	O-260-L
California San Diego, University of	Thiemens	Mark	01-25761	I-165-M/S
California Santa Barbara, University of	Quetin	Langdon	02-17282	B-028-L/P
California Santa Barbara, University of	Smith	Raymond	02-17282	B-032-L/P
California State University Monterey Bay	Kvitek	Rikk	02-29991	B-320-E
Case Western Reserve University	Harvey	Ralph	99-80452	G-058-M
Charleston, University of	DiTullio	Giacomo	02-30513	B-272-M
Chicago, University of	Carlstrom	John	00-94541	A-373-S

Chicago, University of	Carlstrom	John	01-30612	A-379-S
Chicago, University of	MacAyeal	Douglas	02-29546	I-190-M
Chicago, University of	Müller	Dietrich	NSF/NASA agreement	A-125-M
City University of New York/College of Staten Isl.	Veit	Richard	99-83751	B-023-L
Climate Change Institute	Mayewski	Paul	02-29573	I-153-M
Colorado Boulder, University of	Avery	Susan	ATM 00-00957	A-284-S
Colorado Boulder, University of	McKnight	Diane	98-10219	B-421-M
Colorado Boulder, University of	Scambos	Theodore	01-25570	I-186-M
Colorado Boulder, University of	Steffen	Konrad	NASA award	O-309-L
Colorado State University	Wall	Diana	98-10219	B-424-M
Columbia University	Gordon	Arnold	01-25172	O-215-N
Columbia University	Martinson	Douglas	02-17282	B-021-L
Columbia University	Takahashi	Taro	00-03609	O-214-L
Cornell University	Stacey	Gordon	00-94605	A-377-S
Creighton University	Petzel	David	02-29462	B-012-M
Dartmouth College	LaBelle	James	00-90545	A-128-S
Dartmouth College	Lessard	Marc	01-32576	A-136-S
Dartmouth College	Virginia	Ross	98-10219	B-423-M
Delaware, University of	Bieber	John	00-00315	A-120-M/S
Delaware, University of	Gaisser	Thomas	99-80801	A-109-S
Delaware, University of	Marsh	Adam	02-38281	B-029-M
Denver, University of	Murcray	Frank	02-30370	A-255-M/S
Embry Riddle Aeronautical University	Sivjee	Gulamabas	99-09339	A-129-S
Florida, University of	Frazer	Thomas	03-36469 SGER	B-212-E
Georgia Institute of Technology	Eisele	Fred	02-30246	O-176-M/S
Georgia Institute of Technology	Yen	Jeannette	03-24539	B-285-E/L
Georgia, University of	Larson	Edward	.	W-221-M
H.T. Harvey & Associates	Ainley	David	01-25608	B-031-M
Hawaii Manoa, University of	Firing	Eric	98-16226	O-315-N
Hawaii Manoa, University of	Measures	Christopher	02–30445	B-225-L
Hawaii Manoa, University of	Mitchell	B. Greg	02-30445	B-228-L
Idaho, University of	Walden	Von	NASA award	O-213-M
Illinois Chicago, University of	Doran	Peter	98-10219	B-426-M

Illinois Urbana, University of	Blake	Daniel	99-08856	G-065-E
Illinois Urbana, University of	DeVries	Arthur	02-31006	B-005-M
Incorporated Research Institutions for Seismology	Butler	Rhett	EAR 00-04370	G-090-P/S
Kansas Lawrence, University of	Taylor	Edith	01-26230	G-095-M
Kansas Lawrence, University of	Taylor	Edith	02-29877	G-293-M
Magee Scientific Company	Hansen	Anthony	DBI 01-19793	O-314-M
Maine, The University of	Connell	Laurie	01-25611	B-019-M
Maine, The University of	Grew	Edward	02-28842	G-067-E
Maine, The University of	Hall	Brenda	01-24014	I-196-M
Maine, The University of	Hamilton	Gordon	02-29245	I-178-M
Maine, The University of	Kreutz	Karl	02-28052	I-191-M
Maryland, University of	Rosenberg	Theodore	00-03881	A-111-M/S
Maryland, University of	Rosenberg	Theodore	03-34467	A-112-M
Massachusetts, University of	Zhou	Meng	02-29966	B-248-L
Minnesota, University of	Blanchette	Robert	02-29570	B-038-E/M
Minnesota, University of	Goodge	John	02-30280	G-291-M
Montana State University Bozeman	Garrott	Robert	02-25110	B-009-M
Montana State University Bozeman	Priscu	John	MCB 02-37335	B-195-M
Montana State University Bozeman	Priscu	John	98-10219	B-422-M
National Institute of Polar Research	Ejiri	Masaki	U.S./Japan agreement	A-117-S
National Oceanic and Atmospheric Administration	Hofmann	Dave	NOAA/NSF agreement	O-257-S
National Oceanic and Atmospheric Administration	Hofmann	David	NOAA/NSF agreement	O-264-P
National Oceanic and Atmospheric Administration, Southwest Fisheries	Trivelpiece	Wayne	01-25985	B-040-E
National Scientific Balloon Facility (NSBF)	Stepp	William	NSF/NASA agreement	A-145-M
New Mexico Institute of Mining and Technology	Kyle	Philip	02-29305	G-081-M
New York State Department of Health	Bowser	Samuel	02-16043	B-015-M
North Dakota State University	Ashworth	Allan	02-30696	G-294-M
Northeastern University	Detrich	William	01-32032	B-039-N
Northern Carolina, Wilmington, University of	Emslie	Steven	01-25098	B-034-M
Northwestern University	Novak	Giles	01-30389	A-376-S

Oceanites, Inc.	Naveen	Ron	02-30069	B-086-E
Ohio State University	Babcock	Loren	02-29757	G-297-M
Ohio State University	Lyons	W. Berry	02-29836	B-259-M
Ohio State University	Lyons	W. Berry	98-10219	B-420-M
Ohio State University	Wilson	Terry	02-30285	G-079-M
Ohio State University	Wilson	Terry	01-25624	G-099-N
Old Dominion University	Gargett	Ann	01-25818	B-208-N
Oregon, University of	Retallack	Gregory	02-30086	G-299-M
Pennsylvania State University	Anandakrishnan	Sridhar	02-29629	I-205-M
Pennsylvania State University	Sowers	Todd	02-30021	I-177-M
Polar Oceans Group	Fraser	William	02-17282	B-013-L/P
Polar Oceans Group	Fraser	William	01-30525	B-198-P
Portland State University	Fountain	Andrew	98-10219	B-425-M
Rhode Island, University of	Severinghaus	Jeffrey	02-30452	I-184-M
Rochester, University of	Dye	Timothy	01-25893	B-027-M
SETI Institute (Search for Extraterrestrial Intelligence)	Caldwell	Douglas	01-26313	A-103-S
Saint Mary's College of California	Case	Judd	00-03844	G-061-E
San Jose State University	Kim	Stacy	01-26319	B-010-M
Santa Barbara, University California	Luyendyk	Bruce	00-88143	G-152-N
Santa Cruz Institute for Particle Physics	Smith	David	ATM 02-33370	A-144-E/M
Scripps Institution of Oceanography	Hildebrand	John	99-10007	B-239-L
Scripps Institution of Oceanography	Ponganis	Paul	02-29638	B-197-M
Scripps Institution of Oceanography	Tauxe	Lisa	02-29403	G-182-M
Scripps Institution of Oceanography	Vernet	Maria	02-17282	B-016-L/P
Smithsonian Institution	Neale	Patrick	01-27037	B-203-N
Smithsonian Institution	Stark	Antony	01-26090	A-371-S
South Alabama, University of	Kiene	Ronald	02-30497	B-002-N
Stanford University	Fraser-Smith	Antony	01-38126	A-100-M
Stanford University	Inan	Umran	00-93381	A-108-S
Stanford University	Inan	Umran	02-33955	A-306-P
State University of New York Syracuse	Kieber	David	02-30499	B-266-N
Tennessee, University of	Uhle	Maria	02-30237	B-011-M
Texas A & M University	Kennicutt, II	Mahlon	SGER	B-518-M
Texas Austin, University of	Dalziel	Ian	00-03619	G-087-M
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UNAVCO/UCAR	Johns	Bjorn	03413	M
United States Air Force	Kemerait	Robert	NSF/OPP-DoD MOA	G-078-M
United States Department of Energy	Sanderson	Colin	MOU with DOE	O-275-P/S
United States Geological Survey	Mullins	Jerry	02-33246	G-052-M/P/S
Utah State University	Cokinos	Christopher	.	W-223-M
Vanderbilt University	Miller	Molly	01-26146	G-094-M
Virginia Institute of Marine Sciences	Ducklow	Hugh	02-17282	B-045-L/P
Virginia Institute of Marine Sciences	Smith	Walker	00-87401	B-047-M
Washington University	Binns	Walter	NSF/NASA agreement	A-149-M
Washington University	Wiens	Douglas	99-09603	G-089-M
Washington, University of	Conway	Howard	00-87345	I-209-M
Washington, University of	Conway	Howard	00-87144	I-210-M
Washington, University of	Hernandez	Gonzalo	02-29251	A-110-M/S
Washington, University of	Stone	John	02-29314	I-175-M/S
Washington, University of	Warren	Stephen	00-03826	O-201-M
West Florida, University of	Jeffrey	Wade	01-27022	B-200-N
Wisconsin Madison, University of	Halzen	Francis	02-36449, 03-31873	A-333-S
Wisconsin Madison, University of	Morse	Robert	99-80474	A-130-S
Wisconsin Madison, University of	Stearns	Charles	01-26262	O-202-M/P/S
Wisconsin Madison, University of	Stearns	Charles	00-88058	O-283-M/P/S
Woods Hole Oceanographic Institution	Gast	Rebecca	01-25833	B-207-N
Wyoming, University of	Deshler	Terry	02-30424	A-131-M

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003	Day	Thomas	02-30579	Response of terrestrial ecosystems along the Antarctic Peninsula to a changing climate	B-003-P
005	DeVries	Arthur	02-31006	Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution	B-005-M
009	Garrott	Robert	02-25110	Patterns and processes: Dynamics of the Erebus Bay Weddell seal population	B-009-M
010	Kim	Stacy	01-26319	Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic	B-010-M
011	Uhle	Maria	02-30237	Biogeochemistry of Victoria Land coastal ponds: Role in terrestrial ecosystem organic carbon dynamics and structure	B-011-M
012	Petzel	David	02-29462	Drinking and sodium/potasium-ATPase alpha-subunit isoform expression in antarctic fish	B-012-M
013	Fraser	William	02-17282	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	B-013-L/P
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Fahnestock	Mark	I-186-M
Fairhead	V. Anne	B-022-L/P

Faloon	Katrina	I-196-M
Feser	Thomas	A-130-S
Field	Chris	A-145-M
Fielman	Kevin	B-029-M
Filiatrault	Kevin	G-078-M
Finn	Carol	G-291-M
Fisher	Jennifer	B-010-M
Fitzgibbon	Timothy	B-259-M
Flaig	Peter	G-094-M
Fogal	Pierre	A-255-M/S
Foreman	Christine	B-422-M
Forrest	Steven	B-086-E
Forte	Philip	B-005-M
Forte	Philip	B-015-M
Fountain	Andrew	B-425-M
Francis	Jane	G-294-M
Franco	Hugo	A-145-M
Franklin	Linda	B-203-N
Franks	Jill	I-190-M
Fraser	William	B-013-L/P
Frazer	Tom	B-212-E
Frederic Romero-Wolf	Andrew	A-125-M
Gaisser	Thomas	A-109-S
Garcia	Nathan	B-272-M
Gargett	Ann	B-208-N
Garrott	Robert	B-009-M
Gast	Rebecca	B-207-N
Geier	Sven	A-149-M
Geisz	Heidi	B-013-L/P
Gerecht	Eyal	A-371-S
Gerstell	Marguerite	G-071-N
Gille	Sarah	B-228-L
Glass	Alexexander	G-065-E
Glavin	Daniel	G-299-M
Glover	Robert	G-079-M
Goes	Joaquim	B-206-N
Gomes	Helga do Rosario	B-206-N
Gonzalez	Angel	G-052-M/S/P
Goodge	John	G-291-M

Gorham	Peter W	A-149-M
Gottas	Daniel	O-176-M/S
Grant	Donald	G-052-M/S/P
Grant	Donald	G-079-M
Green	James	A-333-S
Green	Kristen	B-028-L/P
Grejner-Brzezinska	Dorota	G-079-M
Grenfell	Thomas	O-201-M
Grew	Edward	G-067-E
Gross	Benjamin	G-071-N
Gurnis	Michael	G-071-E
Habara	Yoshiaki	B-197-M
Hackathorn	Eric	O-257-S
Hadley	Scott	A-145-M
Hadley	Gillian	B-009-M
Hage	Melissa	B-011-M
Hall	Brenda	I-175-M/S
Hall	Brenda	I-196-M
Hallam	Cheryl	G-052-M/S/P
Halter	Bradley	O-213-M
Hammer	William	G-298-M
Hannaford	Terry	A-130-S
Hannaford	Terry	A-333-S
Hansen	Anthony	O-314-M
Harada	Hyakubun	B-002-N
Harnett	Julienne	A-371-S
Harvey	Ralph	G-058-M
Haupt	Alison	B-028-L/P
Hawat	Toufic	A-255-M/S
Hawthorne	Ann	W-224-M
Hedden	Abigail	A-371-S
Heil	Justin	B-197-M
Helbing	Klaus	A-130-S
Hellwig	Marc	A-130-S
Helmig	Detlev	O-176-M/S
Henderson	Randall	A-145-M
Hendy	Chris	I-196-M
Henrys	Stuart	G-099-N
Hernandez	Gonzalo	A-110-M/S
Hewes	Christopher	B-228-L

Hobbie	John	A-145-M
Hoefling	Kevin	B-005-M
Hofstee	Erica	I-196-M
Holder	Steven	A-149-M
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Holzapfel	William	A-378-S
Hopkins	David	B-424-M
Horne	Peter	B-016-L/P
Hothem	Larry	G-079-M
Hothem	Larry	G-052-M/S/P
Howard	Meg	B-011-M
Huber	Bruce	O-215-N
Hudson	Stephen	O-201-M
Huerta	Audrey	G-089-M
Huff	Russel	O-309-L
Hulth	Per Olof	A-130-S
Huss	Leeland	A-144-M/E
Hutterli	Manuel	O-176-M/S
Hyrenbach	David	B-025-E
Hörandel	Jöerg	A-125-M
Iampietro	Pat	B-320-E
Iannuzzi	Richard	B-021-L
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Inan	Umran	A-108-S
Ireland	Darren	B-009-M
Isbell	John	G-094-M
Jackson	Jimmy	G-078-M
Jarnyk	Mark	A-103-S
Jaros	Christopher	B-421-M
Jeffrey	Wade	B-200-N
Jeffries	Martin	O-253-M
Johnson	Wayne	A-125-M
Johnson	Bryan	O-257-S
Johnston	Mark	B-009-M
Joslin	Justin	B-421-M
Joughin	Ian	B-031-M
Joughin	Ian	I-205-M
Jung	Deborah	B-195-M
Jurgens	Joel	B-038-M/E
Kaiser	Amy	B-028-L/P

Karl	Brian	B-031-M
Karle	Albrecht	A-130-S
Kavanaugh	Jeffrey	I-161-M
Keeling	Ralph	O-204-S/P
Kelderhouse	Gary (gak)	A-125-M
Kelley	John	A-333-S
Kelly	Peter	G-081-M
Kendall	Lindsay	B-029-M
Kestel	Martin	A-130-S
Keys	John (Harry) Ross	G-081-M
Khatiwala	Samar	O-215-N
Kieber	David	B-266-N
Kiene	Ronald	B-002-N
Kihm	Allen	G-061-E
Kim	Hyomin	A-136-S
Kim	Stacy	B-010-M
Kim	Young-Jin	I-190-M
Kinoshita	Glen	O-257-S
Klein	Andrew	B-518-M
Klein	Erich	A-145-M
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Knepprath	Nicole	G-094-M
Knight	Kimberly	G-064-M
Knuth	Shelley	O-283-M/S/P
Knuth	Shelley	O-202-M/S/P
Koch	Zelinda	G-094-M
Kokorowski	MIchael	A-144-M/E
Konter	Jasper	G-182-M
Kooi	Jacob	A-371-S
Kooyman	Gerald	B-197-M
Kosciuch	Edward	O-176-M/S
Kovac	John	A-373-S
Kozlowski	Wendy	B-016-L/P
Krahmann	Gerd	O-215-N
Kravchenko	Ilya	A-130-S
Krejny	Megan	A-376-S
Kress	Monika	G-058-M
Kreutz	Karl	I-191-M
Kruger	Kevin	G-298-M
Kuehn	Kyler	A-333-S

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Leaffer	Oren	A-378-S
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Loewenstein	Robert	A-376-S
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Lueuthold	Matthius	A-130-S
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MacDonald	Mikel	G-078-M
Mactutis	Anthony T.	A-110-M/S
Madigan	Michael	B-195-M
Malone	Daniel	B-010-M
Marcelo	Reguero	G-061-E
Marciniewski	Pawel	A-333-S
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Mastromarino	Joe	O-176-M/S
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Miller	Molly	G-094-M

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Moore	John	I-178-M
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Morehead	Sally	B-518-M
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Morris	Kim	O-253-M
Morrison	John	B-012-M
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Morse	Bob	A-333-S
Morse	David	I-161-M
Moss	Joseph	B-200-N
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Mutiso	Charles	A-129-S
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Nam	Jiwoo	A-130-S
Naveen	Ronald	B-086-E
Neale	Patrick	B-203-N
Neumann	Thomas	I-153-M
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Nevitt	Gabrielle	B-035-E
Newcomb	Matthew	A-378-S
Nicholson	John	A-371-S
Nikola	Thomas	A-377-S
Nkem	Johnson	B-424-M
Norman	Shaun	G-299-M
Northrop	Richard	A-125-M
Novak	Giles	A-376-S
Nylen	Thomas	B-425-M
Oakden	James	B-010-M
Oberst	Thomas	A-377-S
Okal	Emile	I-190-M
Okal	Marianne	I-190-M

Olson	John	A-255-M/S
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Orsi	Alejandro	O-215-N
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Osinski	Gordon	G-058-M
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Otis	Pascale	B-005-M
Pace	Leonard	B-029-M
Pakulski	Joseph	B-200-N
Palinkas	Lawrence	B-321-M/S
Palo	Scott	A-284-S
Panter	Kurt	G-081-M
Park	Ji-Hyung	B-003-P
Parker	Tim	I-190-M
Parra	Julie	G-071-E
Parsley	Steven	A-377-S
Paschal	Evans	A-108-S
Patterson	Donna	B-013-L/P
Paulos	Robert	A-333-S
Paulos	Robert	A-130-S
Payne	Joseph	A-112-M
Pelletreau	Karen	B-016-L/P
Peloquin	Jill	B-047-M
Peloquin	Jill	B-203-N
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Pernic	Dave	A-125-M
Pernic	Robert	A-376-S
Pernic	Robert	A-373-S
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Peters	Leo	I-205-M
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Petzel	Anne	B-012-M
Petzel	David	B-012-M
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Ponganis	Paul	B-197-M
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Redinger	Robert	A-145-M
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Reedy	Kathleen	B-321-M/S
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Riley	Paul	A-136-S
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Roberts	Donald	A-145-M
Roberts	Jennifer	G-061-E
Roberts	Stephen	G-090-S/P
Roberts	James	O-176-M/S

Rode	Alycia	G-297-M
Rodriguez	Russell	B-019-M
Rodriguez-Morales	Fernando	A-371-S
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Roland	Norbert	G-291-M
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Roof	Steven	G-294-M
Rose	Julie	B-207-N
Rosen	Marc	A-149-M
Ross	Ronald	I-190-M
Ross	Robin	B-028-L/P
Roth	James	A-333-S
Roth	William	O-213-M
Ruhl	John	A-378-S
Ruhland	Christopher	B-003-P
Sajor	Andrew	G-298-M
Salerno	Jennifer	B-045-P/L
Saltzberg	David	A-149-M
Sample	John	A-144-M/E
Sanders	John	I-161-M
Sanders	Robert	B-207-N
Santora	Jarrod	B-023-L
Sato	Katsufumi	B-197-M
Sattley	William	B-195-M
Savage	Brian	G-071-E
Savarino	Joel	I-165-M/S
Saweny	Safiya	B-029-M
Sawyer	John Foster	G-061-E
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Schneider	Darryn	A-130-S
Schneider	Darryn	A-333-S
Schnetzer	Astrid	B-207-N
Schutt	John	G-058-M
Scofield	Margaret	B-012-M
Scott	Lauren	A-149-M
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Sedwick	Peter	B-272-M
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Sergienko	Olga	I-190-M

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Sheldon	Nathan	G-299-M
Shepanek	Marc	B-321-M/S
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Shore	Patrick	G-089-M
Shulman	Leonard	A-120-M/S
Shultz	Edward	A-333-S
Shulz	Barbara	B-019-M
Sidor	Christian	G-094-M
Simburger	Garry	A-149-M
Simon	Daniel	O-257-S
Sines	Karie	B-016-L/P
Sivjee	Gulamabas	A-129-S
Six	Delphine	O-201-M
Sjostedt	Steven	O-176-M/S
Slezak	Dorothea	B-002-N
Smalley Jr	Robert	G-087-M
Smith	David	A-144-M/E
Smith	Raymond	B-032-L/P
Smith	Walker	B-047-M
Smith	Joseph	B-248-L
Smith	Nathan	G-298-M
Smith	Roger	G-299-M
Smykla	Jerzy	B-034-M
Snels	Marcel	A-131-M
Sniffen	Peter	B-425-M
Sobrino	Cristina	B-203-N
Sowers	Todd	I-177-M
Spencer	Jim	G-087-M
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Stacey	Gordon	A-377-S
Stamatikos	Michael	A-130-S
Stanhope	Jennifer Wu	B-047-M
Staniszewski	Zachary	A-378-S
Stark	Antony	A-371-S
Staudigel	Hubert	G-182-M
Stearns	Leigh	I-178-M
Steffen	Konrad	O-309-L
Stephens	Richard	B-200-N
Stepp	William	A-145-M

Sterling	Rick	A-112-M
Sterling	Karen Henrichs	B-015-M
Stewart	Brent	B-009-M
Stock	Joann	G-071-E
Stockard	Torre (Knower)	B-197-M
Stokstad	Robert	A-130-S
Stone	John	I-175-M/S
Storey	John	A-103-S
Stoyles	Amy	B-019-M
Strauss	Sarah	B-003-P
Stucker	Rebekka	B-423-M
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Sullivan	David	A-145-M
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Sweet	Stephen	B-518-M
Swindle	Timothy	G-058-M
Swordy	Simon	A-125-M
Szela	Tracy	B-029-M
Talley	Shannon	B-028-L/P
Tan	David	O-176-M/S
Tanner	David	O-176-M/S
Tauxe	Lisa	G-182-M
Taylor	Edith	G-293-M
Taylor	Thomas	G-293-M
Taylor	Edith	G-095-M
Taylor	Thomas	G-095-M
Templeton	Mary	I-190-M
Thiemens	Mark	I-165-M/S
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Thom	Jonathan	O-283-M/S/P
Thom	Jonathan	I-190-M
Thoma	Mark	A-125-M
Thomas	Kate	B-320-E
Thomas	Cristina	G-071-E
Thompson	Wayne	G-061-E
Thorson	Phil	B-197-M
Thurnherr	Andreas	O-215-N
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Todd	Claire	I-175-M/S
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Toole	Deirdre	B-266-N
Tothill	Nicolas	A-371-S
Tozzi	Sasha	B-047-M
Tranter	Martyn	B-425-M
Travao	Matthew	B-207-N
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Trivelpiece	Wayne	B-040-E
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Turnipseed	Mary	B-045-P/L
Tutsumi	Masaki	A-117-S
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Ustach	Joseph	B-047-M
Veit	Richard	B-023-L
Venema	Bryan	A-110-M/S
Vernet	Maria	B-016-L/P
Viet	Richard	B-025-E
Vineyard	John	G-090-S/P
Virginia	Ross	B-423-M
Visbeck	Martin	O-215-N
Voigt	Donald	I-205-M
Voigt	Donald	G-089-M
Vukajlovich	Dana	G-071-E
Waddington	Ed	I-209-M
Wagner	Wolfgang	A-130-S
Wakely	Scott	A-125-M
Walden	Von	O-213-M
Waldron	Patricia	B-012-M
Walker	Christopher	A-371-S
Wall	Diana	B-424-M
Wall	Diana	B-259-M
Wang	You-Ren	A-130-S
Wang	Haili	B-228-L
Warren	Stephen	O-201-M
Warshawsky	Mathew	O-176-M/S
Waszkiewicz	Mike	I-191-M
Watson	Timothy	G-089-M

Watts	Jason	B-028-L/P
Weatherwax	Allan	A-128-S
Wefel	John	A-145-M
Weidner	George	O-283-M/S/P
Weiss	Stephanie	B-022-L/P
Weissburg	Marc	B-285-E/L
Welch	Kathleen	B-420-M
White	Bryan	B-016-L/P
White	Emily	B-266-N
Whitney	Michael	A-130-S
Whittaker	Thomas	I-196-M
Wiedemann	Christin	A-130-S
Wiederspahn	Mark	G-099-N
Williamson	Bruce	I-191-M
Willis	Michael	G-079-M
Wilson	Peter	B-031-M
Wilson	Terry	G-079-M
Wilson	Terry	G-099-N
Wilton-Godberfforde	Ruth	A-110-M/S
Winant	Chloe	G-071-E
Winberry	Paul	I-205-M
Winter	Brian	G-081-M
Winters	Wade	G-061-E
Wise	Nathan	A-145-M
Witherow	Rebecca	B-420-M
Wright	Gregory	A-371-S
Wuite	Jan	G-079-M
Wumkes	Mark (Tony)	I-184-M
Ye	Shengyi	A-128-S
Yen	Jeannette	B-285-E/L
Yochem	Pamela	B-009-M
Yoshida	Shigeru	A-333-S
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2003-2004 USAP Field Season

Teachers Experiencing Antarctica and the Arctic (TEA)

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NSF Contact:

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List of 2003-2004 teachers and the science projects they are joining

For information about each teacher, visit http://tea.rice.edu

Teachers Experiencing Antarctica and the Arctic is sponsored by NSF Office of Polar Programs and the Division of Elementary, Secondary, and Informal Education in the Directorate of Education and Human Resources. It is facilitated by Rice University, the Cold Regions Research and Engineering Laboratory, and the American Museum of Natural History.

Candidates are nominated by principal investigators or by themselves. Selections are made in a competitive process. Awardees travel to Antarctica and become working members of research teams. Principal investigators volunteer to accept TEAs on their teams.

TEA is part of the NSF's strategy to integrate research and education in an effort to infuse education with the joy of discovery and an awareness of its connections to exploration. The program's goals are to immerse teachers in research as part of their professional development, to bring polar research into the classroom in engaging ways, to underscore the societal relevance of science and the scientific process, and to maintain a lively community among researchers, teachers, students, and school districts.

NSF funds the extra of supporting teachers including: ·

- A substitute while the teacher is away ·
- Travel to the investigator's institution before the trip ·
- Travel by the teacher to Antarctica ·
- Travel by the investigator to the teacher's school district for joint presentations

This is an exciting program that offers benefits to the research team, the teacher, the classroom, and K-12 students both present and future. Teachers and school districts can find more information at http:tea.rice.edu.

Teacher	School	Event Number	Principal Investigator	Project
Michael Lampert	West Salem High School Salem, OR	A-131-M	Terry Deshler	Measurements addressing quantitative ozone loss ,polar stratospheric Cloud Nucleation, and large polar stratospheric particles duinrg austral winter and spring
Andres Sajor	Peru Central School Peru, NY	G-298-M	William Hammer	Vertebrate Paleontology of the Triassic to Jurassic Sequence in the Beardmore Glacier Area of Antarctica
Coleen Brogenski	St. John's School Houston, TX	G-081-M	Philip Kyle	Mount Erebus Volcano Observatory and Laboratory (MEVOL)
Robin Ellwood	Rye Junior High School Rye, NH	B-426-M	Peter Doran	McMurdo Dry Valleys LTER: The role of natural legacy on ecosystem structure and function in a polar desert
Amy Stoyles	Harlee Middle School Bradenton, FL	B-019-M	Laurie Connell	Yeasts in the Antarctic Dry Valleys: Biological Role, Distribution, and Evolution
Susy Ellison	Yampah Mountain High School Glenwood Springs, CO	B-009-M	Bob Garrott	Patterns and Processes: Dynamics of the Erebus Bay Weddell Seal Population

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2003-2004 USAP Field Season

Scouting in Antarctica

NSF Contact:
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National Science Foundation
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Arlington, VA 22230
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gguthrid@nsf.gov

Cooperative programs between the National Science Foundation and America's two major scouting organizations -- Girl Scouts of the USA and Boy Scouts of America -- sponsor a national competition every two years to select a scout for participation in the U.S. Antarctic Program.

The goal is to acquaint the boy or girl scout with a variety of science disciplines and with career opportunities in polar research and operational support. The scout, through scouting publications and sites on their home pages, shares his or her Antarctic experience with the many other members of the two scouting groups. Inclusion of a scout in the USAP began when Paul Siple joined Richard E. Byrd's expedition 70 years ago.

For the 2003-2004 season, Boy Scout Brad Range of Marietta, Georgia, has been selected. Mr. Range has completed the freshman year at the Georgia Institute of Technology, where he is majoring in mechanical engineering. He graduated from Alan C. Pope High School in 2002, where he developed an interest in science, played several musical instruments, was a member of Academic Bowl and the National Honor Society, studied chaos theory, researched liquid crystal displays, built and tested logic circuits, and surveyed watershed environments while achieving 21 merit badges to earn the rank of Eagle Scout. Also as a Scout, he served as chaplain aide and senior patrol leader, and he now volunteers as an assistant scoutmaster.

Mr. Range will work at McMurdo, South Pole, and camps, and aboard Nathaniel B. Palmer from August 2003 to April 2004. He will join science and engineering events whose PIs or project leaders have volunteered to integrate him into their teams for a week or more each, beginning with measurements of polar stratospheric clouds, condensation nuclei, and ozone and ending with study of continental slope morphology.

Brad Range
4660 Three Springs Court
Marietta, Georgia 30062

Next season, the opportunity will go to a Girl Scout.

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NSF Contact:

Peter West, Public Affairs Officer
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Each year the National Science Foundation selects a limited number of journalists to visit USAP research stations and report on the scientific work being done. The program's goal is inform American taxpayers about the publicly supported program. Without NSF support, these visits would be difficult or impossible since there is no commercial transportation to the continent or within it.

Public affairs officers from NSF's Office of Legislative and Public Affairs (OLPA) assist reporters during their stay in Antarctica. Many reporters maintain their interest in the program for years after they visit the southernmost continent. A reporter may join a research cruise or spend an extended time at a field camp. They may focus on research in a particular discipline, pursue a broader interest in the science program as a whole, or concentrate on a specific project taking place that season.

The Antarctic "group media tour" of the past has been replaced by individual visits, and there are many more requests than can be met. Journalists apply to the program by proposing a reporting plan based on ideas often developed in conjunction with OLPA's staff. Candidates are selected on a competitive basis by a committee drawn from OLPA and the Office of Polar Programs (OPP). The program is open to media professionals and representatives from a variety of media may be selected in a given year.

Media visitors for the 2003-2004 field season have not yet been selected.

Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
B-031-M	01-25608	Ainley	David	Geographic structure of Adelie penguin populations: Demography of population expansion
I-205-M	02-29629	Anandakrishnan	Sridhar	Tidal modulation of ice stream flow
W-219-M/S	.	Armstrong	Jennifer	Ice Through the Ages: A nonfiction young adult book
G-294-M	02-30696	Ashworth	Allan	Terrestrial paleoecology and sedimentary environment of the Meyer Desert Formation, Beardmore Glacier, Transantarctic Mountains
G-297-M	02-29757	Babcock	Loren	Paleobiology and taphonomy of exceptionally preserved fossils from Jurassic Lacustrine deposits, Beardmore Glacier area and southern Victoria Land, Antarctica
W-220-M	.	Baskin	Yvonne	Soil biodiversity book
A-120-M/S	00-00315	Bieber	John	Spaceship Earth: Probing the solar wind with cosmic rays
A-149-M	NSF/NASA agreement	Binns	Walter	Trans-Iron Galactic Element Recorder (TIGER) / ANITA-lite
B-015-M	02-16043	Bowser	Samuel	Remotely operable micro-environmental observatory for antarctic marine biology research
W-223-M	.	Cokinos	Christopher	The fallen sky: Eccentrics and scientists in pursuit of shooting stars
B-019-M	01-25611	Connell	Laurie	Yeasts in the antarctic Dry Valleys: Biological role, distribution, and evolution
W-224-M	.	Conrad	Lawrence (Larry)	Field guide to antarctic features: McMurdo Sound region
I-209-M	00-87345	Conway	Howard	Western divide WAISCORES site selection
I-210-M	00-87144	Conway	Howard	Glacial history of Ridge AB
I-161-M	01-25579	Cuffey	Kurt	Dynamics and climatic response of the Taylor Glacier system.
G-087-M	00-03619	Dalziel	Ian	A GPS network to determine crustal motions in the bedrock of the West Antarctic Ice Sheet (WAIS)
B-005-M	02-31006	DeVries	Arthur	Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution
A-131-M	02-30424	Deshler	Terry	Measurements addressing quantitative ozone loss, polar stratospheric cloud nucleation, and large polar stratospheric particles during austral winter and spring
B-272-M	02-30513	DiTullio	Giacomo	Iron and light effects on Phaeocystis antarctica isolates from the Ross Sea
B-426-M	98-10219	Doran	Peter	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

B-027-M	01-25893	Dye	Timothy	Culture and health in Antarctica
O-253-M	01-26007	Eicken	Hajo	Measurements and improved parameterizations of the thermal conductivity and heat flow through first-year sea ice
O-176-M/S	02-30246	Eisele	Fred	Antarctic Troposphere Chemistry Investigation (ANTCI)
B-034-M	01-25098	Emslie	Steven	Occupation history and diet of Adélie penguins in the Ross Sea region
A-102-M/S	02-33169	Engebretson	Mark	Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites
B-425-M	98-10219	Fountain	Andrew	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
A-100-M	01-38126	Fraser-Smith	Antony	The Operation of an ELF/VLF Radiometer at Arrival Heights, Antarctica
B-009-M	02-25110	Garrott	Robert	Patterns and processes: Dynamics of the Erebus Bay Weddell seal population
G-291-M	02-30280	Goodge	John	Geophysical mapping of the east antarctic shield adjacent to the Transantarctic Mountains
I-196-M	01-24014	Hall	Brenda	Millennial-scale fluctuations of Dry Valleys lakes: A test of Implications for regional climate variability and the interhemispheric (a)synchrony of climate change
I-178-M	02-29245	Hamilton	Gordon	Glaciology of blue ice areas in Antarctica
G-298-M	02-29698	Hammer	William	Vertebrate Paleontology of the Triassic to Jurassic sedimentary sequence in the Beardmore Glacier area of Antarctica
O-314-M	DBI 01-19793	Hansen	Anthony	Solar/wind powered instrumentation module development for polar environmental research
G-058-M	99-80452	Harvey	Ralph	The Antarctic Search for Meteorites (ANSMET)
A-110-M/S	02-29251	Hernandez	Gonzalo	Austral high-latitude atmospheric dynamics
G-295-M	EAR 99-03413	Johns	Bjorn	University NAVSTAR Consortium (UNAVCO) GPS survey support
G-078-M	NSF/OPP-DoD MOA	Kemerait	Robert	Dry Valley seismic project
B-518-M	SGER	Kennicutt, II	Mahlon	Spatial and temporal scales of human disturbance
B-010-M	01-26319	Kim	Stacy	Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic
I-191-M	02-28052	Kreutz	Karl	Dry Valleys Late Holocene climate variability
B-320-E	02-29991	Kvitek	Rikk	Victoria Land latitudinal gradient project: Benthic marine habitat characterization
G-081-M	02-29305	Kyle	Philip	Mount Erebus Volcano Observatory and Laboratory (MEVOL)
W-221-M	.	Larson	Edward	History of science in Antarctica
B-259-M	02-29836	Lyons	W. Berry	Soil biodiversity and response to climate change: A regional comparison of Cape Hallett and Taylor Valley
				McMurdo Dry Valleys Long Term Ecological Research (LTER): The

B-420-M	98-10219	Lyons	W. Berry	role of natural legacy on ecosystem structure and function in a polar desert
I-190-M	02-29546	MacAyeal	Douglas	Collaborative research of Earth's largest icebergs
B-029-M	02-38281	Marsh	Adam	Genomic networks for cold-adaptation in embryos of polar marine invertebrates
I-153-M	02-29573	Mayewski	Paul	A science management office for the United States component of the International Trans Antarctic Scientific Expedition (ITASE) -- South Pole to Northern Victoria Land
B-421-M	98-10219	McKnight	Diane	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
G-094-M	01-26146	Miller	Molly	Late Paleozoic-Mesozoic fauna, environment, climate, and basinal history: Beardmore Glacier area, Tranantarctic Mountains
A-255-M/S	02-30370	Murcray	Frank	Infrared measurements of atmospheric composition over Antarctica
A-125-M	NSF/NASA agreement	Müller	Dietrich	Tracer-Lite II: Transition Radiation Array for Cosmic Energetic Radiation, a balloon borne instrument
B-321-M/S	00-90343	Palinkas	Lawrence	Prevention of environment-induced decrements in mood and cognitive performance
B-012-M	02-29462	Petzel	David	Drinking and sodium/potasium-ATPase alpha-subunit isoform expression in antarctic fish
B-197-M	02-29638	Ponganis	Paul	Diving physiology and behavior of emperor penguins
B-195-M	MCB 02-37335	Priscu	John	Microbial diversity and function in the permanently ice-covered lakes of the McMurdo Dry Valleys
B-422-M	98-10219	Priscu	John	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
G-064-M	01-25194	Renne	Paul	Calibration of cosmogenic argon production rates in Antarctica
G-299-M	02-30086	Retallack	Gregory	Permian-Triassic mass extinction in Antarctica
A-111-M/S	00-03881	Rosenberg	Theodore	Riometry in Antarctica and conjugate region
A-112-M	03-34467	Rosenberg	Theodore	Polar Experiment Network for Geophysical Upper-Atmospheric Investigations (PENGUIN)
I-186-M	01-25570	Scambos	Theodore	Characteristics of snow megadunes and their potential effects on ice core interpretation
I-184-M	02-30452	Severinghaus	Jeffrey	How thick is the convective zone?: A study of firn air in the megadunes near Vostok
B-047-M	00-87401	Smith	Walker	Interannual variability in the Antarctic-Ross Sea (IVARS): Nutrients and seasonal production
I-177-M	02-30021	Sowers	Todd	Refining a 500-thousand-year climate record from the Mt. Moulton blue ice field in West Antarctica
A-145-M	NSF/NASA agreement	Stepp	William	Long Duration Balloon Program (LDB)
I-175-M/S	02-29314	Stone	John	Late Quaternary history of Reedy Glacier
G-182-M	02-29403	Tauxe	Lisa	Geomagnetic field as recorded in the Mount Erebus Volcanic Province: Key to field structure at high southern latitudes

G-095-M	01-26230	Taylor	Edith	Permian and Triassic floras from the Beardmore Glacier region: Icehouse to greenhouse?
G-293-M	02-29877	Taylor	Edith	Shackleton Glacier area: Evolution of vegetation during the Triassic
I-165-M/S	01-25761	Thiemens	Mark	South Pole Atmospheric Nitrate Isotopic Analysis (SPANIA)
B-011-M	02-30237	Uhle	Maria	Biogeochemistry of Victoria Land coastal ponds: Role in terrestrial ecosystem organic carbon dynamics and structure
B-423-M	98-10219	Virginia	Ross	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
O-213-M	NASA award	Walden	Von	Validation of the Atmospheric Infrared Sounder (AIRS) over the Antarctic Plateau
B-424-M	98-10219	Wall	Diana	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert
O-201-M	00-03826	Warren	Stephen	Solar radiation processes on the East Antarctic Plateau
G-089-M	99-09603	Wiens	Douglas	A broadband seismic experiment to investigate deep continental structure across the east-west Antarctic boundary
G-079-M	02-30285	Wilson	Terry	Transantarctic Mountains deformation network: GPS measurements of neotectonic motion in the antarctic interior

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2003-2004 USAP Field Season

Amundsen-Scott South Pole Station

Table of Contents | List projects by PI | List projects by program | List projects by institution | List projects by station | List projects by event number digits | List deploying team members

Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
W-219-M/S	.	Armstrong	Jennifer	Ice Through the Ages: A nonfiction young adult book
A-284-S	ATM 00-00957	Avery	Susan	Dynamics of the antarctic mesosphere-lower-thermosphere (MLT) region using ground-based radar and TIMED instrumentation
A-120-M/S	00-00315	Bieber	John	Spaceship Earth: Probing the solar wind with cosmic rays
G-090-P/S	EAR 00-04370	Butler	Rhett	IRIS - Global Seismograph Station at South Pole
A-103-S	01-26313	Caldwell	Douglas	A search for extrasolar planets from the South Pole
A-373-S	00-94541	Carlstrom	John	Degree Angular Scale Interferometer (DASI)
A-379-S	01-30612	Carlstrom	John	South Pole observations to test cosmological models
O-176-M/S	02-30246	Eisele	Fred	Antarctic Troposphere Chemistry Investigation (ANTCI)
A-117-S	U.S./Japan agreement	Ejiri	Masaki	All-Sky imager at South Pole
A-102-M/S	02-33169	Engebretson	Mark	Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites
A-109-S	99-80801	Gaisser	Thomas	South Pole Air Shower Experiment - SPASE 2
A-333-S	02-36449, 03-31873	Halzen	Francis	IceCube
A-110-M/S	02-29251	Hernandez	Gonzalo	Austral high-latitude atmospheric dynamics
O-257-S	NOAA/NSF agreement	Hofmann	Dave	South Pole monitoring for climatic change: U.S. Department of Commerce NOAA Climate Monitoring and Diagnostic Laboratory
A-378-S	02-32009	Holzapfel	William	High-resolution obervations of the cosmic microwave background (CMB) with ACBAR
A-108-S	00-93381	Inan	Umran	A very-low-frequency (VLF) beacon transmitter at South Pole (2001-2004)
O-204-P/S	ATM 00-00923	Keeling	Ralph	A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems
A-128-S	00-90545	LaBelle	James	A versatile electromagnetic waveform receiver for South Pole Station
A-033-S	02-30438	Lange	Andrew	Background Imaging of Cosmic Extragalactic Polarization (BICEP): An experimental probe of inflation
A-136-S	01-32576	Lessard	Marc	Measurement and analysis of extremely-low-frequency (ELF) waves at South Pole Station
A-104-S	02-30428	Mende	Stephen	Dayside auroral imaging at South Pole
A-130-S	99-80474	Morse	Robert	Antarctic Muon And Neutrino Detector Array (AMANDA)

A-255-M/S	02-30370	Murcray	Frank	Infrared measurements of atmospheric composition over Antarctica
A-376-S	01-30389	Novak	Giles	Mapping galactic magnetic fields with SPARO
B-321-M/S	00-90343	Palinkas	Lawrence	Prevention of environment-induced decrements in mood and cognitive performance
A-111-M/S	00-03881	Rosenberg	Theodore	Riometry in Antarctica and conjugate region
O-275-P/S	MOU with DOE	Sanderson	Colin	Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab
A-129-S	99-09339	Sivjee	Gulamabas	Effects of enhanced solar disturbances during the 2000-2002 solar-max period on the antarctic mesosphere-lower-thermosphere (MLT) and F regions composition, thermodynamics and dynamics
A-377-S	00-94605	Stacey	Gordon	Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on AST/RO
A-371-S	01-26090	Stark	Antony	Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)
I-175-M/S	02-29314	Stone	John	Late Quaternary history of Reedy Glacier
I-165-M/S	01-25761	Thiemens	Mark	South Pole Atmospheric Nitrate Isotopic Analysis (SPANIA)

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Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
B-022-L/P	01-25181	Amsler	Charles	The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula
W-218-P	.	Bledsoe	Lucy	Palmer Station children's novel
G-090-P/S	EAR 00-04370	Butler	Rhett	IRIS - Global Seismograph Station at South Pole
B-003-P	02-30579	Day	Thomas	Response of terrestrial ecosystems along the Antarctic Peninsula to a changing climate
B-045-L/P	02-17282	Ducklow	Hugh	Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-013-L/P	02-17282	Fraser	William	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-198-P	01-30525	Fraser	William	Monitoring the human impact and environmental variability on Adelie Penguins at Palmer Station
O-264-P	NOAA/NSF agreement	Hofmann	David	Collection of atmospheric air for the NOAA/CMDL worldwide flask sampling network
A-306-P	02-33955	Inan	Umran	Global thunderstorm activity and its effects on the radiation belts and the lower ionosphere
O-204-P/S	ATM 00-00923	Keeling	Ralph	A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems
B-028-L/P	02-17282	Quetin	Langdon	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
O-275-P/S	MOU with DOE	Sanderson	Colin	Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab
B-032-L/P	02-17282	Smith	Raymond	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-016-L/P	02-17282	Vernet	Maria	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

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Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
B-039-N	01-32032	Detrich	William	ICEFISH 2003: International collaborative expedition to collect and study fish indigenous to sub-antarctic habitats
O-315-N	98-16226	Firing	Eric	Shipboard acoustic Doppler current profiling aboard the research vessel Nathaniel B. Palmer
B-208-N	01-25818	Gargett	Ann	Interactive effects of UV and Vertical mixing on phytoplankton and bacterioplankton in the Ross Sea
B-207-N	01-25833	Gast	Rebecca	Comparative and quantitative studies of protistan molecular ecology and physiology in coastal antarctic waters
B-206-N	01-26150	Goes	Joaquim	Ultraviolet-radiation-induced changes in the patterns of production and composition of biochemical compounds antarctic marine phytoplankton
O-215-N	01-25172	Gordon	Arnold	ANSLOPE: Cross slope exchanges at the antarctic slope front
B-200-N	01-27022	Jeffrey	Wade	POTATOE: Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects (MOAT)
B-266-N	02-30499	Kieber	David	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea
B-002-N	02-30497	Kiene	Ronald	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea, Antarctica
G-152-N	00-88143	Luyendyk	Bruce	Antarctic cretaceous-Cenozoic climate, glaciation, and tectonics: Site surveys for drilling from the edge of the Ross Ice Shelf
B-203-N	01-27037	Neale	Patrick	Interactive effects of UV radiation and vertical mixing on phytoplankton and bacterioplankton in the Ross Sea
G-071-N	01-26334	Stock	Joann	Improved Cenozoic plate reconstructions of the circum-Antarctic Region
G-099-N	01-25624	Wilson	Terry	Neotectonic structure of Terror Rift, Western Ross Sea

2003-2004 USAP Field Season
Research Vessel Laurence M Gould

(RV LMG)

Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
B-022-L/P	01-25181	Amsler	Charles	The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula
O-317-L	98-16226	Chereskin	Teresa	Shipboard acoustic Doppler current profiling aboard the research vessel Laurence M. Gould
B-045-L/P	02-17282	Ducklow	Hugh	Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-013-L/P	02-17282	Fraser	William	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-239-L	99-10007	Hildebrand	John	Mysticete whale acoustic census in the GLOBEC west antarctic project area
B-021-L	02-17282	Martinson	Douglas	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-225-L	02–30445	Measures	Christopher	Plankton community structure and iron distribution in the southern Drake Passage
B-228-L	02-30445	Mitchell	B. Greg	Plankton community structure and iron distribution in the southern Drake Passage
B-028-L/P	02-17282	Quetin	Langdon	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-032-L/P	02-17282	Smith	Raymond	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
O-260-L	00-03618	Sprintall	Janet	The Drake Passage high density XBT/XCTD program
O-309-L	NASA award	Steffen	Konrad	AMSR sea ice validation during the R/V Laurence M. Gould's traverse to Antarctica
O-214-L	00-03609	Takahashi	Taro	Mesoscale, seasonal and inter-annual variability of surface water CO2 in the Drake Passage
B-023-L	99-83751	Veit	Richard	Dynamics of predator-prey behavior in the Antarctic Ocean
B-016-L/P	02-17282	Vernet	Maria	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment
B-248-L	02-29966	Zhou	Meng	Plankton community structure and iron distribution in the southern Drake Passage

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Four USAP-supported Antarctic deep-field camps will be used by McMurdo-based researchers.

Byrd Surface Camp

80° 05' S, 119° 32' W

Byrd Surface Camp will support Ian Dalziel (G-087-M). One resident contract staff will operate this camp.

Beardmore Glacier Camp

84° 00’ S, 160° 30’ E

Beardmore Glacier Camp will support six science groups: Allan Ashworth (G-294-M), Loren Babcock (G-297-M), Bill Hammer (G-298-M), Molly Miller (G-094-M), Greg Retallack (G-299-M), and Edith Taylor (G-295-M). The camp will operate as a logistical hub for helicopter and twin otter operations. Six resident contract staff will operate this camp.

Moody Nunatak Camp

83° 07’ S, 159° 30’ E

Moody Nunatak Camp will support two science groups: John Goodge (G-291-M) and Molly Miller (G-094-M). The camp will operate as a logistical hub for helicopter and twin otter operations. Four resident contract staff will operate this camp.

Megadunes Camp

80° 30’ S, 125° 00’ E

Megadunes Camp will support two science groups Ted Scambos (G-186-M) and Jeff Severinghaus (G-184-M). Two resident contract staff will operate this camp..

Light Ground Traverse (LGT)

The Light Ground Traverse is a traverse over land from South Pole to Taylor Dome via AGO-4, TAMSEIS camp, and Megadunes. This traverse will support four science groups Paul Mayewski (I-153-M), Ted Scambos (I-186-M), Jeff

Severinghouse (I-184-M and Doug Wiens (G-089-M). Five contract staff will operate this traverse.

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2003-2004 Field Season

McMurdo Station Air Operations

McMurdo-based aircraft (Helicopters, Twin Otter and LC-130 fixed-wing aircraft) will continue to support USAP researchers and program logistical functions.

Petroleum Helicopters Inc. (PHI) will provide helicopter support with four helicopters (two AS-350-B2 “A-Stars” and two Bell 212s) based out of McMurdo station. They will support researches in the McMurdo Dry Valleys, Royal Society Range and on Ross Island.

http://www.phihelico.com/

New York Air National Guard will provide re-supply and research support to South Pole Station. They will support research activities at Siple Dome, Byrd Surface Camp, TAMSEIS Camp, Megadunes Camp, Beardmore Glacier Camp, Moody Nunatak Camp, and Mount Moulton.

http://www-105aw.ang.af.mil/

Twin Otter aircraft, operated by Kenn Borek Air will be used by a number of projects throughout the USAP area of operations.

http://www.borekair.com/

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2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-031-M
NSF/OPP 01-25608
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Cape Crozier, Cape Royds, Cape Bird, Beaufort Islands, Franklin Island, Terra Nova Bay, Ross Island, McMurdo Station
Dates in Antarctica: Mid November to early February

Geographic structure of Adelie penguin populations: Demography of population expansion

Dr. David G. Ainley
H.T. Harvey & Associates
dainley@harveyecology.com
http://www.penguinscience.com

Geographic structure of Adelie Penguin populations: demography of population expansion

Deploying Team Members: David G. Ainley . Grant Ballard . Louise Blight . Willie Cook . Katie Dugger . Ian R. Joughin . Brian J. Karl . Rachael Orben . Pascale Otis . Viola Toniolo . Peter Wilson

Research Objectives: This group investigates the mechanisms responsible for the geographic structuring, the founding of new colonies, and the recent population expansion of the Adélie penguins of Ross and Beaufort Islands. Similar expansion has been occurring throughout the Ross Sea, where 30 percent of the world population of this species resides, and is in some way related to ameliorating climate. So far they have been examining:

+ The relative importance of resources that constrain colony growth (the amount of nesting habitat versus access to food)

+ Aspects of natural history that might be affected by exploitative or interference competition among neighboring colonies (breeding success and foraging effort)

+ Climatic factors that influence the latter, especially extent and concentration of sea ice

+ Behavioral mechanisms that influence colony growth as a function of initial size and location, emigration, and immigration.

None of the colonies are limited by nesting space, and the researchers have shown how sea ice extent and concentration affect diet, foraging effort, and winter survival. In addition, large colonies affect the foraging patterns of smaller ones within range and, perhaps, ultimately their size. The rate and direction of emigration also appear to be constrained by sea ice conditions, with reasonable concentrations of ice favoring growth of smaller colonies where foraging competition is minimal. Yet to be determined is the demographic mechanism of colony growth (or decline). Reproductive success does not appear to be important, however.

Using seven cohorts of marked penguins from each colony, researchers will assess juvenile survival, recruitment age, and age-specific fecundity and subsequent survival. These data will be compared with another demographic study, the only one for this species, conducted at Cape Crozier during the 1960s and 1970s when populations were declining.

Information will be related to sea ice as quantified by satellite images. Global climate is changing fastest in the polar regions. The Adélie penguin is tied to sea ice, a primary factor in rapid polar climate change (less sea ice, less reflection of solar energy). The extreme sensitivity of these penguins to climate change has been often noted. Understanding the demographic mechanisms behind this sensitivity will contribute greatly to knowledge of the effects of climate change on antarctic marine organisms.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-022-L/P

NSF/OPP 01-25181

Station: R/V Laurence M. Gould, Palmer Station

RPSC POC: Rob Edwards

Research Site(s): R/V Laurence M. Gould, Drake Passage, Palmer Station

Dates in Antarctica:

The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula

Dr. Charles D. Amsler
University of Alabama Birmingham
Department of Biology
amsler@uab.edu
http://www.uab.edu/uabbio/s022/

A project dive team (2 divers, 2 tenders) in Hero Inlet on their way to a dive site. Photo by Maggie Amsler.

Deploying Team Members: Margaret D. Amsler . Charles D. Amsler Jr . Bill J. Baker . V. Anne Fairhead . James B. McClintock . Kevin J. Peters . Stephanie T. Weiss

Research Objectives: Many organisms are not mobile and so cannot escape from predators. One way they can keep from being eaten is to make themselves unappetizing by producing defensive chemicals known as secondary metabolites. However, the energy and other resources that go into making these compounds could instead have gone into growth or reproduction. This group studies the evolution of these tradeoffs in an effort to understand ways that organisms maximize the usefulness of their investments in defensive chemistry.

For marine plants, the environment of Antarctica is very different from most other places in the world's oceans because nutrients are plentiful but light is often limited. So the "currency" that "pays" for defense, growth, and reproduction is different than for plants in most other marine communities. This allows researchers to test theories about the costs and benefits of defense in ways not possible elsewhere in the world.

For marine animals, Antarctica is unique in that predation by sea stars is much more important than in other marine communities. Sea stars feed by extending their stomachs and digesting prey outside their bodies. These researchers predict that this should lead to a much higher investment in defensive metabolites in the outer layers of the prey. One of the main goals for the 2002–2003 season will be to test the hypothesis that sponges (a very important component of these communities) will maximize their investment in chemical defense by having the highest levels of defensive secondary metabolites in their outermost layers.

This research should also advance our general understanding of the evolution of chemical defenses. This group hopes to elucidate the nature and role of bioactive agents in the ecology of the antarctic marine benthos (that is, organisms living at the bottom of marine environments).

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-205-M **NSF/OPP** 02-29629

Station: McMurdo Station
RPSC POC: Charles Kaminski
Research Site(s): Siple Coast
Dates in Antarctica: Late October to late January

Tidal modulation of ice stream flow

Dr. Sridhar Anandakrishnan

Pennsylvania State University
Department of Geosciences and Environment Institution
sak@essc.psu.edu
http://www.geosc.psu.edu/~sak/Tides

Photo not available.

Deploying Team Members: Robert A. Bindschadler . Sarah Das . Ian R. Joughin . Leo Peters . Donald E. Voigt . Paul Winberry

Research Objectives: We will investigate the new-found, startling sensitivity of major west antarctic ice streams to tidal oscillations in order to learn the extent and character of the effect and its ramifications. Ice streams D, C, and Whillans (B) all show strong but distinct tidal signals. The ice plain of Whillans is usually stopped outright, forward motion being limited to two brief periods a day, at high tide and on the falling tide. Motion propagates across the ice plain at seismic wave velocities. Near the mouth of D, tides cause a diurnal variation of about 50 percent in ice-stream speed that propagates upglacier more slowly than on Whillans, and seismic data show that C experiences even slower upglacier propagation of signals. Tidal influences are observed more than 100 kilometers (km) upglacier on C and more than 40 km upglacier on D and may be responsible for fluctuations in basal water pressure reported 400 km upstream on Whillans.

During the first year, five coordinated seismic and global positioning system (GPS) instrument packages placed 100 kilometers apart on each stream will measure Whillans and ice stream D.

These packages will be deployed at sites selected by satellite imagery and will operate autonomously for two lunar cycles to study the sensitivity of the streams to spring and neap tides. Also, we will examine existing data sets for clues to the mechanisms involved and develop preliminary models.

During the second and third seasons, we will examine in greater detail the tidal behavior of Whillans and D. We will especially focus on at least one source area for Whillans, assuming that areas inferred from preliminary data remain active. Vertical motions have not yet been detected, but differential GPS will increase sensitivity. Seismic instrumentation will greatly increase temporal resolution and the ability to measure the propagation speed and any spatial heterogeneity.

Improved knowledge of ice-stream behavior will contribute to assessing the potential for rapid ice-sheet change affecting global sea levels. Results will be disseminated through scientific publications and talks at professional meetings, as well as contacts with the press, university classes, visits to schools and community groups, and other activities.

2003-2004 USAP Field Season

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-219-M/S **NSF/OPP** .

Station: McMurdo Station, South Pole Station

RPSC POC: Elaine Hood

Research Site(s): Dry Valleys, West Antarctic Ice Sheet

Dates in Antarctica: Early December to late January

Ice Through the Ages: A nonfiction young adult book

Ms. Jennifer M. Armstrong
sendtojma@aol.com

Ice Through the Ages: A nonfiction young adult book

Deploying Team Members: Jennifer M. Armstrong

Research Objectives: Ms. Armstrong will visit sites at the South Pole, Dry Valleys, and West Antarctica to investigate how scientists use ice in research, either as a tool or as a subject. The book will weave the history of ice in culture, language, art, science, technology, and ethnography into her narratives on the Antarctic ice projects.

Ms. Armstrong won, in 1999, the Orbis Pictus Award for Excellence in Nonfiction for Children for her book, Shipwreck at the Bottom of the World.

Ms Armstrong will make day trips and some overnight trips to areas surrounding McMurdo to observe science. She will spend one week at the South Pole.

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-294-M **NSF/OPP** 02-30696

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Beardmore Glacier, McMurdo Station
Dates in Antarctica: Mid November to late December

Terrestrial paleoecology and sedimentary environment of the Meyer Desert Formation, Beardmore Glacier, Transantarctic Mountains

Dr. Allan Ashworth
North Dakota State University
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Photo not available.

Deploying Team Members: Allan Ashworth . David J. Cantrill . Jane Francis . Forrest McCarthy . Steven Roof

Research Objectives: Terrestrial fossils recovered from the Meyer Desert Formation are providing paleoclimatic information about the interior of Antarctica before the growth of the great ice sheets. The site is located on the Upper Beardmore Glacier, about 500 kilometers from the South Pole. Southern beech wood and leaves were discovered many years ago, but since 1995, the fossils have included the seeds of several species of vascular plants, including buttercups; the stems and leaves of several species of mosses; body parts of beetles; a puparium of a higher fly; shells of freshwater mollusks; valves of an ostracod; and a fish tooth. The largest fossils at the site are cushions of vascular plants buried in their growth positions by sediments of glacial outwash. These sediments were deposited in stream channels and shallow pools associated with moraines that had been colonized by tundra-like vegetation harboring insects and mollusks. The fossils provide the best evidence so far of how much heat the atmosphere near the South Pole can hold.

Although the fossils are fragmentary, they are more closely related to living terrestrial and freshwater organisms than any other fossils found in Antarctica. They are most probably the direct descendants of an ancient biota that was part of Gondwanaland. Until the discovery of the Meyer Desert Formation, no fossils of terrestrial organisms, except for pollen and spores, were available to answer questions about the evolutionary relationships between organisms distributed in southern South America, Australia, New Zealand, and the subantarctic islands.

We will revisit the Meyer Desert Formation to locate and sample new fossiliferous horizons, construct an accurately scaled and correlated cross-section of the complex facies, and collect samples for a pilot project to date the deposits directly. Collectively, these studies will provide information that should help address larger questions about the size and dynamics of the East Antarctic Ice Sheet during the Neogene.

There is extensive public interest in Antarctica, in part because of the romance of exploration but also because of the threat of global warming and the potential instability of the West Antarctic Ice Sheet. Because Antarctica exerts a huge influence on the Earth's climate, oceanic circulation, and sea level, knowledge about warmer climates during the Neogene is vital.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-284-S

NSF/OPP ATM 00-00957

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: January

Dynamics of the antarctic mesosphere-lower-thermosphere (MLT) region using ground-based radar and TIMED instrumentation

Dr. Susan K. Avery
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CIRES
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Photo not available.

Deploying Team Members: James P. Avery . Susan K. Avery . Nikolai Markarov . Scott Palo . Yuri Portnyagin

Research Objectives: This is a propitious time to study a number of atmospheric phenomena, because of the recently-peaked 11-year solar cycle, and NASA's TIMED satellite mission. In addition to measurements derived from instruments on TIMED (Thermosphere-Ionosphere-Mesosphere-Energetics and Dynamics), this project will install a meteor radar at Amundsen-Scott South Pole Station. Concentrating on the dynamics of the mesosphere and lower thermosphere, this group looks at:

+ The space-time decomposition of wave motions

+ Delineation of the spatial climatology over Antarctica with emphasis on the structure of the polar vortex

+ Dynamical response to energetic events

+ Inter-annual variability

The meteor radar is a VHF system capable of measuring the spatial structure and temporal evolution of the horizontal wind field over the South Pole. Spatial climatology data will also come from existing ground-based radars at Davis Station, Syowa Station, Rothera Station, and the Amundsen-Scott base.

As NASA's TIMED satellite orbits over the South Pole, wind and temperature data will provide counterpoint and corroborative information. Experiments based both in space and on the ground may be mounted, and data that was previously reliant on a single source can be better validated.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-297-M

NSF/OPP 02-29757

Station: McMurdo Station

RPSC POC: Melissa Rider

Research Site(s): Carapace Nunatak, Beardmore Glacier, Blizzard Peak, Mount Falla, Brimstone Peak, McMurdo Station

Dates in Antarctica: Early November to mid December

Paleobiology and taphonomy of exceptionally preserved fossils from Jurassic Lacustrine deposits, Beardmore Glacier area and southern Victoria Land, Antarctica

Dr. Loren E. Babcock
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Dept. of Geological Sciences
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Photo not available.

Deploying Team Members: Loren E. Babcock . Stephen Leslie . Robert "Ty" Milford . Alycia L. Rode

Research Objectives: Sedimentary interbeds of the Kirkpatrick Basalt represent unusual, exceptionally well preserved deposits, characterized by the presence of a variety of non-biomineralizing (so-called soft-bodied) organisms. Fieldwork in previous decades resulted in the discovery of abundant remains of conchostracans (bivalved arthropods having non-mineralized exoskeletons) and fishes; less common remains of various arthropods such as insects, syncarids, and isopods; and plant fragments. The arthropod and fish fossils range in preservational quality from disarticulated pieces to articulated remains comparable to the finest in the fossil record.

Present indications are that the Kirkpatrick lake deposits offer important windows into the evolutionary history of high-latitude, freshwater ecosystems of the middle Mesozoic.

Paleoecologic and taphonomic study of these deposits can be expected to provide additional clues to the general conditions under which exceptional preservation of non-mineralized skeletal parts, and perhaps soft parts, occurred in the geologic past. This is significant because nearly all of our current understanding of conditions surrounding exceptional preservation has been derived from studies of marine deposits, marginal-marine deposits, or freshwater deposits from low to middle paleolatitudes.

Our principal objectives are to

+ Collect and systematically document the biota of the sedimentary interbeds of the Kirkpatrick sites in the Beardmore Glacier area and southern Victoria Land;

+ Document and interpret taphonomic information on the Kirkpatrick sites, including diagenetic alteration of fossils;

+ Describe and interpret trace fossils that are associated with the body fossils; and

+ Document and interpret the stratigraphic and sedimentologic context of exceptional preservation.

Considerable importance attaches to the Jurassic sites in the Transantarctic Mountains, because few sites from aqueous ecosystems of high-paleolatitude areas are known to contain non-biomineralized fossils. Completion of this study will result in a more complete understanding of the biota and paleoecology of high-latitude lake ecosystems of the middle Mesozoic. The Kirkpatrick sites will also provide information useful for interpreting Jurassic biotas in a global context. Data from this study are expected to provide information on the fundamental question of why exceptional preservation of organisms has occurred in freshwater, high high-latitude settings.

2003-2004 USAP Field Season

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-220-M **NSF/OPP** .

Station: McMurdo Station
RPSC POC: Elaine Hood
Research Site(s): McMurdo Station, Dry Valleys, Convoy Range
Dates in Antarctica: Mid December to mid January

Soil biodiversity book

Ms. Yvonne C. Baskin
ybaskin@aol.com

Photo of the artist by Michael E. Gilpin.

Deploying Team Members: Yvonne C. Baskin

Research Objectives: Until recently, scientists treated the soil as a black box, monitoring its physical and chemical status while ignoring the fate and identity of most members of the soil community. Now research has begun to put “names and faces” on key soil organisms that are vital to sustaining aboveground food chains and maintaining the health of our air, lands, and waters. The work of soil ecologists on the polar desert soil communities in the McMurdo Dry Valleys has been critical to this effort. These ultra-low-diversity systems, devoid of aboveground plant and animal life, with nematode worms at the top of the food chain, allow researchers to examine more easily the relationship between species diversity and key ecological processes.

Ms. Baskin plans to use her reporting in a book for general readers on the diversity and importance of life underfoot. The book will highlight the sharp decline in soil invertebrate populations in Taylor Valley during the last decade—apparently thanks to an anomalous cooling in that part of Antarctica—to illustrate how human activities affect even the earth’s smallest and most remote below ground creatures.

Ms. Baskin is a freelance science writer who has published two other books on ecological topics, both from Island Press: The Work of Nature: How the Diversity of Life Sustains Us (1997) and A Plague of Rats and Rubbervines: The Growing Threat of Species Invasions (2002). Her articles have appeared in Natural History, Discover, Science, Atlantic Monthly, and numerous other magazines.

The author will spend three to four weeks in January 2004 working with and interviewing soil ecologists from the McMurdo Dry Valleys LTER program and visiting their research sites in the Taylor Valley and at Battleship Promontory.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-120-M/S

NSF/OPP 00-00315

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): USCG Icebreaker, SkyLab, COSRAY

Dates in Antarctica: Early October to early April (McMurdo), mid January to mid February (South Pole)

Spaceship Earth: Probing the solar wind with cosmic rays

Dr. John W. Bieber
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Bartol Research Institute
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http://www.bartol.udel.edu/~neutronm/

Solar and heliospheric studies with antarctic cosmic rays

Deploying Team Members: Paul A. Evenson . Leonard M. Shulman

Research Objectives: Cosmic rays -- atomic nuclei and electrons from outer space traveling near the speed of light -- continuously bombard the earth. When they collide with nuclei of molecules in the upper atmosphere, they create a cascade of secondary particles that shower the earth. Neutron monitors deployed in Antarctica provide a vital three-dimensional perspective on this shower of particles.

These data are used to advance our understanding of a variety of fundamental plasma processes occurring on the sun and in interplanetary space. Neutron monitor records, which begin in 1960 at McMurdo and in 1964 at South Pole, play a crucial role in efforts to understand the nature and causes of cosmic-ray and solar-terrestrial variations occurring over the 11-year sunspot cycle, the 22-year Hale cycle, and even longer time scales. At the other extreme, new methods of studying high time resolution (10-second) cosmic ray data will be used to determine the three-dimensional structure of turbulence in space and to understand the mechanism by which energetic charged particles scatter in this turbulence.

This project continues the year-round observations of cosmic rays with energies upwards of one billion electron volts at McMurdo and South Pole stations.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-149-M
NSF/OPP NSF/NASA agreement
Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, Williams Field
Dates in Antarctica: Late October to late January

Trans-Iron Galactic Element Recorder (TIGER) / ANITA-lite

Dr. Walter R. Binns
Washington University
Physics Department
wrb@howdy.wustl.edu
http://cosray2.wustl.edu/current.html

Trans-Iron Galactic Element Recorder/ANITA-lite (TIGER/ANITA-lite)

Deploying Team Members:

David Z. Besson . Walter R. Binns . Dana L. Braun . Eric R. Christian . Paul F. Dowkontt . Michael Duvernois . John W. Epstein . Sven Geier . Peter W Gorham . Steven Holder . Kurt Liewer . Jason T. Link . Shigenobu Matsuno . Marc Rosen . David Saltzberg . Lauren M. Scott . Garry E. Simburger

Research Objectives: Our primary objectives for the Trans-Iron Galactic Element Recorder (TIGER) experiment are to measure ultra-heavy galactic cosmic rays in order to determine the source of the material that is accelerated as galactic cosmic rays and the mechanism for injecting that material into the cosmic ray accelerator. Specifically, TIGER will build on our previous work and will collect additional data in order to measure the abundance of the elements in the charge range of interest. Our primary objectives for the Antarctic Impulsive Transient Antenna (ANITA)–lite experiment, which will fly on the same balloon with TIGER, are to measure the ambient very-high-frequency and ultra-high-frequency (VHF/UHF) impulsive noise levels at float altitudes over the antarctic ice sheet. The ANITA-lite experiment is a pathfinding mission for the ANITA experiment, which is a neutrino telescope that will be designed to detect neutrinos converting in the polar ice sheet.

We will place these experiments on an long-duration balloon that will fly two revolutions around Antarctica to obtain a long data acquisition time for galactic cosmic rays (TIGER) and VHF/UHF impulsive noise levels (ANITA-lite). We will collaborate with the National Scientific Balloon Facility (NSBF), which will ship our experiment and associated equipment to McMurdo Station, provide laboratory space for integration and testing, launch the TIGER/ANITA-lite payload from Williams Field, and conduct flight operations. We will monitor the experiment with electronic ground support equipment at Williams Field for line-of-sight data. Following the flight, NSBF and project personnel will recover the instrument and ship it back to the United States.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-065-E

NSF/OPP 99-08856

Station: Special Project
RPSC POC: John Evans
Research Site(s): Seymour Island field camp (via R/V Laurence M. Gould)
Dates in Antarctica: Late November to late December

Global climate change and the evolutionary ecology of antarctic mollusks in the Late Eocene

Dr. Daniel B. Blake
University of Illinois Urbana
Geology
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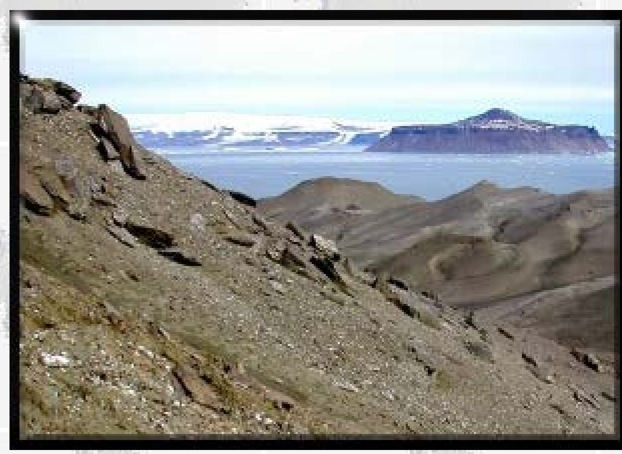

Fossiliferous Eocene rocks on Seymour Island with Cockburn Island in the background.

Deploying Team Members: Daniel B. Blake . Kurtis C. Burmeister . Alexexander Glass . Ryan M. Moody

Research Objectives: Global climate change in the late Eocene had an important influence in Antarctica. This was the beginning of the transition from a cool-temperate climate to the current one. The cooling trend strongly influenced the structure of shallow-water and antarctic marine communities, and these effects are evident in the ecological relationships among modern species. Cooling reduced the abundance of fish and crabs, which in turn reduced skeleton-crushing predation on invertebrates. Reduced predation allowed dense populations of ophiuroids (brittlestars) and crinoids (sea lilies) to appear in shallow-water settings at the end of the Eocene. These low-predation communities appear as dense fossil echinoderm assemblages in the La Meseta Formation on Seymour Island.

Today, dense ophiuroid and crinoid populations are common in the shallow waters of Antarctica but have generally disappeared from similar habitats at temperate and tropical latitudes. Although the influence of declining predation on antarctic ophiuroids and crinoids is well documented, the effects of cooling on the more abundant mollusks have not been investigated. We will therefore examine the evolutionary ecology of gastropods (snails) and bivalves (clams) in the late Eocene.

We will test a series of hypotheses based on the predicted responses of mollusks to declining temperature and changing levels of predation:

+ First, defensive features of gastropod shells, such as spines and ribbing, should decline as the temperature and, therefore, the activity of skeleton-crushing predators declined.

+ Second, drilling of bivalve prey by predatory gastropods should increase, since the drillers should themselves have been subject to less predation as the temperature declined. Drilled shells should become more common.

+ Third, patterns in the thickness of shells will make it possible to separate the direct physiological effects of temperature (shells are harder to produce at cooler temperatures and so should be thinner) from the indirect effects of temperature (increased drilling predation should result in thicker shells).

Seymour Island contains the only readily accessible fossil outcrops from this crucial period in Antarctica. Global climate change will probably increase upwelling in some temperate coastal regions. Evidence suggests that the resulting decline in sea temperatures could lower predation in those areas. Understanding the response of the La Meseta fauna to cooling in the late Eocene will provide direct insight into the rapidly changing structure of modern benthic communities.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-038-E/M
NSF/OPP 02-29570
Station: E/M
RPSC POC: Melissa Rider
Research Site(s): Cape Evans, Cape Royds, Allan Hills, McMurdo Station
Dates in Antarctica: Mid to late January

Investigations on deterioration in the historic huts of Antarctica

Dr. Robert A. Blanchette
University of Minnesota
robertb@umn.edu

Investigations on deterioration in the historic huts of Antarctica

Deploying Team Members: Brett Arenz . Joel A. Jurgens

Research Objectives: During the first two decades of the 20th century, Europeans mounted a handful of expeditions in hopes of reaching (and claiming) the geographic South Pole. Base camps established in the McMurdo Sound region by Scott at Hut Point and Cape Evans and by Shackleton at Cape Royds were abandoned once the expeditions were over, leaving behind thousands of artifacts, as well as the huts the explorers built for shelter and storage. Over the intervening 90 years, the extremes of the polar environment have actually protected some of the artifacts from rapid decay, but conservators have recently become concerned about the serious degradation of what is an important historical, archaeological site.

Some of the gravest threats are as follows:

+ Wood in contact with the ground is being destroyed by a specific wood-destroying fungus. Various molds and cellulose-degrading fungi are attacking artifacts made of leather, textiles, and other organic materials.

+ Exterior wood is being degraded by nonbiological processes as well, including salt, ultraviolet radiation, and wind erosion.

+ Chemical damage within the huts is apparent, and the soils on the site are contaminated with aromatic hydrocarbons from petroleum products.

We plan to identify the biological and nonbiological agents responsible for the deterioration, study the mechanisms and progressive sequence of the events taking place, test methods to be used to control future deterioration, determine the extent of environmental pollutants in soils at the historic sites, and evaluate chemical spills within the huts. The goal is to provide the scientific data conservators need to help protect these important sites for future generations. But the project should also shed light on these unique deterioration processes, as well as augment scientific understanding of the biology of antarctic microorganisms and the biodiversity of microbes present in this unusual environment.

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-218-P **NSF/OPP** .

Station: Palmer Station
RPSC POC: Elaine Hood
Research Site(s): Palmer Station
Dates in Antarctica: Mid November to late December

Palmer Station children's novel

Ms. Lucy Bledsoe
lucyjane@msn.com

Palmer Station children's novel

Deploying Team Members: Lucy Bledsoe

Research Objectives: Lucy Jane Bledsoe will write a sequel to The Antarctic Scoop, a middle-grades novel she researched during her 1999-2000 season on the Ice with the Antarctic Artists & Writers program. The first novel, to be published in the fall of 2003, features astrophysics at the South Pole. The sequel will feature a biology theme at Palmer Station.

Ms. Bledsoe’s novels for young people include Cougar Canyon and Hoop Girlz. Her photographic essay, How to Survive in Antarctica, will be published in 2004. She is a 2002-2003 recipient of the California Arts Council Individual Fellowship in Literature.

Ms. Bledsoe will observe science onboard the R/V Laurence M. Gould en route to Palmer Station as well as on the return trip to Punta Arenas. She will spend one month at Palmer Station observing science there and in immediately surrounding areas.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-015-M
NSF/OPP 02-16043

Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, New Harbor, McMurdo Sound
Dates in Antarctica: Early November to mid December

Remotely operable micro-environmental observatory for antarctic marine biology research

Dr. Samuel S. Bowser
New York State Department of Health
Division of Molecular Medicine
bowser@wadsworth.org
http://www.bowserlab.org

Photo not available.

Deploying Team Members: Jeffrey R. Blair . Samuel S. Bowser . Douglas Coons . Philip E. Forte . Karen Henrichs Sterling . Mary Turnipseed

Research Objectives: Research diving over the past two decades has yielded important insights into the ecological importance of giant (larger than 1 mm) foraminifera in McMurdo Sound. Unfortunately, the in situ behavior of these single-celled organisms and their interactions within the food web can be observed only in “snapshots” during summer dives, when algal production is at a maximum under 24-hour light. Much would be learned by observing foraminifera over extended periods, to study mobility, response to food availability, and other directed behaviors. It would be valuable to be able to extend observations to the winter months in order to study these organisms in the dark, with no algal production, and to experimentally manipulate in situ conditions and observe the behavioral response.

Research diving requires costly support and cannot provide extended observation of individual organisms. Moreover, the logistical requirements, costs, complexities, and risks of winter diving at remote locations in Antarctica are prohibitive. However, human diving is not required to make long-term in situ observations. Technology and communications have advanced to the point where it is feasible and practical to install video macro- and microview cameras in a submersible enclosure, transmitting both live and sequential time-lapse images over the Internet to a remote user throughout the year. Such an instrumentation platform could then be used for experimental manipulation of the environment.

We intend to develop a submersible, remotely operable underwater observatory for the study of foraminifera and associated benthic fauna. This observatory would be connected to a shoreline unit by fiberoptic cable and linked by radio to the Internet for year-round access. The design and operation of this observatory will function as a technology template to meet other year-round antarctic research requirements by means of telescience rather than personnel deployment.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-090-P/S
NSF/OPP EAR 00-04370

Station: Palmer Station, South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Early November to mid January

IRIS - Global Seismograph Station at South Pole

Dr. Rhett G. Butler
Incorporated Research Institutions for Seismology
Global Seismograph Network Program Manager
rhett@iris.edu

Photo not available.

Deploying Team Members: Valerie I. Peyton . Stephen C. Roberts . John J. Vineyard

Research Objectives: Seismology, perhaps as much as any other science, is a global enterprise. Seismic waves resulting from earthquakes and other events can only be interpreted through simultaneous measurements at strategic points all over the planet. The measurement and analysis of these seismic waves are not only fundamental for the study of the earthquakes, but also serve as the primary data source for the study of the Earth's interior. To help establish the facilities required for this crucial scientific mission, IRIS (the Incorporated Research Institution for Seismology) was created in 1985.

IRIS is a consortium of universities with research and educational programs in seismology. Ninety-seven universities are currently members, including nearly all U.S. universities that run seismological research programs. Since 1986, IRIS (through a cooperative agreement with the National Science Foundation (NSF) and in cooperation with the U.S. Geological Survey) has developed and installed the Global Seismographic Network (GSN). The GSN now has about 135 broadband, digital, high-dynamic-range, seismographic stations around the world, all with real-time communications.

The GSN seismic equipment at Amundsen-Scott South Pole Station and at Palmer Station, Antarctica, was installed jointly by IRIS and ISGS, who together continue to operate and maintain them. The GSN sites in Antarctica are vital to seismic studies of Antarctica and the Southern Hemisphere. The state-of-the-art seismic instrumentation is an intrinsic component of the NSF effort to advance seismology and Earth science globally.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-103-S
NSF/OPP 01-26313
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): Dark Sector
Dates in Antarctica: Early January to early February

A search for extrasolar planets from the South Pole

Dr. Douglas A. Caldwell
SETI Institute (Search for Extraterrestrial Intelligence)
dcaldwell@mail.arc.nasa.gov
http://www-space.arc.nasa.gov/~vulcan/south/

A search for extrasolar planets from the South Pole

Deploying Team Members: Michael C.B. Ashley . Douglas A. Caldwell . Ethan R. Dicks . Mark Jarnyk . Kevin R. Martin . John Storey . Ching-Hwa Yu

Research Objectives: We will operate a small optical telescope at the South Pole to search for and characterize extrasolar planets by continuously following a southern galactic star field with a charge-coupled device photometer and searching for the periodic dimming that occurs as a planet transits its parent star.

The recent discovery of many close-in giant exoplanets has expanded our knowledge of other planetary systems and has demonstrated how different such systems can be from the solar system. However, their discovery poses important questions about the effects of such planets on the presence of habitable planets. To date only one extrasolar planet—HD 209458b—has been observed to transit a parent star. This project has the potential for a 10-fold increase in the number of extrasolar planets for which transits are observed. The South Pole is an excellent location to detect such planets because randomly phased transits can most efficiently be detected during the long winter night. Also, the constant altitude of a stellar field at the pole avoids large daily atmospheric extinction variations, thus allowing for higher photometric precision and a search for smaller planets.

Specifically, we will establish an automated planet-finding photometer at the South Pole for two austral winters. The statistics of planetary systems of nearby solar-type stars would indicate that about 10 to 15 extrasolar planets should be detected. There is also the possibility of finding lower mass planets that have not previously been detectable. Combining the transit results (which give the size of the planet) with Doppler velocity measurements (which give the planetary mass) will allow the planetary density to be determined, thus indicating whether the planet is a gas giant like Jupiter, an ice giant like Uranus, or a rocky planet like the Earth. These data will provide basic observational information that is vital to theoretical models of planetary structure and formation.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-373-S
NSF/OPP 00-94541
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Early November to mid February

Degree Angular Scale Interferometer (DASI)

Dr. John E. Carlstrom
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http://astro.uchicago.edu/dasi

Degree Angular Scale Interferometer (DASI)

Deploying Team Members: John E. Carlstrom . John K. Cartwright . Allan Day . John Kovac . Erik M. Leitch . Robert J. Pernic . Clement Pryke

Research Objectives: Researchers plan to continue cosmological observations with the degree angular scale interferometer (DASI) which was first deployed at the Amundsen–Scott South Pole Station during the 1999–2000 austral summer. DASI provides continuous high-quality measurements of the cosmic microwave background (CMB) radiation anisotropy over the critical range of angular scales spanning the first three acoustic peaks in the CMB power spectrum. The data are transferred daily to the University of Chicago, where analysis is keeping pace with the data rate. Plans are to publish the resulting power spectrum by the end of the year.

During the next austral winter, researchers will use DASI to measure the currently undetected polarization of the CMB anisotropy. The measurements will provide a critical test of the standard theory of the early universe. The observations will use full Stokes parameters, allowing a measurement of the cross-correlation of total intensity and polarization anisotropy. Project team members will construct new receiver components to reconfigure DASI from 30 giga-Hertz (GHz) to 100 GHz for intensity and polarization measurements of the fine-scale CMB anisotropy power spectrum. These new capabilities will allow detailed observations of the Sunyaev-Zel'dovich Effect (SZE) in nearby galaxy clusters and allow SZE surveys from massive clusters.

These proposed efforts complement other ongoing and planned CMB experiments with instruments in Chile and at the South Pole. These three instruments can view the same region of the sky and will provide detailed power spectra over this angular range, thereby gathering crucial data for understanding foreground contamination. Working together, these three instruments will allow this essentially unexplored but theoretically important portion of the CMB anisotropy power spectrum to be fully determined.

Outreach and education related to the project will be disseminated and implemented through established structures and mechanisms. These programs, which reach out to local and distant K–12 teachers and students, will use the excitement of exploring our universe to help attract women and minorities to science. Graduate and undergraduate education and research will be integrated into the construction of the instrumentation, as well as the data analysis.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-379-S

NSF/OPP 01-30612

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Early November to mid February

South Pole observations to test cosmological models

Dr. John E. Carlstrom
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Photo not available.

Research Objectives: One of the most important discoveries in cosmology is that apparently much, if not most, of the mass in the Universe is made up not of stars and glowing gas, but of dark matter, which emits little or no light or other electromagnetic radiation and makes its presence known only through the gravitational force it exerts on luminous matter. There is some indication that dark matter may in fact not even be baryonic (Baryons are subatomic particles that are built from quarks and interact via strong nuclear force). Just what fraction of the mass is in the form of noninteracting nonbaryonic particles is of great interest to cosmologists and physicists.

The University of Chicago will lead a consortium of six institutions to design and use an 10-meter off-axis telescope at Amundsen-Scott South Pole Station to survey galaxy clusters. This survey will allow us to study integrated cluster abundance and its red shift evolution and will give us precise cosmological constraints that are completely independent of those from supernova distance and cosmic microwave background (CMB) anisotropy measurements.

Measuring the mass in baryons along with the total mass in a region of the Universe that could be considered a fair sample would provide a crucial direct determination of the dark matter content. In recent years, just such a test-bed has been found in massive clusters of galaxies, which contain large amounts of gas (baryons) in the form of a highly ionized gas atmosphere that emits x rays. Nearly all of the baryons in the clusters are believed to be in the hot phase (millions of degrees), and so it is likely that we are truly measuring the baryonic mass in the cluster.

In addition to emitting x rays, the hot cluster gas also scatters CMB radiation. This scattering, called the Sunyaev-Zel'dovich Effect (SZE), is measurable using radio telescopes. The SZE is important to the study of cosmology and the CMB for two main reasons:

+ The observed hotspots created by the kinetic effect will distort the power spectrum of CMB anisotropies. These need to be separated from primary anisotropies in order to probe inflation properties.

+ The thermal SZE can be measured and combined with x-ray observations to determine the values of cosmological parameters, in particular the Hubble constant.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-061-E

NSF/OPP 00-03844

Station: Special Project
RPSC POC: John Evans
Research Site(s): Vega Island field camp (via R/V Laurence M. Gould)
Dates in Antarctica: Late November to late December

Evolution and biogeography of Late Cretaceous vertebrates from the James Ross Basin, Antarctic Peninsula

Dr. Judd A. Case
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Photo not available.

Deploying Team Members: Jennifer Roberts . John Foster Sawyer . Marcelo Reguero . Judd A. Case . Allen J. Kihm . James E. Martin . Robert W. Meredith . Amanda C. Person . Jennifer Roberts . Wayne Thompson . Wade L. Winters

Research Objectives: We plan to investigate the Late Mesozoic vertebrate paleontology of the James Ross Basin. The Campanian through the Maastrichtian Ages (80 to 65 million years ago) are important in the history of vertebrate biogeography (dispersals and separations due to moving landmasses) and evolution between Antarctica and the rest of the Southern Hemisphere. Moreover, the dispersal of terrestrial vertebrates such as dinosaurs and marsupial mammals from North America to Antarctica and beyond to Australia via Patagonia and the Antarctic Peninsula, as well as the dispersal of modern birds from Antarctica northward, are unresolved questions in paleontology. These dispersals include vertebrates in marine settings as well. Both widely distributed and localized marine reptile species have been identified in

Antarctica, creating questions about their dispersal in conjunction with terrestrial animals.

The Weddellian Paleobiogeographic Province extends from Patagonia through the Antarctic Peninsula and western Antarctica to Australia and New Zealand. Within this province lie the dispersal routes for interchanges of vertebrates between South America and Madagascar and India, and also Australia. On the basis of our previous work, we theorize that an isthmus between more northern South America and the Antarctic craton brought typical North American dinosaurs, such as hadrosaurs (duck-billed dinosaurs) and presumably marsupials traveling overland while marine reptiles swam along coastal waters, to Antarctica in the late Cretaceous. This region also served as the cradle for the evolution, if not the origin, of groups of modern birds, and the evolution of typical Southern Hemisphere plants.

To confirm and expand on these hypotheses, we will continue our investigations into late Cretaceous marine and terrestrial deposits in the James Ross Basin. We have previously recovered the following vertebrates from these sedimentary deposits: plesiosaur and mosasaur marine reptiles; plant-eating dinosaurs; a meat-eating dinosaur; and a variety of modern bird groups, including shorebirds, wading birds, and lagoonal birds.

Our research will result in important insights about the evolution and geographic dispersal of several vertebrate species. We will collaborate with scientists from the Instituto Antártico Argentino and with vertebrate paleontologists from the Museo de La Plata, both in the field and at our respective institutions in Argentina and in the United States.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-317-L
NSF/OPP 98-16226

Station: R/V Laurence M. Gould
RPSC POC: Todd Johnson
Research Site(s): USAP research vessel cruise tracks
Dates in Antarctica: Instruments operate year-round

Shipboard acoustic Doppler current profiling aboard the research vessel Laurence M. Gould

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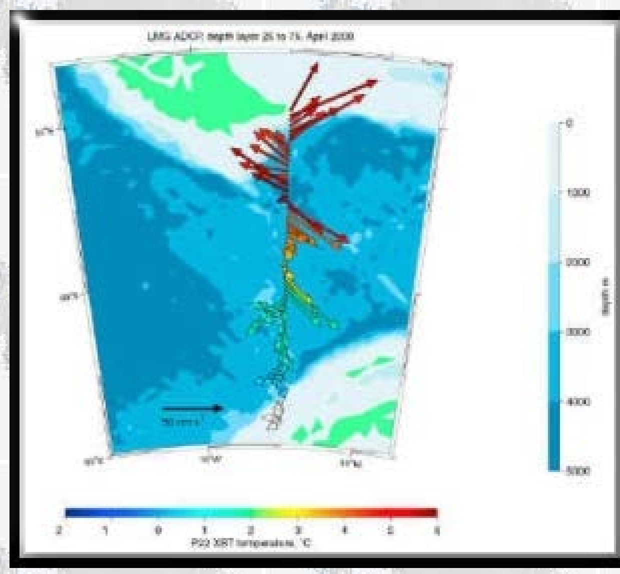

Currents from an April 2000 crossing of Drake Passage. Velocity vectors are colored according to ocean temperature. Courtesy of Teresa Chereskin.

Deploying Team Members: Teresa K. Chereskin . Yueng-Djern Lenn

Research Objectives: Currents in the Southern Ocean have a profound influence on the world's oceans, and therefore upon global temperature and the planet's ecosystem. Yet some remote regions receive little scientific attention. Using Doppler technology (sound-wave transmission and reflection), this project is exploring upper ocean current velocities. Researchers are building a quality-controlled data set in one such sparsely sampled and remote region, which nonetheless appears to play a significant role in global ocean circulation. They will develop and maintain a shipboard acoustic Doppler current profiler (ADCP) program on board the USAP research vessel Laurence M. Gould (R/V LMG).

Part of the long-term science goal is to characterize the temporal and spatial velocity structure in the Southern Ocean. This entails measuring the seasonal and annual changes in upper ocean currents within the Drake Passage and then combining this information with similar temperature observations to see how the heat exchange varies and how it drives upper ocean currents.

For five years, this project's ADCP and TSG (thermosalinograph) instruments have been installed on the R/V LMG. During each cruise, data is collected and transmitted to the home institution. Shipboard electronics technicians and computer support staff maintain and monitor the systems.

2003-2004 USAP Field Season

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-223-M **NSF/OPP** .

Station: McMurdo Station

RPSC POC: Elaine Hood

Research Site(s): McMurdo Station, LaPaz Icefield, Allan Hills, Elephant Moraine, Beardmore Glacier

Dates in Antarctica: Early December to early February

The fallen sky: Eccentrics and scientists in pursuit of shooting stars

Mr. Christopher A. Cokinos
Utah State University
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The fallen sky: Eccentrics and scientists in pursuit of shooting stars: Field work with Antarctic Search for Meteorites (ANSMET) main party and recon team

Deploying Team Members: Christopher A. Cokinos

Research Objectives: Chris Cokinos has a contract with Tarcher/Putnam to publish a book combining science, folklore, history and personal narrative showing the importance of meteorites, our fascination with them and the poetry of encountering them—and the true stories about those who become obsessed by rocks from space.

Mr. Cokinos has traveled in the U.S., France, Germany, and Greenland gathering information for this book, retracing the steps of amateur meteorite hunters, interviewing scientists about the latest developments in meteoritics, and seeing how these rocks can inspire humans to meditate on the origins of life on Earth and the effects of cosmic impacts.

Mr. Cokinos will work with Dr. Ralph Harvey's Antarctic Search for Meteorites project (ANSMET), G-058-M and G-057-M.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-019-M **NSF/OPP** 01-25611
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): Taylor Valley, Labyrinth, McMurdo Station
Dates in Antarctica: Mid November to mid February

Yeasts in the antarctic Dry Valleys: Biological role, distribution, and evolution

Dr. Laurie B. Connell
The University of Maine
School of Marine Sciences
laurie.connell@umit.maine.edu

Sampling site in the Taylor Valley with photomicrograph of yeasts grown from a soil sample (inset). Photo by Scott Craig.

Deploying Team Members: Laurie B. Connell . Scott D. Craig . Regina S. Redman . Russell J. Rodriguez . Barbara Shulz . Amy Stoyles

Research Objectives: The soil community of the antarctic polar desert comprises few endemic species of bacteria, fungi, and invertebrates. Both filamentous and single-cell fungi have been isolated from a diversity of antarctic soil types, but only yeasts appear to be endemic to the polar desert soils. Although their ecological role in antarctic soils is undefined, yeasts may be the principal taxa synthesizing the sterols required by soil invertebrates. In addition, yeasts may be involved in accumulating and mobilizing growth-limiting nutrients such as phosphorus into the polar desert food web. Although yeasts have been well described in agricultural and industrial systems, little is known about their ecological role.

This multidisciplinary, collaborative research will characterize the role(s) soil yeasts play in the McMurdo Dry Valley ecosystem in order to better understand polar deserts and other extreme environments, as well as provide a foundation for incorporating yeasts into biogeochemical models of temperate environments. Soil microbiota mediate most processes such as decomposition, soil respiration, uptake and fixation of micro- and macronutrients, and detoxification of heavy metals and serve as major global carbon sinks. The complexity of soil communities in temperate regions poses difficulties in studying the relationships between biotic and abiotic parameters, and the factors controlling populations of soil microbiota remain poorly understood. The extreme climate and relatively simple community structure of the continental antarctic desert lend themselves to such studies.

Researchers will correlate the abundance and distribution of yeasts in polar desert soils with physical and chemical soil properties. Several physiological parameters will be explored in vitro to develop a basis for understanding the functional role(s) these organisms might play. Sterols synthesized by McMurdo Dry Valley soil yeasts, as well as their ability to survive multiple freeze-thaw cycles, will be characterized. The capacity of indigenous antarctic yeasts to use, compete for, and store phosphorus will be ascertained. The evolution of dry valley yeasts will be addressed by determining intra- and intervalley relatedness patterns based on DNA sequence.

Both soil samples and extracted DNA will be shared with other interested laboratories. Moreover, students from middle school (Biolab Inc.) through college (University of Maine) will be given the opportunity to collaborate on this project, as well as to develop their own projects.

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-224-M **NSF/OPP** .

Station: McMurdo Station

RPSC POC: Elaine Hood

Research Site(s): Ross Island, Wright Valley, Taylor Valley, Mount Erebus, Royal Society Range, McMurdo Station

Dates in Antarctica: Late August to late February

Field guide to antarctic features: McMurdo Sound region

Mr. Lawrence (Larry) J. Conrad
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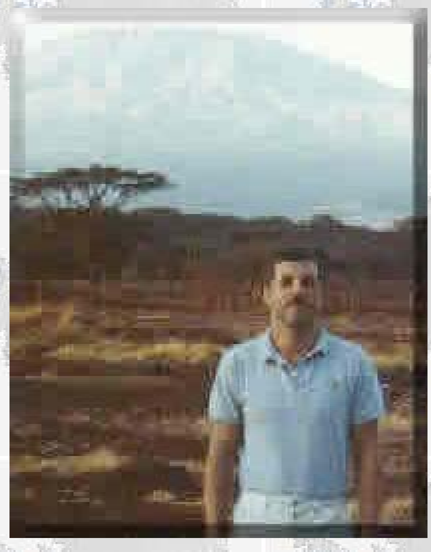

Field Guide to Antarctic Features: McMurdo Sound Region

Deploying Team Members: Ann Hawthorne

Research Objectives: This project will observe and photograph named geographic features for a historical gazetteer of the McMurdo region. Photographer Ann Hawthorne, historian-geographer Larry Conrad, and a mountaineer will travel on the surface to photograph as many as 1,500 features in the area from Ross Island to the polar plateau and from the Nordenskjold Ice Tongue to the Koettlitz Névé.

The team will locate the positions of photographs taken on the area's initial exploration by Scott and Shackleton and take new photographs from the same positions. The gazetteer will be published in print and digitally.

Two team members and a mountaineer will travel via ski-doo through historical land areas in Victoria Land and then by foot through the McMurdo Dry Valleys. Twenty hours of dedicated helicopter support is required for laying caches and team member relocations.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-209-M
NSF/OPP 00-87345
Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): Byrd Surface Camp
Dates in Antarctica: Early January to early February

Western divide WAISCORES site selection

Dr. Howard B. Conway
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Department of Geophysics
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http://www.ess.washington.edu/Surface/Glaciology/

2002-03 camp near the prospective drill site near the divide between the Ross and Amundsen Sea drainage systems. Photo by Erin Pettit.

Deploying Team Members: Howard B. Conway . Maurice Conway . Kenichi Matsuoka . Erin Pettit . Ed Waddington

Research Objectives: The West Antarctic Ice Cores (WAISCORES) community has identified the western divide, between the Ross embayment and the Amundsen Sea, as the region for the next deep-ice core. The Ice Core Working Group (ICWG) has developed a document (WAISCORES: Science and Implementation Plan, 2000) that outlines the objectives of the drilling and the physical and chemical properties the core must have to achieve those objectives.

The divide region spans more than 40,000 square kilometers, and preliminary site selection using airborne geophysical methods is now underway. This work has identified several potential drilling sites where the climate record should be best preserved throughout its long history of ice dynamics. Researchers will place a suite of ground-based geophysical measurements to map spatial variations of iceflow, accumulation rate, internal layering, and ice thickness at two of the most promising sites. The chief investigative tools include:

+ High and low frequency ice-penetrating radar

+ Repeat global positioning system surveys to calculate the present-day surface velocity field

+ Synthetic aperture radar interferometry to calculate the regional velocity field

+ Short firn cores to calculate present-day accumulation rates.

Beyond the initial mapping and interpretation of internal layers and surface velocity, the measurements will be used to constrain iceflow modeling. In particular, researchers will use these measurements and models to identify a site that is most likely to satisfy the following ICWG criteria:

+ Minimal disturbance from an iceflow,

+ A record that extends back at least 50,000 years

+ Countable annual layers back 20,000 years.

A fourth criterion (the good preservation of chemical species) will be addressed by other projects.

The first criterion (minimal disturbances) will be evident from the patterns of radar-detected internal layers. To address the other two, researchers will use the measurements as input for time-dependent iceflow and temperature models that predict depth variations of age, layer thickness, and temperature. The mismatch between the model predictions and the data eventually recovered from the core will help infer thinning and climate histories for the region, in addition to yielding an estimate of expected conditions before drilling. The information gathered will help guide site selection for the drilling.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-210-M
NSF/OPP 00-87144

Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, Siple Coast
Dates in Antarctica: Early November to mid December

Glacial history of Ridge AB

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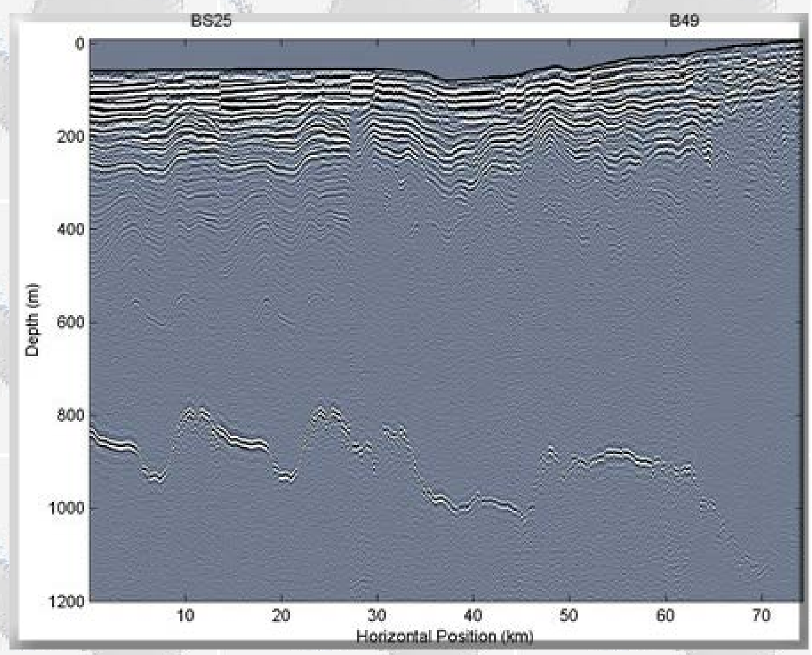
http://www.ess.washington.edu/Surface/Glaciology/



Radar (5MHz) profile across Ridge AB. The bright reflector near 800m depth is the bed. Radar-detected internal layers, which can be interpreted as isochrones, are generally continuous but disturbed.

Deploying Team Members: Ginny Catania . Howard B. Conway . Maurice Conway . Charles F. Raymond

Research Objectives: Scientists do not fully understand how the configuration and activity of the drainage system of the West Antarctic Ice Sheet are changing. For the following reasons, Ridge AB constitutes a key area for studying this issue:

+ While previous studies of inter–ice stream ridges in West Antarctica have revealed much about the history of the surrounding ice streams, there remains an information gap in the southern sector of the ice sheet. We believe that a targeted study of Ridge AB will reveal new information about recent changes in the configuration and activity of ice streams A and B.

+ Geologic evidence from Reedy Glacier indicates that the ice near Ridge AB was about 700 meters (m) thicker during the last glacial maximum. This helps constrain the magnitude of thinning that has occurred through the Holocene and opens the possibility of linking the history of the West Antarctic Ice Sheet to the geologic record in the Transantarctic Mountains.

We will begin by using high- and low-frequency radar systems, global positioning system surveying methods, and short (20-m) firn cores to map spatial variations of internal layering, buried crevasses, surface velocity, and accumulation rate. We will then put these diagnostic measurements into ice-flow models to infer the glacial history of Ridge AB and the surrounding ice streams. We will interpret this history in the context of the histories that are emerging from the other inter–ice stream ridges, as well as the geologic evidence from Reedy and other outlet glaciers in the Transantarctic Mountains. These explorations and analyses will enhance scientific understanding of the evolution of the drainage system of the West Antarctic Ice Sheet.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-161-M **NSF/OPP** 01-25579
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, Taylor Glacier
Dates in Antarctica: Mid October to early February

Dynamics and climatic response of the Taylor Glacier system.

Dr. Kurt Cuffey
University of California Berkeley
Department of Geography
kcuffey@socrates.berkeley.edu

Dynamics and Climatic Response of the Taylor Glacier System.

Deploying Team Members: John W. Sanders . Sarah Aciego . Andrew Bliss . Kurt Cuffey . Jeffrey L. Kavanaugh . David L. Morse

Research Objectives: Taylor Glacier drains from Taylor Dome eastward and terminates in Taylor Valley at Lake Bonney. This glacier connects the Taylor Dome region, studied extensively in the early-mid 1990s, to the Taylor Valley ecosystem. Understanding the flow and response of this system is essential for interpreting the glacial geologic record in the southern Dry Valleys, and for understanding long-term changes in the Taylor Valley ecosystem physical environment (especially Lake Bonney).

This project's objective is to understand the Taylor Glacier: how it flows, and how it responds to climatic changes. Project team members will build a comprehensive set of measurements of surface velocity and ablation rates along Taylor Glacier, and also to map subglacial topography. The proposed work is an outgrowth of work done by the New Zealand Program in the mid-1980s (Robinson) and by the University of Washington in 1992-93. Researchers on this project participated in that effort, and in that context completed cross-valley surveys of velocity and basal topography at several locations. In this project, they seek to vastly increase this data set for use in a modeling program to understand climatic response of the Taylor Glacier system. Surface velocities, strain rates, ablation rates, ice thickness, and subglacial topography will be measured.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-087-M
NSF/OPP 00-03619
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): Byrd Surface Camp
Dates in Antarctica: November

A GPS network to determine crustal motions in the bedrock of the West Antarctic Ice Sheet (WAIS)

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Institute for Geophysics
ian@ig.utexas.edu

Photo not available.

Deploying Team Members: Michael Bevis . Ian W. Dalziel . Robert Smalley Jr . Jim Spencer

Research Objectives: Motion in the bedrock that underlies the West Antarctic Ice Sheet is suspected from rifting, active volcanism and uncertainties in global plate circuits, but it is unconstrained. Without reliable data - on both tectonic and ice-induced crustal motions-we will never be able to fully comprehend the ice sheet's past, present, and future dynamics. Without that knowledge, we can neither develop reliable global change scenarios for the future nor accurately factor the Antarctic region into global plate movements. Currently, permanent global positioning system (GPS) networks that measure bedrock movement are established only on the fringe of the West Antarctic Ice Sheet; they cannot provide the data that are needed for understanding of subglacial volcanism, active tectonics, and ice streaming.

This project is focused on establishing baseline, long-term, reliable geodetic measurements of the crustal motion in the bedrock beneath the West Antarctic Ice Sheet. To obtain them, we are building a West Antarctica GPS Network (WAGN) of at least 15 GPS sites on nunataks across the West Antarctic interior-an area comparable to the area from the Rocky Mountains to the Pacific coast-over 3 years, beginning in the 2001-2002 austral summer.

The first season, we initiated the WAGN network and tested the precision and velocities at critical control sites along the interior Transantarctic margin of the East Antarctic craton. The second season we monumented and made initial measurements on sites at the base of the Antarctic Peninsula, and on the Ellsworth-Whitmore mountains crustal block. The embryonic network will begin to fill a major gap in GPS coverage by looking for potential bedrock movements. If crustal motions are relatively slow, meaningful results will only begin to emerge over the next 5 years or so. Once it is permanently established, however, the network should yield increasingly meaningful results. Indeed, the slower the rates turn out to be, the more important it is to start measuring early.

West Antarctic Ice Sheet bedrock is so scattered and remote that to erect a continuous string of permanent GPS stations is unrealistic with presently available technology and logistic support. Instead, we are following the ''multimodal occupation strategy' (MOST), which entails roving receivers (based in permanent monuments set in solid rock outcrops) in place for only a short time at each site, providing data that can be ranged against continuous data acquired from permanent GPS stations elsewhere. Each of these "bases" can be converted in the future to a permanent, autonomous station when more logistics and satellite data linkage throughout West Antarctica are in place. When detectable motions occur, we can reoccupy the most critical sites, obtain more reliable velocities, and make decisions about reoccupying the entire network.

We expect the results of this project to establish important early indicators of crustal plate dynamics beneath the West Antarctic Ice Sheet. As scientists take these into account in refining their models, future measurements and a time-series of the geodetic data should gradually produce a more constrained picture of subglacial dynamics for the West Antarctic Ice Sheet-that is, plate rotations and both elastic and viscoelastic motions caused by deglaciation and ice-mass changes.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-003-P **NSF/OPP** 02-30579
Station: Palmer Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station
Dates in Antarctica: Early December to early February

Response of terrestrial ecosystems along the Antarctic Peninsula to a changing climate

Dr. Thomas A. Day
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Department of Plant Biology
tadday@asu.edu

A graduate student measures the photosynthesis of Antarctic hairgrass near Palmer Station. Photo by Thomas A. Day.

Deploying Team Members: Thomas A. Day . Jeffrey M. Klopatek . Ji-Hyung Park . Christopher T. Ruhland . Sarah N. Strauss

Research Objectives: The striking increases in air temperatures and ultraviolet-B radiation (UV-B) documented along the west coast of the Antarctic Peninsula over the past 50 years represent a profound climatic change, arguably larger than that experienced by any other region on Earth during this time. Along with these well-documented changes, annual precipitation and the depth of the winter snow pack also appear to be increasing along the peninsula. These rapid changes in climate provide a unique opportunity to examine the effects of climate change on terrestrial ecosystems.

Building on past work that focused on the impact of warming and UV-B on terrestrial vascular plants on the peninsula, we will examine how climate change alters nutrient (carbon and nitrogen) pools and cycling among plants, litter, and soils in vascular-plant-dominated communities, with the overall goal of predicting long-term effects on plant productivity. We will use two complementary approaches.

In the first approach, we will study shorter term responses to climate change by manipulating temperature, water availability, and UV-B exposure of vascular-plant microcosms over three growing seasons. We will assess how these manipulations influence plant growth and primary productivity, carbon dioxide fluxes, litter quality and decomposition, pools and turnover rates of carbon and nitrogen, and the structure of soil microbial and arthropod communities. These realistic environmental manipulations will allow us to accurately assess the effects of different future warming scenarios, as well as the effects of solar UV-B.

In the second approach, we will examine longer term responses to warming by measuring pools of carbon and nitrogen in plants, litter, and soils in plant communities along transects that represent gradients of long-term temperature regimes. Analyzing the results from short-term warming manipulations in the context of patterns found along these gradients will make it possible to develop a conceptual model of warming impacts over time.

The broader impacts of this project include

+ Recruiting and training undergraduate students from underrepresented minorities;

+ Disseminating findings to the general public; and

+ Contributing to society at large by improving our understanding of how climate change affects plant productivity and ecosystem carbon storage, as well as whether ecosystem responses to climate change will mitigate or promote continued buildups of greenhouse gases.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-005-M **NSF/OPP** 02-31006

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, Britina Island, McMurdo Sound
Dates in Antarctica: Late August to mid February

Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution

Dr. Arthur L. DeVries
University of Illinois Urbana
Molecular and Integrative Physiology Department
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Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution

Deploying Team Members: Bev Dickson . Chi-Hing C. Cheng-De Vries . Arthur L. De Vries . Clive Evans . Philip E. Forte . Kevin Hoefling . Pascale Otis

Research Objectives: Despite temperatures that can dip below 0°C, antarctic waters provide a life sustaining environment for a number of fish species. How are they able to take the most frigid waters on earth through their gills without themselves freezing? A primary reason are the so-called antifreeze proteins, an adaptation found in a number of polar and subpolar species. The Southern Ocean provides the ideal laboratory and molecular biology the ideal probe to study this phenomenon.

This group studies the physiology of fish and larvae from these waters to see how ice grows in biological tissues -- a crystallization process called nucleation -- and how antifreeze glycoproteins (AFGP) inhibit it. The antifreeze function has enabled the antarctic notothenioids to colonize their frigid habitats very successfully. These researchers are mounting comprehensive multidisciplinary analyses of this adaptation at the level of the gene as well as the protein.

This season, deploying team members will:

+ Investigate the relationship between the severity of different antarctic marine environments (McMurdo vs. Peninsula) on notothenoid fish antifreeze capacity and function.

+ Characterize the antifreeze capacity at both the gene and protein levels of representative species from the five antarcticfamilies of notothenoid fish.

+ Characterize the evolution of AFGP gene families and the suborder Notothenoidei using molecular and cytogenetics techniques.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-131-M **NSF/OPP** 02-30424

Station: McMurdo Station
RPSC POC: Charles Kaminski
Research Site(s): McMurdo Station
Dates in Antarctica: Mid August to late October

Measurements addressing quantitative ozone loss, polar stratospheric cloud nucleation, and large polar stratospheric particles during austral winter and spring

Dr. Terry Deshler
University of Wyoming
Department of Atmospheric Science
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Measurements addressing quantitative ozone loss, polar stratospheric cloud nucleation, and large polar stratospheric particles during austral winter and spring

Deploying Team Members: Terry Deshler . Guido Di Donfrancesco . Michael Lampert . Paola Massoli . Jennifer Mercer . Maria Luisa Moriconi . Bradford A. Range . Marcel Snels

Research Objectives: The stratospheric ozone layer provides life on Earth with an essential shield from solar ultraviolet radiation. The discovery in 1985 of large ozone losses above Antarctica each spring took the world and the scientific community by surprise. Since that time, the cause of this unprecedented ozone loss has been determined to be chlorine compounds interacting on the surfaces of clouds that formed the previous winter [polar stratospheric clouds (PSCs)]. This interaction helps explain why ozone depletion is so severe in the polar regions. However, many details must still be clarified before we can comprehensively model the stratospheric ozone balance. An international experiment to address some of these details is planned for June through October 2003.

This experiment will compare balloon-borne ozone observations from nine antarctic stations (South Pole, General Belgrano II, Dumont d'Urville, Vicecomodoro Marambio, Georg von Neumayer, Rothera, Syowa, Davis, and McMurdo) with several three-dimensional chemical transport models. Balloon releases will be coordinated to sample air parcels previously sampled at another location. Comparing the changes within these air parcels will provide an excellent test of our understanding of stratospheric chemistry as represented in the models.

Observations from McMurdo Station will also add to our database of annual vertical ozone profiles and will be completed as stratospheric chlorine levels are peaking to provide a baseline to detect the first signs of ozone recovery. In addition to these ozone observations, we will extend our observations of PSCs. We use an optical radar (lidar, light detection and ranging) to study PSCs, stratospheric aerosol, and the thermal behavior and dynamics of the atmosphere above McMurdo Station. Continuous lidar observations provide insight into these PSCs, more specifically, estimates of the size and concentration of the particles that form in them and estimates of the surfaces available for heterogeneous chemistry (the activation of chlorine so it can destroy ozone), of the rates of denitrification and dehydration, and of particle composition.

Measurements of vertical ozone profiles are archived in the database of the Network for the Detection of Stratospheric Change, a global set of high-quality remote-sounding research stations for observing and understanding the physical and chemical state of the atmosphere (see www.ndsc.ws on the Internet). This project represents a collaboration between Italian researchers and the University of Wyoming.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-039-N
NSF/OPP 01-32032
Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Weddell Sea
Dates in Antarctica: Mid May to mid July

ICEFISH 2003: International collaborative expedition to collect and study fish indigenous to sub-antarctic habitats

Dr. William Detrich
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Photo not available.

Research Objectives: Notothenioids are a major group of fish in the Southern Ocean. The ancestral notothenioid fish stock of Antarctica probably arose as a sluggish, bottom-dwelling perciform species that evolved some 40 to 60 million years ago in the then temperate shelf waters of the antarctic continent. The grounding of the ice sheet on the continental shelf and changing trophic conditions may have eliminated taxonomically diverse late Eocene fauna and initiated the original diversification of notothenioids. On the high antarctic shelf today, notothenioids dominate the ichthyofauna in terms of species diversity, abundance, and biomass, the latter two at levels of 90 percent to 95 percent. Since the International Geophysical Year of 1957–1958, fish biologists from the Antarctic Treaty nations have made impressive progress in understanding the notothenioid ichthyofauna of the cold antarctic marine ecosystem. However, integration of this work into the broader marine context has been limited, largely because of lack of access to, and analysis of, specimens of subantarctic notothenioid fish.

The fish of this suborder are critical for a complete understanding of the evolution, population dynamics, ecophysiology, and ecobiochemistry of their antarctic relatives. Our project will support an international, collaborative research cruise to collect and study fish indigenous to subantarctic habitats. Research topics include systematics and evolutionary studies; life history strategies and population dynamics; physiological, biochemical, and molecular biological investigations of major organ and tissue systems; genomic resources for the subantarctic notothenioids; and ecological studies of transitional benthic invertebrates.

In a world that is experiencing changes in global climate, the loss of biological diversity, and the depletion of marine fisheries, the antarctic and subantarctic regions and their biota offer compelling natural laboratories for understanding the evolutionary impact of these processes. Our work will contribute to developing a baseline understanding of these sensitive ecosystems, one against which future changes in species distribution and survival can be evaluated judiciously.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-272-M
NSF/OPP 02-30513
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): McMurdo Station
Dates in Antarctica: Early to mid January (McMurdo), mid December to early January (R/V NBP)

Iron and light effects on Phaeocystis antarctica isolates from the Ross Sea

Dr. Giacomo R. DiTullio

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http://www.cofc.edu/~ditullio/

Photo not available.

Deploying Team Members: Giacomo R. DiTullio . Nathan S. Garcia . Sarah F. Riseman . Peter Sedwick

Research Objectives: The colonial prymnesiophyte Phaeocystis antarctica is a major bloom-forming alga in antarctic shelf waters, where, together with diatoms, it is considered a key species in regional biogeochemical cycling and ecosystem structure. Iron levels in these waters fall sharply during the mid- to late summer to concentrations that are likely to limit the growth of phytoplankton, including P. antarctica. However, in contrast to diatoms, very little work has been done to examine the effects of iron, or the combined effects of iron and irradiance, on the growth, physiology, and biochemical composition of P. antarctica. We will collect samples of P. antarctica from the southern Ross Sea and samples grown in semicontinuous batch cultures to investigate the effects of iron availability and irradiance on growth rate, cellular iron quota, buoyancy, biogenic sulfur production, pigment content, redox-protein expression, and photosynthetic efficiency.

Over time scales ranging from seasonal to interannual, P. antarctica is known to have a significant effect on regional biogeochemical cycles of carbon, nutrient elements, and sulfur in the Ross Sea. This species may also have played a central role in the inferred basin-scale changes in biogeochemical cycles linked to glacial-interglacial climatic change. Thus, it is important to develop a mechanistic understanding of the factors that control the growth, physiology, and biochemical composition of P. antarctica in order to better understand the biogeochemical ecology of the Ross Sea and the wider Southern Ocean and possible linkages with regional and global climate. The data we gather from these laboratory experiments, together with the results of recent and ongoing field and modeling studies, will substantially improve our ability to predict how the antarctic region will be affected by and modulate future climate change.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-426-M
NSF/OPP 98-10219

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Dry Valleys, Lake Vida, Lake Vanda
Dates in Antarctica: Early November to late December

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

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Department of Earth and Environmental Sciences
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http://tigger.uic.edu/~pdoran/home.htm

Making holes in the lake ice on Lake Fryxell to collect samples. Photo by Peter Doren.

Deploying Team Members: Phil Allen . Peter T. Doran . Robin Ellwood

Research Objectives: This project is the paleoclimatology, paleoecology, meteorology component of McMurdo LTER. A critical part of the LTER legacy research will be carried out this season. The group will extract long sediment cores from the Taylor Valley lakes and analyzing sediment from these cores to directly assess legacy.

These analyses will also tie into another project that extracts paleoclimatic information from these sediment cores. This group also oversees the recollection of a sediment addition experiment (one of the original LTER experiments I) which is resampled by divers every other year.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-045-L/P

NSF/OPP 02-17282

Station: R/V Laurence M. Gould, Palmer Station

RPSC POC: Rob Edwards

Research Site(s): R/V Laurence M. Gould, Palmer Station

Dates in Antarctica:

Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

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http://www.icess.ucsb.edu/lter/lter.html

Palmer Station, as seen from the Adelie penguin colony on Torgersen Island in Arthur Harbor, Anvers Island, Anatrctica. Photo by Hugh Ducklow.

Deploying Team Members: Hugh Ducklow . Nikki Middaugh . Anne Mills . Helen Quinby . Shana Rapoport . Lauren Rogers . Jennifer Salerno . Mary Turnipseed

Research Objectives: The Palmer Long-Term Ecological Research Project (PAL LTER) seeks to understand the structure and function of the antarctic marine and terrestrial ecosystem in the context of physical forcing by seasonal to interannual variability in atmospheric and sea-ice dynamics, as well as long-term climate change. The PAL LTER grid is designed to study marine and terrestrial food webs consisting principally of diatom primary producers, the dominant herbivore antarctic krill, Euphausia superba, and the apex predator Adélie penguin, Pygoscelis adeliae. An attenuated microbial food web, consisting of planktonic bacteria and Archaea and bacterivorous protozoa, is also a focus of study.

This project monitors western Antarctic Peninsula ecosystems annually over a grid of oceanographic stations and seasonally at Palmer Station. The extent and variability of sea ice affect changes at all trophic levels. In recent years, sea ice has diminished in response to a general regional warming. A long-term population decline of ice-dependent Adélie penguins provides a clear example of the impact of this trend in the Palmer region. Adélie populations at the five major rookeries located near Palmer Station and studied for the past 30 years have all shown a gradual decrease in numbers. The western Antarctic Peninsula, the site of PAL-LTER research, runs perpendicular to a strong climatic gradient between the cold, dry continental regime to the south, characteristic of the interior, and the warm, moist maritime regime to the north. More maritime conditions appear to be replacing the original polar ecosystem in the northern part of the peninsula as the climatic gradient shifts southward. To date, this shift appears to be matched by an ecosystem shift along the peninsula, as evidenced by declines in Adélie penguins, which require longer snow-cover seasons.

We hypothesize that ecosystem migration is most clearly manifested by changes in upper-level predators (penguins) and certain polar fishes in predator-foraging environments because these longer-lived species integrate recent climate trends and because individual species are more sensitive indicators than aggregated functional groups. We hypothesize that in the years ahead, analogous modifications will also become evident at lower trophic levels, although these changes are likely to be seen only through long-term studies of ecosystem boundaries along the peninsula.

By studying extant food webs in both the marine and terrestrial environments, we will continue to investigate ecosystem changes at lower trophic levels; changes in response to continued, dramatic warming; and shifts in the poleward climatic gradient along the western Antarctic Peninsula.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-027-M
NSF/OPP 01-25893
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): McMurdo Station
Dates in Antarctica: Early October to late November

Culture and health in Antarctica

Dr. Timothy D. Dye
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Photo not available.

Deploying Team Members: Nancy P. Chin . Ann M. Dozier . Timothy D. Dye

Research Objectives: The emergence of a long-term population in space will, in many ways, parallel the emergence of a sustained population in Antarctica, where development has expanded beyond the initial population of scientific and military personnel and now includes support staff and construction personnel. Experts speculate that a similar mix of residents may emerge as space populations develop. Such organizational and cultural merging in restricted environments undoubtedly creates new cultural landscapes (ethnoscapes) that could influence health and health behavior. Because of the extreme environmental circumstances, health risks and health care are particularly important. The study of cultural emergence in Antarctica as an analog to space could prove useful in the development of models of health and health behavior in an isolated confined environment (ICE) and could help planners better structure these environments to reduce health risks and identify factors that predispose people to those risks.

This group will

+ Model the emergence of cultural stages in ICE ethnoscapes as experienced by both short-and long-term populations,

+ Identify those elements of ICE ethnoscapes that are specific to an individual season and those that are repeated,

+ Relate how the temporal and content stages of ICE ethnoscapes interact with risk, behavior, and injury, and

+ Demonstrate the utility of electronic and distance-based assisted ethnography in the conduct of social research in ICE environments of Antarctica, and possibly in space.

Researchers will begin with key informant interviews and focus groups conducted throughout the United States with people who have spent at least one season on the ice within the past three years. The purpose is to elucidate the behaviors, risks, and health events that face residents, particularly in the emergence of ethnoscapes. During the next phase, researchers will reside in Antarctica for an extended period and conducting onsite participant observation and interviews at two different sites. This phase will include the Self-Disclosure Technique (SDT), an anthropological method for identifying the conceptual structure of a cultural event. SDT will be used to describe cultural dynamics in occupational, recreational, spiritual, and other group activities. Fieldwork will involve both short- and long-term residence. The data will be processed, and models will be tested for validity with informants on the ice.

This research could contribute to the development of screening procedures for long-term residence in ICEs and context-sensitive explanatory models of culture and injury risk, as well as illustrate the utility of distance-based ethnography.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-253-M
NSF/OPP 01-26007
Station: McMurdo Station
RPSC POC: Charles Kaminski
Research Site(s): McMurdo Sound
Dates in Antarctica: Late December to late January

Measurements and improved parameterizations of the thermal conductivity and heat flow through first-year sea ice

Dr. Hajo Eicken
University of Alaska Fairbanks
Geophysical Institute
hajo.eicken@gi.alaska.edu

Meg Smith and Lars Backstrom prepare to drill a sea ice core off the Erebus Glacier tongue near an instrumented sea ice site that this group studied jointly with colleagues from the New Zealand Antarctic Program. Photo by Hajo Eicken.

Deploying Team Members: Lars G. Backstrom . Hajo Eicken . Martin O. Jeffries . Kim Morris

Research Objectives: The sea-ice cover in the polar oceans strongly modifies ocean-atmosphere heat transfer. Most important, the ice cover thermally insulates the ocean, with sea-ice thermal conductivity determining the magnitude of the heat flow for a given ice-temperature gradient. Despite its importance (second only to ice albedo), knowledge of sea-ice thermal conductivity is limited to highly idealized models developed several decades ago. General circulation models (GCMs) and large-scale sea-ice models currently include overly simplistic parameterizations of ice thermal conductivity that are likely to contribute significantly to errors in estimating ice production rates.

Researchers will carry out a set of field measurements from which the thermal conductivity of first-year sea ice will be derived as a function of ice microstructure, temperature, salinity, and other parameters. Measurements will be carried out by letting thermistor arrays freeze into the McMurdo Sound fast ice, which represents an ideal natural laboratory for this type of measurement. To minimize errors and identify the most robust technique, the research team will collaborate with colleagues from New Zealand and compare different methodologies for measurement and analysis. They will also assess the impact of ice microstructure (spatial distribution of brine, crystal sizes) and convective processes on the effective rate of heat transfer.

Antarctic data will be compared with arctic thermal conductivity data sets to assess regional contrasts and the impact of different physical processes on heat flow and to arrive at a comprehensive, improved parameterization of ice thermal conductivity for large-scale simulations and GCMs. This component of the work will involve ice-growth modeling and collaboration with the Sea-Ice Model Intercomparison Project Team established under the auspices of the World Climate Research Program. This research will advance and improve

+ The understanding of the processes and parameters controlling heat transfer and the thermal conductivity of first-year sea ice

+ Techniques for deriving thermal conductivity and heat flow data from thermistor arrays

+ The understanding of sea-ice processes and heat flow through the ice cover in McMurdo Sound

+ Parameterizations of thermal conductivity for use in large-scale and high-resolution one-dimensional simulations

+ The representation of first-year ice thermal properties (both antarctic and arctic) in GCMs.

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-176-M/S

NSF/OPP 02-30246

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): McMurdo Station, South Pole Station

Dates in Antarctica: Late November to late December (McMurdo), mid November to mid January (South Pole)

Antarctic Troposphere Chemistry Investigation (ANTCI)

Dr. Fred Eisele
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School of Earth and Atmospheric sciences

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Photo not available.

Deploying Team Members: Anne Case . Steve Brooks . Jack Dibb . Fred Eisele . Daniel Gottas . Detlev Helmig . Manuel Hutterli . Edward Kosciuch . Joe Mastromarino . Roy Mauldin III . James Roberts . Steven Sjostedt . David Tan . David Tanner . Mathew Warshawsky

Research Objectives: We will study sulfur chemistry in the antarctic atmosphere to enhance our understanding of the processes that control tropospheric levels of reactive hydrogen radicals, reactive nitrogen, sulfur, and other trace species for the further purpose of improving the climatic interpretation of sulfur-based signals in antarctic ice-core records. Specifically, we will be making observations of reactive hydrogen radicals, sulfuric acid and its sulfur precursors, and the flux of ultraviolet radiation. The results we derive will lead to a far more comprehensive understanding of antarctic atmospheric chemistry, as well as the factors that influence the levels and distributions of climate proxy species in antarctic ice cores.

Our major science objectives include

+ Evaluating the processes that control spring and summer levels of reactive radicals in the atmospheric surface layer at the South Pole,

+ Assessing how representative previously obtained South Pole and coastal measurements are in the larger context of polar plateau processes, and

+ Investigating the relative importance of the oxidative processes involved in the coast-to-plateau transport of reduced sulfur and determining the principal chemical transition regions.

Secondary objectives include investigating snow/firn chemical species that undergo extensive exchange with the atmosphere and assessing the different chemical forms of the trace elements and their relationships to levels of ozone and other oxidants.

Atmospheric sulfur chemistry is important in climate change because both naturally and anthropogenically emitted sulfur compounds form minute particles in the atmosphere (so-called aerosols) that reflect solar radiation, produce atmospheric haze and acid rain, and affect ozone depletion. These sulfate particles may also act as condensation nuclei for water vapor and enhance global cloudiness. The primary natural sources of sulfur are volcanic emissions and dimethylsulfide production by oceanic phytoplankton.

On the millennial time scale, the variability and background level of atmospheric aerosols can be reconstructed from ice cores. It is, however, necessary to understand how the physical and chemical environment of the process affects the relative concentrations of the oxidation products that become buried in the ice.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-117-S
NSF/OPP U.S./Japan agreement

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station, SkyLab
Dates in Antarctica: Early to mid November

All-Sky imager at South Pole

Dr. Masaki Ejiri
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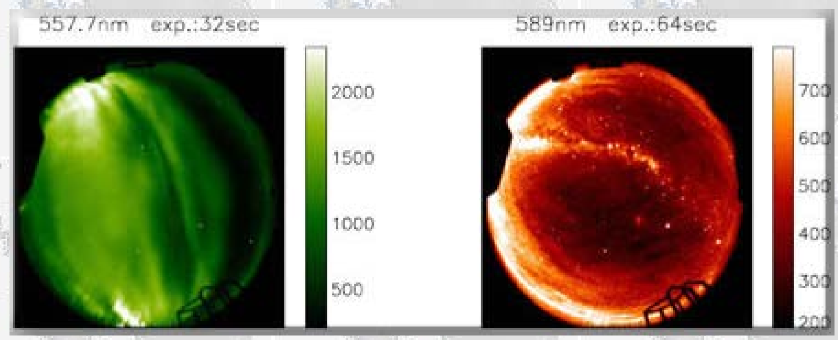

Air glow and green aurora taken by the All Sky Imager instrument near-simultaneously. Photo courtesy of National Institute of Polar Research, Japan.

Deploying Team Members: Masaki Ejiri . Masaki Tutsumi . Akira Yukimatsu

Research Objectives: The South Pole is a unique platform for observing aurora during the austral winter. The pole provides a unique vantage point for observing the airglow and to discern the characteristics of acoustic gravity waves in the polar region as they vary in altitude and wavelength. The continuous observation available at the South Pole allows researchers to collect data on auroras that develop from precipitating low-energy particles entering the magnetosphere from the solar wind:

+ Dayside polar cusp/cleft aurora,

+ Afternoon aurora that are closely associated with the nightside magnetospheric storm/substorm activities,

+ The polar cap aurora, which is dependent on the polarity of the interplanetary magnetic field.

Though data have been acquired at the South Pole since 1965 using a film-based, all-sky camera system, newer technology produces digital images and permits automatic processing of large amounts of information. This group uses the all-sky-imager (ASI), a digital CCD imager monitored and controlled by the Japanese NIPR (National Institute of Polar Research).

These international collaborations should enhance knowledge of the magnetosphere, the ionosphere and of upper/middle atmosphere physics. The HF (high frequency) radars at Halley Bay, Sanae, and Syowa Station provide the vector velocity of ionospheric plasma over the South Pole.

These studies should provide further insight into the physics of the magnetosphere, the convection of plasma in the polar cap, and solar wind effects - specifically dayside auroral structure, nightside substorm effects, and polar-cap arcs.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-034-M
NSF/OPP 01-25098
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): Cape Adare, Cape Hallett, Terra Nova Bay, McMurdo Station
Dates in Antarctica: Mid December to mid February

Occupation history and diet of Adélie penguins in the Ross Sea region

Dr. Steven D. Emslie

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http://www.uncwil.edu/tc/AntarcticaLive

An abandoned penguin colony near Australia's Casey Station before excavation. The mounded concentration of pebbles stands out from the rest of the natural landscape and makes these sites easy to identify. The mound was formed after penguins collected pe

Deploying Team Members: Jerzy Smykla . Ed Cavallerano . Larry Coats . Steven D. Emslie

Research Objectives: We will build on previous studies to investigate the occupation history and diet of Adélie penguins (Pygoscelis adeliae) with excavations of the many abandoned and active penguin colonies in the Ross Sea region: more specifically, the Victoria Land coast from Cape Adare to Marble Point. Some of these sites have been radiocarbon-dated and indicate that Adélie penguins have occupied these sites for 13,000 years. The material we will recover, as demonstrated from previous investigations, will include penguin bones, tissue, and eggshell fragments, as well as abundant remains of prey (fish bones, otoliths, squid beaks) preserved in ornithogenic soils (formed from bird guano). These organic remains will be quantified and subjected to radiocarbon analyses to obtain a colonization history of the penguins in this region. Identification of prey remains in the sediment will allow us to assess penguin diet.

We will collaborate with New Zealand scientists to analyze other data from these sites (ancient DNA) and will interpret past climatic conditions from published ice-core and marine-sediment records. These data will be used to test the hypothesis that Adélie penguins respond predictably to climate change, past and present. In addition, we will test the hypothesis that these penguins alter their diet in accordance with climate, sea-ice conditions, and other marine environmental variables along a latitudinal gradient. Graduate and undergraduate students will be involved, and a Web site will be developed to report results and maintain educational interaction between project personnel and students at local middle and high schools in Wilmington, North Carolina.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-102-M/S

NSF/OPP 02-33169

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): Arrival Heights, CUSP Laboratory

Dates in Antarctica: Instruments operate year-round, early to mid January (project team deploys)

Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites

Dr. Mark J. Engebretson

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Photo not available.

Research Objectives: The Earth's magnetic field arises from its mass and motion around the polar axis, but it creates a powerful phenomenon at the edge of space known as the magnetosphere, which has been described as a comet-shaped cavity or bubble around the Earth, carved in the solar wind. When that supersonic flow of plasma emanating from the Sun encounters the magnetosphere, the result is a long cylindrical cavity, flowing on the lee side of the Earth, fronted by the blunt nose of the planet itself. With the solar wind coming at supersonic speed, this collision produces a “bow shock” several Earth radii in front of the magnetosphere proper.

One result of this process is fluctuations in the Earth's magnetic field, called micropulsations, which can be measured on time scales between 0.1 second and 1,000 seconds. It is known that magnetic variations can significantly affect power grids and pipelines. We plan to use magnetometers (distributed at high latitudes in both the antarctic and arctic regions) to learn more about how variations in the solar wind can affect the Earth and manmade systems.

We will study these solar-wind-driven variations and patterns at a variety of locations and over periods up to a complete solar cycle. Since satellite systems are now continuously observing solar activity and also monitoring the solar wind, it is becoming feasible to develop models to predict the disruptions caused by such magnetic anomalies. And while our work is geared specifically toward a better understanding of the world and the behavior of its manmade systems, it will also involve space weather prediction.

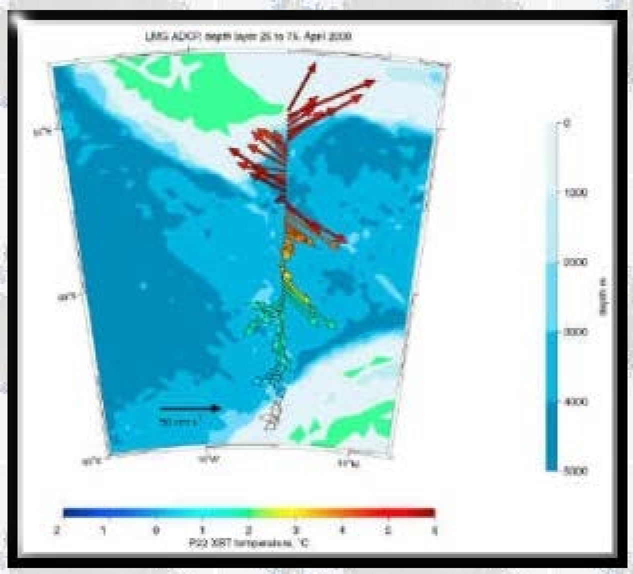
Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-315-N
NSF/OPP 98-16226
Station: RV/IB Nathaniel B. Palmer
RPSC POC: Todd Johnson
Research Site(s): USAP research vessel cruise tracks
Dates in Antarctica: Instruments operate year-round

Shipboard acoustic Doppler current profiling aboard the research vessel Nathaniel B. Palmer

Dr. Eric Firing
University of Hawaii Manoa
Department of Oceanography
http://currents.soest.hawaii.edu/antarctic/index.html



Currents from an April 2000 crossing of Drake Passage. Velocity vectors are colored according to ocean temperature. Courtesy of Teresa Chereskin.

Research Objectives: Currents in the Southern Ocean have a profound influence on the world's oceans, and therefore upon global temperature and the planet's ecosystem. Yet some remote regions receive little scientific attention. Using Doppler technology (sound-wave transmission and reflection), this project is exploring upper ocean current velocities. Researchers are building a quality-controlled data set in one such sparsely sampled and remote region, which nonetheless appears to play a significant role in global ocean circulation. They will develop and maintain a shipboard acoustic Doppler current profiler (ADCP) program on board the USAP research vessel Nathaniel B. Palmer (R/V NBP).

Part of the long-term science goal is to characterize the temporal and spatial velocity structure in the Southern Ocean. This entails measuring the seasonal and annual changes in upper ocean currents within the Drake Passage and then combining this information with similar temperature observations to see how the heat exchange varies and how it drives upper ocean currents.

For five years, this project's ADCP and TSG (thermosalinograph) instruments have been installed on the R/V NBP. During each cruise, data is collected and transmitted to the home institution. Shipboard electronics technicians and computer support staff maintain and monitor the systems.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-425-M

NSF/OPP 98-10219

Station: McMurdo Station

RPSC POC: Jessie Crain

Research Site(s): Lake Hoare, McMurdo Station, Beacon Valley, Lake Bonney, Canada Glacier, Explorers Cove, Lake Fryxell, Taylor Glacier, Lake Vanda, Lake Brownworth, Lake Vida, Taylor Valley, Dry Valleys

Dates in Antarctica: Late October to early February

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Dr. Andrew Fountain
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The Role of Natural Legacy on Ecosystem Structure and Function in a Polar Desert: The McMurdo Dry Valley Long Term Ecological Research Program

Deploying Team Members: Amy F. Ebnet . Andrew Fountain . Thomas H. Nylen . Peter Sniffen . Martyn Tranter

Research Objectives: This project is the glacier mass balance, melt and energy balance component of the McMurdo LTER.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-013-L/P
NSF/OPP 02-17282

Station: R/V Laurence M. Gould, Palmer Station
RPSC POC: Jessie Crain
Research Site(s): R/V Laurence M. Gould, Adelaide Island, Palmer Station
Dates in Antarctica:

Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

Dr. William R. Fraser
Polar Oceans Group
bfraser@3rivers.net

Palmer Long Term Ecological Research Project: Climate, ecological migration, and teleconnections in an ice-dominated environment

Deploying Team Members: Cynthia D. Anderson . William R. Fraser . Heidi N. Geisz . Donna L. Patterson . Brett C. Pickering

Research Objectives: The seabird component of the Long Term Ecological Research (LTER) project will continue studies of seabird communities within the LTER sampling grid with emphasis placed on species abundance and dietary components during summer.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-198-P
NSF/OPP 01-30525
Station: Palmer Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station
Dates in Antarctica:

Monitoring the human impact and environmental variability on Adelie Penguins at Palmer Station

Dr. William R. Fraser

Polar Oceans Group
bfraser@3rivers.net

Photo not available.

Research Objectives: The potential consequences of antarctic tourism on Adélie penguins (Pygoscelis adeliae) have been debated for more than 20 years. However, the rapid proliferation of these activities since 1970, particularly on the Antarctic Peninsula, has not only forced an extension of these questions to wildlife populations in general, but also colored them with a sense of urgency and controversy that has polarized opinions. The key concern is that continued increases in these activities will eventually overcome the ability of research to address critical issues in a timely and biologically meaningful manner. This is a valid concern, since studies to examine human impacts have either not been implemented at critical sites or are limited in scope because of logistic and experimental constraints.

Understanding how tourism might affect Adélie penguins rests fundamentally on the need to quantify and understand the natural variability manifested by breeding populations over spatial and temporal scales. However, although it is generally recognized that without these data it will be difficult to critically assess any localized changes from tourism, this ecosystem approach is expensive and complex and is not likely to be justified by the need to understand tourist impacts.

This group will continue a tourist monitoring program underway at Palmer Station as part of a large ecosystem-scale study. Palmer Station mirrors current patterns in tourism and tourist–wildlife interactions in the western Antarctic Peninsula. It also provides unique opportunities for research on human impacts. This includes the presence of long-term databases that document environmental variability over time and space scales in both marine and terrestrial habitats, as well as the ability to examine potential tourist impacts as part of controlled experiments.

This research is expected to capitalize and expand on two key findings to date. One is the discovery of a previously unrecognized source of variability in the Adélie penguin population that results from interactions between landscape geomorphology and changing patterns of snow deposition due to climate warming. The other is the observation that penguins breeding in less desirable landscapes may be more susceptible to cumulative impacts induced by the presence of human activity.

These findings have important implications for understanding interactions between climate change and ecosystem response, and for detecting, mitigating, and managing the consequences of human activities such as tourism.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-100-M **NSF/OPP** 01-38126

Station: McMurdo Station
RPSC POC: Charles Kaminski
Research Site(s): McMurdo Station
Dates in Antarctica: Instruments operate year-round

The Operation of an ELF/VLF Radiometer at Arrival Heights, Antarctica

Dr. Antony C. Fraser-Smith
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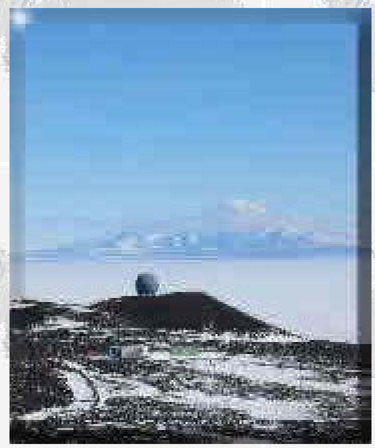

View from the ELF/VLF radio antenna on the "Second Crater" at Arrival Heights. Mt. Discovery provides a backdrop for the New Zealand communications satellite installation on top of the "First Crater." US (white) and New Zealand (green) huts are also vis

Research Objectives: Since it was discovered in the 1930s that natural phenomena emit the lowest form of electromagnetic energy (radio waves), the field of radio astronomy has joined the scientific effort to analyze both atmospheric and extraterrestrial signals. The extremely-low-frequency and very-low-frequency (ELF/VLF) record of data collected by this project at Arrival Heights-chosen because it is unusually free from manmade electromagnetic interference-now extends unbroken for almost 15 years.

The radiometers at McMurdo operate in both the ELF and VLF ranges, monitoring radio noise from natural sources such as thunderstorms. Characterizing the possible sources of radio interference is important for operational purposes. Since thunderstorms generate telltale radio signals, tracking variations in global noise reflects thunderstorm activity and thus can provide information on changes in global climate.

The Arrival Heights site is one of a network of eight such radiometers operated by Stanford University for the Office of Naval Research.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-212-E

NSF/OPP 03-36469 SGER

Station: Special Project
RPSC POC: John Evans
Research Site(s): Juan Carlos I (Spanish base) via R/V Hesperides
Dates in Antarctica: Early January to late February

Complex pelagic interactions in the Southern Ocean: Deciphering the antarctic paradox

Dr. Thomas K. Frazer
University of Florida
Department of Fisheries and Aquatic Sciences
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Photo not available.

Deploying Team Members: Tom Frazer

Research Objectives: Our primary goal is to quantify, examine, model, and validate the complex interactions involving the direct, indirect, and feedback effects that regulate the planktonic food web in the coastal waters of the Southern Ocean in order to find the causes of low phytoplankton biomass and production there despite the plentiful availability of nutrients. In particular, we will evaluate the feedback mechanisms induced through the role of ammonium, which is largely released by aggregations of herbivorous zooplankton (krill specifically) present in the Southern Ocean, on the resistance to ultraviolet stress by the phytoplanktonic community and, in particular, the effects on nitrogen incorporation rates, both ammonium and nitrate, and the subsequent development of phytoplankton blooms.

We will not only address the problem experimentally, but will also consider the context of the heterogeneous landscape, dominated by small parcels of water, where these complex interactions occur. This project will be conducted through a shore-based (at the Spanish station

Juan Carlos I) operation in 2004 and a subsequent cruise (on the R/V Hesperides) in 2005.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-109-S

NSF/OPP 99-80801

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Mid November to mid February

South Pole Air Shower Experiment - SPASE 2

Dr. Thomas K. Gaisser
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South Pole Air Shower Experiment in December 1995 just after the array was installed. The spacing between detectors is 100 feet. The inset shows a close-up of a nearby detector with its four modules. Cables to some of the outer detectors are also visible.

Deploying Team Members: Thomas K. Gaisser . Serap Tilav

Research Objectives: Cosmic rays consist of protons and other atomic nuclei, accelerated (scientists believe) to high energy levels in such distant astrophysical sources as supernova remnants. As cosmic rays from space arrive at the Earth, they interact in the upper atmosphere. The South Pole Air Shower Experiment-2 (SPASE-2) is a sparsely filled array of 120 scintillation detectors spread over 15,000 square meters at South Pole. This array detects the charged particles (primarily electrons) that are produced by interactions of these very high energy cosmic rays.

A nine-station subarray called VULCAN has been constructed to detect the Cherenkov radiation (light emitted by a charged particle moving through a medium at a higher speed than the speed of light within that material, analogous to the shock wave produced by objects moving faster than the speed of sound) produced high above the ground in the same showers. The SPASE array is located less than half a kilometer from the top of AMANDA and is designed to complement AMANDA's (A-130-M) neutrino detecting capacity.

The first of SPASE's two goals is to investigate the high-energy primary cosmic radiation that comes from galaxies by determining the relative contribution of different groups of nuclei at energies greater than about 100 teraelectron volts. This can be done by analyzing coincidences between SPASE and AMANDA. Such coincident events are produced by high-energy cosmic-ray showers with trajectories that pass through SPASE (on the surface) and AMANDA (buried 1.5 to 2 kilometers deep). AMANDA detects high-energy muons penetrating the Earth in those same showers for which SPASE detects the low-energy electrons arriving at the surface. The ratio of muons to electrons depends on the mass of the original primary cosmic ray nucleus. The VULCAN detector further permits the calculation of two other ratios that also depend on primary mass in readings from the showers it detects.

The second goal is to use the coincident events as a tagged beam. This configuration permits investigation and calibration of certain aspects of the AMANDA response. This project cooperates with the University of Leeds in the United Kingdom.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-208-N
NSF/OPP 01-25818

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Late October to late November

Interactive effects of UV and Vertical mixing on phytoplankton and bacterioplankton in the Ross Sea

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Photo not available.

Deploying Team Members: Ann G. Gargett . Christopher M. Powell

Research Objectives: Ultraviolet (UV) radiation influences plankton in the near-surface waters of most ecosystems. In particular, the Southern Ocean is affected in the austral spring, when UV radiation is enhanced by ozone depletion. While progress has been made in estimating the impact of UV radiation on bacteria and phytoplankton in the Southern Ocean, important issues remain to be resolved. Little is known, for example, about responses in systems dominated by the colonial haptophyte Phaeocystis antarctica, which dominates spring blooms in the southern Ross Sea. The presence of open water at a far southerly location in the spring, well within the ozone hole, and continuous daylight, with implications for DNA repair, make the Ross Sea of intense interest.

A number of studies suggest that vertical mixing can significantly modify the impact of UV radiation. However, the limited measurements of turbulence intensity in the surface layer that have been done have not been integrated with parallel studies of the effects of UV radiation on phytoplankton and bacterioplankton. To address these issues, we will focus on vertical mixing and UV radiation in the Ross Sea and characterize phytoplankton and bacterioplankton responses in both laboratory and solar incubations. These studies will lead to biological weighting functions and response models capable of predicting the impact of UV radiation on photosynthesis, bacterial incorporation, and DNA damage in the surface layer.

We will use measure depth-dependent profiles of DNA damage, bacterial incorporation, photosynthesis, and fluorescence parameters over a 24-hour cycle. We have optimized measurements for typical springtime conditions in the Ross Sea, where stabilizing influences like solar heating and/or surface freshwater from melting ice mean that not enough turbulence is present to thoroughly mix the upper layer.

We will develop fine-scale vertical density profiles to directly estimate large eddy scales. Estimated turbulent diffusivities and eddy scales will be directly related to surface layer effects and used to generate models of UV radiation responses in the surface mixed layer.

This first in-depth study of UV radiation in the Ross Sea will enhance scientific understanding of vertical mixing processes, trophic interactions, and biogeochemical cycling in the Ross Sea and will provide a valuable comparison with previous work in the Weddell-Scotia Confluence and Palmer Station regions.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-009-M **NSF/OPP** 02-25110

Station: McMurdo Station

RPSC POC: Patricia Jackson

Research Site(s): McMurdo Station, Beaufort Islands, Big Razorback, Cape Evans, Hutton Cliffs, Hut Point, Cape Royds, Scott Base, McMurdo area sea ice, Turtle Rock

Dates in Antarctica: Early October to late February

Patterns and processes: Dynamics of the Erebus Bay Weddell seal population

Dr. Robert A. Garrott

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Ecology
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http://www.montana.edu/ecology/staff/garrott/antarctica/index.htm

Jeff Warren records the tag numbers of a mother and her pup on the north side of the Erebus Glacier tongue. Photo by Darren Ireland.

Deploying Team Members: Susan J. Ellison . Robert A. Garrott . Gillian L. Hadley . Darren S. Ireland . Mark D. Johnston . Kelly Proffitt . Brent S. Stewart . Pamela K. Yochem

Research Objectives: The Erebus Bay Weddell seal (Leptonychotes weddellii) population study in eastern McMurdo Sound was initiated in 1968 and represents one of the longest intensive field investigations of a long-lived mammal in existence. Over nearly 35 years, a total of 15,636 animals have been tagged, with 144,927 resighting records logged in the database. This study is a valuable resource for understanding population dynamics not only of Weddell seals, but also of other species of both terrestrial and marine mammals. We intend to proceed with two lines of investigation that combine the long-term database with new field initiatives.

The continuity of the demographic data will be maintained by annually marking all pups born, replacing lost or broken tags, and performing censuses. We will combine the new data with the existing database and perform a progressively complex series of demographic analyses that will allow us to test specific hypotheses about population regulation and evaluate previously determined temporal and spatial patterns of variation in vital rates among colonies.

The primary new field initiative will involve an intensive study of mass dynamics of both pups and adult females to assess annual variation in marine resources and their potential role in limiting or regulating the population. In addition to collecting data on body mass dynamics, we will use satellite imagery to develop an extended time-series of sea ice in McMurdo Sound. (Regional extent of sea ice affects both regional primary productivity and availability of haul-out areas.) Increased primary productivity may increase marine resources, which would be expected to have a positive effect on foraging efficiency, leading to increased body mass. Understanding the mechanisms that limit or regulate Weddell seal populations and the specific linkages between climate, oceans, ice, and antarctic food webs can make important contributions to knowledge of pinniped population dynamics, as well as theoretical understanding of populations, communities, and ecosystems.

Such knowledge can be readily applied to enhance the ability of natural resource managers to effectively maintain assemblages of other large mammal species and the ecological processes they facilitate. Continuation of this long-term study may also contribute to understanding the potential impacts of human activities such as global warming and the commercial exploitation of antarctic marine resources.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-207-N

NSF/OPP 01-25833

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Late October to late November

Comparative and quantitative studies of protistan molecular ecology and physiology in coastal antarctic waters

Dr. Rebecca J. Gast
Woods Hole Oceanographic Institution
rgast@whoi.edu

Photo not available.

Deploying Team Members: Mark R. Dennett . Rebecca J. Gast . Dawn M. Moran . Julie Rose . Robert W. Sanders . Rebecca Schaffner . Astrid Schnetzer . Matthew Travao

Research Objectives: Phototrophic and heterotrophic protists (single-cell organisms — e.g., protozoa) are ubiquitous in extreme cold water environments, where they are central to the production and use of energy and the cycling of elements. The dominance of protists in antarctic food webs indicates major ecological and biogeochemical roles for these unicellular eukaryotes. Understanding the structure and diversity of these communities and the adaptations that allow them to flourish near the lower limit of temperature in the ocean is of fundamental importance to biological oceanography and to understanding the activities and evolution of life on our planet.

The diversity of protistan assemblages has traditionally been studied using microscopy and morphological characterization. Such an approach is inadequate for ecological studies of these communities due to its tedious nature and the inherent lack of taxonomic characters associated with most small protists. Molecular methods that use gene sequences to identify and quantify naturally occurring protists offer a better solution to this problem.

We will perform molecular and physiological studies on protistan assemblages in the sea water and ice habitats of the Ross Sea in order to address community structure, population abundance, and adaptation to life in extreme cold. We will focus primarily on species of phagotrophic protists (protozoa) that are ecologically important but for which no information exists. Our work is designed to contribute to the understanding of the biodiversity of the protistan assemblages of coastal Antarctica, to provide tools for ecological studies, and to produce benchmark data on the basic physiological processes of protistan species in this extreme cold-water environment.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-206-N

NSF/OPP 01-26150

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): R/V Nathaniel B. Palmer
Dates in Antarctica: Mid October to late November

Ultraviolet-radiation-induced changes in the patterns of production and composition of biochemical compounds antarctic marine phytoplankton

Dr. Joaquim I. Goes
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Department of Ocean Sciences
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Photo not available.

Deploying Team Members: Ashley Below . Joaquim I. Goes . Helga do Rosario Gomes . Nissa L. Lohrmann

Research Objectives: There is enough evidence to show that present levels of incident ultraviolet (UV) radiation—280 to 400 nanometers (nm)—are impairing phytoplankton productivity in the Southern Ocean. Yet efforts aimed at extrapolating these findings to allow accurate and unambiguous predictions of the consequences of UV radiation on the antarctic marine food web and biogeochemical cycles in the sea have been confounded by uncertainty. Estimates of the effects of UV radiation on the antarctic marine ecosystem range from insignificant to catastrophic. This disparity has been attributed to lack of information in key areas of photobiology and photochemistry.

Generally, studies have been based on broadband UV radiation and do not take into account competing responses of phytoplankton at different wavelengths across the waveband. Such information is critical if we are to understand the consequences of UV radiation enhancement on carbon assimilation by marine phytoplankton and its consequences for the food web and biogeochemical cycles. This is especially true in regions like the Antarctic, where stratospheric ozone concentrations can decrease by about 50 percent each spring, thereby altering the proportion of UV–B (280 to 320 nm) and UV–A (320 to 400 nm) radiation that phytoplankton receive during their growth season.

We will systematically investigate changes in the production rates and composition of biochemical compounds within antarctic phytoplankton cells under spectrally defined conditions. We will examine both laboratory cultures and natural populations in order to understand

+ How the cellular biochemical processes of phytoplankton are affected by the interplay between the different UV wavelengths and visible light,

+ How sensitivity to UV radiation varies across taxonomic groups of phytoplankton, and

+ Whether this difference in sensitivity is responsible for the dominance of one species over the other.

We will also study the effect of UV radiation on nutrient uptake by phytoplankton cells. The information we gain will help ascertain the role of UV radiation in the phytoplankton dynamics of the Southern Ocean.

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-291-M
NSF/OPP 02-30280
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Nimrod Glacier, McMurdo Station
Dates in Antarctica: Mid November to early February

Geophysical mapping of the east antarctic shield adjacent to the Transantarctic Mountains

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Photo not available.

Deploying Team Members: Jared Abraham . Eric Anderson . Peter Braddock . Detlef Damaske . Carol A. Finn . John W. Goodge . Heinz-Dieter Moeller . Mike Reiser . Norbert Roland

Research Objectives: The East Antarctic Shield is one of Earth's oldest and largest cratonic assemblies. Interest in the evolution of the shield has been rekindled over the past decade by tectonic models linking East Antarctica with other Precambrian crustal elements in the Rodinia and Gondwanaland supercontinents. It has been postulated that the Pacific margin of East Antarctica was rifted from Laurentia during the late Neoproterozoic breakup of Rodinia; it then developed as an active plate boundary during the subsequent amalgamation of Gondwanaland. A better understanding of the geological evolution of the shield is therefore critical for studying Precambrian crustal evolution in general, as well as resource distribution, biosphere evolution, and glacial and climate history during later periods. Because of nearly complete coverage by the polar continental-size ice capsheets, however, Antarctica remains the single most geologically unexplored continent. Also, little is known about the composition and structure of the shield's interior.

Therefore, we will conduct an airborne magnetic survey (coupled with ground-based gravity measurements) across an important window into the shield where it is exposed in the Nimrod Glacier area of the central Transantarctic Mountains. Specific goals are to

+ Characterize the magnetic and gravity signature of the east antarctic crustal basement exposed at the Ross margin,

+ Extend magnetic data westward along a corridor across the polar ice capeast antarctic ice sheet to image the crust in ice-covered areas,

+ Obtain magnetic data over the Ross Orogen to image the ice-covered boundary between + basement and supracrustal rocks, and

+ Use the shape, trends, wavelengths, and amplitudes of magnetic anomalies to define magnetic domains in the shield.

Our survey (to be done in collaboration with German colleagues) will, for the first time, use geophysical methods to characterize the shield terrain in this sector. This baseline over the exposed shield will allow for a better interpretation of geophysical patterns in other ice-covered regions and can be used to target future investigations. Once the survey is done, we will then perform data reduction, interpretation, and geological correlation.

This research will lead to new basic knowledge about the antarctic continent, which in turn may help with applied research in other fields such as the glacial history of Antarctica.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-215-N **NSF/OPP** 01-25172

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Karl Newyear
Research Site(s): R/V Nathaniel B. Palmer
Dates in Antarctica: Late February to mid April

ANSLOPE: Cross slope exchanges at the antarctic slope front

Dr. Arnold L. Gordon

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The first AnSlope cruise. Photo by Arnold Gordon.

Deploying Team Members: Amy Bratcher . Kathryn Brooksforce . Bruce Huber . Samar Khatiwala . Gerd Krahmann . Fred Martwick . Philip Mele . Alejandro Orsi . Andreas Thurnherr . Martin Visbeck

Research Objectives: What is the role of the antarctic slope front (ASF) and continental slope morphology in the exchanges of mass, heat, and freshwater between the shelf and oceanic regimes, in particular those leading to outflows of dense water into intermediate and deep layers of the adjacent deep basins and world ocean circulation?

The importance to the global ocean circulation and climate of cold water masses originating in the Antarctic is understood, but the processes by which these water masses enter the deep ocean circulation are not. Our program, called AnSlope, will address this problem. Our primary goal is to identify the principal physical processes that govern the transfer of shelf-modified dense water into intermediate and deep layers of the adjacent deep ocean, as well as understand the compensatory poleward flow of waters from the oceanic regime. The upper continental slope is the critical gateway for the exchange of shelf and deep ocean waters. Here the topography, velocity, and density fields associated with the nearly ubiquitous ASF must strongly influence the transfer of water properties between the shelf and oceanic regimes.

AnSlope has four specific objectives:

+ Determine the ASF's mean structure and the principal scales of spatial and temporal variability, and estimate the ASF's role in cross-slope exchanges and mixing of adjacent water masses;

+ Determine the influence of slope topography on frontal location and outflow of dense shelf water;

+ Establish the role of frontal instabilities, benthic boundary layer transports, tides, and other oscillatory processes on cross-slope advection and fluxes; and

+ Assess the effect of shear-driven and double-diffusive mixing, lateral mixing identified through intrusions, and nonlinearities in the equation of state on the rate of descent and the fate of outflowing, near-freezing shelf water.

We will address these objectives with an integrated observational and modeling program. We will perform a set of measurements whose basic elements are moorings, microstructure analysis, tracers, and basic tidal modeling. Three cruises over a 12- to 14-month period beginning in the austral summer of 2003 will provide the data. Moorings will be in place throughout this period. Existing Italian and German programs will provide enhancement and a test bed for our parameterizations of cross-front exchange.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-067-E

NSF/OPP 02-28842

Station: Special Project
RPSC POC: John Evans
Research Site(s): Australia's Davis Station
Dates in Antarctica: Mid November to early February

Boron in antarctic granulite-facies rocks: Under what conditions is boron retained in the middle crust?

Dr. Edward S. Grew
The University of Maine
Department of Geological Sciences
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At the joint Geological Association of Canada-Mineralogical Association of Canada meeting in Vancouver (May '03), principle investigators Ed Grew (left) and Chris Carson plan for upcoming fieldwork on borosilicate minerals in the Larsemann Hills, Prydz Ba

Deploying Team Members: Chris Carson . Edward S. Grew

Research Objectives: Trace elements provide valuable information on the changes sedimentary rocks undergo as temperature and pressure increase during burial. One such element, boron, is particularly sensitive to increasing temperature because of its affinity for aqueous fluids, which are lost as rocks are buried. The boron content of unmetamorphosed pelitic sediments ranges from 20 to over 200 parts per million, but rarely exceeds 5 parts per million in rocks subjected to the conditions of the middle and lower crust. Devolatization with loss of aqueous fluid and partial melting with removal of melt have been cited as primary causes for boron depletion in granulite-facies rocks. Despite the pervasiveness of both these processes, rocks rich in boron are locally found in granulite-facies in the Larsemann Hills along Prydz Bay. More than 20 lenses and layered bodies containing four borosilicate mineral species crop out over a 50-square-kilometer area.

While most investigators have focused on the causes of boron loss, we will use field observations and mapping, chemical analyses of minerals and their host rocks, and microprobe age-dating to investigate how boron is retained during high-grade metamorphism. Our working hypothesis is that a high initial content facilitates retention of boron during metamorphism. For example, in a rock with large amounts of the borosilicate tourmaline (such as strata-bound tourmalinite), the breakdown of tourmaline to melt could result in the formation of prismatine and grandidierite, two borosilicates found in the Larsemann Hills. This situation is rarely observed in rocks with a modest boron content, in which tourmaline breakdown releases boron into partial melts, which in turn remove it when they leave the system.

Strata-bound tourmalinite is associated with manganese-rich quartzite, phosphorus-rich rocks, and sulfide concentrations that could be indicative of a tourmalinite protolith in a highly metamorphosed complex where sedimentary features have been destroyed by deformation. Because partial melting plays an important role in the fate of boron, our research will focus on the relationship between borosilicate units, granite pegmatites, and other granitic intrusives. Our results will provide information on boron cycling at deeper levels in the Earth's crust and on possible sources of boron for granites originating from deep-seated rocks.

Glaciology

Dr. Julie Palais
Program Manager

I-196-M

NSF/OPP 01-24014

Station: McMurdo Station

RPSC POC: Melissa Rider

Research Site(s): Lake Vanda, Lake Bonney, Lake Joyce, Lake Fryxell, Lake Vida, Convoy Range, McMurdo Station, Dry Valleys

Dates in Antarctica: Late December to early February

Millennial-scale fluctuations of Dry Valleys lakes: A test of Implications for regional climate variability and the interhemispheric (a)synchrony of climate change

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Sediment coring crew on Lake Fryxell, January 2003. Photo by Brenda Hall.

Deploying Team Members: Gordon Bromley . Katrina R. Faloon . Brenda L. Hall . Chris Hendy . Erica Hofstee . Thomas Whittaker

Research Objectives: A key unresolved question in antarctic glaciology concerns the stability of the West Antarctic Ice Sheet (WAIS). The WAIS is marine-based, meaning that its substratum is a series of archipelagoes in the northwestern Ross Sea Embayment off the northern Scott Coast. At its relatively fixed position, the WAIS is grounded on the continental shelf with plate boundaries nearby. In contrast, the East Antarctic Ice Sheet sits on a stable lithospheric plate.

As deglaciation began after the last glacial maximum (LGM), the WAIS became unmoored. Scientists believe this was likely the first area of the shelf to become free of grounded ice. Learning how and when and in what sequence this occurred is a critical step towards isolating the mechanisms (sea level, climate, ocean temperature, and internal dynamics) that control

WAIS dynamics.

The northern Scott Coast is of particular interest to researchers looking for mechanisms that may have triggered the key stages of deglaciation. An important first step is to better constrain the age of structures where the inquiry is focused. The Barbados coral record suggests the initial retreat from the Ross Sea Embayment may have begun as early as 17,000 years ago. In contrast, recent glacial geologic mapping and relative sea-level suggests that deglaciation on the southern Scott Coast occurred more recently. Using carbon-14 dating (14C), it appears that deglaciation occurred there during the Holocene (the last 11,000 years) with southward grounding-line migration past Ross Island shortly before 6,500 years ago. This chronology suggests that rising sea level could not have driven grounding-line retreat to the Siple Coast, because deglacial sea-level rise essentially would already have occurred by mid-Holocene.

To begin to resolve this conflict, one deficiency in the data from the southern Scott Coast might be corrected. Those data cannot differentiate among the possible triggering mechanisms because they come from 450 kilometers south of the LGM grounding-line position. The goal of this project is to try to overcome this by constructing relative sea-level curves on a transect along the northern Scott Coast. Researchers hope to get the ages for this work from accelerator mass spectrometer 14C dates of seal skins and shells within raised beaches. These curves should reveal when the grounded ice from the northwestern Ross Sea Embayment cut loose.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Dr. John Lightbody
Program Managers

A-333-S **NSF/OPP** 02-36449, 03-31873

Station: South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): South Pole Station

Dates in Antarctica: Early November to early February

IceCube

Dr. Francis Halzen
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Physics Department
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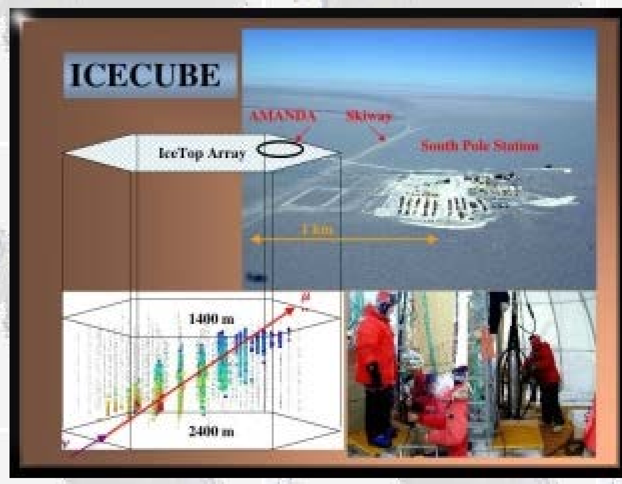
http://icecube.wisc.edu



Occupying a volume of one cubic kilometer, the IceCube neutrino telescope uses the Antarctic ice sheet as its window to the cosmos.

Deploying Team Members: Robin J. Bolsey . Jeff Cherwinka . Jonathan Eisch . Paul A. Evenson . James A. Green . Terry B. Hannaford . John Kelley . Kyler W. Kuehn . Pawel J. Marciniewski . Andrew McDermott . Bob Morse . Mark Mulligan . Rolf Nahnhauer . Robert Paulos . James A. Roth . Darryn Schneider . Edward F. Shultz . Shigeru Yoshida

Research Objectives: We will begin building the IceCube Observatory, which will be installed at the South Pole. IceCube is a neutrino telescope that will be buried 1.4 to 2.4 kilometers under the ice and used during the austral summers over a 6-year period. The detector will consist of 4,800 optical modules deployed on 80 vertical strings. AMANDA (see project A–130–S) serves as a prototype for this international collaborative effort.

Using neutrinos as cosmic messengers, IceCube will open unexplored wavelength bands and will answer such fundamental questions as what the physical conditions in gamma ray bursts are and whether the photons originating in the Crab supernova remnant and near the super massive black holes of active galaxies are of hadronic (derived from subatomic particles composed of quarks) or electromagnetic origin. The telescope will also serve to examine the particle nature of dark matter, aid in the quest to observe super symmetric particles, and search for compactified dimensions.

This season we will plan the schedule and begin assembling and testing the components and drilling systems we will use to construct the observatory. Since many parts of the Universe cannot be explored using other types of radiation (protons do not carry directional information because they are deflected by magnetic fields, neutrons decay before they reach the Earth, and high-energy photons may be absorbed), IceCube will fill a gap in our knowledge and occupy a unique place in astronomical research.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-178-M **NSF/OPP** 02-29245

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Mount Moulton, Allan Hills, McMurdo Station
Dates in Antarctica: Early January to early February

Glaciology of blue ice areas in Antarctica

Dr. Gordon S. Hamilton
The University of Maine
Institute for Quaternary and Climate Studies
gordon.hamilton@maine.edu

Photo not available.

Deploying Team Members: Andrei Kurbatov . John C. Moore . V. Blue Spikes . Leigh A. Stearns

Research Objectives: A horizontal ice core was collected at the Mount Moulton blue ice field in West Antarctica, and preliminary analyses of the sample suggest that a climate record of roughly 500,000 years is preserved in the ice there. We aim to contribute to the understanding of the Mount Moulton record by assessing the possibility that the ice-flow record has been deformed.

Specifically, we will

+ Resurvey an existing global positioning system (GPS) grid to determine ice velocities and strain rates,

+ Use ground-penetrating radar (GPR) to image the internal stratigraphy of the ice,

+ Use GPR to map subglacial topography, and

+ Collect two firn ice cores to determine stratigraphic continuity and modern accumulation rates.

In addition, we will build on the recognition of blue ice areas as archives of long climate records by conducting reconnaissance studies for a potential horizontal ice-core location in the Allan Hills of East Antarctica. We will

+ Resurvey an existing GPS to confirm earlier ice-velocity measurements and calculate strain rates,

+ Survey several profiles using GPR to image internal stratigraphy and bedrock geometry,

+ Collect one or two shallow firn cores to study accumulation rates,

+ Conduct dielectric profiling to study stratigraphic continuity over a 1- to 2-kilometer profile, and

+ Collect meteorites.

By collecting relevant measurements of ice flow and subglacial topography and taking samples of material, we will be able to assess the preservation of the stratigraphic sequences and contribute to the understanding of blue ice areas.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-298-M
NSF/OPP 02-29698

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, Beardmore Glacier
Dates in Antarctica: Mid November to late December

Vertebrate Paleontology of the Triassic to Jurassic sedimentary sequence in the Beardmore Glacier area of Antarctica

Dr. William R. Hammer
Augustana College
Department of Geology
glhammer@augustana.edu

Vertebrate Paleontology of the Triassic to Jurassic sedimentary sequence in the Beardmore Glacier area of Antarctica

Deploying Team Members: Peter Braddock . James W. Collinson . Philip J. Currie . William R. Hammer . Kevin Kruger . Andrew Sajor . Nathan D. Smith

Research Objectives: During a 3-year study, we will investigate fossils from Triassic and Jurassic dinosaurs and other vertebrates in the central Transantarctic Mountains. A field program to search for Upper Triassic to Jurassic fossil vertebrates in the Beardmore Glacier region will be carried out in the 2003–04 austral summer. Initially, we will concentrate our efforts on the Hanson Formation, which has produced the only Jurassic dinosaur fauna in Antarctica. We will then further excavate the Hanson dinosaur locality on Mount Kirkpatrick and will follow that with an extensive search of other exposures of the Hanson, Falla, and Upper Fremouw Formations in the Beardmore area.

Our field party will operate for 3 to 4 weeks out of a small helicopter camp in the Beardmore area. The field party will consist of six persons, to allow two groups of three to work independently at different sites. One group will excavate the Mount Kirkpatrick site, while the other reconnoiters. In addition to collecting new specimens, we will interpret the depositional settings for each of the vertebrate sites. Our second and third years will be dedicated to preparing and studying the vertebrates.

Antarctic vertebrates provide a unique opportunity to study the evolutionary and biogeographic significance of high-latitude Mesozoic fauna, and this project should result in significant advances in knowledge.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-314-M
NSF/OPP DBI 01-19793

Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, New Harbor
Dates in Antarctica: Late October to late January

Solar/wind powered instrumentation module development for polar environmental research

Dr. Anthony D. Hansen
Magee Scientific Company
tonyhansen@mageesci.com
http://www.mageesci.com/researchreports

PI Tony Hansen stands beside one of two autonomous instrumentation modules this group installed in the Dry Valleys in the 2002-03 field season. In addition to a payload of scientific instrumentation, each installation is solar-powered and sends live webca

Deploying Team Members: Anthony D. Hansen . Joseph D. Mastroianni

Research Objectives: We will develop and test a self-contained, transportable module that will provide a sheltered, temperature-controlled interior environment for standard, rack-mounted equipment. Electric power will be provided by solar panels and a wind generator, backed up by batteries with several days' capacity. The module will offer both alternating and direct current for internal and external use and will include data logging and communications capability for practical application in a polar environment.

At South Pole Station, McMurdo Station, and almost all other inhabited camps in Antarctica, aircraft, helicopters, ground vehicles, diesel generators, and other sources release exhaust, which can affect the environment. The collection of real-time pollution data at downwind locations can be used to assess the amount of pollution and the effectiveness of efforts to improve air quality. At this time, optimal placement of measuring instruments is severely limited by the availability of power and shelter, a limitation that this module is intended to overcome.

Although designed to facilitate measurements at the South Pole, the module will be helpful in a variety of other situations where remotely located equipment is to be used for long-term monitoring of environmental phenomena. The module will have no emissions at all and therefore will not affect the environment that it is designed to study. Also, it could be placed anywhere it is needed.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-058-M

NSF/OPP 99-80452

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, LaPaz Icefield
Dates in Antarctica: Late November to early February

The Antarctic Search for Meteorites (ANSMET)

Dr. Ralph P. Harvey
Case Western Reserve University
Department of Geological Sciences
rph@po.cwru.edu
http://www.cwru.edu/affil/ansmet

The Antarctic Search for Meteorites (ANSMET)

Deploying Team Members:

Nancy Chabot . Gordon Osinski . Christopher A. Cokinos . Gretchen Benedix . Oliver Botta . Barbara Cohen . Andrew J. Dombard . Ralph P. Harvey . Monika Kress . Rene Martinez . William J. McCormick . John W. Schutt . Timothy D. Swindle

Research Objectives: Since 1976, ANSMET (the antarctic search for meteorites program) has recovered more than 12,000 meteorite specimens from locations along the Transantarctic Mountains. Antarctica is the world's premier meteorite hunting ground for two reasons:

+ First, although meteorites fall at random all over the globe, the likelihood of finding a meteorite is enhanced if the background material is plain and the accumulation rate of terrestrial sediment is low; this makes the East Antarctic Ice Sheet the perfect medium.

+ Second, along the margins of the sheet, ice flow is sometimes blocked by mountains, nunataks, and other obstructions; this exposes slow-moving or stagnant ice to the fierce katabatic winds, which can deflate the ice surface and expose a lag deposit of meteorites (a representative portion of those that were sprinkled throughout the volume of ice lost to the wind). When such a process continues for millennia, a spectacular concentration of meteorites can be unveiled.

The continued recovery of antarctic meteorites is of great value because they are the only available source of new, nonmicroscopic extraterrestrial material. As such, they provide essential “ground truth” about the composition of asteroids, planets, and other bodies of our solar system. ANSMET recovers samples from the asteroids, the Moon, and Mars for a tiny fraction of the cost of returning samples directly from these bodies.

During the 2003–2004 field season, ANSMET's main field party (eight people) will work at the LaPaz icefields, approximately 250 miles from Amundsen-Scott South Pole Station. More than 200 meteorites were recovered from the site during reconnaissance visits in 1991 and 2002. This year's field team will begin systematic searches of the icefields in an effort to recover a representative sample of the extraterrestrial material falling to Earth.

A second team consisting of four people will conduct high-level reconnaissance at a number of icefields throughout the mid Transantarctic Mountains, from the Miller Range in the north to Roberts Massif in the south. This reconnaissance team will visit poorly known or previously unvisited icefields, recovering meteorites and identifying their potential for more detailed searches during future seasons.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-110-M/S

NSF/OPP 02-29251

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): Arrival Heights, SkyLab

Dates in Antarctica: Mid January to early February (McMurdo), late January (South Pole)

Austral high-latitude atmospheric dynamics

Dr. Gonzalo Hernandez
University of Washington
hernandez@u.washington.edu

Photo not available.

Deploying Team Members: Stephen T. Barlow . Gonzalo Hernandez . Anthony T. Mactutis . Michael P. McCarthy . Bryan Venema . Ruth Wilton-Godberfforde

Research Objectives: Atmospheric dynamics observations at Antarctica provide critical understanding of the global behavior of the atmosphere in the high latitude regions.

The South Pole is a unique and interesting spot from which to observe the dynamic motion of the atmosphere. It's position on the earth's axis of rotation strongly restricts the types of wave motions that can occur there compared to lower latitude sites.

This project uses high-resolution Fabry-Perot spectrometers at South Pole Station and Arrival Heights (78S) to make simultaneous azimuthal observations of the individual line spectra of several upper atmospheric trace species, most importantly the hydroxyl radical (OH) and atomic oxygen. The observed Doppler shift of the emission lines provides a direct measure of the line-of-sight wind speed, while the wind field structure can also be derived from these multi-azimuth measurements. The simultaneously observed line widths also provide a direct measurement of kinetic temperature.

The goal of this project is to observe, characterize and understand high-latitude mesospheric motions and thermospheric persistent vertical winds near Arrival Heights simultaneously with those at South Pole. In both locations, observations are made during the austral winter.

During the austral summer, project team members deploy to both stations to perform maintenance and system upgrades. During the austral winter, the instruments operate in 24-hour data acquisition mode and station technicians perform routine maintenance and operations.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-239-L
NSF/OPP 99-10007
Station: R/V Laurence M. Gould
RPSC POC: Alice Doyle
Research Site(s): Antarctic Peninsula Area
Dates in Antarctica: Late March to mid April

Mysticete whale acoustic census in the GLOBEC west antarctic project area

Dr. John A. Hildebrand
Scripps Institution of Oceanography
Marine Physical Laboratory
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Photo not available.

Research Objectives: The U.S. Southern Ocean Global Ocean Ecosystems Dynamics (GLOBEC) program focused on the distribution of antarctic krill (Euphausia superba) in the Marguerite Bay/West Antarctic Peninsula region, as well as on environmental and ecosystem factors that are important for krill distribution. Our primary goal was to study the distribution and abundance of mysticete whales by using both visual and acoustic techniques. These data allowed us to model the rates of krill predation by whales in the study area.

In continuing our research, we hope to better understand the relationship between the physical and biological factors that affect the behavior of whales and their krill predation. To estimate the population of mysticete whales, we used passive acoustic recording of vocalizing marine mammals and assessed their abundance and distribution by a combination of bottom-mounted acoustic recorders and sonobuoys. During the 2001–2002 austral summer, eight bottom-mounted acoustic recorders were recovered and redeployed at sites in the west Antarctic Peninsula. This austral summer, we intend to recover these acoustic recorders and begin analyzing our findings.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-257-S
NSF/OPP NOAA/NSF agreement
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): ARO, Clean Air Sector
Dates in Antarctica: Instruments operate year-round

South Pole monitoring for climatic change: U.S. Department of Commerce NOAA Climate Monitoring and Diagnostic Laboratory

Dr. Dave Hofmann
National Oceanic and Atmospheric Administration
R/CMDL1
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http://www.cmdl.noaa.gov

National Oceanic and Atmospheric Administration /Climate Monitoring and Diagnostics Laboratory staff Loreen Lock (right) and Brian Vasel (left) launch a plastic balloon on September 22, 2002 carrying an ozonesonde to study the 2002 Antarctic Ozone Hole e

Deploying Team Members: Andy Clark . Glen Kinoshita . Geoff Dutton . Eric Hackathorn . Bryan Johnson . Jason M. Seifert . Daniel Simon

Research Objectives: The National Oceanic and Atmospheric Administration (NOAA) has been conducting studies to determine and assess the long-term buildup of trace atmospheric constituents that influence climate change and the ozone layer. Time-series analyses of long-term data provide insight into several phenomena of particular interest. These include:

+ Seasonal and temporal variations in greenhouse gases,

+ Stratospheric ozone depletion,

+ Transantarctic transport and deposition,

+ The interplay of the trace gases and aerosols with solar and terrestrial radiation fluxes that occur on the polar plateau, and

+ The development of polar stratospheric clouds over Antarctica.

Project scientists measure carbon dioxide, methane, carbon monoxide, stable isotopic ratios of carbon dioxide and methane, aerosols, halocarbons, and other trace constituents. Flask samples are collected and returned for analysis, while concurrent in situ measurements are made of carbon dioxide, nitrous oxide, selected halocarbons, aerosols, solar and terrestrial radiation, water vapor, surface and stratospheric ozone, wind, pressure, air and snow temperatures and atmospheric moisture. Air samples at Palmer Station are also collected.

These measurements allow researchers to determine the rates at which concentrations of these atmospheric constituents change. They also point to likely sources, sinks, and budgets. This group collaborates with climate modelers and diagnosticians to explore how the rates of change of these parameters affect climate.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-264-P
NSF/OPP NOAA/NSF agreement

Station: Palmer Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station
Dates in Antarctica: Instruments operate year-round

Collection of atmospheric air for the NOAA/CMDL worldwide flask sampling network

Dr. David Hofmann

National Oceanic and Atmospheric Administration
R/CMDL
dhofmann@cmdl.noaa.gov
http://www.cmdl.noaa.gov

Kristin Van Konyenburg, the Palmer Station physician in 2002, shown here operating the NOAA/Climate Monitoring and Diagnostic Laboratory, carbon cycle flask sampler. The sampler can be seen in the background with the sample inlet line extended twelve f

Deploying Team Members: Thomas Conway

Research Objectives: The National Oceanic and Atmospheric Administration (NOAA) has been conducting studies to determine and assess the long-term buildup of trace atmospheric constituents that influence climate change and the ozone layer. Time-series analyses of long-term data provide insight into several phenomena of particular interest. These include:

+ Seasonal and temporal variations in greenhouse gases,

+ Stratospheric ozone depletion,

+ Transantarctic transport and deposition,

+ The interplay of the trace gases and aerosols with solar and terrestrial radiation fluxes that occur on the polar plateau.

Personnel at Palmer Station will collect air samples to be analyzed for carbon dioxide, methane, carbon monoxide, stable isotopic ratios of carbon dioxide and methane. Flasks will also be collected for analysis of halocarbons, nitrous oxide, and other trace constituents.

These measurements allow researchers to determine the rates at which concentrations of these atmospheric constituents change. They also point to likely sources, sinks, and budgets. This group collaborate with climate modelers and diagnosticians to explore how the rates of change of these parameters affect climate.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-378-S
NSF/OPP 02-32009

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Instruments operate year-round, mid October to mid February (project team deploys)

High-resolution obervations of the cosmic microwave background (CMB) with ACBAR

Dr. William L. Holzapfel
University of California Berkeley
Physics
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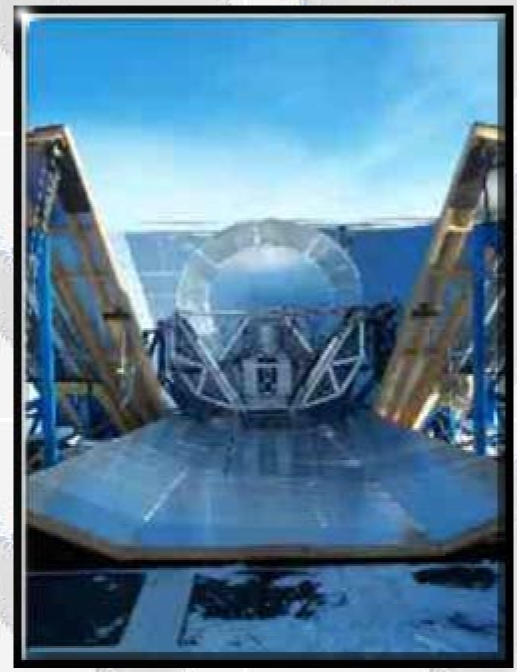
http://cosmology.berkeley.edu/group/swlh/acbar



High-resolution obervations of the cosmic microwave background (CMB) with ACBAR

Deploying Team Members: Michael Daub . William L. Holzapfel . Oren Leaffer . Matthew Newcomb . Jeffrey B. Peterson . Christian Reichardt . John Ruhl . Zachary Staniszewski

Research Objectives: We will continue our observations with the Arcminute Cosmology Bolometer Array Receiver (ACBAR), a 16-element 230-micro-Kelvin bolometer receiver designed to produce high-resolution images of the cosmic microwave background (CMB) in 3-mm wavelength bands. Mounted on the 2.1-meter Viper telescope at the South Pole, ACBAR has sensitivity that rivals balloon-borne experiments and angular resolution that they cannot hope to achieve. Making full use of the excellent atmospheric conditions in the austral winter at the South Pole, ACBAR is producing images of CMB radiation with sensitivity and resolution that exceed the capabilities of even the European Space Agency's proposed Planck satellite (to be launched in 2007)

Observations of the CMB provide a unique window on the early Universe; moreover, these data play a key role in transforming cosmology into a precise science. In particular, small angular-scale observations of the CMB are a new frontier about which comparatively little is known. On these angular scales, contributions from secondary anisotropies introduced by intervening structures are expected to become dominant. For example, the scattering of photons by hot gas bound to clusters of galaxies results in a spectral distortion of the CMB known as the Sunyeav-Zel'dovich Effect (SZE). Observations of the SZE can provide important new constraints on theories of how the Universe grew.

The unique capabilities of ACBAR, which was deployed to the South Pole in December 2000, allow it to address a broad range of science focused on measuring primary and secondary CMB anisotropies. Our observations and analysis will help realize the full potential of this powerful instrument for the study of cosmology. Four institutions will continue to collaborate in the maintenance and operation of ACBAR and Viper and participate in the data analysis.

The results will serve as a vital complement to the large-scale Microwave Anistropy Probe (MAP) spacecraft data set and provide an essential check of the fine-scale excess power reported by other single-frequency experiments. The novel instrumentation, observation techniques, and analysis developed for ACBAR are generally applicable to future ground-based millimeter astronomy experiments. In addition, this project has provided hands-on research experience to several undergraduate and graduate students.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-025-E
NSF/OPP 02–34570 SGER
Station: Special Project
RPSC POC: John Evans
Research Site(s): French sub-Antarctic Islands
Dates in Antarctica: Early December to late February

Food web structure across a large-scale ocean productivity gradient: Top predator assemblages in the southern Indian Ocean

Dr. George L. Hunt
University of California Irvine
Ecological and Evolutionary Biology
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Photo not available

Deploying Team Members: David Hyrenbach . Richard Viet

Research Objectives: A pervasive goal of biological oceanography is to understand the processes that structure pelagic communities. Research suggests that the distribution of oceanic species is influenced by physical and biological variability on a number of spatial-temporal scales. Our objective is to test the hypothesis that the dispersion and community of top predators vary in accordance with large-scale variability in physical structure and ocean productivity in pelagic ecosystems. We will therefore conduct a survey of bird and mammal use of distinct oceanographic domains in the southern Indian Ocean.

Two U.S. scientists will join French scientists on board a French research vessel near Reunion Island. The French scientists will sample the physical environment and estimate oceanic productivity, while the U.S. scientists will survey top predator distributions in physical and biological properties across a 35-degree latitudinal gradient from subtropical to subantarctic waters.

We hypothesize that top predator assemblages are structured by spatial gradients in hydrographic properties and ocean productivity patterns known to influence the distribution and patchiness of their prey (zooplankton, fish, and squid) and that the overall abundance of marine top predators within a specific oceanic domain is largely determined by ocean productivity. Also, we hypothesize that the energetic costs of foraging determine which types of top predators inhabit specific domains. Species with high foraging costs must exploit dense prey aggregations within highly productive areas. Conversely, taxa with low foraging costs can inhabit low-productivity areas with more dispersed prey.

We will quantify the association of specific water masses with top predator assemblages, as well as their aggregative response at hydrographic and bathymetric domains. Because top predators respond to oceanographic variability at multiple scales of time and space, we will use a variety of analytical methods to assess their responses in the context of large- and coarse-scale (thousands and tens of kilometers, respectively) hydrographic and ocean productivity patterns in the subtropical and subantarctic Indian Ocean. This interdisciplinary perspective will enhance our understanding of the way physical and biological processes structure pelagic communities in the southern Indian Ocean and will provide a model that has broader implications for the oceans as a whole.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-108-S
NSF/OPP 00-93381
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Instruments operate year-round

A very-low-frequency (VLF) beacon transmitter at South Pole (2001-2004)

Dr. Umran S. Inan

Stanford University
Department of Electrical Engineering
inan@nova.stanford.edu
http://www-star.stanford.edu/~vlf/south_pole/south%20pole.htm

Photo not available.

Deploying Team Members: Jeff Chang . Umran S. Inan . Evans Paschal

Research Objectives: Relativistic electrons -- measured at geosynchronous orbit with energies of more than 300 kiloelectron volts -- appear to fluctuate in response to substorm and solar activity. During such events, these highly energetic electrons can penetrate as low as 30 to 40 kilometers above the Earth's surface. At that altitude, they can wreak havoc in the atmosphere, ionizing chemical species, creating X-rays, and perhaps influencing the chemistry that produces ozone.

This is a 3-year project to establish and operate a very-low-frequency (VLF) beacon transmitter at South Pole to measure solar effects on the mesosphere and lower ionosphere. The extent of relativistic electron precipitation can be calculated from variations in amplitude and phase of the VLF signals at different antarctic stations. The transmitter will also produce other data as well - on solar proton events, relativistic electron precipitation from Earth's outer radiation belts, and on the Joule heating components of high-latitude/ polar-cap magnetosphere/ionosphere coupling processes.

VLF data from the South Pole beacon provides a valuable complement to two other efforts: The southern hemisphere coherent HF radar network, Super4 Dual Auroral Network (SUPERDARN), and the Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX), ongoing satellite-based measurements of trapped and precipitating high-energy electrons at high and low altitudes.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-306-P
NSF/OPP 02-33955

Station: Palmer Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station
Dates in Antarctica: Instruments operate year-round

Global thunderstorm activity and its effects on the radiation belts and the lower ionosphere

Dr. Umran S. Inan
Stanford University
Department of Electrical Engineering
inan@nova.stanford.edu
http://www-star.stanford.edu/~palmer/

Photo not available.

Deploying Team Members: Umran S. Inan

Research Objectives: Tracking dynamic storms is a challenge, but lightning associated with thunderstorms can provide scientists an indirect way of monitoring global weather. This project employs very-low-frequency (VLF) radio receivers at Palmer Station, operated in collaboration with the British and Brazilian Antarctic Programs, both of which operate similar receivers. All are contributors to the Global Change Initiative.

The VLF receivers measure changes in the amplitude and phase of signals received from several distant VLF transmitters. These changes follow lightning strokes because radio (whistler) waves from the lightning can cause very energetic electrons from the Van Allen radiation belts to precipitate into the upper atmosphere. This particle precipitation then increases ionization in the ionosphere, through which the propagating VLF radio waves must travel. Because the orientations to the VLF transmitters are known, it is possible to triangulate the lightning sources that caused the changes. Once the direction of the lightning source is known, it can be subjected to waveform analysis and used to remotely track the path of thunderstorms.

The data will be correlated with data from the antarctic Automatic Geophysical Observatory network and will be used by scientists studying the magnetosphere and the ionosphere.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-200-N **NSF/OPP** 01-27022

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Late August to early December

POTATOE: Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects (MOAT)

Dr. Wade H. Jeffrey

University of West Florida
Center for Environ Diagnostics and Bioremediation
wjeffrey@uwf.edu
http://www.serc.si.edu/uvb/Ross_Sea_index.htm

Photo not available.

Deploying Team Members: Amy J. Baldwin . Wade H. Jeffrey . Jarah Meador . Joseph Moss . Joseph D. Pakulski . Richard Stephens

Research Objectives: Ultraviolet (UV) radiation influences plankton in the near-surface waters of most ecosystems. In particular, the Southern Ocean is affected in the austral spring, when UV radiation is enhanced by ozone depletion. While progress has been made in estimating the impact of UV radiation on bacteria and phytoplankton in the Southern Ocean, important issues remain to be resolved. Little is known, for example, about responses in systems dominated by the colonial haptophyte Phaeocystis antarctica, which dominates spring blooms in the southern Ross Sea. The presence of open water at a far southerly location in the spring, well within the ozone hole, and continuous daylight, with implications for DNA repair, make the Ross Sea of intense interest.

A number of studies suggest that vertical mixing can significantly modify the impact of UV radiation. However, the limited measurements of turbulence intensity in the surface layer that have been done have not been integrated with parallel studies of the effects of UV radiation on phytoplankton and bacterioplankton. To address these issues, we will focus on vertical mixing and UV radiation in the Ross Sea and characterize phytoplankton and bacterioplankton responses in both laboratory and solar incubations. These studies will lead to biological weighting functions and response models capable of predicting the impact of UV radiation on photosynthesis, bacterial incorporation, and DNA damage in the surface layer.

We will use measure depth-dependent profiles of DNA damage, bacterial incorporation, photosynthesis, and fluorescence parameters over a 24-hour cycle. We have optimized measurements for typical springtime conditions in the Ross Sea, where stabilizing influences like solar heating and/or surface freshwater from melting ice mean that not enough turbulence is present to thoroughly mix the upper layer.

We will develop fine-scale vertical density profiles to directly estimate large eddy scales. Estimated turbulent diffusivities and eddy scales will be directly related to surface layer effects and used to generate models of UV radiation responses in the surface mixed layer.

This first in-depth study of UV radiation in the Ross Sea will enhance scientific understanding of vertical mixing processes, trophic interactions, and biogeochemical cycling in the Ross Sea and will provide a valuable comparison with previous work in the Weddell-Scotia Confluence and Palmer Station regions.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-295-M
NSF/OPP EAR 99-03413
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): McMurdo Station
Dates in Antarctica: Mid October to mid February

University NAVSTAR Consortium (UNAVCO) GPS survey support

Mr. Bjorn Johns
UNAVCO/UCAR
bjorn@unavco.ucar.edu
http://www.unavco.ucar.edu/project_support/polar/polar.html

GPS survey of a geodetic control point at Cape Hallett. Photo by Chuck Kurnik.

Deploying Team Members: Beth Ann Bartel . Charles Kurnik

Research Objectives: UNAVCO provides year-round support for scientific applications of the Global Positioning System (GPS) to U.S. Antarctic Program, supported and managed by the National Science Foundation's Office of Polar Programs. This support includes pre-season planning, field support, and post-season follow-up, as well as development work for supporting new applications. UNAVCO maintains a "satellite" facility at McMurdo Station during the austral summer research season, providing a full range of support services, including geodetic GPS equipment, training, project planning, field support, technical consultation, data processing, and data archiving.

UNAVCO also operates a community differential GPS (DGPS) base station that covers McMurdo Sound and Taylor Valley, provides maintenance support to the MCM4 continuous GPS station as contractual support to the NASA GPS Global Network (GGN), and supports remote continuous GPS stations for scientific investigations.

Using GPS, vector baselines between receivers separated by 100 kilometers or more are routinely measured to within 1 centimeter (that is, 100 parts per billion). UNAVCO is also able to support researchers who are investigating global, regional, and local crustal motions where maximum accuracy (in the millimeter range) of baseline measurement is required. GPS measurements using portable equipment can be completed in a few hours or less. Such expediency lends itself to research applications in global plate tectonics, earthquake mechanics, volcano monitoring, and regional tectonics.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-204-P/S
NSF/OPP ATM 00-00923
Station: Palmer Station, South Pole Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station
Dates in Antarctica: Instruments operate year-round

A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems

Dr. Ralph F. Keeling
University of California San Diego
Scripps Institution of Oceanography
rkeeling@ucsd.edu
http://bluemoon.ucsd.edu

Photo not available.

Deploying Team Members: Ralph F. Keeling

Research Objectives: Oxygen, the most abundant element on the Earth, comprises about a fifth of the atmosphere. But much of the Earth's oxygen resides in other chemical species (in water, rocks, and minerals) and, of course, in flora and fauna that recycle it (both directly and as carbon dioxide) through the processes of photosynthesis and respiration. Thus scientists are interested in measuring the concentration of molecular oxygen and carbon dioxide in air samples. This project includes a subset of sample collections being made at a series of baseline sites around the world.

These data should help to improve estimates of the processes whereby oxygen is cycled throughout the global ecosystem, specifically, through photosynthesis and atmospheric mixing rates. They improve predictions of the net exchange rates of carbon dioxide with biota, on land and in the oceans. An important part of the measurement program entails developing absolute standards for oxygen-in-air, to ensure stable long-term calibration. This group will also conduct surveys of the oxidative oxygen/carbon ratios of both terrestrial- and marine-based organic carbon, hoping to improve the quantitative basis for linking the oxygen and carbon dioxide geochemical cycles.

These results should help enhance understanding of the processes that regulate the buildup of carbon dioxide in the atmosphere and of the change processes -- especially climate change -- that regulate ecological functions on land and in the sea.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-078-M

NSF/OPP NSF/OPP-DoD MOA

Station: McMurdo Station
RPSC POC: Doug Miller
Research Site(s): Dry Valleys, Mount Newall, McMurdo Station
Dates in Antarctica: Late October to mid December

Dry Valley seismic project

Dr. Robert C. Kemerait
United States Air Force
AFTAC
kemerait@tt.aftac.gov

Clay Himmelsbach, Kevin Filiatrault and Will Burk installing a new seismic data digitizing system in a borehole close to Bull Pass in the Wright Valley. Photo by Jimmy Jackson.

Deploying Team Members: Kevin L. Filiatrault . Jimmy L. Jackson . Mikel MacDonald

Research Objectives: The Dry Valleys Seismic Project monitors regional and global seismicity. This station is an element in the Air Force Technical Applications Center (AFTAC) Southern Network (ASN). The network provides near real time data from nine locations within the southern hemisphere. The data is telemetered to the National Data Center in Florida and is available to the international scientific community.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-518-M
NSF/OPP SGER

Station: McMurdo Station
RPSC POC: Karen Pavich
Research Site(s): McMurdo Station
Dates in Antarctica: Late November to mid December

Spatial and temporal scales of human disturbance

Dr. Mahlon C. Kennicutt, II
Texas A & M University
Geochemical & Environmental Research Group
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http://www.gerg.tamu.edu

With Scott Hut in the background, Chuck Kennicutt records data for monitoring spatial and temporal scales of human disturbance. Photo by Dianna Gielstra.

Deploying Team Members: Stephen Sweet . Sally Morehead . Andrew Klein

Research Objectives: Antarctica represents perhaps one of the most carefully-tended and strictly-monitored habitats on Earth. Aside from the manifest desire to protect the flora, fauna and the atmosphere of a relatively pristine environment, there is the value the extreme southern latitudes provide as a virtual baseline barometer of global pollution. The Antarctic Treaty's Protocol on Environmental Protection, supplemented by the policies and practices of the nations who work and do science there, have combined to focus scrutiny on any anthropogenic impacts that can be foreseen or detected.

This project is collecting a system of observations that should enable scientists to be more aware of any such impacts - on both marine and terrestrial habitats - in and around McMurdo Station, locating them precisely and tracking them over time. Based on a three-year pilot program of sampling and data analysis, an initial environmental monitoring program is being initiated. The feasibility of this design will be evaluated in the current season. Point-data sampling grids at various spatial scales measuring a series of attributes indicative of change will be established. Our objectives are to determine:

+ The spatial and temporal scales of change, and its origin;

+ How efficiently this observational system documents relevant changes in important habitat characteristics; and

+ The usefulness of various approaches to reference or control locations.

We will use GIS-techniques and geostatistical methods to organize these diverse data sets into a coherent, coordinated framework. The results should provide additional fundamental scientific information for developing a long-term strategy to document and minimize the impacts of future science (and support operations) on antarctic resources and values.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-266-N **NSF/OPP** 02-30499
Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Mid October to late November

Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea

Dr. David J. Kieber
State University of New York Syracuse
Chemistry Department
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http://www.esf.edu/chemistry/kieber/kieber.htm

Photo not available.

Deploying Team Members: John Bisgrove . David J. Kieber . Deirdre A. Toole . Emily M. White

Research Objectives: Areas of the Southern Ocean have spectacular blooms of phytoplankton during the austral spring and early summer. One of the dominant species, the haptophyte Phaeocystis antarctica, is a prolific producer of the organic sulfur compound dimethylsulfoniopropionate (DMSP), and Phaeocystis blooms are associated with some of the world's highest concentrations of DMSP and its volatile degradation product, dimethylsulfide (DMS). Sulfur, in the form of DMS, is transferred from the oceans to the atmosphere and can affect the chemistry of precipitation and influence cloud properties and, possibly, climate. DMSP and DMS are also quantitatively significant components of the carbon, sulfur, and energy flows in many marine food webs, although very little information is available on these processes in high-latitude systems.

We will study how solar radiation and iron cycling affect DMSP and DMS production by phytoplankton and the subsequent use of these labile forms of organic matter by the microbial food web. Four interrelated hypotheses will be tested in field-based experiments and in situ observations:

+ That solar radiation, including enhanced ultraviolet-B due to seasonal ozone depletion, plays an important role in determining the net ecosystem production of DMS in the Ross Sea;

+ That development of shallow mixed layers promotes the accumulation of DMS in surface waters, because of enhanced exposure of plankton communities to high doses of solar radiation;

+ That DMSP production and turnover represent a significant part of the carbon and sulfur flux through polar food webs; and

+ That bloom development and resulting nutrient depletion (e.g., iron) will result in high production of DMSP and high DMS concentrations and atmospheric fluxes.

Results from this study will greatly improve understanding of the underlying mechanisms controlling DMSP and DMS concentrations in polar waters, thereby improving our ability to predict DMS fluxes to the atmosphere from this important climatic region.

We actively engage high school, undergraduate, and graduate students in our research and are involved in formal programs that target underrepresented groups. The information gained from this research will also be used in teaching undergraduate and graduate courses and will enrich students' experience.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-002-N
NSF/OPP 02-30497
Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Mid October to late November

Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea, Antarctica

Dr. Ronald P. Kiene

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University South Alabama
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http://www.southalabama.edu/marinesciences/fac_kiene.html

Principal investigator Ron Kiene secures quartz tubes for overside incubation.

Deploying Team Members: Daniela del Valle . Hyakubun Harada . Ronald P. Kiene . Dorothea Slezak

Research Objectives: Areas of the Southern Ocean have spectacular blooms of phytoplankton during the austral spring and early summer. One of the dominant species, the haptophyte Phaeocystis antarctica, is a prolific producer of the organic sulfur compound dimethylsulfoniopropionate (DMSP), and Phaeocystis blooms are associated with some of the world's highest concentrations of DMSP and its volatile degradation product, dimethylsulfide (DMS). Sulfur, in the form of DMS, is transferred from the oceans to the atmosphere and can affect the chemistry of precipitation and influence cloud properties and, possibly, climate. DMSP and DMS are also quantitatively significant components of the carbon, sulfur, and energy flows in many marine food webs, although very little information is available on these processes in high-latitude systems.

We will study how solar radiation and iron cycling affect DMSP and DMS production by phytoplankton and the subsequent use of these labile forms of organic matter by the microbial food web. Four interrelated hypotheses will be tested in field-based experiments and in situ observations:

+ That solar radiation, including enhanced ultraviolet-B due to seasonal ozone depletion, plays an important role in determining the net ecosystem production of DMS in the Ross Sea;

+ That development of shallow mixed layers promotes the accumulation of DMS in surface waters, because of enhanced exposure of plankton communities to high doses of solar radiation;

+ That DMSP production and turnover represent a significant part of the carbon and sulfur flux through polar food webs; and

+ That bloom development and resulting nutrient depletion (e.g., iron) will result in high production of DMSP and high DMS concentrations and atmospheric fluxes.

Results from this study will greatly improve understanding of the underlying mechanisms controlling DMSP and DMS concentrations in polar waters, thereby improving our ability to predict DMS fluxes to the atmosphere from this important climatic region.

We actively engage high school, undergraduate, and graduate students in our research and are involved in formal programs that target underrepresented groups. The information gained from this research will also be used in teaching undergraduate and graduate courses and will enrich students' experience.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-010-M **NSF/OPP** 01-26319

Station: McMurdo Station

RPSC POC: Curt LaBombard

Research Site(s): Cape Armitage, Cinder Cones, Cape Chocolate, Cape Evans, New Harbor, Turtle Rock, McMurdo area sea ice, McMurdo Station

Dates in Antarctica: Early October to early December

Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic

Dr. Stacy L. Kim

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http://www.mlml.calstate.edu/groups/benthic/aspire2/index.htm

While diving at the Dailey Islands, Andrew Thurber prepares to enter a tide crack. Photo Stacy Kim.

Deploying Team Members: Kathleen Conlan . Jonna Engel . Jennifer L. Fisher . Stacy L. Kim . Craig V. Lewis . Daniel P. Malone . James M. Oakden

Research Objectives: The Antarctic is considered one of the most pristine habitats on the planet. Humans occupy only a tiny portion of the continent. Though the human footprint in Antarctica is small and generally highly localized, there are areas where anthropogenic contamination is severe. For example, past practices at McMurdo Station have resulted in a few highly contaminated marine areas, such as the one near the sewage outfall. High levels of organic enrichment have radically altered the local benthic community. The altered community and surrounding undisturbed communities have been well described over a 10-year period.

In January 2003, a sewage treatment plant was completed at McMurdo Station, and the organic input to the seafloor has dropped markedly. On the basis of existing information on community recovery dynamics in polar ecosystems from ice-mediated disturbances (icebergs and anchor ice) and in temperate ecosystems from organic-loading, we predict that recovery will begin immediately. However, growth and reproduction are often slow in antarctic species. Thus, complete recovery may extend over a much longer period than in temperate areas. In addition, slow microbial processes at low polar temperatures have allowed a large pile of organic material to build up at the outfall site, and some changes may be the result of burial rather than organic enrichment. Finally, the size of the disturbance is unusual; small organic inputs such as seal feces and dead fish are common, but large sewage outfalls are not. Thus, the outfall and new treatment plant provide a unique opportunity for a large-scale experiment on recovery.

In October and November 2002, we collected data to describe the habitat and community while the outfall was still in operation. This will be added to the data we collected from 1988 to 1998 to provide a baseline. We initiated experiments with organic content, burial, and disturbance size as variables. During the next two seasons, we will track the recovery of the benthic community, compare the rates with those predicted from a meta-analysis of recovery from organic disturbance in a variety of habitats, and contrast the role of organic loading with burial and patch size. Our integrated approach will further the understanding of anthropogenic impacts in polar environments.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-191-M
NSF/OPP 02-28052

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, Dry Valleys, Canada Glacier
Dates in Antarctica: Mid October to mid December

Dry Valleys Late Holocene climate variability

Dr. Karl J. Kreutz
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IQCS/ Department of Geological Sciences

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Eclipse ice core drill in operation. Photo by Karl Kreutz.

Deploying Team Members: Steven A. Arcone . Karl J. Kreutz . Erich C. Osterberg . Mike Waszkiewicz . Bruce Williamson

Research Objectives: We will collect and develop high-resolution ice-core records from the Dry Valleys in southern Victoria Land and provide interpretations of interannual to decadal climate variability during the past 2,000 years (late Holocene). We will test hypotheses related to ocean/atmosphere teleconnections (e.g., El Niño Southern Oscillation, Antarctic Oscillation) that may be responsible for major late Holocene climate events such as the Little Ice Age in the Southern Hemisphere.

Conceptual and quantitative models of these processes in the Dry Valleys during the late Holocene are critical for understanding recent climate changes. We plan to collect intermediate-length ice cores (100 to 200 meters) at four sites along transects in Taylor and Wright Valleys and analyze each core at high resolution for stable isotopes, major ions, and trace elements. A suite of statistical techniques will be applied to the multivariate glaciochemical data set to identify chemical associations and to calibrate the time-series records with available instrumental data.

Broader impacts of the project include

+ contributions to several ongoing interdisciplinary antarctic research programs;

+ graduate and undergraduate student involvement in field, laboratory, and data interpretation activities;

+ use of project data and ideas in several University of Maine courses and outreach activities; and

+ data dissemination through peer-reviewed publications, University of Maine and other paleoclimate data archive Web sites, and presentations at national and international meetings.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-320-E
NSF/OPP 02-29991
Station: McMurdo Station
RPSC POC: Karen Pavich
Research Site(s): R/V Italica, Terra Nova Bay
Dates in Antarctica: Late January to early March

Victoria Land latitudinal gradient project: Benthic marine habitat characterization

Dr. Rikk G. Kvitek

California State University Monterey Bay
Earth Systems Science and Policy
rikk_kvitek@monterey.edu
http://seafloor.csumb.edu/

Photo not available.

Deploying Team Members: Pat Iampietro . Rikk G. Kvitek . Erica Summers . Kate Thomas

Research Objectives: Our work is part of a multinational, multidisciplinary program called the Victoria Land Latitudinal Gradient Project (VLLGP), which includes scientists from both the Italian Antarctic Research Program (PNRA) and the Antarctica New Zealand Research Program. The overall goal of the VLLGP is to take a latitudinal gradient approach to ecosystem studies in Victoria Land.

Personnel from the Seafloor Mapping Lab (SFML) at California State University–Monterey Bay will participate in a 20-day PNRA cruise on the research ship Italica during January 2004. The specific goals of this Italian/U.S. collaboration are to

+ Identify the environmental gradients linked to latitude and to relate community transitions along the Victoria Land coast to climatic, geomorphologic, and oceanographic features;

+ Identify biochemical, physiological, and other adaptive responses of representative organisms;

+ Quantify biodiversity patterns and test the hypothesis of progressive emergence of marine assemblages with latitude; and

+ Use biotic changes associated with steep environmental gradients to predict possible effects of climate change.

We will use high-resolution acoustic remote-sensing (multibeam and sidescan sonar) and spatial data-modeling tools to identify and characterize benthic habitats and species/habitat associations along the gradient from a depth of 0 to 200 meters. Accurate mapping and classification of habitat types within each study area will be critical to selecting comparable sampling sites so valid community comparisons can to be made along the latitudinal gradient. Since the Ross Sea coast extends across one of the longest latitudinal gradients in the Antarctic (15 degrees), this study offers a unique opportunity for predicting and establishing a baseline to detect environmental and community responses to global change and anthropogenic disturbance.

This work will not only foster research, logistical, and data management collaboration among scientists from different disciplines and national programs, but it will also provide undergraduate students with the opportunity to participate in the research.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-081-M

NSF/OPP 02-29305

Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): Mount Erebus
Dates in Antarctica: Mid November to early January

Mount Erebus Volcano Observatory and Laboratory (MEVOL)

Dr. Philip R. Kyle
New Mexico Institute of Mining and Technology
Department of Earth & Environmental Science
kyle@nmt.edu
http://www.ees.nmt.edu/Geop/Erebus/erebus.html

Werner Giggenbach descending into the crater of Mt. Erebus for gas samples. Just before reaching the lava lake, an eruption forced Werner to return to the rim with singed ropes and clothes. Photo by William McIntosh.

Deploying Team Members:

Kurt Panter . Brian Winter . Shauna Mikelich . John (Harry) Ross Keys . Colleen B. Brogenski . Jacquelin Caplin-Auerbach . Julie Ann Calkins . Peter Kelly . Philip R. Kyle . Clive Matthew Martin Oppenheimer . Dawn Catherine Sweeney

Research Objectives: Mount Erebus, Antarctica's most active volcano, is a rare example of a persistently active magmatic system. This volcano, which has a history of low-level eruptive activity associated with a highly accessible summit vent complex, also features one of Earth's few long-lived lava lakes. We will develop an interdisciplinary geophysics/geochemistry laboratory on Mount Erebus to pursue basic research on the eruption physics and associated magmatic recharge of active volcanoes. Erebus is especially appropriate because of its persistent open-conduit magmatic system, frequent eruptions, ease of access (by antarctic standards), and established scientific and logistical infrastructure, including real-time data links and relative safety.

The key integrated data-gathering components we will rely on include video surveillance and seismic, infrasound, Doppler radar, infrared, volcanic gas, and geodetic studies. To collect the data, a combination of core Mount Erebus Volcano Observatory and Laboratory (MEVOL)–supported personnel and their students (with specialties in seismology, gas studies, and general volcanology) will collaborate with internationally recognized volcano researchers (with specialties in infrared, Doppler radar, gas studies, and infrasound).

We will then develop quantitative models of the magmatic system of an active volcano, including eruptive energy balance (gravity; explosive gas decompression; and thermal, seismic, acoustic, and kinetic components) and magma recharge (volcanic tremor, convection, residence time, gas emissions, and deformation). We expect this research to contribute substantially to basic knowledge of active volcanoes around the world.

Another part of our work involves a project to develop and deploy integrated low-power, low-cost, real-time-telemetered volcano monitoring stations at Erebus and other active volcanoes. (Many volcanoes, particularly in the developing world, have little or no modern instrumentation.) The goal is to contribute to the development of low-power, low-cost interdisciplinary geophysical observatories within the larger seismology, geodesy, and geophysical communities.

Our work also includes the education of graduate and undergraduate students in volcanology and geophysics, the dissemination of information to high school audiences, and the provision of year-round monitoring information to the National Science Foundation and to McMurdo Station. Finally, to convey the excitement and societal relevance of volcanology and other aspects of earth science, we expect to continue public outreach through lectures, media interaction, and inquiry response.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-128-S
NSF/OPP 00-90545
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Early to mid January

A versatile electromagnetic waveform receiver for South Pole Station

Dr. James W. LaBelle
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Department of Physics & Astronomy
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http://www.dartmouth.edu/artsci/physics/spacephy/experiment.html

Principal investigator James LaBelle next to the project's antenna in the science sector at South Pole. Photo by Shengyi Ye.

Deploying Team Members: James W. LaBelle . Allan T. Weatherwax . Shengyi Ye

Research Objectives: The Earth's aurora naturally emits a rich variety of radio waves at low, medium, and high frequencies (LM/MF/HF) which are signatures of the interaction between the auroral electron beam and the ionospheric plasma. Yet some of the mechanisms that generate plasma waves are not well understood. This project focuses on several types of signals detectable at ground level, including auroral hiss, which occurs primarily at very low frequencies but often extends into the LF/MF range, and auroral roar, a relatively narrow band emission generated near or at the second and third harmonics of the electron cyclotron frequency.

This group uses a versatile electromagnetic waveform receiver deployed at South Pole Station. Only recently has it been possible to conceive of an inexpensive, versatile receiver of this type for the South Pole. An antarctic location is essential for ground-based observations of LF auroral hiss because the broadcast bands usually found in the northern hemisphere are typically absent in Antarctica. Further, the absence of broadcast bands improves the effectiveness of automatic wave-detection algorithms.

Researchers can use the receiver to address many issues. For example, it has recently been discovered that auroral roar is sometimes modulated at frequencies between 7 and 11 Hertz, a phenomenon called flickering auroral roar. This receiver will enable researchers to discover how common flickering auroral roar is, the conditions under which it occurs, what the frequencies are, and how the amplitude and frequency vary over time.

Between 15 percent and 30 percent of auroral hiss events are not observable at very low frequencies. The receiver will determine whether LF auroral hiss consists exclusively of relatively unstructured broadband impulses or whether it sometimes displays a fine structure similar to that of auroral kilometric radiation and whistler mode waves in the same frequency range detected in the lower ionosphere. Project team members will also define and test auroral roar and auroral hiss mechanisms. Despite its extensive application for communications, the LF/MF/HF band has been relatively little investigated as a source of natural radio emissions detectable at ground level.

A complete knowledge of our geophysical environment requires understanding the physics of these emissions. Further, electron beam–plasma interactions analogous to the terrestrial aurora occur in many space physics and astrophysics applications. Often, the electromagnetic radiation emitted by these systems is our only source of knowledge about them. The local auroral plasma provides an opportunity to view some plasma radiation processes at close range.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-033-S
NSF/OPP 02-30438
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): MAPO
Dates in Antarctica: Instruments operate year-round

Background Imaging of Cosmic Extragalactic Polarization (BICEP): An experimental probe of inflation

Dr. Andrew Lange
California Institute of Technology
Physics
ael@astro.caltech.edu
http://www.astro.caltech.edu/~lgg/bicep_front.htm

BICEP mount and environmental enclosure. The mount allows the receiver to continuously rotate about the optical axis and periodically toggle by 180 degrees in azimuth.

Research Objectives: The Cosmic Microwave Background (CMB) provides three strong but circumstantial pieces of evidence that the visible Universe was created by the superluminal inflation of a tiny volume of space: namely,

+ The near isotropy (homogeneity) of the horizon,

+ The flatness of space, and

+ The phase-synchronicity of acoustic oscillations in the early Universe.

To better understand the origins of the Universe, we must probe this epoch of inflation directly. The most promising probe is the unique signature that the gravity wave background (GWB) imprints on the polarization of the CMB. The amplitude of this signature depends on the energy-scale of inflation.

Detection will require only modest angular resolution (about 1 degree), but long integration (about a year) on a restricted and contiguous patch of sky. The 6-month night, the extremely dry and stable weather, and the precise rotation of the sky about the zenith make South Pole Station the ideal terrestrial site for this ambitious project. A CMB polarimeter (BICEP) uniquely capable of detecting the signature of the GWB is being constructed and will be available for deployment in 2003. BICEP will operate simultaneously at 100 and 150 gigahertz (GHz) to both minimize and recognize confusion from polarized astrophysical foregrounds. At these frequencies, a modest (and thus relatively easy to deploy and maintain) 20-cm primary aperture will provide a resolution of 1 degree at 100 GHz and 0.7 of a degree at 150 GHz.

By combining a new polarization-sensitive bolometric detector technology developed for the European Space Agency's Planck satellite (to be launched in 2007) with four independent levels of signal differencing and a carefully optimized observing strategy, BICEP will reach the current limit on CMB polarization in the first hour of integration, reach the sensitivity of Planck over 1 percent of the sky in the first week, and precisely measure CMB polarization on the critical angular scales of 1 degree to 10 degrees.

Observational cosmology is enjoying a renaissance that has captured the public imagination and serves as one of the most effective vehicles for stimulating interest in science in general. Detecting the signature of the GWB in the CMB would represent a triumph of fundamental physics and cosmology that would revolutionize our understanding of the origins of the Universe.

2003-2004 USAP Field Season

Artists & Writers

Mr. Guy Guthridge
Program Manager

W-221-M **NSF/OPP** .

Station: McMurdo Station

RPSC POC: Elaine Hood

Research Site(s): McMurdo Station, Dry Valleys, New Harbor, Mount Erebus, Cape Royds, Beardmore Glacier, WAIS

Dates in Antarctica: Late November to late January

History of science in Antarctica

Dr. Edward J. Larson

University of Georgia
History
edlarson@uga.edu

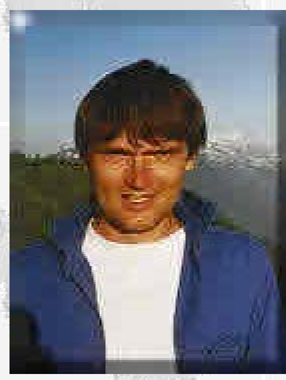

Photo of the artist by David Parkam.

Deploying Team Members: Edward J. Larson

Research Objectives: Dr. Larson will chronicle the history of scientific research in the Antarctic, beginning with Captain Cook's expedition and concluding with the region's present scientific significance. He has authored four books, co-authored four books, and written over fifty published articles, mostly on science, medicine and law issues. His most recent book, Evolution's Workshop: God and Science in the Galapagos Islands (2001), sold 20,000 copies in six months, and Summer for the Gods: The Scopes Trial and America's Continuing Debate Over Science and Religion (1997) won a Pulitzer Prize. The Fulbright Program named Larson to the John Adams Chair in American Studies for 2001, and he received the 2000 George Sarton Award from the American Association for the Advancement of Science.

Dr. Larson will work out of McMurdo for two months. He plans to visit science teams as they work in the field as well as the historic huts.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-136-S
NSF/OPP 01-32576

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Mid December to mid January

Measurement and analysis of extremely-low-frequency (ELF) waves at South Pole Station

Dr. Marc R. Lessard
Dartmouth College
Thayer School of Engineering
marc.lessard@dartmouth.edu

ELF magnetic sensor coil, receiver, and the data acquisition system. Inside the receiver (inset). Photo by Hyomin Kim.

Deploying Team Members: Hyomin Kim . Marc R. Lessard . Paul Riley

Research Objectives: This project aims to detect and record magnetic field fluctuations in the extremely-low-frequency (ELF) range at South Pole Station, specifically auroral ion cyclotron waves, which have been well correlated with flickering aurora. Theory predicts that these waves modulate precipitating electron fluxes, thereby causing the flickering in luminosity emissions. Substantial evidence now supports this theory, although the excitation mechanism responsible for the ion cyclotron waves is somewhat uncertain. Perhaps the most well-developed theory suggests that the waves result from an electron-beam instability. In any case, the frequency of the flickering or, equivalently, the frequency of the ground-based observations of ion cyclotron waves can be used to infer the altitude of the excitation mechanism, since the wave frequency depends on the strength of the background magnetic field, which is a known quantity. As such, the information that will be acquired can be used to test models of auroral acceleration mechanisms, as well as study dispersive ELF waves, a type of wave that has been reported in the literature only a few times, but one that may provide important information on substorm onset or, perhaps, the boundaries of open and closed magnetic fields.

A first step is to identify the wave mode and to determine the location and geomagnetic conditions under which these waves can be observed. The equipment used to make these observations consists of an induction coil magnetometer and data acquisition system. The induction coil is a commercially available device, one that was originally designed for geophysical exploration. Data will be returned to Dartmouth College for analysis.

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-152-N **NSF/OPP** 00-88143

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Ashley Lowe
Research Site(s): Ross Sea
Dates in Antarctica: Early to mid January

Antarctic cretaceous-Cenozoic climate, glaciation, and tectonics: Site surveys for drilling from the edge of the Ross Ice Shelf

Dr. Bruce P. Luyendyk
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Institute for Crustal Studies
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Photo not available.

Deploying Team Members: Tonya Sue Del Sontro . Louis Bartek

Research Objectives: Many of the questions on the evolution of the East and West Antarctic Ice Sheets, antarctic climate, global sea level, and tectonic history of the West Antarctic Rift System can be answered by drilling into the floor of the Ross Sea. We will therefore conduct site surveys for drilling from the Ross Ice Shelf into the seafloor beneath. Climate data for this sector of Antarctica are lacking for the Cretaceous and Early Cenozoic. Questions include,

+ Was there any ice during the Late Cretaceous?

+ What was the antarctic climate like during the Paleocene-Eocene global warming?

+ When was the Cenozoic onset of antarctic glaciation? When did glaciers reach the coast and when did they advance onto the margin?

+ Was the Ross Sea shelf nonmarine in the Late Cretaceous? If so, when did it become marine?

Tectonic questions include,

+ What was the timing of the Cretaceous extension in the Ross Sea rift and where was it located?

+ What is the basement composition and structure?

+ Where are the time and space limits of the effects of Adare Trough spreading?

Sampling at four drill sites was completed in the early 1970s but had low recovery and did not sample the Early Cenozoic. Other drilling has been restricted to the McMurdo Sound area of the western Ross Sea, and results can be correlated for the Victoria Land Basin but not eastward across basement highs. Further, Early Cenozoic and Cretaceous rocks have not been sampled.

Our surveys (including core samples and long profiles and detailed grids over potential drilling sites) will be conducted a kilometer or two north of the ice-shelf front. In 2 to 4 years, the northward advance of the shelf will cover surveyed locations and drilling can begin. The calving of giant icebergs from the ice front in the eastern Ross Sea have exposed 16,000 square kilometers of seafloor that has been covered for decades and has therefore not been explored. We will be able to map structure and stratigraphy below unconformity RSU6 farther south and east, study the place of Roosevelt Island in the Ross Sea rifting history, and determine subsidence history during the Late Cenozoic in the far south and east. Finally we will observe current sedimentary processes beneath the ice shelf in the newly exposed areas.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-259-M
NSF/OPP 02-29836
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Cape Hallett, McMurdo Station
Dates in Antarctica: Early November to mid February

Soil biodiversity and response to climate change: A regional comparison of Cape Hallett and Taylor Valley

Dr. W. Berry Lyons
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Byrd Polar Research Center
lyons.142@osu.edu

Photo not available.

Deploying Team Members: John E. Barrett . Craig Cary . Timothy O. Fitzgibbon . Diana H. Wall

Research Objectives: Soil ecosystems along the Victoria Land coast from the McMurdo Dry Valleys in the south to Cape Hallett in the north occur across broad gradients of biodiversity, climate, and soil resource legacies from previous climates (organic matter, nutrients, and salts). The range of conditions can be used to test specific hypotheses derived from a soil biodiversity and habitat model developed from the McMurdo Dry Valleys Long-Term Ecological Research Program (LTER). This habitat suitability model describes the distribution, abundance, and diversity of soil biota based on a combination of legacy and contemporary soil and climate properties.

We will extend this model to the greater Victoria Land region at Cape Hallett. Insights into the relationship between biodiversity (microbes and invertebrates) and ecosystem functioning (soil respiration and nutrient cycling) may be especially important in Victoria Land since it encompasses a range of ecosystems, from those with near minimum organic matter and no invertebrates to those with very high organic matter deposits and complex food webs. Our 2-year program of field and laboratory research will address how soil food webs and ecosystem processes are affected by climate, legacy, and contemporary soil processes.

We will begin the regionalization of results and insights from the McMurdo LTER study and determine whether the changes in biodiversity along the range of soil habitats and landscape gradients in Taylor Valley occur similarly across gradients in a richer, more complex habitat (Cape Hallett). There is a immediate need to understand how soil biodiversity and ecosystem functioning are related and to determine the factors influencing the distribution of soil biodiversity across Antarctica.

The taxonomic complexity of soil food webs elsewhere limits our ability to draw inferences about the functional significance of biodiversity and the responses of soil communities to varying conditions and climate. The extension and testing of a conceptual model of soil biodiversity based on the simplest soil communities on Earth will contribute to the knowledge of complex temperate ecosystems. These linked studies of microbial and invertebrate diversity in relation to soil organic matter, moisture, and temperature change at Taylor Valley and Cape Hallett will provide one of the most complete quantitative assessments of soil diversity to date.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-420-M
NSF/OPP 98-10219

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Taylor Valley, Wright Valley, McMurdo Station, Lake Hoare, Lake Fryxell, Lake Bonney, Lake Joyce, Lake Miers
Dates in Antarctica: Mid October to mid February

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Dr. W. Berry Lyons
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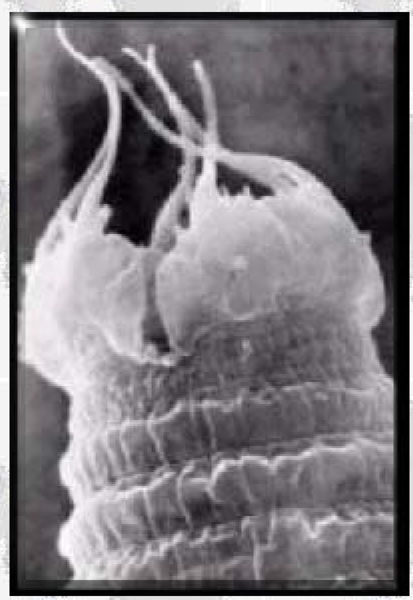

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Deploying Team Members: Carol E. Landis . Kathleen A. Welch . Rebecca Witherow

Research Objectives: Chemistry of streams, lakes, and glaciers component of McMurdo LTER. The group is responsible for monitoring the inorganic geochemistry of waters collected from glaciers, streams and lakes of the dry valleys. This year the group will address questions about the concentrations and fluxes of phosphorus in various components of the ecosystem. They will coordinate with another project of the principal investigator (GO-074-O) to examine the nature of chemical weathering in the Dry Valleys.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-190-M
NSF/OPP 02-29546
Station: McMurdo Station
RPSC POC: Doug Miller
Research Site(s): McMurdo Station, USCG Icebreaker, Drygalski Ice Tongue, Ross Ice Shelf
Dates in Antarctica: Early October to mid February

Collaborative research of Earth's largest icebergs

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RV Polar Sea "facing off" against iceberg B15A for the first time in January of 2001. This project flew off the deck of the Polar Sea and placed sensors and GPS receivers on the iceberg, allowing them to monitor it's position and weather conditions. Photo

Deploying Team Members: Tim Parker . Mary Templeton . Ronals Ross . Andrew Bliss . Jill Franks . Young-Jin Kim . Douglas R. MacAyeal . Emile Okal . Marianne H. Okal . Olga V. Sergienko . Jonathan E. Thom

Research Objectives: Icebergs released by the antarctic ice sheet represent the largest movements of fresh water within the natural environment. Several of these icebergs, B–15, C–19, and others calved since 2000, represent over 6,000 cubic kilometers of fresh water—an amount roughly equivalent to 100 years of the flow of the Nile River.

We will study the drift and breakup of the Earth's largest icebergs, which were recently released into the Ross Sea as a result of calving from the Ross Ice Shelf. We will attempt to ascertain the physics of iceberg motion within the dynamic context of ocean currents, winds, and sea ice, which determine the forces that drive iceberg motion, and the relationship between the iceberg and the geographically and topographically determined pinning points on which it can ground. In addition, we will study the processes by which icebergs influence the local environment (sea ice near Antarctica, access to penguin rookeries, air-sea heat exchange and upwelling at iceberg margins, nutrient fluxes), as well as the processes by which icebergs generate globally far-reaching ocean acoustic signals that are detected by seismic-sensing networks.

In addition, we will attempt to deploy automatic weather stations, seismometer arrays, and global positioning system tracking stations on several of the largest icebergs presently adrift, or about to be adrift, in the Ross Sea. Data generated and relayed via satellite to our home institutions will lead to theoretical analysis and computer simulation and will be archived on a Web site (http://amrc.ssec.wisc.edu/amrc/iceberg.html) that scientists and the general public can access.

A better understanding of the impact of iceberg drift on the environment, and particularly the impact on ocean stratification and mixing, is essential to understanding the abrupt global climate changes witnessed by proxy during the Ice Age and future greenhouse warming. More specifically, the study will generate a knowledge base useful for the better management of antarctic logistical resources that can occasionally be influenced by the adverse effects icebergs have on sea ice (the shipping lanes to McMurdo Station, for example).

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-029-M
NSF/OPP 02-38281
Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station
Dates in Antarctica: Early October to late December

Genomic networks for cold-adaptation in embryos of polar marine invertebrates

Dr. Adam G. Marsh
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Photo not available.

Deploying Team Members: Kevin T. Fielman . Lindsay R. Kendall . Adam G. Marsh . Leonard Pace . Safiya Saweny . Tracy Szela

Research Objectives: Although the cold ocean ecosystems comprise 72 percent of Earth's biosphere by volume, they remain sparsely inhabited and relatively unexploited, particularly the metazoan phyla. Consequently, the few animals that can exist at this border of intracellular freezing are ideal for exploring genomic-level processes of environmental adaptation. Understanding life at the margin will convey significant insights into the processes essential for survival under intense selection pressures.

Our study of adaptive mechanisms in genomic networks focuses on a system that faces a formidable challenge at cold temperatures: embryonic development of two antarctic echinoderms, the seastar Odontaster validus and the sea urchin Sterechinus neumayeri, at sea water temperatures of –1.8º C. We will quantify temperature effects on gene expression and protein turnover networks during early development by using a Bayesian network analysis to identify clusters of genes and proteins whose levels of expression are associated in fixed, synergistic interactions. Ultimately, the question to be addressed is whether it is more or less difficult (complex) for an embryo to develop in an extreme environment. To answer this question, we will decipher network topologies and subnet structuring to uncover gene connectivity patterns associated with embryonic development in this polar environment. We also intend to interest students in the developing field of environmental genomics by increasing the awareness of career opportunities within the field and increasing the racial diversity of those attracted to it.

Working in a remote, extreme environment such as Antarctica is always a challenge, but the adventurous nature of the work can be used to establish educational and outreach components of high interest to both undergraduate students and the public. We will bring the experience of working in Antarctica to a larger audience by

+ Incorporating environmental genomics into a new bioinformatics curriculum being developed at the University of Delaware,

+ Implementing an intern program to involve minority undergraduates in summer research in the United States and then to bring them to Antarctica to participate in research, and

+ Creating a K–12 education program that will bring the excitement of working in Antarctica to the classrooms of thousands of children (in the United States and around the world) through a program produced in conjunction with the Marine Science Public Education Office at the University of Delaware.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-021-L

NSF/OPP 02-17282

Station: R/V Laurence M. Gould
RPSC POC: Karl Newyear
Research Site(s): R/V Laurence M. Gould
Dates in Antarctica: Early January to mid February

Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

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Lamont-Doherty Earth Observatory
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Photo not available.

Deploying Team Members: Richard A. Iannuzzi . Douglas G. Martinson

Research Objectives: The modeling component of the Long Term Ecological Research (LTER) project focuses on temperature and salinity profiles of the water column at each standard station in the study areas. The models will also include weather and navigational data such as wind speed and direction, air temperature and humidity at east station site, as well as latitude and longitude data. Data from shipboard ADCP is also used for interpretation and checking of geostrophic calculations.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-153-M
NSF/OPP 02-29573
Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, US ITASE Traverse, Taylor Dome
Dates in Antarctica: Mid November to mid January

A science management office for the United States component of the International Trans Antarctic Scientific Expedition (ITASE) -- South Pole to Northern Victoria Land

Dr. Paul Mayewski
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http://www.ume.maine.edu/USITASE/

Co-PIs Eric Steig and Paul Mayewski with the solar-powered 2" drill that will be used this year on the traverse. Photo by Dan Dixon.

Deploying Team Members: Daniel Dixon . Thomas Neumann

Research Objectives: We will operate a science management office for a pilot ice-core drilling and analysis program to test the feasibility of obtaining well-dated, high-resolution isotope and chemistry records from East Antarctica. Shallow ice cores will be obtained from two locations:

+ 100 kilometers from the South Pole toward the Pole of Inaccessibility, as an extension of the Byrd Station-to-South Pole International Trans Antarctic Scientific Expedition (ITASE) traverse; and

+ Taylor Dome, near the original deep-coring site.

AGO 3 and AGO 4 (automated geophysical observatories) may also be sampled as part of a logistics traverse to these sites.

All of the cores collected will be examined at very high resolution and analyzed for major ions. Results from this calibration work, along with those from another project that is analyzing stable isotopes, will be used to help plan a larger program, with the objective of mapping the spatial expression of climate variability in East Antarctica.

In addition, we will organize a community workshop to coordinate the second phase of U.S. ITASE, as well as one workshop a year, for 2 years, dedicated to writing and preparing scientific papers from phase 1 of U.S. ITASE. Further, we will use satellite image mapping to select routes for the follow-on traverse in East Antarctica. We also will produce a summary that will be made available to the community to help with planning related field programs such as deep ice radar, firn radar profiling, atmospheric chemistry, ice coring, snow surface properties for satellite observations, ice surface elevation, and mass balance.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-421-M
NSF/OPP 98-10219
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Dry Valleys, McMurdo Station
Dates in Antarctica: October to late February

McMurdo Dry Valleys Long Term Ecological Research (LTER):
The role of natural legacy on ecosystem structure and function in a polar desert

Dr. Diane M. McKnight
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Institute of Arctic and Alpine Research (INSTAAR)
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http://huey.colorado.edu

The Role of Natural Legacy on Ecosystem Structure and Function in a Polar Desert: The McMurdo Dry Valley Long Term Ecological Research Program

Deploying Team Members: Karen Cozzetto . Christopher L. Jaros . Justin Joslin . Diane M. McKnight

Research Objectives: This project is the flow, sediment transport, and productivity of streams component of McMurdo LTER. The researchers plan to monitor the flow, sediment transport, and productivity of glacial melt streams in the McMurdo Dry Valleys.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-225-L

NSF/OPP 02–30445

Station: R/V Laurence M. Gould
RPSC POC: Don Michaelson
Research Site(s): Antarctic Peninsula Area
Dates in Antarctica: Mid February to mid March

Plankton community structure and iron distribution in the southern Drake Passage

Dr. Christopher Measures
University of Hawaii Manoa
chrism@soest.hawaii.edu

Photo not available.

Deploying Team Members: Christopher Measures

Research Objectives: The Shackleton Fracture Zone (SFZ) in the Drake Passage marks a boundary between low- and high-phytoplankton waters. West of the passage, waters have very low concentrations of surface chlorophyll, and east of the SFZ, mesoscale eddy kinetic energy and chlorophyll are higher than they are west of it. Data from a 10-year survey confirm the existence of a strong hydrographic and chlorophyll gradient in the region. We hypothesize that bathymetry, including the 2,000-meter-deep SFZ, influences mesoscale circulation and transport of iron, leading to the differences in phytoplankton patterns.

To test this hypothesis, we will examine phytoplankton and bacterial physiological states (including responses to iron enrichment) and the structure of plankton communities from virus to zooplankton; the concentration and distribution of iron, manganese, and aluminum; and mesoscale flow patterns near the SFZ. We will examine relationships between iron concentrations and phytoplankton in the context of the mesoscale transport of trace nutrients to determine how much of the variability in biomass can be attributed to iron supply, as well as the most important sources of iron east of the Drake Passage. Our goal is to better understand how plankton productivity and community structure in the Southern Ocean are affected by bathymetry, mesoscale circulation, and nutrient distributions.

We will perform rapid surface surveys of chemical, plankton, and hydrographic properties, complemented by a mesoscale station grid for vertical profiles, water sampling, and bottle incubation enrichment experiments. Manganese and aluminum distributions will help distinguish aeolian, continental shelf, and upwelling sources of iron. We will monitor the physiological state of the phytoplankton by active fluorescence methods sensitive to iron limitation. Concentrations of pigment, carbon, and nitrogen will be obtained by analysis of filtered samples, cell size distributions by flow cytometry, and species identification by microscopy. We will measure primary production and photosynthesis parameters (absorption, quantum yields, variable fluorescence) with depth profiles, surface surveys, and bulk samples from enrichment experiments. We will also determine the abundance of viruses and bacteria and ascertain whether bacterial production is limited by iron or organic carbon sources.

We aim to improve scientific understanding of processes controlling iron distribution and the response of plankton communities in the Southern Ocean. Moreover, we will have an undergraduate and teacher outreach component and plan to create an Web site and K–12 curricular modules.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-104-S **NSF/OPP** 02-30428
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Mid December to late January

Dayside auroral imaging at South Pole

Dr. Stephen B. Mende
University of California Berkeley
Space Sciences Laboratory
mende@ssl.berkeley.edu

Dayside auroral imaging at South Pole. Photo by Charles Kaminski.

Deploying Team Members: Stephen B. Mende

Research Objectives: We plan to operate two ground-based imagers at South Pole Station and combine their observations with simultaneous global auroral observations by the IMAGE (Imager for Magnetopause to Aurora Global Exploration) spacecraft investigating temporal and spatial effects in the ionosphere from the reconnection processes at the magnetopause. The South Pole has advantages for auroral imaging because the continuous darkness during the winter allows 24 hours of optical observations and because the ideal magnetic latitude permits observation of the dayside aurora. The reconnection (merging) region of the magnetosphere provides the most significant entry point for solar wind plasma. It is now widely accepted that the dayside region contains the footprint of field lines that participate in reconnection processes with the interplanetary field.

Although there is a body of literature about the auroral footprints of the dayside reconnection region derived from ground-based observations, it has not been possible to relate those results to simultaneous global auroral images. Global observations of proton auroras from the IMAGE spacecraft have provided direct images of the footprint of the reconnection region, showing that reconnection occurs continuously and that the spatial distribution of the precipitation follows theoretically predicted behavior as a function of the interplanetary field. The apogee of the IMAGE spacecraft orbit is slowly drifting south, and during the austral winter of 2004, the apogee will be over the Southern Hemisphere. Thus, it will be possible to obtain simultaneous global images of the aurora by IMAGE and of the high-latitude dayside region by two ground-based imagers (electron and proton auroras) at South Pole Station.

Our main goal is to capitalize on this unique opportunity and use the IMAGE satellite as the telescope and the ground-based imagers as the microscope for these observations in an attempt to better understand substorms and related phenomena. Understanding the Earth's electromagnetic environment is key to predicting space weather and to determining how geoactive magnetic storms are. We will continue to involve students in every phase of the program, thereby encouraging some of them to start a career in upper-atmospheric research.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-094-M

NSF/OPP 01-26146

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): McMurdo Station, Beardmore Glacier
Dates in Antarctica: Early November to mid January

Late Paleozoic-Mesozoic fauna, environment, climate, and basinal history: Beardmore Glacier area, Tranantarctic Mountains

Dr. Molly F. Miller
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millermf@ctrvax.vanderbilt.edu

Photo not available.

Deploying Team Members: Timothy Cully . Peter P. Flaig . John L. Isbell . Nicole Knepprath . Zelinda Koch . Molly F. Miller . Christian A. Sidor

Research Objectives: We will investigate paleoenvironmental conditions during the late Paleozoic and Mesozoic in central interior Antarctica. The 4-kilometer-thick sequence of sedimentary rocks in the Beardmore Glacier area, known as the Beacon Supergroup, records 90 million years of Permian through Jurassic history of this high-paleolatitude sector of Gondwanaland. The sequence accumulated in a foreland basin with a rate of subsidence approximately equal to the rate of deposition. The deposits have yielded diverse vertebrate fossils, fossil forests, and exceptionally well preserved plant fossils that give a unique glimpse of glacial, lake, and stream/river environments and ecosystems and provide an unparalleled record of the depositional, paleoclimatic, and tectonic history of the area.

We plan to integrate sedimentologic, paleontologic, and ichnologic observations to answer the following focused questions:

+ What are the stratigraphic architecture and alluvial facies of Upper Permian to Jurassic rocks in the Beardmore Glacier area?

+ In what tectonostratigraphic setting were these rocks deposited?

+ Did vertebrates inhabit the cold, near-polar Permian floodplains, as indicated by vertebrate burrows, and can these burrows be used to identify for the first time the presence of small early mammals in Mesozoic deposits?

+ How did bottom-dwelling animals in lakes and streams use substrate ecospace, how did ecospace use at these high paleolatitudes differ from use in equivalent environments at low paleolatitudes, and what does burrow distribution reveal about the seasonality of river flow and thus about paleoclimate?

Answers to these questions will

+ Clarify the paleoclimatic, basinal, and tectonic history of this part of Gondwanaland;

+ Elucidate the colonization of near-polar ecosystems by vertebrates;

+ Provide new information on the environmental and paleolatitudinal distributions of early mammals; and

+ Allow semiquantitative assessment of the activity and abundance of bottom-dwelling animals in different freshwater environments at high and low latitudes.

We expect this project to contribute significantly to an understanding of paleobiology and paleoecology on a high-latitude floodplain during a time in Earth’s history when the climate was much different than it is today.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-228-L
NSF/OPP 02-30445
Station: R/V Laurence M. Gould
RPSC POC: Don Michaelson
Research Site(s): R/V Laurence M. Gould, Drake Passage
Dates in Antarctica: Mid February to mid March

Plankton community structure and iron distribution in the southern Drake Passage

Dr. B. Greg Mitchell
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Scripps Institution of Oceanography
chrism@soest.hawaii.edu
http://www.spg.ucsd.edu

Photo not available.

Deploying Team Members: Farooq Azam . Katherine Barbeau . Sarah Gille . Christopher D. Hewes . Osmund Holm-Hansen . B. Greg Mitchell . Haili Wang

Research Objectives: The Shackleton Fracture Zone (SFZ) in the Drake Passage marks a boundary between low- and high-phytoplankton waters. West of the passage, waters have very low concentrations of surface chlorophyll, and east of the SFZ, mesoscale eddy kinetic energy and chlorophyll are higher than they are west of it. Data from a 10-year survey confirm the existence of a strong hydrographic and chlorophyll gradient in the region. We hypothesize that bathymetry, including the 2,000-meter-deep SFZ, influences mesoscale circulation and transport of iron, leading to the differences in phytoplankton patterns.

To test this hypothesis, we will examine phytoplankton and bacterial physiological states (including responses to iron enrichment) and the structure of plankton communities from virus to zooplankton; the concentration and distribution of iron, manganese, and aluminum; and mesoscale flow patterns near the SFZ. We will examine relationships between iron concentrations and phytoplankton in the context of the mesoscale transport of trace nutrients to determine how much of the variability in biomass can be attributed to iron supply, as well as the most important sources of iron east of the Drake Passage. Our goal is to better understand how plankton productivity and community structure in the Southern Ocean are affected by bathymetry, mesoscale circulation, and nutrient distributions.

We will perform rapid surface surveys of chemical, plankton, and hydrographic properties, complemented by a mesoscale station grid for vertical profiles, water sampling, and bottle incubation enrichment experiments. Manganese and aluminum distributions will help distinguish aeolian, continental shelf, and upwelling sources of iron. We will monitor the physiological state of the phytoplankton by active fluorescence methods sensitive to iron limitation. Concentrations of pigment, carbon, and nitrogen will be obtained by analysis of filtered samples, cell size distributions by flow cytometry, and species identification by microscopy. We will measure primary production and photosynthesis parameters (absorption, quantum yields, variable fluorescence) with depth profiles, surface surveys, and bulk samples from enrichment experiments. We will also determine the abundance of viruses and bacteria and ascertain whether bacterial production is limited by iron or organic carbon sources.

We aim to improve scientific understanding of processes controlling iron distribution and the response of plankton communities in the Southern Ocean. Moreover, we will have an undergraduate and teacher outreach component and plan to create an Web site and K–12 curricular modules.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-130-S
NSF/OPP 99-80474

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Mid November to mid February

Antarctic Muon And Neutrino Detector Array (AMANDA)

Dr. Robert M. Morse
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Antarctic Muon And Neutrino Detector Array (AMANDA)

Deploying Team Members:

Markus Ackermann . Jens Christopher Ahrens . Elisa Bernardini . David Z. Besson . Collin Blaise . David J. Boersma . Christian I. Bohm . Thomas T. Burgess . Steve T. Churchwell . Anna Kristina Davour . Thomas Feser . Terry B. Hannaford . Klaus Helbing . Marc Hellwig . Per Olof Hulth . Albrecht Karle . Martin Kestel . Ilya V. Kravchenko . Alf Timo Messarius . Robert M. Morse . Jiwoo Nam . Robert Paulos . Steffen Richter . Matthius Lueuthold . Darryn Schneider . Michael Stamatikos . Robert G. Stokstad . Karl-Heinz Sulanke . Lars Thollander . Wolfgang Wagner . You-Ren Wang . Michael Whitney . Christin Wiedemann

Research Objectives: Neutrinos are elementary particles, with no electrical charge, and very little mass. They are very penetrating, interacting rarely with other particles. Low energy neutrinos have been detected from the sun and from Supernova 1987a in the Large Magellanic Cloud -- to date the only sources of extra-terrestrial neutrinos. The primary goal of the AMANDA experiment is to detect the expected sources of high energy neutrinos from cosmic objects such as active galaxies, pulsars, neutron stars, blazars, and gamma-ray bursts. If the present understanding of the acceleration mechanisms in these objects are correct, gamma-ray bursts should be copious emitters of neutrinos.

AMANDA is the largest detector of neutrinos in the world. Over the last five seasons, the project has drilled an array of holes in the ice 1 to 2 kilometers deep and installed over 600 photomultiplier tubes with "strings" of instrument suspended inside. The ice at South Pole is so clear that the tubes can detect Cherenkov radiation from several hundred meters away. Cherenkov radiation, visible as a blue glow, is emitted by collisions of high-energy neutrinos with ice or rock.

There are currently 26 strings in the ice, each hard-wired to computers in the Martin A. Pomerantz Observatory (MAPO) facility. The computers analyze the gigabytes of collected data to determine true neutrino events.

Only in recent years has it become technically possible to build such large neutrino detectors. As one of the first of this new generation, AMANDA promises to make seminal contributions to the new field of high energy neutrino astronomy.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-052-M/P/S **NSF/OPP** 02-33246

Station: McMurdo Station, Palmer Station
RPSC POC: Jessie Crain
Research Site(s): Cape Roberts, Dry Valleys, Ross Island, Fishtail Point
Dates in Antarctica: Late October to mid January

Geodesy and geospatial program

Dr. Jerry L. Mullins
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Geographic Sciences
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Photo not available.

Deploying Team Members: Angel L. Gonzalez . Donald B. Grant . Cheryl A. Hallam . Larry D. Hothem . Jerry Mullins

Research Objectives: Geodetic surveying, aerial photography, remote sensing (principally using several varieties of satellite imagery), and mapping are all activities necessary for the successful operation of a multifaceted scientific and exploration effort in Antarctica. The U.S. Geological Survey provides these support activities to the U.S. Antarctic Research Program.

Year-round data acquisition, cataloging, and data dissemination activities will continue in the U.S. Antarctic Resource Center for geospatial information. Field surveys will be conducted in support of specific research projects, and as part of a continuing program to collect the ground-control data necessary to transform existing geodetic data to an earth-centered system suitable for future satellite mapping programs.

LandSat data will be collected as part of satellite image mapping activities. This will permit continued publication of additional 1:50,000 scale topographic maps in the McMurdo Dry Valleys region. Such topographic studies provide a uniform base map on which to ensure that scientific information (from geology, glaciology, biology and other areas) is spatially accurate. These, as well as the satellite image maps, are used by scientists to plan and execute future research work. Spatially-referenced, digital cartographic data will be produced in tandem with the published maps.

In the austral summer of 2001-2002, this group will collaborate with NASA's Airborne Topographic Mapper Program to collect very high-resolution elevation data in portions of the McMurdo Dry Valleys and vicinity. The detailed land surface characterizations will be tested for feature recognition in the Beacon Valley, glacier studies in the Taylor Valley, and geologic applications in the Mt. Discovery area. The data will be tested for positional accuracy and resampled to provide regularly spaced observations for use in models and science. The USGS team will work with selected scientists to develop elevation data at resolutions that best serve their research needs. The data will then be used to develop elevation models at a variety of resolutions.

Very high-resolution data also will be collected for use by the ICESat (Ice, Cloud, and Land Elevation Satellite) research community to calibrate their 70-meter elevation data in Antarctica. The McMurdo Dry Valleys comprise a primary site for calibration and validation of NASA's ICESat satellite, scheduled for launch in December 2001. The primary sensor on ICESat is a laser altimeter, designed to measure the surface elevation very precisely, within the 70-meter footprint of the laser. Because the altimeter will be operated with off-nadir pointing, it is equally important to calibrate for mounting angle as well as for range. A calibration site for such a sensor requires precise knowledge of local topography, which must be a stable, snow-free surface region with minimal vegetation. Angle calibration is also enhanced if you have variable surface slopes of moderately large amplitude (10-20 degrees). With accurately measured surface elevations, the Dry Valleys provide a nearly ideal calibration site for ICESat. Furthermore, the Dry Valleys are in the region of the maximum altitude for the orbit of ICESat, allowing measurement errors to be detected through comparisons with measurements from other parts of the world. No other site in the world can provide this unique combination of features.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-255-M/S

NSF/OPP 02-30370

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): Arrival Heights, South Pole Station

Dates in Antarctica: Late November to late December

Infrared measurements of atmospheric composition over Antarctica

Dr. Frank J. Murcray
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Photo not available.

Deploying Team Members: Pierre F. Fogal . Toufic M. Hawat . John R. Olson

Research Objectives: Using passive infrared instruments, we will measure year-round atmospheric chemistry to acquire better data for the photochemical transport models used to predict ozone depletion and climate change. The ozone hole has shown how sensitive the southern polar stratosphere is to chlorine, and although gradual healing of the hole is expected, model predictions indicate a possible delay in recovery because of the impact of global warming on the catalytic ozone destruction process.

Since most satellite instruments do not sample the polar regions in the winter, ground-based instruments can make important contributions, and the data from our instruments would also provide validation for new satellite sensors. We will install two spectrometers, one at South Pole Station and another at McMurdo Station for year-round operation, and a solar spectrometer at South Pole Station for summer operation. Also, we will collaborate with and receive data from the New Zealand National Institute for Water and Air Research, which operates a similar solar spectrometer at Arrival Heights. During the polar night, two instruments will provide important information on nitric acid and denitrification, as well as dehydration, and high-resolution spectra from which we will derive vertical profiles, vertical column amounts of many molecules important in the ozone destruction process, and atmospheric tracers. Specifically, we will derive year-round column abundance measurements of nitric acid, methane, ozone, water, nitrous oxide, the chlorofluorocarbons (CFCs), and nitrogen dioxide.

The solar instruments will provide some altitude profile information about those molecules and others. The data set we obtain will be used to determine the current state of nitrogen oxide partitioning; to measure denitrification, vapor profiles in the stratosphere, and dehydration; to determine current CFC and stratospheric chlorine levels; and to gain more insight into vortex-related chemical and dynamic effects.

In addition, the data will allow photochemical transport modelers to compare outputs with actual measurements, especially at intermediate stages. As the recovery from ozone destruction begins, it is important to have a data set that comprehensively covers the major constituents of both the catalytic ozone destruction sequence and global warming, in order to place the relative influence of the two mechanisms in perspective.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-125-M

NSF/OPP NSF/NASA agreement

Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, Williams Field
Dates in Antarctica: Late October to mid February

Tracer-Lite II: Transition Radiation Array for Cosmic Energetic Radiation, a balloon borne instrument

Dr. Dietrich Müller

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Photo not available.

Deploying Team Members:

Maximo Ave . Patrick (Jojo) Boyle . Eugene Drag . Andrew Frederic Romero-Wolf . Jöerg Hörandel . Wayne Johnson . Gary (gak) Kelderhouse . Dietrich Müller . Richard Northrop . Dave Pernic . Andrew Romero-Wolf . Simon Swordy . Mark Thoma . Scott Wakely

Research Objectives: The origin of high-energy cosmic rays remains a mystery. To solve this mystery, it is important to know the energy spectrum of cosmic rays at the source, which is known to be different from the observed energy spectrum, at least over a narrow range of energies. Examining the chemical composition of cosmic rays at high energies provides the only means of determining the cosmic ray spectrum at the source. The steeply falling energy spectrum of cosmic rays requires long observation times with large detectors. The Transition Radiation Array for Cosmic Energetic Radiation (TRACER) was constructed for long-duration balloon flights around the polar circle. It will study the abundance of elements from oxygen to iron in the cosmic ray spectrum up to approximately 10 tera electron volts/nucleon. Such information can be used to constrain models of cosmic ray propagation and acceleration.

The instrument requires careful handling and storage. During its trip from Port Hueneme to Williams Field, its temperature must remain between 0° C and +40° C. Project members will arrive in Antarctica at intervals as the mission unfolds: one will arrive early to help unload, transport, and store the instrument. Then, others will arrive to unpack it and prepare it for flight. Once that stage is complete, different personnel will be responsible for monitoring the flight. After the flight, still other personnel will take part in the recovery phase, dismantle the instrument, and pack it for return shipment to Port Hueneme.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-086-E **NSF/OPP** 02-30069

Station: Special Project
RPSC POC: John Evans
Research Site(s): Petermann Island field camp
Dates in Antarctica: Mid November to mid February

Long-term data collection at select Antarctic Peninsula visitor sites

Mr. Ron Naveen
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Photo not available.

Deploying Team Members: Rosemary Dagit . Steven Forrest . Ronald Naveen

Research Objectives: The Antarctic Site Inventory Project has collected biological data and site-descriptive information in the Antarctic Peninsula since 1994. This research has provided data on sites visited by tourists on shipboard expeditions in the region. Our aim is to obtain data on the population of several key species of antarctic seabirds that might be affected by the cumulative impact of visits to the sites. We will focus on two heavily visited Antarctic Peninsula sites: Paulet Island, in the northwestern Weddell Sea, and Petermann Island, in the Lemaire Channel near Anvers Island. We selected these sites because both rank among the 10 most visited sites in Antarctica each year in terms of numbers of visitors and zodiac landings, both are diverse in species composition, and both are sensitive to potential environmental disruptions from visitors.

We will collect data over 5 years on two important biological parameters for penguins and blue-eyed shags:

+ Breeding population size (number of occupied nests) and

+ Breeding success (number of chicks per occupied nest).

Our main focus will be Petermann Island, which we selected for intensive study because of its visitor status and location near Palmer Station. This will allow us to compare data with the Palmer Long-Term Ecological Research Program.

We will collect demographic data in accordance with the standard methods established by the Convention for the Conservation of Antarctic Marine Living Resources Ecosystem Monitoring Program, and the information we gather will thus be comparable with similar data sets being compiled by the research programs of other Antarctic Treaty nations. While separating human-induced change from change resulting from a combination of environmental factors will be difficult, this work will provide a first step toward identifying potential impacts. The long-term data sets we compile will contribute to a better understanding of biological processes in the entire region and will also contribute valuable information to be used by Antarctic Treaty nations as they address environmental stewardship issues in Antarctica.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-203-N
NSF/OPP 01-27037
Station: RV/IB Nathaniel B. Palmer
RPSC POC: Don Michaelson
Research Site(s): Ross Sea
Dates in Antarctica: Mid October to late November

Interactive effects of UV radiation and vertical mixing on phytoplankton and bacterioplankton in the Ross Sea

Dr. Patrick J. Neale

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http://www.serc.si.edu/uvb/Ross_Sea_index.htm

Photo not available.

Deploying Team Members: Linda Franklin . Jenna Lempa . Patrick J. Neale . Jill A. Peloquin . Cristina Sobrino

Research Objectives: Ultraviolet (UV) radiation influences plankton in the near-surface waters of most ecosystems. In particular, the Southern Ocean is affected in the austral spring, when UV radiation is enhanced by ozone depletion. While progress has been made in estimating the impact of UV radiation on bacteria and phytoplankton in the Southern Ocean, important issues remain to be resolved. Little is known, for example, about responses in systems dominated by the colonial haptophyte Phaeocystis antarctica, which dominates spring blooms in the southern Ross Sea. The presence of open water at a far southerly location in the spring, well within the ozone hole, and continuous daylight, with implications for DNA repair, make the Ross Sea of intense interest.

A number of studies suggest that vertical mixing can significantly modify the impact of UV radiation. However, the limited measurements of turbulence intensity in the surface layer that have been done have not been integrated with parallel studies of the effects of UV radiation on phytoplankton and bacterioplankton. To address these issues, we will focus on vertical mixing and UV radiation in the Ross Sea and characterize phytoplankton and bacterioplankton responses in both laboratory and solar incubations. These studies will lead to biological weighting functions and response models capable of predicting the impact of UV radiation on photosynthesis, bacterial incorporation, and DNA damage in the surface layer.

We will use measure depth-dependent profiles of DNA damage, bacterial incorporation, photosynthesis, and fluorescence parameters over a 24-hour cycle. We have optimized measurements for typical springtime conditions in the Ross Sea, where stabilizing influences like solar heating and/or surface freshwater from melting ice mean that not enough turbulence is present to thoroughly mix the upper layer.

We will develop fine-scale vertical density profiles to directly estimate large eddy scales. Estimated turbulent diffusivities and eddy scales will be directly related to surface layer effects and used to generate models of UV radiation responses in the surface mixed layer.

This first in-depth study of UV radiation in the Ross Sea will enhance scientific understanding of vertical mixing processes, trophic interactions, and biogeochemical cycling in the Ross Sea and will provide a valuable comparison with previous work in the Weddell-Scotia Confluence and Palmer Station regions.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-035-E
NSF/OPP 02-29775
Station: Special Project
RPSC POC: John Evans
Research Site(s): Reunion Island, Kerguelen Region
Dates in Antarctica: Late November to late January

The development of olfactory foraging strategies in antarctic procellariiform seabirds

Dr. Gabrielle A. Nevitt
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A "sleeping" blue petrel chick is tested for its response to an odourant on Kerguelen Island in the austral summer of 2001. Photo by Simon Chamaille.

Deploying Team Members: Gabrielle A. Nevitt

Research Objectives: Procellariiform seabirds (petrels, albatrosses, and shearwaters) are distinguished by their acute sense of smell. These birds have pelagic lifestyles and forage over thousands of miles of ocean to find patchily distributed resources. We will study the development of olfactory sensitivity in burrow-nesting procellariiform seabirds within the Kerguelen Archipelago and will explore the hypothesis that during development, chicks become tuned to odors associated with feeding in a manner analogous to olfactory imprinting.

We have three primary objectives:

+ First, we will use videotape documentation to characterize the behavioral responses of chicks to two prey-related odors (dimethylsulfide and cod-liver oil), one novel odor (phenyl ethyl alcohol or rose scent), and burrow-related odors (burrow and colony dirt).

+ Second, we will determine whether chicks can learn odor cues by exposing them to a nonprey-related odor during the egg stage and then testing for increased sensitivity to that odor after they hatch.

+ Third, we will quantify key behavioral responses induced when a chick is exposed to an odor plume within a portable wind flume.

Only a handful of studies have addressed the olfactory abilities of procellariiform seabirds or indeed any bird. Results from our research will be among the first to address the development of olfaction in an ecologically important context. Overall, these results will greatly extend our knowledge of the foraging ecology of these fascinating birds. Such knowledge is not only useful to basic science, but it may also help bolster efforts to ensure the conservation of procellariiforms, given the threatened or endangered status of many species.

Our work will include research experience for a graduate student and an active international collaboration with the French Institute for Polar Research and Technology. Furthermore, our results may be transferable to other potentially important organisms, such as salmon and insects, where understanding the developmental stages of olfaction has commercial importance.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-376-S
NSF/OPP 01-30389
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Instruments operate year-round

Mapping galactic magnetic fields with SPARO

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Mapping galactic magnetic fields with SPARO

Deploying Team Members: Megan M. Krejny . Hua-Bai Li . Robert F. Loewenstein . Giles Novak . Robert J. Pernic

Research Objectives: The submillimeter polarimeter for antarctic observations (SPARO) maps interstellar magnetic fields by measuring the linear polarization of submillimeter thermal emission from magnetically aligned interstellar dust grains. Interstellar magnetic fields are generally difficult to observe, especially in the dense regions to which SPARO is most sensitive. It is important to study these fields because their energy density is comparable to that of the other physical ingredients that are found in interstellar regions, so they can play important roles in the physical processes that occur there. This program is designed to contribute to our understanding of two general problems in which interstellar gas (and thus probably also magnetic fields) plays important roles: The study of the Galactic Center region and star formation.

The study of the super-massive black holes that are found at the centers of many galaxies is motivated in part by the desire to understand the behavior of nature in such extreme environments and in part by the likely influence of these active galactic nuclei on the evolution of galaxies and perhaps of the Universe. Magnetic fields in star-forming regions may also help support star-forming clouds against gravity, or they may help clouds collapse via angular momentum transfer.

The SPARO instrument is operated on the Viper 2-meter telescope at the South Pole. Observations are carried out by personnel who remain there for the 8-month winter when South Pole Station is inaccessible. These observations are complementary to submillimeter polarimetry that is being carried out by larger telescopes at Mauna Kea, but SPARO is much more sensitive to submillimeter emissions because of the exceptionally good atmosphere transmission and the stability of the winter skies over the Antarctic Plateau.

Therefore, these observations are specifically aimed at (a) confirming SPARO's recent discovery of a large-scale toroidal magnetic field at the Galactic Center, (b) testing a magnetic outflow model for the Galactic Center Lobe, a radio structure possibly tracing gas that has been ejected from the galactic nucleus, and (c) mapping large-scale magnetic fields in a sample of star-forming clouds to study the relationship between the elongated shapes of these clouds and their magnetic fields.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-321-M/S

NSF/OPP 00-90343

Station: McMurdo Station, South Pole Station

RPSC POC: Charles Kaminski

Research Site(s): McMurdo Station, South Pole Station

Dates in Antarctica: Early November to late January

Prevention of environment-induced decrements in mood and cognitive performance

Dr. Lawrence A. Palinkas

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Department of Family and Preventive Medicine
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Photo not available.

Deploying Team Members: Lawrence A. Palinkas . Kathleen R. Reedy . Marc Shepanek

Research Objectives: Cognitive performance degrades with residence in Antarctica, and mood alteration fits a seasonal pattern during extended residence. Although these changes suggest psychological responses to physiological adaptations to cold and dim light, the exact mechanisms are poorly understood. The first objective is to determine whether long-term exposure to cold temperatures and/or to dim light is associated with significant changes in cognitive performance and emotional well-being:

+ Is physiological adaptation to cold and/or adaptation to dim light independently or synergistically associated with decrements in cognitive performance and emotional well-being?

+ Do personnel at South Pole Station experience greater physiological adaptation and decrements than personnel at McMurdo Station?

This group will also determine whether these decrements can be prevented or minimized by pharmacologic interventions and/or phototherapy:

+ What are the effects of combining liothyronine sodium with levothyroxine sodium versus supplementation with tyrosine (a precursor to both thyroid hormone and catecholamines) and daily phototherapy?

+ Is phototherapy used in combination with a pharmacologic agent more effective than either intervention used alone?

In phase I, project team members will establish computer-testing protocols, develop an effective placebo capsule, package the necessary drugs, and test the validity and reliability of computer-administered cognition and mood protocols with 30 hypothyroid outpatients on constant thyroid hormone replacement and 30 age- and sex-matched healthy controls in New Zealand.

In phase II, 50 members of the 2002 winter (v) crews, 35 at McMurdo Station and 15 at South Pole Station, will be randomized in a double-blind crossover design into 1 of 2 treatment groups (20 subjects in each group) and 1 control group (10 subjects). Baseline measurements will be conducted, and treatment groups will be switched after a 1-month washout period. Mood and memory testing will comprise 5 assessments over 12 months. Treatments consist of 50 micrograms (mcg) of levothyroxine sodium plus 12.5 mcg of liothyronine per day, 150 milligrams per kilogram of tyrosine per day, and a placebo.

In phase III, a similar design will be used to evaluate the effectiveness of phototherapy, alone and in combination with the more effective of the two pharmacologic interventions.

This research will lead to an improved understanding of the specific environmental conditions and physiological mechanisms that affect behavior and performance in the Antarctic, help develop countermeasures for circannual oscillations of mood and cognitive performance, and contribute to a reduction in accidental injuries at high latitudes.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-012-M
NSF/OPP 02-29462
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): McMurdo Station
Dates in Antarctica: Late August to late December

Drinking and sodium/potasium-ATPase alpha-subunit isoform expression in antarctic fish

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Photo not available.

Deploying Team Members: Philip R. Brauer . John Morrison . Anne Petzel . David Petzel . Margaret Scofield . Patricia Waldron

Research Objectives: Nototheniid fishes inhabiting the near-freezing (–2ºC) waters of McMurdo Sound have some of the highest serum and cellular sodium concentrations and the lowest gill sodium/potassium-ATPase (Na/K-ATPase, the sodium/potassium pump) activities of any marine teleost. The enzyme Na/K-ATPase regulates the sodium concentration in the cells of many organisms. Maintaining a high salt content in the cells of these fish lowers the freezing point to allow them to inhabit cold antarctic waters and reduces the salt gradient between them and the sea water.

On the basis of previous studies of temperature effects, we hypothesize that compared with New Zealand nototheniids that inhabit warmer waters, antarctic nototheniids have lower drinking rates, lower salt excretion rates, and a higher proportion of the low intracellular sodium affinity for a specific subunit of the Na/K-ATPase (a3-isoform). These unique osmoregulatory properties explain the high serum and cellular sodium concentrations found in nototheniids south of the antarctic Polar Front. We will compare and contrast the unique osmoregulatory mechanisms of antarctic and New Zealand nototheniids with respect to

+ Sea water drinking rates and the serum and cellular chemical composition of the fish,

+ Enzymatic properties and the expression pattern of mRNA and protein, and

+ Temporal and spatial localization of the Na/K-ATPase a3-isoform subunit in the gills.

To accomplish these objectives, we will study four species of nototheniids, representing ecologically diverse habits above and below the Polar Front.

The information we gain will increase our knowledge about the role of Na/K-ATPase in the cellular function in many organisms, strengthen our understanding of the biochemical and physiological adaptations that allow antarctic nototheniids to survive and thrive in the ice-laden waters south of the antarctic Polar Front, provide field and laboratory research experience for graduate and undergraduate students, and contribute to significant outreach activities in science education for elementary and high school students and teachers.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-197-M
NSF/OPP 02-29638
Station: McMurdo Station
RPSC POC: Charles Kaminski
Research Site(s): McMurdo Sound, Cape Crozier, Beaufort Islands, Cape Washington
Dates in Antarctica: Early October to mid December

Diving physiology and behavior of emperor penguins

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Emperor penguin exiting the experimental dive hole at the penguin ranch in the 1999 field season. Photo by Paul Ponganis.

Deploying Team Members: Yoshiaki Habara . Justin Heil . Gerald Kooyman . Gregory Marshall . Katherine Ponganis . Paul J. Ponganis . Katsufumi Sato . Torre (Knower) Stockard . Phil Thorson

Research Objectives: The emperor penguin, Aptenodytes forsteri, is the premier avian diver and a top predator in the antarctic ecosystem. The routine occurrence of 500-meter dives during foraging trips is a physiological and behavioral enigma. We will attempt to determine how and why emperor penguins dive as deeply and long as they do by examining four major topics: pressure tolerance, management of oxygen stores, end-organ tolerance of diving hypoxemia/ischemia, and deep-dive foraging behavior. These subjects are relevant to the role of the emperor as a top predator in the antarctic ecosystem and to critical concepts in diving physiology, including decompression sickness, nitrogen narcosis, shallow water blackout, hypoxemic tolerance, and extension of aerobic dive time.

We will test the following hypotheses:

+ Prevention of nitrogen narcosis and decompression sickness in emperor penguins is due to inhibition of pulmonary gas exchange at depth.

+ Shallow water blackout does not occur because of greater cerebral hypoxemic tolerance and, in deep dives, because of resumption of pulmonary gas exchange during the final ascent.

+ The rate of depletion of blood oxygen stores is a function of the depth of the dive and the heart rate.

+ The aerobic dive limit reflects the onset of lactate accumulation in locomotory muscle, not total depletion of all oxygen stores.

+ Elevation of tissue antioxidant capacity and free-radical scavenging enzyme activities protect against the ischemia and reperfusion that routinely occur during diving.

+ During deep dives, the antarctic silverfish, Pleuoragramma antarcticum, is the primary prey.

In addition to evaluating these hypotheses, we will cooperate with U.S. and foreign organizations such as the National Institute of Polar Research in Japan, Centro de Investigaciones del Noroeste in Mexico, National Geographic, University of Texas Southwestern Medical Center, and Sea World. Our work will be featured in National Geographic television documentaries that will provide unique educational opportunities for the general public.

Development of state-of-the-art technology (e.g., blood oxygen electrode recorders, blood samplers, and miniaturized digital cameras) will lay the groundwork for future research. Moreover, during our planned fieldwork at several Ross Sea colonies, we will continue to evaluate the effects of the B–15 iceberg on the breeding success of emperor penguins by taking population censuses.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-195-M
NSF/OPP MCB 02-37335
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Dry Valleys, McMurdo Station
Dates in Antarctica: Mid October to late December

Microbial diversity and function in the permanently ice-covered lakes of the McMurdo Dry Valleys

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Photo not available.

Deploying Team Members: Deborah O. Jung . Michael T. Madigan . Joel L. Moore . John C. Priscu . William M. Sattley

Research Objectives: We plan to study prokaryotic organisms in the permanently ice-covered lakes of the McMurdo Dry Valleys in order to identify and characterize novel organisms and elucidate those aspects of their genome and metabolism that are critical to understanding their role in biogeochemical cycles. We will use molecular tools in concert with conventional and high-throughput culturing techniques to define representative prokaryotic groups responsible for the contemporary geochemical gradients existing in these lakes.

The McMurdo Dry Valleys form the driest and coldest ecosystem on Earth and, until relatively recently, have been thought to harbor little life. A primary reason for establishing a microbial observatory for these lakes is to understand not only how the environment controls the diversity of organisms, but also how diversity itself controls the way ecosystems function. The McMurdo Dry Valley lake systems lend themselves to answering this question in a unique way. Given their isolation, the lack of higher life forms, and their evolutionary history, these lakes offer a unique experimental arena to search for novel microorganisms and to study the interplay of microbial diversity and ecosystem function.

The results we derive will be significant to the growing body of literature in biodiversity, biotechnology, geobiology, polar ecology, and astrobiology. We will work with existing and new programs to archive the phylogenetic and physiological data we collect so that anyone who is interested can access it easily over the Internet. Strong linkages will be made with the highly visible education, outreach, and human diversity programs supported by the National Science Foundation's Office of Polar Programs and the McMurdo Long-Term Ecological Research Program to yield a project that will have a broad impact on society.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-422-M **NSF/OPP** 98-10219
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Dry Valleys, McMurdo Station
Dates in Antarctica: Mid October to late December

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

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Helicopter putting in the field team at Lake Vida when the temperature was -48 C.

Deploying Team Members: Kerry McKenna . Jill Mikucki . John C. Priscu . Alexandre Tsapin . Christine Foreman

Research Objectives: This project is the lake pelagic and benthic productivity and microbial food webs component of McMurdo LTER. The group will continue measurements of biological, chemical, and physical limnological properties of Dry Valley lakes, with special emphasis on LTER core research areas. They will also measure other parameters relevant to modeling the Taylor Valley Lake Ecosystems.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-028-L/P

NSF/OPP 02-17282

Station: R/V Laurence M. Gould, Palmer Station

RPSC POC: Rob Edwards

Research Site(s): R/V Laurence M. Gould, Palmer Station

Dates in Antarctica: Early January to mid February

Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

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Palmer Long Term Ecological Research Project: Climate, ecological migration, and teleconnections in an ice-dominated environment (prey component)

Deploying Team Members:

Brian Cheng . Kristen Green . Alison Haupt . Amy Kaiser . Daniel Martin . Langdon B. Quetin . Robin Ross . Shannon Talley . Jason Watts

Research Objectives: The zooplankton component of the Long Term Ecological Research (LTER) project is concerned with investigating and defining seasonal scale processes in krill demography and distribution in relation to the abiotic and biotic environment.

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-064-M

NSF/OPP 01-25194

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Beacon Valley, McMurdo Station
Dates in Antarctica: Mid December to late January

Calibration of cosmogenic argon production rates in Antarctica

Dr. Paul R. Renne
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prenne@bgc.org

Photo not available.

Deploying Team Members: Kimberly B. Knight . Cliff Riebe

Research Objectives: Researchers intend to establish the systematics of cosmogenic argon production required to establish its measurement as a routine surface exposure dating tool analogous to existing methods based on helium-3, beryllium-10, carbon-14, neon-21, and aluminum-26. Cosmogenic argon offers advantages over existing cosmogenic chronometers in that it is stable (hence applicable to long-term or ancient exposure dating) and less prone to diffusive loss than helium or neon.

Argon-38 is produced principally by spallation of calcium and (probably) potassium, and it is most easily measured using neutron-irradiated samples, as has been done routinely on extraterrestrial samples for decades. Initial measurements on antarctic samples demonstrate the viability of this method for terrestrial samples and suggest an average production rate of greater than 100 atoms/gram-calcium/year. Existing data suggest that argon-38/calcium exposure ages younger than 105 years can be accurately determined by this method.

Further work on calcic minerals (apatite, sphene, clinopyroxene, plagioclase, calcite) whose exposure histories are constrained by helium-3 and neon-21 concentration data will be used to determine the calcium-derived production rate. Analogous work on potassium-rich minerals (potassium-feldspars, micas) will be used to constrain the production of argon-38 from potassium, which should theoretically be comparable to that from calcium when the same neutron-activation method is used.

Analytical work will use existing samples plus new samples to be collected from the dry valleys of Antarctica to maximize cosmic radiation dosage for purposes of calibration. Laboratory studies of the retentivity of argon-38 in appropriate minerals will be used to help evaluate results and guide future applications.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-299-M **NSF/OPP** 02-30086
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Beardmore Glacier, McMurdo Station
Dates in Antarctica: Mid November to late December

Permian-Triassic mass extinction in Antarctica

Dr. Gregory J. Retallack
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http://darkwing.uoregon.edu/%7Edogsci/retall/rsch.html

Coalsack Bluff, a site for investigating the end-Permian mass extinction event. Photo by Luann Becker.

Deploying Team Members: Luann Becker . Daniel P. Glavin . Christine Metzger . Shaun M. Norman . Robert Joseph. Poreda . Gregory J. Retallack . Nathan D. Sheldon . Roger MH. Smith

Research Objectives: We will study fluvial sediments in Antarctica for evidence of what caused the greatest mass extinction in the history of life on Earth. The Permian-Triassic boundary was, until recently, difficult to locate and thought to be unequivocally disconformable in Antarctica. New studies, however (particularly those using carbon isotopic chemostratigraphy, and paleosols and root traces as indicators), together with improved fossil plant, reptile, and pollen biostratigraphy, now suggest that the precise location of the boundary might be identified; these studies have also led to local discovery of iridium anomalies, shocked quartz, and fullerenes with extraterrestrial noble gases. These anomalies are associated with a distinctive claystone breccia bed, similar to strata known in South Africa and Australia, and accepted as evidence of deforestation.

There is already much evidence from Antarctica and elsewhere that the mass extinction on land was abrupt and synchronous with extinction in the ocean. What led to such death and destruction? Carbon isotopic values are so low in these and other Permian-Triassic boundary sections that there was likely to have been some role for catastrophic destabilization of methane clathrates. Getting the modeled amount of methane out of likely reservoirs would require such catastrophic events as a meteor impact, flood-basalt eruption, or collapse of the continental-shelf, which have all been implicated in the mass extinction and for which there is independent evidence. Teasing apart these various hypotheses requires careful reexamination of beds that appear to represent the Permian-Triassic boundary and search for more informative sequences, as was the case for the Cretaceous-Tertiary boundary.

Our research on the geochemistry and petrography of boundary beds and paleosols; on carbon isotopic variation through the boundary interval; and on fullerenes, iridiums, and helium is designed to test these ideas about the Permian-Triassic boundary in Antarctica and to shed light on the processes that contributed to this largest of mass extinctions. We will conduct our fieldwork in the central Transantarctic Mountains and in southern Victoria Land, with an initial objective of examining the stratigraphic sequences for continuity across the boundary. Such continuity is critical for the work to be successful. If fieldwork indicates sufficiently continuous sections, a full analytical program will follow.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-111-M/S

NSF/OPP 00-03881

Station: McMurdo Station, South Pole Station

RPSC POC: Doug Miller

Research Site(s): McMurdo Station, SkyLab

Dates in Antarctica: Early to mid December

Riometry in Antarctica and conjugate region

Dr. Theodore J. Rosenberg
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The University of Maryland's Imaging Riometer antenna at Arrival Heights in McMurdo, January 1998. Photo by [unknown].

Research Objectives: The University of Maryland will continue studies of the polar ionosphere and magnetosphere from Antarctica and nominally conjugate regions in the Arctic. High frequency (HF) cosmic noise absorption measurements (riometry) and auroral luminosity measurements (photometry) form the basis of these investigations. However, research efforts also involve extensive collaboration with other investigators using complementary data sets.

Riometers measure the relative opacity of the ionosphere. Working at both McMurdo and South Pole, this group maintains and uses an imaging riometer system called IRIS (imaging riometer for ionospheric studies), broad-beam riometers, an auroral photometers. This group has helped to extend antarctic coverage by providing imaging riometers for the British Halley Bay and the Australian Davis stations. The instruments work synergistically with a number of other instruments that are operated at all of these sites by other investigators. They also provide the data acquisition systems at South Pole and McMurdo for the common recording of other geophysical data and the provision of these data to collaborating investigators. To enhance the usefulness and timeliness of these data to the general scientific community, the data is made available in near real time on the Internet. Imaging riometer measurements will also be continued at Iqaluit, NWT, Canada, the nominal magnetic conjugate point of South Pole station.

Continuation of these activities will enable this group to participate in, and contribute to, several major science initiatives, including the GEM, CEDAR, ISTP/GGS, and National Space Weather programs. A primary focus of the analysis activities over the next year will include coordinated ground- and satellite-based studies of Sun-Earth connection events.

These disparate activities have the common goal of enhancing understanding of the relevant physical processes and forces that drive the observed phenomena, both internal (e.g. magnetospheric/ionospheric instabilities) and external (e.g. solar wind/IMF variations). From such knowledge may emerge an enhanced forecasting capability. Many atmospheric events can have negative technological or societal impact, and accurate forecasting could ameliorate these impacts

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-112-M
NSF/OPP 03-34467

Station: McMurdo Station
RPSC POC: Doug Miller
Research Site(s): AGO 2, AGO 1, AGO 5
Dates in Antarctica: Early December to mid January

Polar Experiment Network for Geophysical Upper-Atmospheric Investigations (PENGUIN)

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AGO P1 (Automatic Geophysical Observatory site P1) in January, 2003. Photo by Rick Sterling.

Deploying Team Members: Joseph Payne . Rick Sterling

Research Objectives: Continued progress in understanding the Sun's influence on the structure and dynamics of the Earth's upper atmosphere depends on increasing knowledge of the electrodynamics of the polar cap region and the key role this region plays in coupling the solar wind with the Earth's magnetosphere, ionosphere, and thermosphere. Measurements that are central to understanding include the electric field convection pattern across the polar cap and knowledge of the response of the atmosphere to the many forms of high-latitude wave and particle energy inputs during both geomagnetically quiet and disturbed situations.

The U.S. automatic geophysical observatory (AGO) network, which consists of a suite of nearly identical instruments (optical and radio wave auroral imagers, magnetometers, and narrow- and wide-band radio receivers) at locations on the polar plateau, actively studies the coupling of the solar wind to ionospheric and magnetospheric processes, emphasizing polar cap dynamics, substorm phenomena, and space weather. Among these projects are

+ An investigation that uses extreme-low -frequency and very-low-frequency waves as an observing tools to understand the electrodynamic coupling between upper-atmospheric regions and the interaction of the magnetosphere and ionosphere

+ An investigation that employs autonomous, compact, and low-power atmospheric lidar instruments to detect polar stratospheric clouds and profile the overlying atmosphere

+ An investigation that uses magnetometers at conjugate sites in Antarcitca and the Northern Hemisphere to measure variations in hydromagnetic waves with the optical emissions caused by charged particles that precipitate from the trapped radiation of the Earth into the upper atmosphere

When combined with measurements made at certain staffed stations, AGO network data facilitate both large- and small-scale studies of the energetics and dynamics of the high-latitude magnetosphere. The research will be carried out with in situ observations of the geospace environment by spacecraft, in close cooperation with other nations working in Antarctica and in conjunction with studies performed in the Northern Hemisphere.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-275-P/S

NSF/OPP MOU with DOE

Station: Palmer Station, South Pole Station
RPSC POC: Rob Edwards
Research Site(s): Palmer Station, South Pole Station
Dates in Antarctica: Instruments operate year-round

Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab

Dr. Colin Sanderson
United States Department of Energy
Environmental Measurements Lab
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Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab

Research Objectives: Radionuclides, some of which occur naturally in the surface air, are atoms emitting radioactive energy. It is these, as well as nuclear fallout and any accidental releases of radioactivity, that the Environmental Measurements Laboratory's (EML's) Remote Atmospheric Measurements Program (RAMP) is designed to detect and monitor. Since 1963, EML, as part of the U.S. Department of Energy, has run the Global Sampling Network to monitor surface air. The RAMP system provides on-site analysis in 13 different locations around the world, including Palmer Station. Using a high-volume aerosol sampler, a gamma ray spectrometer, and a link to the National Oceanic and Atmospheric Administration's ARGOS satellite system, we continue sampling air at Palmer Station for anthropogenic radionuclides.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-186-M **NSF/OPP** 01-25570

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): McMurdo Station, Megadunes
Dates in Antarctica: Mid December to late January

Characteristics of snow megadunes and their potential effects on ice core interpretation

Dr. Theodore A. Scambos

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Aerial view of the megadunes near TAMSEIS Camp (between Vostok and McMurdo). It shows the vast scale of these features. The lighter stripes are accumulation areas, covered with rough sastrugi up to 1 m in height; the gray areas are interdune 'glaze' area

Deploying Team Members: Robert J. Bauer . Lawrence Cathles . Zoe R. Courville . Mark Fahnestock . Theodore A. Scambos

Research Objectives: The extensive snow 'megadune' areas of the East Antarctic Plateau appear to be the result of intense snow-atmosphere interaction, caused by katabatic wind flow (at about 20 knots for 11 months of the year) and ablation/vapor redeposition of firn. The features are extremely subtle, 2 to 4 meters in amplitude over a 2 to 4 kilometer wavelength. January and December provides good conditions for this work, including temperatures of -25 to -30 Centigrade and lighter winds than other times of the year. Earlier field reports indicate that the surface of the leeward faces of the dunes is very smooth.

This group plans to conduct ground penetrating radar surveys, global positioning surveys, firn cores, pit sampling, AWS (automatic weather station) installation, and snow permeability experiments. The overall objective is to determine the physical and chemical characteristics of the dunes, and investigate whether dunes may have an effect on the interpretation of climate in deep ice cores.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-184-M
NSF/OPP 02-30452

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): McMurdo Station, Megadunes
Dates in Antarctica: Mid December to late January

How thick is the convective zone?: A study of firn air in the megadunes near Vostok

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Photo not available.

Deploying Team Members: Lou Albershardt . Jeffrey P. Severinghaus . Makoto Suwa . Mark (Tony) A. Wumkes

Research Objectives: In the megadunes, extremely low snow accumulation rates lead to structural changes (large grains, pipes, and cracks) that make the permeability of firn-to-air movement orders of magnitude higher than normal. The unknown thickness of the convective zone has hampered the interpretation of ice-core nitrogen/argon isotope ratios as indicators of past firn thickness, which is a key constraint on the climatically important variables of temperature, accumulation rate, and gas age–ice age difference. We will therefore study the chemical composition of air in the snow layer (firn) in a region of megadunes near Vostok Station to test the hypothesis that a deep convective zone of vigorous wind-driven mixing can prevent gas fractionation in the upper third of the polar firn layer. Studying this extreme end-member example will better define the role of the convective zone in gas reconstructions.

We will pump air from a profile of about 20 depths in the firn to definitively test for the presence of a convective zone based on how well inert gas isotopes fit a molecular- and eddy-diffusion model. Permeability measurements on the core and two-dimensional air flow modeling will permit a more physically realistic interpretation of the isotope data and will relate mixing vigor to air velocities. We will also test a new proxy indicator of convective zone thickness on firn and ice-core bubble air; this indicator is based on the principle that isotopes of slow-diffusing heavy noble gases (krypton, xenon) should be more affected by convection than isotopes of fast-diffusing nitrogen.

Finally, we intend to test the hypothesis that the megadunes and a deep convective zone existed at the Vostok site during glacial periods; this would explain the anomalously low nitrogen/argon isotope ratios in the Vostok ice-core glacial periods. Our work will clarify phase relationships of greenhouse gases and temperature in ice-core records, with implications for understanding past and future climates.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-129-S
NSF/OPP 99-09339

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): Aurora Laboratory
Dates in Antarctica: Instruments operate year-round

Effects of enhanced solar disturbances during the 2000-2002 solar-max period on the antarctic mesosphere-lower-thermosphere (MLT) and F regions composition, thermodynamics and dynamics

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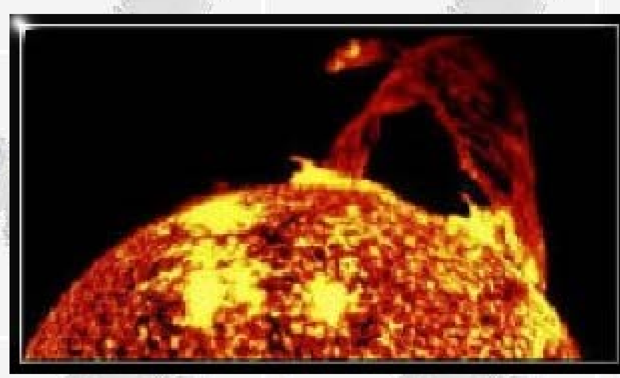

Effects of enhanced solar disturbances during the 2000-2002 solar-max period on the antarctic Mesosphere-Lower-Thermosphere (MLT) and F regions composition, thermodynamics and dynamics

Deploying Team Members: Lisandro Martinez . Charles Mutiso . Gulamabas Sivjee

Research Objectives: Variations in the sun's energy affect people in obvious ways, for example, driving the weather and the seasons. However, there are many cycles and variations on scales from seconds to centuries to eons that are of deeper interest to science. One of the most basic is the 11-year cycle when the sun's magnetic poles reverse direction. The 23rd cycle since reliable observations began has just recently peaked. Coincident with this cycle, sunspots and other solar activity are waxing to peak levels.

NASA is using this opportunity to conduct its TIMED (Thermosphere-Ionosphere-Mesosphere-Energetics and Dynamics) satellite study, focusing on the region between 60 and 180 kilometers above the earth's surface.

This project takes advantage of the timing of both of these events, using observations in the visible and near-infrared ranges of upper-atmospheric emissions above South Pole Station to study the heating effects of auroral electrical currents in the ionosphere, as well as planetary waves and atmospheric tides.

TIMED will provide data on the temperature, winds, and tides of earth's upper atmosphere, especially above the poles as it passes overhead. But tracking satellites often have difficulty differentiating between variations in location or time. The South Pole ground-based observations conducted by this group will be valuable in sorting out the time-location question.

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-144-E/M
NSF/OPP ATM 02-33370
Station: E/M
RPSC POC: Curt LaBombard
Research Site(s): McMurdo Station, Williams Field
Dates in Antarctica: Late November to early January

Development and test flight of a small, automated balloon payload for observations of terrestrial x-rays

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MAXIS balloon payload ascending from McMurdo: January 12, 2000. The MINIS balloon program is a an extension of the MAXIS science, using smaller, hand-launched balloons with a smaller but better-targeted suite of instrumentation for discovering the cause

Deploying Team Members: Edgar A. Bering, III . Leeland Huss . MIchael Kokorowski . Robyn Millan . Brandon Reddell . John Sample . David M. Smith

Research Objectives: We plan to develop and test a balloon payload designed to detect mega electron volt (MeV) electron precipitation into the atmosphere from the Earth's radiation belts. Relativistic electron precipitation has been found to occur at high latitudes, but it is not known how common such events are, nor is much known about the conditions that lead to these events. These particles endanger astronauts and unmanned satellites, but neither the cause of their energization nor the cause of their loss (precipitation) is well understood. The precipitation of the highest energy electrons occurs in rare, rapid events that we will study with a balloon payload.

The instrument we will develop will be very small and lightweight, and it will include real-time data communications via the Iridium satellite system. This new technology will allow a payload that can be launched on small balloons as well as on long-duration balloons.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-032-L/P

NSF/OPP 02-17282

Station: R/V Laurence M. Gould, Palmer Station

RPSC POC: Rob Edwards

Research Site(s): R/V Laurence M. Gould, Palmer Station

Dates in Antarctica:

Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

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Photo not available.

Deploying Team Members: Eli Loomis . Kim McCoy . Raymond C. Smith

Research Objectives: The bio-optical component of the Long Term Ecological Research (LTER) project focuses on the space/time variability of ecological processes. They also investigate the linkage between shipboard surface observations and satellite observations relevant to these various processes including sea ice coverage and phytoplankton biomass and production.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-047-M
NSF/OPP 00-87401

Station: McMurdo Station
RPSC POC: Don Michaelson
Research Site(s): USCG Icebreaker
Dates in Antarctica: Early December to late February

Interannual variability in the Antarctic-Ross Sea (IVARS): Nutrients and seasonal production

Dr. Walker O. Smith

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Photo not available.

Deploying Team Members: Vernon L. Asper . Liza De Lizo . Jill A. Peloquin . Ray Pluhar . Jessie Sebbo . Amy R. Shields . Walker O. Smith . Jennifer Wu Stanhope . Sasha Tozzi . Joseph Ustach

Research Objectives: During the last few decades, oceanographers and other scientists have found significant variations in Southern Ocean biogeochemical processes from year to year. Some of the more significant of these inter-annual variations are ice extent and concentration, the composition of herbivore communities, and the distributions and reproductive success of bird and marine mammals.

Surprisingly, because it is so central to the food web, little is known about how phytoplankton production varies from year to year or what role these variations may play. The production system in the Ross Sea consists predominantly of two major functional groups - diatoms and Phaeocystis Antarctica, a colonial haptophyte. Project team members will collect time-series data and assess the inter-annual variations of the production of phytoplankton in the southern

Ross Sea, Antarctica.

The Ross Sea provides a unique setting for such an investigation, for a number of reasons. Researchers can build upon a de facto time-series already ongoing in the Ross Sea because so many studies have been conducted there in the last decade. It is established that there are fewer species there (relative to some other sites) and that seasonal production is as great as anywhere in the Antarctic. Most importantly, seasonal production of both the total phytoplankton community (as well as its two functional groups) can be estimated from late summer nutrient profiles.

Inter-annual variations in seasonal production (and of the two major taxa of producers) may be an important factor in the growth and survival of higher trophic levels within the Ross Sea food web. They also shed light on the natural variability of the suite of biogeochemical processes in the region. Having a scientific handle on that baseline of change is important, because of the scientific efforts to model how climate may change in the future. As climate changes, so too will biology be profoundly affected. Accurately modelling and evaluatihng such change means placing it in the context of "natural" inter-annual variability.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-177-M

NSF/OPP 02-30021

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Mount Moulton, McMurdo Station
Dates in Antarctica: Mid November to mid January

Refining a 500-thousand-year climate record from the Mt. Moulton blue ice field in West Antarctica

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The Moulton "horizontal ice core". This blue ice region in West Antarctica may provide a 400,000 year climate record with absolute radiometric age control. Photo by Nelia.Dunbar.

Deploying Team Members: Nelia W. Dunbar . William C. McIntosh . Pratigya J. Polissar . Trevor Popp . Todd A. Sowers

Research Objectives: The summit crater of Mount Moulton contains a 600-meter-thick, horizontally exposed section of ice with intercalated tephra layers from nearby Mount Berlin. Argon-40/argon-39 dating of the thick, near-source tephra indicates that the age of the horizontal ice section ranges between 15,000 and 492,000 years. Thus, the Mount Moulton site offers an unparalleled repository of ancient West Antarctic snow and trapped air that can be used to investigate climate over much of the past 500,000 years. The planar nature and consistent dips of the tephra layers suggest that although the ice section has thinned, it is otherwise undeformed.

We visited the Mount Moulton site during the 1999–2000 field season, at which time we collected a horizontal core representing approximately 400 meters of ice, ranging from 15,000 to more than 480,000 years old. In addition to this horizontal core, we took samples at various depths to test the quality of the climate record in the ice. We also collected 40 intercalated tephra layers to provide a chronology for the ice section. The results of this first effort are extremely encouraging. There is clearly a usable record of past climate extending back beyond 140,000 years.

There is work to do, however, to realize the full potential of this horizontal ice core. The elemental and isotopic composition of trapped gases suggests some contamination by modern air. Since gas cross-dating of ice cores is the current standard by which climate records are compared, we need to understand why and how the gas record is compromised before adding Mount Moulton to our arsenal of ice-core paleoclimate records.

Our research has the following objectives:

+ To evaluate more thoroughly the integrity of the climatic record through shallow drilling of blue ice, as well as the snow field upslope from this area;

+ To improve the radioisotopic dating of specific tephra layers;

+ To obtain baseline information about modern snowfall deposition, mean annual temperature, and wind pumping around the summit of Mount Moulton; and

+ To study how firn densification differs when surface accumulation changes from net accumulation to net ablation.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-260-L

NSF/OPP 00-03618

Station: R/V Laurence M. Gould
RPSC POC: Randy Sliester
Research Site(s): Drake Passage
Dates in Antarctica: Instruments operate year-round

The Drake Passage high density XBT/XCTD program

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Photo not available.

Research Objectives: During each crossing of the research ship Laurence M. Gould, we intend to launch expendable bathythermographs (XBTs), supplemented by expendable conductivity-depth-temperature (XCDT) probes, to obtain high-density sections from which to study the seasonal variability and long-term change in the upper ocean structure of the Drake Passage, which is off the tip of South America. Whenever the distance between Antarctica and neighboring land is narrow, as in the Drake Passage and the area off the Cape of Good Hope, the Antarctic Circumpolar Current, which drives the waters in the Southern Ocean, is extremely strong.

The information we gather will lead to the establishment of a high-quality database that can be used to study the magnitude and depth of penetration of the seasonal signals, the connections to atmospheric forcing, and the effects of interannual variations such as those associated with the Antarctic Circumpolar Wave.

The sections obtained during these voyages will supplement the approximately 20 sections that we have been gathering and studying since September 1996. Our continuing data analysis will be carried out in cooperation with the Argentine Antarctic Institute in Buenos Aires.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-377-S
NSF/OPP 00-94605
Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): AST/RO
Dates in Antarctica: Early November to mid February

Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on AST/RO

Dr. Gordon J. Stacey

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Photo not available.

Deploying Team Members: Thomas Nikola . Thomas E. Oberst . Steven C. Parsley . Gordon J. Stacey

Research Objectives: SPIFI (South Pole imaging Fabry-Perot interferometer) is the first direct detection imaging spectrometer for use in the submillimeter band and was designed for use on the 1.7-meter Antarctic Submillimeter Telescope and Remote Observatory (AST/RO) at the South Pole in the far-infrared and submillimeter windows. After having developed and extensively field-tested SPIFI, the primary scientific goals of this project are to:

+ Image the inner regions of the galaxy, in particular submillimeter lines that characterize excitation conditions in the Central Molecular Zone (CMZ), and trace the dynamics of the gas. Questions to be answered are, among others, Can neutral gas flowing through the CMZ be traced? Are there shocks from cloud-cloud collisions in this flow? What is the connection between the CMZ molecular clouds and the circumnuclear ring?

+ Map the Large Magellanic Cloud and Small Magellanic Cloud in these lines. The low metalicity environment in these dwarf galaxies may mimic that of protogalaxies, so that investigating the interaction between star formation and the interstellar matter in these galaxies is key to understanding the star formation process in the early Universe.

+ Characterize and map the physical conditions of the interstellar matter in nearby galaxies. These data are unique and will be key to understanding the relationships between density waves, bar potentials, and galaxy-wide star formation.

These projects can be undertaken only with the high sensitivity and mapping capabilities of the SPIFI AST/RO combination. SPIFI is much more sensitive than the best heterodyne receivers, which do not have the sensitivity, or (often) the bandwidth, to detect the broad, weak lines from galaxies, or the spatial multiplexing capability necessary for wide-field mapping projects.

This group plans plan to gradually upgrade SPIFI by a factor of 10. They will also make modest optical and cryogenic modifications to SPIFI to improve it in ways important to successful polar operations. The result will be better spatial resolution, with a wider field of view, and a large improvement in system sensitivity. Moreover, the new cryogenic system will require servicing every five days rather than the current 40 hours. This is helpful for outdoor polar operations. This new system also reduces helium consumption (by a factor of 2) and therefore reduces cost

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-371-S

NSF/OPP 01-26090

Station: South Pole Station
RPSC POC: Charles Kaminski
Research Site(s): South Pole Station
Dates in Antarctica: Instruments operate year-round

Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)

Dr. Antony A. Stark
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http://cfa-www.harvard.edu/~adair/AST_RO

Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)

Deploying Team Members: Eyal Gerecht . Abigail S. Hedden . Patrick Puetz . Jacob Kooi . Craig Kulesa . Adair P. Lane . Andrea Loehr . John Nicholson . Fernando Rodriguez-Morales . Antony A. Stark . Julienne Harnett . Nicolas Tothill . Christopher K. Walker . Gregory Wright . Xin Zhao

Research Objectives: Astronomy is undergoing a revolutionary transformation, where for the first time researchers can observe the full range of electromagnetic radiation emitted by astronomical sources. One of the newly developed and least explored bands is the submillimeter, at frequencies from about 300 giga-Hertz up into the tera-Hertz range. Submillimeter-wave radiation is emitted by dense gas and dust between the stars, and submillimeter-wave observations allow scientists to study in unprecedented detail the galactic forces acting on that gas and the star formation processes within it.

The Antarctic Submillimeter Telescope and Remote Observatory (AST/RO) is a 1.7-meter, single-dish instrument that has been operating for nine years in several submillimeter bands. It has made position-position-velocity maps of submillimeter-wave spectral lines with arcminute resolution over regions of sky that are several square degrees in size. AST/RO is a valuable complement to the planned arrays, which are inefficient when observing large areas because of their small field of view. AST/RO can observe molecular clouds throughout the fourth quadrant of the Milky Way and the Magellanic Clouds to locate star-forming cores and study in detail the dynamics of dense gas in our own galaxy. AST/RO studies are showing how molecular clouds are structured, how the newly formed stars react back on the cloud, and how galactic forces affect cloud structure. They have also shown that the structure of molecular clouds is affected by their heavy element content and by their proximity to spiral arms, have studied the gradient of heavy elements in the galaxy, and have recently produced extensive, high sensitivity maps of several atomic and molecular transitions toward the Galactic Center.

Essential to AST/RO's capabilities is its location at Amundsen–Scott South Pole Station. Most submillimeter radiation is absorbed by irregular concentrations of atmospheric water vapor before it reaches the Earth's surface. The dry air over South Pole Station allows an accurate intercomparison of submillimeter-wave power levels from locations on the sky separated by several degrees. This is essential to the study of submillimeter-wave radiation on the scale of the Milky Way and its companion galaxies.

Project researchers will devote equal effort to three initiatives: Making large-scale maps of emissions in the Galactic Center and the Magellanic Clouds (these will be made freely available), supporting proposals from the scientific community, and installing and using the detector systems currently under development.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-202-M/P/S **NSF/OPP** 01-26262

Station: McMurdo Station, Palmer Station

RPSC POC: Patricia Jackson

Research Site(s): McMurdo Station, Palmer Station, Atmospheric Research Facility

Dates in Antarctica: Instruments operate year-round, mid November to mid December (project team deploys)

Antarctic Meteorological Research Center (AMRC) (2002-2005)

Dr. Charles R. Stearns

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Center/AMRC
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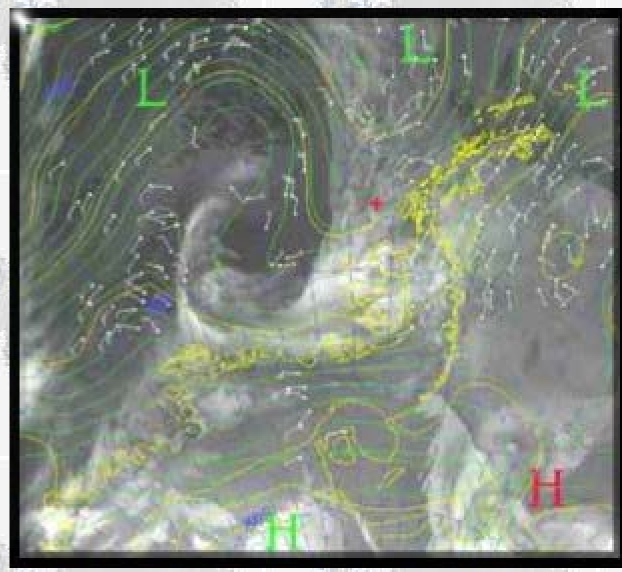
http://amrc.ssec.wisc.edu



Antarctic Meteorological Research Center (2002-2005)

Deploying Team Members: Shelley L. Knuth

Research Objectives: The Antarctic Meteorological Research Center (AMRC) was created in 1992 to improve access to meteorological data from the Antarctic. The AMRC's mission is to conduct research in observational meteorology and the stewardship of meteorological data, along with providing data and expert assistance to the antarctic community to support research and operations. The AMRC continues to fulfill its mission this season by:

+ Maintain and expanding the long-term record of all meteorological data on Antarctica and the Southern Ocean, and make these data available to the scientific community for multidisciplinary use. Special attention is given to obtaining data not normally or readily available by other means.

+ Generating satellite products, including but not limited to antarctic composite imagery, and expand and improve on them as much as possible

+ Conducting research in observational meteorology especially with regard to climatological analyses and case studies

Conducting and expanding educational and public outreach activities associated with antarctic meteorology and related fields.

Using available meteorological interactive processing software and other standard computing tools, the research team will collect data from all available sources for processing, archiving, and distribution.

The mission of the AMRC not only includes the opportunity to advance the knowledge of antarctic meteorology, but with the free availability of its data holdings, the AMRC gives others the opportunity to advance the frontiers of all antarctic science. Continuing educational outreach activities on meteorology and the Antarctic, an important component of this work, have the potential to raise the science literacy of the general public, as well as the level of K-12 science education.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-283-M/P/S
NSF/OPP 00-88058

Station: McMurdo Station, Palmer Station
RPSC POC: Patricia Jackson
Research Site(s): South Pole Station
Dates in Antarctica: Instruments operate year-round, mid November to late January (project team deploys)

Antarctic Automatic Weather Station Program (AWS): 2001-2004

Dr. Charles R. Stearns
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Antarctic Automatic Weather Station Program: 2001-2004

Deploying Team Members: John Cassano . Shelley L. Knuth . Jonathan E. Thom . George A. Weidner

Research Objectives: A network of nearly 50 automatic weather stations (AWS) has been established on the antarctic continent and several surrounding islands. These facilities were built to measure surface wind, pressure, temperature, and humidity. Some of them also track other atmospheric variables, such as snow accumulation and incident solar radiation.

Their data are transmitted via satellite to a number of ground stations and put to several uses, including operational weather forecasting, accumulation of climatological records, general research purposes, and specific support of the U.S. Antarctic Program - especially the LTER program at McMurdo and Palmer Stations. The AWS network has grown from a small-scale program in 1980 into a significant data retrieval system that is now extremely reliable, and has proven indispensable for both forecasting and research purposes. This project maintains and augments the AWS, as necessary.

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-309-L

NSF/OPP NASA award

Station: R/V Laurence M. Gould

RPSC POC: Karl Newyear

Research Site(s): Bellingshausen Sea, R/V Nathaniel B. Palmer

Dates in Antarctica: Mid August to early September

AMSR sea ice validation during the R/V Laurence M. Gould's traverse to Antarctica

Dr. Konrad Steffen
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Ice thickness experiment using the EM31 electromagnetic probe on floating first year ice in the Bellingshausen Sea with the R/V Laurence M. Gould in background. Graduate students Nicolas Cullen and Russell Huff wear special waterproof clothing and a Zodiac boat (not seen) is nearby. Photo by Konrad Steffen.

Deploying Team Members: Nicolas Cullen . Russel Huff . Masahige Nakayama . Konrad Steffen

Research Objectives: We intend to make passive microwave measurements onboard the Laurence M. Gould while enroute from Puente Arenas, Chile, to Antarctica in August and September 2003. We will use passive microwave radiometers to monitor the sea-ice surface at four frequencies [11.4 gigahertz (GHz), 21 GHz, 35 GHz, and 94 GHz] at horizontal vertical polarizations. The brightness temperatures can then be related to aircraft overflight measurements and to AMSR-E [Advanced Microwave Scanning Radiometer EOS (Earth Observing System)] satellite measurements.

We will also

+ Make meteorological measurements of temperature, wind speed and direction, humidity, and pressure;

+ Make latent and sensible heat flux measurements with eddy-correlation instruments to derive the heat fluxes over various types of ice;

+ Examine short- and long-wave radiation components of incoming and outgoing fluxes;

+ Gather cloud statistics with an all-sky camera with hemispheric coverage;

+ Make optical path-length measurements;

+ Make sea and ice-surface temperature profile measurements along the ship's transect;

+ Make in situ ice thickness and salinity profile measurements of various ice types characteristic of regions along the ship's transect;

+ Analyze snow layers over sea ice with ground-penetrating radar;

+ Make spectral reflectance measurements of different snow and ice types for the 300- to 2,500-nanometer (nm) range with 1- to 3-nm spectral resolution.

We also plan to launch about 50 radiosonde balloons to measure the temperature, wind speed and direction, and humidity profile from the surface of the water to about 10 kilometers above it.

2003-2004 USAP Field Season

Aeronomy & Astrophysics

Dr. Vladimir Papitashvili
Program Manager

A-145-M

NSF/OPP NSF/NASA agreement

Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): Williams Field
Dates in Antarctica: Late October to early February

Long Duration Balloon Program (LDB)

Mr. William Stepp
National Scientific Balloon Facility (NSBF)
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http://www.nsbf.nasa.gov/index.html

Long Duration Balloon Program

Deploying Team Members:

Paul Brasfield . Reid Chambers . Mark Cobble . Darla E. Cook . Victor Davison . Andrew Denney IV . Derek Dolbey . Chris Field . Hugo Franco . Scott C. Hadley . Randall Henderson . John Hobbie . Erich Klein . Otto (Joe) Masters . Robert Redinger . Donald Roberts . William Stepp . David W. Sullivan . John Wefel . Nathan F. Wise

Research Objectives: Free-flying balloons offer many advantages over satellites as a means of high-altitude exploration: They remain at a specific location much longer and cost a fraction to launch. NASA's National Scientific Balloon Faciltity (NSBF), based in Palestine Texas, operates the Long Duration Balloon (LDB) program near Williams Field at McMurdo Station. NSBF staff work with researchers, launching, tracking, and recovering high-altitude balloons carrying scientific payloads into the stratosphere.

The NSBF will launch two stratospheric balloons, each with a volume of 28.42 million cubic feet and capable of ascending at a rate of approximately 900 feet per minute to a float altitude of 125,000 feet.

Both launches will take place at the LDB site near Williams Field, reach float altitude, circumnavigate the continent between 77 degrees south latitude and 80 degrees south longitude. They will be terminated and recovered on the Ross Ice Shelf or on the Polar Plateau. The launch window is mid-December to mid-January.

To terminate the flight an aircraft flies within line-of-sight of the balloon and sends a command to the payload from an onboard communication system. At the point of release, the payload will descend with a parachute to a predicted impact zone. Recovery operations then follow.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-071-N

NSF/OPP 01-26334

Station: RV/IB Nathaniel B. Palmer
RPSC POC: Ashley Lowe
Research Site(s): R/V Nathaniel B. Palmer
Dates in Antarctica: Late August to mid October

Improved Cenozoic plate reconstructions of the circum-Antarctic Region

Dr. Joann M. Stock

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Photo not available.

Deploying Team Members: Marguerite Gerstell . Benjamin Gross . Teresa S. Baker . Robert Clayton . Emily W. Crawford . Timothy M. Doyle . David Baker . Michael Gurnis . Kylara M. Martin . Julie Parra . Xyoli Perez-Campos . Brian Savage . Joann M. Stock . Cristina Thomas . Dana J. Vukajlovich . Chloe Winant

Research Objectives: Well-constrained Cenozoic plate reconstructions of the circum-antarctic region are critical for examining a number of problems of global geophysical importance. This group seeks to improve reconstructions involving the Antarctic and Pacific plates by surveying gravity, magnetics, and swath bathymetry on Palmer transit cruises of geological importance.

On transit cruise NBP 0207 they will take advantage of the planned track on the Pacific plate to survey across several major fracture zones, across part of the Manihiki Plateau and the Osbourne trough (to test aspects of the Mesozoic plate motion history of this region, when it may have been much farther south, adjacent to Antarctica), and along the Hikurangi trench (to study the rheology of the downgoing plate).

Also during the cruise the principal investigators will conduct a formal class in marine geophysics for 16 graduate and undergraduate students from a variety of institutions. In this way teaching activities can be integrated with the real field work of a research project.

Glaciology

Dr. Julie Palais
Program Manager

I-175-M/S **NSF/OPP** 02-29314

Station: McMurdo Station, South Pole Station

RPSC POC: Melissa Rider

Research Site(s): Reedy Glacier, McMurdo Station

Dates in Antarctica: Late November to mid January

Late Quaternary history of Reedy Glacier

Dr. John O. Stone
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Photo not available.

Deploying Team Members: Angela Bond . Howard B. Conway . Maurice Conway . Brenda L. Hall . John O. Stone . Claire Todd

Research Objectives: The stability of the marine West Antarctic Ice Sheet remains an important, unresolved issue for predicting future changes in sea level. Studies indicate that the mass balance of the ice sheet today could be negative or positive. The apparent difference could stem in part from short-term fluctuations in flow. By comparison, geologic observations provide evidence of behavior over much longer time scales. Recent work suggests that deglaciation of both the Ross embayment and coastal Marie Byrd Land continued into the late Holocene (about the last 2,000 years ago) and leaves open the possibility of ongoing deglaciation and grounding-line retreat. However, previous work in the Ross embayment was based on data from just three locations that are all far north of the present grounding line. Additional data from farther south are needed to determine whether the recession has ended or whether the rate and pattern of deglaciation inferred from our previous study still apply.

We will therefore reconstruct the evolution of Reedy Glacier, in the southern Transantarctic

Mountains, since the last glacial maximum. Because the glacier emerges from the mountains above the grounding line, its surface slope and elevation should record changes in the thickness of grounded ice in the Ross Sea up to the present. The deglaciation chronology of Reedy Glacier can thus indicate whether the Holocene retreat of the West Antarctic Ice Sheet ended thousands of years ago or is still continuing.

Over two field seasons, we will map, date, and correlate moraines at sites along the length of the glacier. We will make radar and global positioning system measurements to supplement existing ice thickness and velocity data. We will also construct a model of glacier dynamics and use it to relate geologic measurements to the grounding-line position downstream. Ultimately, we will integrate the mapping, dating, and ice-modeling components of the study into a reconstruction that defines changes in ice thickness in the southern Ross Sea since the last glacial maximum and relates these changes to the history of grounding-line retreat.

Our work directly addresses the key goals of the West Antarctic Ice Sheet Initiative, which are to understand the dynamics, recent history, and possible future behavior of the West Antarctic Ice Sheet.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-214-L

NSF/OPP 00-03609

Station: R/V Laurence M. Gould
RPSC POC: Bob Kluckhohn
Research Site(s): Drake Passage
Dates in Antarctica: Instruments operate year-round

Mesoscale, seasonal and inter-annual variability of surface water CO_2 in the Drake Passage

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Photo not available.

Research Objectives: The Southern Ocean provides an important component of the global carbon budget. Cold surface temperatures, with consequent low vertical stability, ice formation, and high winds, produce a very active environment where the atmospheric and oceanic reservoirs readily exchange gaseous carbon. The Drake Passage is the narrowest point through which the Antarctic Circumpolar Current and its associated fronts must pass; this so-called chokepoint provides the most efficient site to measure the latitudinal gradients of gas exchange.

Working from the R/V Laurence M. Gould, we will use equipment designed to measure both dissolved carbon dioxide and occasional total carbon dioxide in the surface waters during transects of the Drake Passage. This work extends similar measurements made aboard R/V Nathaniel B. Palmer and complements other data collected on surface temperatures and currents. These several data sets, supplemented by satellite imagery, will enable scientists to estimate the net production and carbon export by the biological community, as well as the basic targets-a quantitative description of the sources of dissolved carbon dioxide variability and a calculation of carbon dioxide fluxes between the ocean and the atmosphere.

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-182-M
NSF/OPP 02-29403
Station: McMurdo Station
RPSC POC: Patricia Jackson
Research Site(s): Royal Society Range, Cape Crozier, Cape Bird, McMurdo Station
Dates in Antarctica: Early January to mid February

Geomagnetic field as recorded in the Mount Erebus Volcanic Province: Key to field structure at high southern latitudes

Dr. Lisa Tauxe
Scripps Institution of Oceanography
ltauxe@ucsd.edu

Photo not available.

Deploying Team Members: Cathy Constable . Jasper G. Konter . Hubert Staudigel . Lisa Tauxe

Research Objectives: We aim to use lava flows from the Mount Erebus Volcanic Province to study the magnetic field of the Earth over the past 5 million years in order to test models of its geomagnetic dynamo. Paleomagnetic data (directions of ancient geomagnetic fields obtained from rocks) play an important role in a variety of geophysical studies of the Earth, including plate tectonic reconstructions, magnetostratigraphy, and studies of the behavior of the ancient geomagnetic field (called paleogeomagnetism).

Over the past four decades, the key assumption in many studies has been that the average direction of the paleomagnetic field corresponds to one that would have been produced by a geocentric axial dipole (analogous to a bar magnet at the center of the Earth) and that paleoinclinations (the dip of magnetic directions from rocks) provide data of sufficient accuracy to enable them to be used in plate reconstructions. A recent reexamination of the fundamental data underlying models of the time-averaged field has shown that the most glaring deficiency in the existing database is a dearth of high-quality information, including paleointensity data, from high latitudes.

We will therefore undertake a sampling and laboratory program on suitable sites from the Mount Erebus Volcanic Province in order to produce the quality data from high southern latitudes that are essential to an enhanced understanding of the time-averaged field and its long-term variations.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-095-M **NSF/OPP** 01-26230

Station: McMurdo Station

RPSC POC: Melissa Rider

Research Site(s): Skaar Ridge, Fremouw Peak, Beardmore Glacier, McMurdo Station

Dates in Antarctica: Early to late December

Permian and Triassic floras from the Beardmore Glacier region: Icehouse to greenhouse?

Dr. Edith L. Taylor
University of Kansas Lawrence
Department of Ecology and Evolutionary Biology
etaylor@ku.edu

Glossopteris leaves from Skaar Ridge (Late Permian) of the Beardmore Glacier area.

Deploying Team Members: Pablo Puerta . David Buchanan . N. Ruben Cuneo . Charles P. Daghlian . Edith L. Taylor . Thomas N. Taylor

Research Objectives: Over the past 30 years, the rocks of the central Transantarctic Mountains have been a source of outstanding plant fossil discoveries, including Permian and Triassic permineralized peat, fossil forests silicified in growth position, and compression floras with cuticular preservation. The rare juxtaposition of sites that include many different types of plant preservation, its exceptional quality, and the richness of the sites make this area unique.

We will collect Permian and Triassic plant megafossils from the Beardmore Glacier area (compression floras, especially those from Graphite Peak, and permineralized peats from Skaar Ridge and Fremouw Peak, both near Walcott Névé). Since permineralizations preserve a three-dimensional record of plant organs, they are important in understanding the basic morphology and anatomy of fossil plants, as well as detailing relationships among groups. The data provided by the juxtaposition of plant fossils preserved as permineralizations and compressions have already contributed greatly to our understanding of late Paleozoic–early Mesozoic plant evolution.

The Permian and Triassic represent an important time in plant evolution, and one about which we still know relatively little. The glossopterid seed ferns in the Permian and the corystosperms in the Triassic were the dominant plant groups in Gondwana. Since both groups had enclosed seeds, they have been proposed at one time or another as possible ancestors of flowering plants and have figured prominently in phylogenetic analyses of seed plants. Only through a combination of permineralizations and compressions is it possible to reveal a complete picture of fossil plants and, more importantly, to understand their position in seed plant evolution.

We will collect plants and silicified logs from Graphite Peak, which is believed to contain the Permian/Triassic boundary. Silicified logs have been noted in the lower Buckley Formation at this site, and these will be collected and examined for tree rings, which can be compared with tree rings in Late Permian wood (upper Buckley) from nearby Mount Achernar. The Late Permian has been assumed to be much warmer than Early-Middle Permian, and this should be reflected in the rings' width and structure.

Our findings should lead to significant improvements in knowledge of plant evolution and paleoenvironmental conditions during the critical Permian to Triassic interval.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-293-M | **NSF/OPP** 02-29877

Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Beardmore Glacier, Collinson Ridge, Schroeder Hill, McMurdo Station
Dates in Antarctica: Mid to late November

Shackleton Glacier area: Evolution of vegetation during the Triassic

Dr. Edith L. Taylor
University of Kansas Lawrence
Department of Ecology and Evolutionary Biology
etaylor@ku.edu

Stem with attached Dicroidium leaves (Late Triassic) from the Shackleton Glacier area.

Deploying Team Members: Pablo Puerta . David Buchanan . N. Ruben Cuneo . Charles P. Daghlian . Edith L. Taylor . Thomas N. Taylor

Research Objectives: The rocks of the central Transantarctic Mountains have been a source of fossil discoveries over the past 30 years. The rare juxtaposition of sites that include many different types of plant preservation, the exceptional quality of the fossils, and the biodiversity of the sites make this area unique. The Paleozoic to Mesozoic transition is a critical time in plant evolution. A unique variety of seed plant groups existed, and several have been suggested as the ancestors of flowering plants. There was also a massive floral change from the Permian to the Triassic.

While most fossil plants occur as disarticulated leaves, stems, and reproductive organs, many in the Shackleton Glacier area are partially articulated, thus making it possible to gain a more accurate picture of the entire plant and its place in the ecosystem. We will examine Triassic floras from two sites in the Shackleton Glacier area (Collinson Ridge and an unnamed ridge southeast of Schroeder Hill). In addition to compression fossils, the latter also includes some permineralized peat and fossil stumps. The Collinson Ridge site is important because it contains fossil peat and logs in presumably Lower Triassic rocks. Preliminary analysis of petrified material collected during the 1995–1996 field season, however, suggests that perhaps it is Late Permian rather than Early Triassic, as would be expected. It is therefore important to elucidate the biostratigraphy of this area because the position of the Permian-Triassic boundary is crucial in understanding the timing of terrestrial extinctions around it. Further collecting at both of these sites and analysis of the fossil material in the laboratory will address these discrepancies and yield important new information about Triassic plant evolution.

Paleobotany is ideally suited to education and outreach. Workshops and temporary exhibits on antarctic science have been developed through programs sponsored by the University of Kansas Natural History Museum and Biodiversity Research Center, and we will continue this activity. Student involvement has also been extensive and will be continued.

2003-2004 USAP Field Season

Glaciology

Dr. Julie Palais
Program Manager

I-165-M/S

NSF/OPP 01-25761

Station: McMurdo Station, South Pole Station

RPSC POC: Karen Pavich

Research Site(s): Dome C, Quiet Sector

Dates in Antarctica: Late December to early February (Dome C), mid to late December (South Pole)

South Pole Atmospheric Nitrate Isotopic Analysis (SPANIA)

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Snow pit dug by glaciologist Dan Stone (image from an article published by the University of Alaska at Fairbanks, available at http://www.uaf.edu/seagrant/NewsMedia/01ASJ/12.07.01mountain-change.html). Photo by Jon Krakauer.

Deploying Team Members: Justin McCabe . Joel Savarino . Mark H. Thiemens

Research Objectives: Despite decades of research, several important issues in antarctic atmospheric science are presently inadequately resolved, including quantifying the sources of nitrate aerosols over time. Today, little is known about past denitrification of the stratosphere in high-latitude regions. This lack of knowledge significantly limits our ability to understand the chemical state of ancient atmospheres and therefore evaluate present and past-coupled climate/atmosphere models. The role of nitrogen in environmental degradation is well known, and atmospheric aerosols have now been shown to have a mass-independent oxygen isotopic content.

We will therefore perform a detailed laboratory analysis of the mass-independent isotopic composition of processes associated with atmospheric nitrate trapped in the snow pack at the South Pole. Specifically, we will test whether the oxygen isotopes 16O, 17O, and 18O of nitrate can be used to probe the denitrification of the antarctic stratosphere.

We will also investigate the stable oxygen isotope ratios of nitrate collected both in real time and from the snow in Antarctica. Full-year nitrate aerosol collections, with resolution time horizons of a week, will be performed at the South Pole. Weekly aerosol collections will help us identify any seasonal trend in the oxygen-17 excess anomaly and eventually link it to the denitrification of the antarctic stratosphere.

In addition, we will use this data set to test our assumption that the oxygen isotopic anomaly of nitrate is mainly formed in the stratosphere and is well preserved in the snow pack. If this is true, we will for the first time resolve an atmospheric signal extracted from a nitrate profile. The snow pit will allow us to see any trend in the data over a time span of many decades.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-040-E
NSF/OPP 01-25985
Station: Special Project
RPSC POC: John Evans
Research Site(s): Copacabana Field Camp on St. George Island
Dates in Antarctica: Early January to mid February

Foraging behavior and demography of Pygoscelis penguins

Dr. Wayne Z. Trivelpiece
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Foraging behavior and demography of Pygoscelis penguins

Deploying Team Members:

Stacey Buckelew . Simonetta Corsolini . David B. McWethy . Michael Polito . Susan G. Trivelpiece . Wayne Z. Trivelpiece

Research Objectives: Seabird research conducted at Admiralty Bay, King George Island, in the Antarctic Peninsula region has documented annual variability in the life history parameters of the population biology of three related penguin species: the Adélie, the gentoo, and the chinstrap (Pygoscelis adeliae, P. papua, and P. antarctica, respectively). This long-term study has collected 25 years of data on these three related species, including survival and recruitment, population size and breeding success, and diets and foraging ecology.

We will extend the research linking penguin demography and foraging ecology to variability in the antarctic marine ecosystem. A major focus will be on the population biology data for the Adélie and gentoo penguins and the distribution and trophic interactions among the three species during the breeding season and the nonbreeding, winter period. Recent studies using satellite tags and time-depth recorders to examine postfledging foraging have provided the first detailed data on the wintering distributions of Adélie and chinstrap penguins in the Antarctic Peninsula.

Specific topics include an examination of the size and sex of krill captured by penguins feeding chicks and krill collected concurrently by net hauls in the adjacent marine environment and the length-frequency distribution of krill collected from penguin diet samples. The winter survival of breeding adults and the recruitment of young (2- to 4-year-old) prebreeding penguins to their natal colony will be compared to the extent of sea ice in the winter before the breeding season. These variables are expected to be positively correlated for the Adélie but negatively correlated for the chinstrap penguin. Detailed studies of adult gentoo penguins, which do not disperse widely from their natal colony, will be conducted using satellite tags.

The data we gather on the impact of environmental variation on the structure of upper-trophic-level predators such as the Pygoscelis penguins will improve our understanding of the structure and function of the Antarctic.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-011-M **NSF/OPP** 02-30237
Station: McMurdo Station
RPSC POC: Melissa Rider
Research Site(s): Taylor Valley, McMurdo Station
Dates in Antarctica: Mid November to late December

Biogeochemistry of Victoria Land coastal ponds: Role in terrestrial ecosystem organic carbon dynamics and structure

Dr. Maria Uhle
University of Tennessee
Department of Geological Sciences
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Photo not available.

Deploying Team Members: Roman Borochin . Melissa Hage . Meg Howard . Maria L. Uhle

Research Objectives: Structure, processes, and functional linkages in the antarctic terrestrial ecosystem have been the focus of the Long-Term Ecological Research site in the McMurdo Dry Valleys since 1993. This ecosystem has a modern component linking organic carbon dynamics between the soils, glaciers, streams, and ice-covered lakes, plus a legacy to ancient glacial events that deposited paleo-organic carbon. The soil reservoir contains 72 percent of the seasonally unfrozen and biologically available organic carbon within Taylor Valley, and a substantial fraction may be recalcitrant carbon derived from ancient climatic events.

One potentially large source of labile, and hence bioavailable, organic carbon that has not been investigated is the many small ponds found in most areas of the McMurdo Dry Valleys, especially near the coast. These ponds have a relatively large surface area, and they seem to generate a significant amount of stranded microbial mat as they shift position. The transient nature of these ponds renders the organic matter vulnerable to transport and possibly represents a significant source of modern, labile carbon in the ecosystem. A preliminary estimate suggests that the coastal pond reservoir may constitute at least 11 percent of the carbon in the Dry Valleys soil reservoir. Therefore, these ponds may significantly affect the carbon cycle and must be considered in developing a carbon budget for this polar desert.

We will determine the extent of the coastal pond reservoir, assess how productive it is, and determine whether it is a source or sink within organic carbon dynamics and the overall structure of the terrestrial ecosystem. We will focus on understanding the biogeochemistry of these ponds in terms of the factors affecting organic carbon production and nutrient cycling.

We should derive a more detailed understanding of the linkages between modern ecosystem components, develop insights into the biogeochemical cycling within polar desert ecosystems, and, possibly, identify mechanisms that help sustain life in extreme environments. We will also involve predominantly African-American K–5 students from Knoxville city schools. These students will be involved in question-and-answer sessions over the Internet, and older students will design experiments and be introduced to the scientific method. Science and math classes will use data analysis to develop analytical skills and place them in a relevant context.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-023-L
NSF/OPP 99-83751
Station: R/V Laurence M. Gould
RPSC POC: Karl Newyear
Research Site(s): R/V Laurence M. Gould
Dates in Antarctica: Late November to late December

Dynamics of predator-prey behavior in the Antarctic Ocean

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Photo not available.

Deploying Team Members: Jaqueline LeBlanc . Marie-Caroline Martin . Evelyn Neunteufel . Malin L. Pinsky . Jarrod Santora . Richard R. Veit

Research Objectives: We plan to bring two groups of undergraduate students to the Antarctic, where they will learn a broad range of skills in physical and biological oceanography by participating in collecting data on seabird abundance and behavior. We will combine research on the dynamics of seabirds that feed on antarctic krill with the teaching of mathematical modeling of foraging behavior and spatial statistics. Our goal is to learn how foraging antarctic seabirds respond to changes in the abundance and distribution of their prey, primarily antarctic krill.

Our approach will be to study bird behavior near krill swarms and to contrast this behavior with that observed in areas lacking krill. From these comparisons, we will build foraging models that will make predictions about the dispersion of birds under differing levels of krill abundance. Our long-term goal is to be able to make predictions about the impact of future changes in krill stocks on seabirds. We will conduct our work in the vicinity of Elephant Island over two seasons. Each season, we will survey the insular shelf north of Elephant Island and record the abundance, distribution, and behavior of seabirds.

We will attempt to quantify the linkage between prey abundance and bird behavior in order to use this behavioral information to index long-term changes in the prey base. Our teaching goal is twofold: first, we will introduce inner-city college students to a spectacular and economically important ecosystem. Through their work on an oceanographic research vessel, students will be exposed to a broad range of research topics and methods, from behavioral ecology to physical oceanography. Second, once back at home, students will participate in the development of a mathematical biology initiative at the College of Staten Island. Here, they will be encouraged to apply basic mathematical reasoning and computer modeling to a real problem—determining how foraging choices made by seabirds can ultimately impact their reproductive success.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-016-L/P

NSF/OPP 02-17282

Station: R/V Laurence M. Gould, Palmer Station

RPSC POC: Rob Edwards

Research Site(s): R/V Laurence M. Gould, Palmer Station

Dates in Antarctica:

Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment

Dr. Maria Vernet
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Marine Research Division
mvernet@ucsd.edu
http://pal.lternet.edu

Photo not available.

Deploying Team Members: Peter Horne . Wendy A. Kozlowski . Karen Pelletreau . Karie A. Sines . Maria Vernet . Bryan White

Research Objectives: The phytoplankton ecology component of the Long Term Ecological Research (LTER) project focuses on rates of primary production and phytoplankton community structure, particularly their relationship to physical forcing.

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-423-M
NSF/OPP 98-10219

Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): McMurdo Station, Taylor Valley, Dry Valleys
Dates in Antarctica: Instruments operate year-round, early December to early February (project team deploys)

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Dr. Ross A. Virginia
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Environmental Studies Program
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http://huey.Colorado.EDU/LTER/

The Role of Natural Legacy on Ecosystem Structure and Function in a Polar Desert: The McMurdo Dry Valley Long Term Ecological Research Program

Deploying Team Members: Kathleen Catapano . Michael Poage . Rebekka M. Stucker . Ross A. Virginia

Research Objectives: This project is one of two soil productivity components of McMurdo LTER. This season the group will focus on:

+ The influence of climate and edaphic factors on carbon and nitrogen cycling in terrestrial ecosystems of the Antarctic Dry Valleys.

+ The influence of climate and soil chemistry on the distribution and abundance of soil biodiversity in the Antarctic Dry Valleys.

+ Understanding the linkages between soil biological communities and underlying ecosystem functioning.

+ Evaluating the influence of changes in climate on terrestrial ecosystems and invertebrate communities.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-213-M

NSF/OPP NASA award

Station: McMurdo Station
RPSC POC: Karen Pavich
Research Site(s): Dome C
Dates in Antarctica: Late November to mid February

Validation of the Atmospheric Infrared Sounder (AIRS) over the Antarctic Plateau

Dr. Von Walden
University of Idaho
vonw@uidaho.edu

Validation of the Atmospheric Infrared Sounder (AIRS) over the Antarctic Plateau

Deploying Team Members: Bradley Halter . David Longenecker . William L. Roth . Von Walden

Research Objectives: The Antarctic Plateau is ideal for calibrating and validating infrared satellite instruments. The large continental ice sheet is one of the most homogeneous surfaces on Earth in terms of surface temperature and emissivity. Ground-based measurements of upwelling infrared radiation from the surface between 8 and 12 micrometers are very nearly equal to those measured by satellite instruments because of minimal atmospheric emission and absorption. Therefore, accurate measurements of spectral infrared radiance can provide valuable validation data for the National Aeronautics and Space Administration's Atmospheric Infrared Sounder (AIRS).

We will measure upwelling and downwelling spectral infrared radiance with the Polar Atmospheric Emitted Radiance Inferometer. Its viewing angle will be adjustable in both nadir and azimuth to match the AIRS viewing angle of the surface and atmosphere. Also, we will use the AIRS Mobile Observing System to map changes in surface radiation at spatial scales similar to the AIRS field of view. Then, in conjunction with the University of Nice and the University of New South Wales, we will use a Vaisala atmospheric sounding system to obtain temperature and humidity profiles. Finally, using a ground-based global positioning system unit, we will attempt to measure the extremely low values of total precipitable water (about 1 millimeter in the summer).

The data we gather will be extremely helpful in validating the measurements obtained from AIRS.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-424-M
NSF/OPP 98-10219
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Taylor Valley, Dry Valleys, McMurdo Station
Dates in Antarctica: Mid December to mid February

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Dr. Diana H. Wall
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Natural Resource Ecology Laboratory
diana@nrel.colostate.edu
http://www.nrel.colostate.edu/projects/soil/

McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert

Deploying Team Members: Byron J. Adams . Emma J. Broos . David Hopkins . Johnson Nkem . Diana H. Wall

Research Objectives: This project is one of two soil productivity components of McMurdo LTER. The group will continue to maintain (through application of water and nutrients), monitor (soil moisture and temperature) and sample (soils) in our various long-term experimental plots near Lakes Fryxell, Hoare and Bonney. The overall goal is to determine the impacts of natural factors and those associated with potential climate change on the abundance, distribution, and diversity of soil biota.

2003-2004 USAP Field Season

Oceans & Climate

Dr. Bernhard Lettau
Program Manager

O-201-M

NSF/OPP 00-03826

Station: McMurdo Station
RPSC POC: Karen Pavich
Research Site(s): Dome C
Dates in Antarctica: Late November to mid February

Solar radiation processes on the East Antarctic Plateau

Dr. Stephen G. Warren
University of Washington
Atmospheric Sciences Dept.
sgw@atmos.washington.edu

The 33 meter tower, a platform for instruments that measure snow surface reflectance. Photo by Richard Brandt.

Deploying Team Members: Richard E. Brandt . Thomas C. Grenfell . Stephen Hudson . Delphine M. Six . Stephen G. Warren

Research Objectives: This project is an experimental study of solar radiation processes near the surface at Dome C, the French-Italian station in East Antarctica. It will be carried out in cooperation with the Laboratoire de Glaciologie et Geophysique de l'Environment in Grenoble, France. The emphasis is on the reflection of sunlight by snow and the transmission of sunlight through clouds. The observations researchers gather will be relevant to climate, remote sensing, and the physics of ice and snow.

Observations of the angular pattern of solar radiation reflected from the snow surface will allow the researchers to validate information derived from satellite-derived radiances. Using radiative transfer modeling through the atmosphere, the project's research team will reconcile measured surface reflection functions with the empirical functions obtained from the Advanced Very High Resolution Radiometer on the polar orbiting satellites of the National Oceanic and Atmospheric Administration.

The research team will measure transmission of solar radiation through clouds, and these measurements will be used to obtain effective cloud optical depths to estimate cloud radiative forcing, with applications in climate models. They will develop a method to obtain this information from pyranometers alone so that the historical record of solar radiation observations in the antarctic interior can be analyzed for climatological information on clouds.

Finally, the spectral peak of snow albedo will be accurately located in order to resolve a discrepancy over the spectral absorption of pure ice in the visible to near-ultraviolet range.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-089-M
NSF/OPP 99-09603
Station: McMurdo Station
RPSC POC: Jessie Crain
Research Site(s): Transantarctic Mountains
Dates in Antarctica: Mid November to mid January

A broadband seismic experiment to investigate deep continental structure across the east-west Antarctic boundary

Dr. Douglas Wiens
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A broadband seismic experiment to investigate deep continental structure across the East-West Antarctic boundary

Deploying Team Members: Audrey D. Huerta . Glenn R. Osburn . Moira L. Pyle . Patrick J. Shore . Donald E. Voigt . Timothy Watson

Research Objectives: Antarctica's outline shape looks generally like Australia, though half again as large. However beneath its enormous ice sheet lies evidence of its origin. East Antarctica has a bedrock continent-like foundation, while the ice sheet over West Antarctica -- a third the area -- in fact covers a series of "islands." West Antarctica shares a geologic history with the South American Andes Mountains, the result of plates colliding and subducting. East Antarctica is more like a large coherent chunk that broke free of the supercontinent, Gondwanaland, and drifted to a new position at the bottom of the world. The boundary between these two regions (with their disparate geologic pedigrees) is called the east-west antarctic boundary. The crust and upper mantle here reveals many important and interesting distinctions which tells the basic story of the tectonic development of Antarctica.

In November 2000 this group began making seismic measurements using three arrays and a total of 44 seismic stations, all geared to evaluating geodynamic models of the evolution of

Antarctica that rely on data about the crust and upper mantle. To analyze the data, researchers use a variety of proven modeling techniques, including body- and surface-wave tomography, receiver function inversion, and shear-wave splitting analysis.

One basic question is, "How were the Transantarctic Mountains formed?" Though widely considered a classic example of rift-flank uplift, there is little consensus about the uplift mechanism. Many theories have been proposed ranging from delayed phase changes to transform-flank uplift. All make various assumptions about upper mantle structure beneath and adjacent to the rift-side of the mountain front.

Another focus will be the structure of the east antarctic craton, the highest ice block in the world. Was this anomalous elevation a prime driver in the onset of glaciation there? More to the point, how did it arise? Proposed models include isostatic uplift from thickened crust, anomalously depleted upper mantle, and thermally modified upper mantle, as well as dynamic uplift. How far the old continental lithosphere extends is also uncertain. In particular, it is unknown whether the old lithosphere extends to the western edge of East Antarctica beneath the crustal rocks deformed during the Ross Orogeny (formation).

When completed and analyzed, this comprehensive set of data and theory testing will enable new maps of the variation in crustal thickness, upper mantle structure, anisotropy, and mantle discontinuity topography across the boundary of East and West Antarctica, providing a much enhanced foundation for understanding the geodynamics of the antarctic.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-079-M
NSF/OPP 02-30285
Station: McMurdo Station
RPSC POC: Curt LaBombard
Research Site(s): Transantarctic Mountains
Dates in Antarctica: Late October to early February

Transantarctic Mountains deformation network: GPS measurements of neotectonic motion in the antarctic interior

Dr. Terry J. Wilson
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Photo not available.

Deploying Team Members: Graeme Blick . Robert Glover . Donald B. Grant . Dorota Grejner-Brzezinska . Larry D. Hothem . Sarah Morris . Michael J. Willis . Terry J. Wilson . Jan Wuite . Yi Yudan

Research Objectives: We will conduct global positioning system (GPS) measurements of bedrock crustal motions in an extension of the Transantarctic Mountains Deformation Network (TAMDEF) in order to document neotectonic displacements caused by tectonic deformation within the West Antarctic Rift or mass changes in the antarctic ice sheets. By monitoring the U.S. and Italian networks of bedrock GPS stations along the Transantarctic Mountains and on offshore islands in the Ross Sea, we will tightly constrain horizontal displacements related to active neotectonic rifting, strike-slip translations, and volcanism. We will use GPS-derived crustal motions, together with information from other programs on the ice sheets and from ongoing structural and seismic investigations in Victoria Land, to model glacio-isostatic adjustments due to deglaciation and to modern mass changes in the ice sheets. The integrative and iterative nature of this modeling will yield a holistic interpretation of neotectonics and ice sheet history that will help us discriminate tectonic crustal displacements from viscoelastic/elastic glacio-isostatic motions.

We will do repeat surveys of key sites southward about 250 kilometers along the Transantarctic Mountains. These measurements will cross gradients in predicted vertical motion due to viscoelastic rebound. The southward extension will also allow us to determine the southern limit of the active Terror Rift and will provide a better baseline for constraints on any ongoing tectonic displacements across the West Antarctic Rift system as a whole. Further, we will investigate unique aspects of GPS geodesy in Antarctica to determine how the error spectrum compares with that found in mid-latitude regions and to identify optimum measurement and data processing methods. The geodetic research will improve position accuracies within our network and will also yield general recommendations for other deformation-monitoring networks in polar regions.

An education and outreach program targeted at Ohio State University undergraduates who are not science majors will illuminate the research process for nonscientists. This effort will educate students about science and inform them about Antarctica and how it relates to global science issues.

2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra
Program Manager

G-099-N

NSF/OPP 01-25624

Station: RV/IB Nathaniel B. Palmer

RPSC POC: Ashley Lowe

Research Site(s): Ross Sea

Dates in Antarctica: Late January to mid February

Neotectonic structure of Terror Rift, Western Ross Sea

Dr. Terry J. Wilson
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Photo not available.

Deploying Team Members: Marcy Davis . Nedra Bonal . Stuart Henrys . Lawrence A. Lawver . Mark Wiederspahn . Terry J. Wilson

Research Objectives: Displacements between East and West Antarctica have long been proposed based on global plate circuits, apparent hot-spot motions, geologic grounds, seafloor magnetic anomalies, or paleomagnetism. Such motions require plate boundaries that cross Antarctica, yet these boundaries have never been explicitly defined.

We will attempt to delineate the late Cenozoic boundary between East and West Antarctica along the Terror Rift in the western Ross Sea by using marine and airborne geophysical data to map the fault patterns and volcanic structure along the eastern margin. We will also map the orientations of volcanic fissures and seamount alignments on the seafloor. The volcanic alignments will show the regional extension or shear directions across the rift and the orientations of associated crustal stresses.

Delineation of neotectonic fault patterns will demonstrate whether the eastern margin of the rift forms a continuous boundary and whether the rift itself can be linked with postulated strike-slip faults in the northwestern Ross Sea. We will combine seafloor findings with fault kinematic and stress field determinations from the surrounding volcanic islands and the Transantarctic Mountains.

Over 3 years, we will complete a collaborative structural analysis of existing multichannel and single-channel seismic profiles and aeromagnetic data over the Terror Rift, locating volcanic vents or fissures and any fault scarps on the seafloor and making a preliminary determination of the age and kinematics of deformation in the Terror Rift. We will then carry out multibeam sonar mapping of selected portions of the seafloor and use these data to map the orientations and forms of volcanic bodies and the extent and geometry of neotectonic faulting associated with the Terror Rift.

In summary, we will

+ Complete a map of neotectonic faults and volcanic structures in the Terror Rift,

+ Interpret the structural pattern to derive the motions and stresses associated with the development of the rift,

+ Compare rift structures with faults and lineaments mapped in the Transantarctic Mountains to improve age constraints on the structures, and

+ Integrate the late Cenozoic structural interpretations from the western Ross Sea with Southern Ocean plate boundary kinematics.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-285-E/L
NSF/OPP 03-24539
Station: E/L
RPSC POC: John Evans
Research Site(s): R/V Laurence M. Gould
Dates in Antarctica: Mid November

Dynamic similarity or size proportionality?: Adaptations of a polar copepod

Dr. Jeannette Yen
Georgia Institute of Technology
School of Biology
jeannette.yen@biology.gatech.edu

Photo not available.

Deploying Team Members: Marc Weissburg . Jeannette Yen

Research Objectives: We will explore the feasibility of using fluid physical analyses to evaluate the importance of viscous forces over compensatory temperature adaptations in a polar copepod. The water of the Southern Ocean is 20ºC colder and nearly twice as viscous as subtropical seas, and the increased viscosity has significant implications for swimming zooplankton. In each of these warm and cold aquatic environments have evolved abundant carnivorous copepods in the family Euchaetidae.

In this exploratory study, we will compare two species from the extremes of the natural temperature range (0º and 23ºC) to test two alternate hypotheses on how plankton adapt to the low temperature–high viscosity realm of the Antarctic and to evaluate the importance of viscous forces in the evolution of plankton. How do stronger viscous forces and lower temperature affect the behavior of the antarctic species? If the antarctic congener is dynamically similar to its tropical relative, it will operate at the same Reynolds number (Re). Alternatively, if the adaptations of the antarctic congener are proportional to size, they should occupy a higher Re regime, which suggests that the allometry of various processes is not constrained by having to occupy a transitional fluid regime.

We designed our experiments with clearly defined outcomes on a number of copepod characteristics, such as swimming speed, propulsive force, and size of the sensory field. These characteristics determine not only how copepods relate to the physical world, but also how their biological interactions are structured. The results we derive will provide insights into major evolutionary forces affecting plankton and provide a means of evaluating the importance of fluid physical conditions relative to compensatory measures for temperature.

Fluid physical, biomechanical, and neurophysiological techniques have not been previously applied to these polar plankton. However, if productive and feasible, these approaches will provide ways to explore the sensory ecology of polar plankton and the role of small-scale biological-physical-chemical interactions in a polar environment. Experimental evidence validating the importance of viscous effects will also justify further research using latitudinal comparisons of other congeners along a temperature gradient in the world’s oceans.

2003-2004 USAP Field Season

Biology & Medicine

Dr. Polly Penhale
Program Manager

B-248-L
NSF/OPP 02-29966

Station: R/V Laurence M. Gould
RPSC POC: Don Michaelson
Research Site(s): R/V Laurence M. Gould, Drake Passage
Dates in Antarctica: Mid February to mid March

Plankton community structure and iron distribution in the southern Drake Passage

Dr. Meng Zhou
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http://www.es.umb.edu/mz/sfz/sfz.htm

Photo not available.

Deploying Team Members: Ryan D. Dorland . Joseph Smith

Research Objectives: The Shackleton Fracture Zone (SFZ) in the Drake Passage marks a boundary between low- and high-phytoplankton waters. West of the passage, waters have very low concentrations of surface chlorophyll, and east of the SFZ, mesoscale eddy kinetic energy and chlorophyll are higher than they are west of it. Data from a 10-year survey confirm the existence of a strong hydrographic and chlorophyll gradient in the region. We hypothesize that bathymetry, including the 2,000-meter-deep SFZ, influences mesoscale circulation and transport of iron, leading to the differences in phytoplankton patterns.

To test this hypothesis, we will examine phytoplankton and bacterial physiological states (including responses to iron enrichment) and the structure of plankton communities from virus to zooplankton; the concentration and distribution of iron, manganese, and aluminum; and mesoscale flow patterns near the SFZ. We will examine relationships between iron concentrations and phytoplankton in the context of the mesoscale transport of trace nutrients to determine how much of the variability in biomass can be attributed to iron supply, as well as the most important sources of iron east of the Drake Passage. Our goal is to better understand how plankton productivity and community structure in the Southern Ocean are affected by bathymetry, mesoscale circulation, and nutrient distributions.

We will perform rapid surface surveys of chemical, plankton, and hydrographic properties, complemented by a mesoscale station grid for vertical profiles, water sampling, and bottle incubation enrichment experiments. Manganese and aluminum distributions will help distinguish aeolian, continental shelf, and upwelling sources of iron. We will monitor the physiological state of the phytoplankton by active fluorescence methods sensitive to iron limitation. Concentrations of pigment, carbon, and nitrogen will be obtained by analysis of filtered samples, cell size distributions by flow cytometry, and species identification by microscopy. We will measure primary production and photosynthesis parameters (absorption, quantum yields, variable fluorescence) with depth profiles, surface surveys, and bulk samples from enrichment experiments. We will also determine the abundance of viruses and bacteria and ascertain whether bacterial production is limited by iron or organic carbon sources.

We aim to improve scientific understanding of processes controlling iron distribution and the response of plankton communities in the Southern Ocean. Moreover, we will have an undergraduate and teacher outreach component and plan to create an Web site and K–12 curricular modules.

2003-2004 USAP Field Season
Aeronomy & Astrophysics

Dr. Vladimir Papitashvili, Program Manager

PI Last Name	PI First Name	Project Title	NSF/OPP Award #	Event #
Avery	Susan	Dynamics of the antarctic mesosphere-lower-thermosphere (MLT) region using ground-based radar and TIMED instrumentation	ATM 00-00957	A-284-S
Bieber	John	Spaceship Earth: Probing the solar wind with cosmic rays	00-00315	A-120-M/S
Binns	Walter	Trans-Iron Galactic Element Recorder (TIGER) / ANITA-lite	NSF/NASA agreement	A-149-M
Caldwell	Douglas	A search for extrasolar planets from the South Pole	01-26313	A-103-S
Carlstrom	John	Degree Angular Scale Interferometer (DASI)	00-94541	A-373-S
Carlstrom	John	South Pole observations to test cosmological models	01-30612	A-379-S
Deshler	Terry	Measurements addressing quantitative ozone loss, polar stratospheric cloud nucleation, and large polar stratospheric particles during austral winter and spring	02-30424	A-131-M
Ejiri	Masaki	All-Sky imager at South Pole	U.S./Japan agreement	A-117-S
Engebretson	Mark	Conjugate studies of ultra-low-frequency (ULF) waves and magnetospheric dynamics using ground-based induction magnetometers at four high-latitude manned sites	02-33169	A-102-M/S
Fraser-Smith	Antony	The Operation of an ELF/VLF Radiometer at Arrival Heights, Antarctica	01-38126	A-100-M
Gaisser	Thomas	South Pole Air Shower Experiment - SPASE 2	99-80801	A-109-S
Halzen	Francis	IceCube	02-36449, 03-31873	A-333-S
Hernandez	Gonzalo	Austral high-latitude atmospheric dynamics	02-29251	A-110-M/S
Holzapfel	William	High-resolution obervations of the cosmic microwave background (CMB) with ACBAR	02-32009	A-378-S
Inan	Umran	A very-low-frequency (VLF) beacon transmitter at South Pole (2001-2004)	00-93381	A-108-S
Inan	Umran	Global thunderstorm activity and its effects on the radiation belts and the lower ionosphere	02-33955	A-306-P
LaBelle	James	A versatile electromagnetic waveform receiver for South Pole Station	00-90545	A-128-S
Lange	Andrew	Background Imaging of Cosmic Extragalactic Polarization (BICEP): An experimental probe of inflation	02-30438	A-033-S
Lessard	Marc	Measurement and analysis of extremely-low-frequency (ELF) waves at South Pole Station	01-32576	A-136-S
Mende	Stephen	Dayside auroral imaging at South Pole	02-30428	A-104-S
Morse	Robert	Antarctic Muon And Neutrino Detector Array (AMANDA)	99-80474	A-130-S
				A-255-

Murcray	Frank	Infrared measurements of atmospheric composition over Antarctica	02-30370	M/S
Müller	Dietrich	Tracer-Lite II: Transition Radiation Array for Cosmic Energetic Radiation, a balloon borne instrument	NSF/NASA agreement	A-125-M
Novak	Giles	Mapping galactic magnetic fields with SPARO	01-30389	A-376-S
Rosenberg	Theodore	Riometry in Antarctica and conjugate region	00-03881	A-111-M/S
Rosenberg	Theodore	Polar Experiment Network for Geophysical Upper-Atmospheric Investigations (PENGUIN)	03-34467	A-112-M
Sivjee	Gulamabas	Effects of enhanced solar disturbances during the 2000-2002 solar-max period on the antarctic mesosphere-lower-thermosphere (MLT) and F regions composition, thermodynamics and dynamics	99-09339	A-129-S
Smith	David	Development and test flight of a small, automated balloon payload for observations of terrestrial x-rays	ATM 02-33370	A-144-E/M
Stacey	Gordon	Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on AST/RO	00-94605	A-377-S
Stark	Antony	Antarctic Submillimeter Telescope and Remote Observatory (AST/RO)	01-26090	A-371-S
Stepp	William	Long Duration Balloon Program (LDB)	NSF/NASA agreement	A-145-M

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2003-2004 USAP Field Season
Biology & Medicine

Dr. Polly Penhale, Program Manager

Long-Term Ecological Research (LTER)

Palmer Station | McMurdo Station

Lake Fryxell Spill Study

PI Last Name	PI First Name	Project Title	NSF/OPP Award #	Event #
Ainley	David	Geographic structure of Adelie penguin populations: Demography of population expansion	01-25608	B-031-M
Amsler	Charles	The chemical ecology of shallow-water marine macroalgae and invertebrates on the Antarctic Peninsula	01-25181	B-022-L/P
Blanchette	Robert	Investigations on deterioration in the historic huts of Antarctica	02-29570	B-038-E/M
Bowser	Samuel	Remotely operable micro-environmental observatory for antarctic marine biology research	02-16043	B-015-M
Connell	Laurie	Yeasts in the antarctic Dry Valleys: Biological role, distribution, and evolution	01-25611	B-019-M
Day	Thomas	Response of terrestrial ecosystems along the Antarctic Peninsula to a changing climate	02-30579	B-003-P
DeVries	Arthur	Antifreeze proteins in antarctic fishes: Integrated studies of freezing environments and organismal freezing avoidance, protein structure-function and mechanism, genes, and evolution	02-31006	B-005-M
Detrich	William	ICEFISH 2003: International collaborative expedition to collect and study fish indigenous to sub-antarctic habitats	01-32032	B-039-N
DiTullio	Giacomo	Iron and light effects on Phaeocystis antarctica isolates from the Ross Sea	02-30513	B-272-M
Doran	Peter	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-426-M
Ducklow	Hugh	Palmer Long Term Ecological Research Project (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-045-L/P
Dye	Timothy	Culture and health in Antarctica	01-25893	B-027-M
Emslie	Steven	Occupation history and diet of Adélie penguins in the Ross Sea region	01-25098	B-034-M
Fountain	Andrew	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-425-M
Fraser	William	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-013-L/P
Fraser	William	Monitoring the human impact and environmental variability on Adelie Penguins at Palmer Station	01-30525	B-198-P
Frazer	Thomas	Complex pelagic interactions in the Southern Ocean: Deciphering the antarctic paradox	03-36469 SGER	B-212-E

Gargett	Ann	Interactive effects of UV and Vertical mixing on phytoplankton and bacterioplankton in the Ross Sea	01-25818	B-208-N
Garrott	Robert	Patterns and processes: Dynamics of the Erebus Bay Weddell seal population	02-25110	B-009-M
Gast	Rebecca	Comparative and quantitative studies of protistan molecular ecology and physiology in coastal antarctic waters	01-25833	B-207-N
Goes	Joaquim	Ultraviolet-radiation-induced changes in the patterns of production and composition of biochemical compounds antarctic marine phytoplankton	01-26150	B-206-N
Hildebrand	John	Mysticete whale acoustic census in the GLOBEC west antarctic project area	99-10007	B-239-L
Hunt	George	Food web structure across a large-scale ocean productivity gradient: Top predator assemblages in the southern Indian Ocean	02–34570 SGER	B-025-E
Jeffrey	Wade	POTATOE: Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects (MOAT)	01-27022	B-200-N
Kennicutt, II	Mahlon	Spatial and temporal scales of human disturbance	SGER	B-518-M
Kieber	David	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea	02-30499	B-266-N
Kiene	Ronald	Impact of solar radiation and nutrients on biogeochemical cycling of DMSP and DMS in the Ross Sea, Antarctica	02-30497	B-002-N
Kim	Stacy	Community dynamics in a polar ecosystem: Benthic recovery from organic enrichment in the Antarctic	01-26319	B-010-M
Kvitek	Rikk	Victoria Land latitudinal gradient project: Benthic marine habitat characterization	02-29991	B-320-E
Lyons	W. Berry	Soil biodiversity and response to climate change: A regional comparison of Cape Hallett and Taylor Valley	02-29836	B-259-M
Lyons	W. Berry	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-420-M
Marsh	Adam	Genomic networks for cold-adaptation in embryos of polar marine invertebrates	02-38281	B-029-M
Martinson	Douglas	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-021-L
McKnight	Diane	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-421-M
Measures	Christopher	Plankton community structure and iron distribution in the southern Drake Passage	02–30445	B-225-L
Mitchell	B. Greg	Plankton community structure and iron distribution in the southern Drake Passage	02-30445	B-228-L
Naveen	Ron	Long-term data collection at select Antarctic Peninsula visitor sites	02-30069	B-086-E
Neale	Patrick	Interactive effects of UV radiation and vertical mixing on phytoplankton and bacterioplankton in the Ross Sea	01-27037	B-203-N
Nevitt	Gabrielle	The development of olfactory foraging strategies in antarctic procellariiform seabirds	02-29775	B-035-E
Palinkas	Lawrence	Prevention of environment-induced decrements in mood and cognitive performance	00-90343	B-321-M/S
Petzel	David	Drinking and sodium/potasium-ATPase alpha-subunit isoform expression in antarctic fish	02-29462	B-012-M

Ponganis	Paul	Diving physiology and behavior of emperor penguins	02-29638	B-197-M
Priscu	John	Microbial diversity and function in the permanently ice-covered lakes of the McMurdo Dry Valleys	MCB 02-37335	B-195-M
Priscu	John	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-422-M
Quetin	Langdon	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-028-L/P
Smith	Raymond	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-032-L/P
Smith	Walker	Interannual variability in the Antarctic-Ross Sea (IVARS): Nutrients and seasonal production	00-87401	B-047-M
Trivelpiece	Wayne	Foraging behavior and demography of Pygoscelis penguins	01-25985	B-040-E
Uhle	Maria	Biogeochemistry of Victoria Land coastal ponds: Role in terrestrial ecosystem organic carbon dynamics and structure	02-30237	B-011-M
Veit	Richard	Dynamics of predator-prey behavior in the Antarctic Ocean	99-83751	B-023-L
Vernet	Maria	Palmer Long Term Ecological Research (LTER): Climate, ecological migration, and teleconnections in an ice-dominated environment	02-17282	B-016-L/P
Virginia	Ross	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-423-M
Wall	Diana	McMurdo Dry Valleys Long Term Ecological Research (LTER): The role of natural legacy on ecosystem structure and function in a polar desert	98-10219	B-424-M
Yen	Jeannette	Dynamic similarity or size proportionality?: Adaptations of a polar copepod	03-24539	B-285-E/L
Zhou	Meng	Plankton community structure and iron distribution in the southern Drake Passage	02-29966	B-248-L

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2003-2004 USAP Field Season

Geology & Geophysics

Dr. Rama K. Kotra, Program Manager

PI Last Name	PI First Name	Project Title	NSF/OPP Award #	Event #
Ashworth	Allan	Terrestrial paleoecology and sedimentary environment of the Meyer Desert Formation, Beardmore Glacier, Transantarctic Mountains	02-30696	G-294-M
Babcock	Loren	Paleobiology and taphonomy of exceptionally preserved fossils from Jurassic Lacustrine deposits, Beardmore Glacier area and southern Victoria Land, Antarctica	02-29757	G-297-M
Blake	Daniel	Global climate change and the evolutionary ecology of antarctic mollusks in the Late Eocene	99-08856	G-065-E
Butler	Rhett	IRIS - Global Seismograph Station at South Pole	EAR 00-04370	G-090-P/S
Case	Judd	Evolution and biogeography of Late Cretaceous vertebrates from the James Ross Basin, Antarctic Peninsula	00-03844	G-061-E
Dalziel	Ian	A GPS network to determine crustal motions in the bedrock of the West Antarctic Ice Sheet (WAIS)	00-03619	G-087-M
Goodge	John	Geophysical mapping of the east antarctic shield adjacent to the Transantarctic Mountains	02-30280	G-291-M
Grew	Edward	Boron in antarctic granulite-facies rocks: Under what conditions is boron retained in the middle crust?	02-28842	G-067-E
Hammer	William	Vertebrate Paleontology of the Triassic to Jurassic sedimentary sequence in the Beardmore Glacier area of Antarctica	02-29698	G-298-M
Harvey	Ralph	The Antarctic Search for Meteorites (ANSMET)	99-80452	G-058-M
Johns	Bjorn	University NAVSTAR Consortium (UNAVCO) GPS survey support	EAR 99-03413	G-295-M
Kemerait	Robert	Dry Valley seismic project	NSF/OPP-DoD MOA	G-078-M
Kyle	Philip	Mount Erebus Volcano Observatory and Laboratory (MEVOL)	02-29305	G-081-M
Luyendyk	Bruce	Antarctic cretaceous-Cenozoic climate, glaciation, and tectonics: Site surveys for drilling from the edge of the Ross Ice Shelf	00-88143	G-152-N
Miller	Molly	Late Paleozoic-Mesozoic fauna, environment, climate, and basinal history: Beardmore Glacier area, Tranantarctic Mountains	01-26146	G-094-M
Mullins	Jerry	Geodesy and geospatial program	02-33246	G-052-M/P/S
Renne	Paul	Calibration of cosmogenic argon production rates in Antarctica	01-25194	G-064-M
Retallack	Gregory	Permian-Triassic mass extinction in Antarctica	02-30086	G-299-M
Stock	Joann	Improved Cenozoic plate reconstructions of the circum-Antarctic Region	01-26334	G-071-N
		Geomagnetic field as recorded in the Mount Erebus Volcanic Province: Key		G-182-

Tauxe	Lisa	to field structure at high southern latitudes	02-29403	M
Taylor	Edith	Permian and Triassic floras from the Beardmore Glacier region: Icehouse to greenhouse?	01-26230	G-095-M
Taylor	Edith	Shackleton Glacier area: Evolution of vegetation during the Triassic	02-29877	G-293-M
Wiens	Douglas	A broadband seismic experiment to investigate deep continental structure across the east-west Antarctic boundary	99-09603	G-089-M
Wilson	Terry	Transantarctic Mountains deformation network: GPS measurements of neotectonic motion in the antarctic interior	02-30285	G-079-M
Wilson	Terry	Neotectonic structure of Terror Rift, Western Ross Sea	01-25624	G-099-N

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2003-2004 USAP Field Season
Glaciology

Dr. Julie Palais, Program Manager

PI Last Name	PI First Name	Project Title	NSF/OPP Award #	Event #
Anandakrishnan	Sridhar	Tidal modulation of ice stream flow	02-29629	I-205-M
Conway	Howard	Western divide WAISCORES site selection	00-87345	I-209-M
Conway	Howard	Glacial history of Ridge AB	00-87144	I-210-M
Cuffey	Kurt	Dynamics and climatic response of the Taylor Glacier system.	01-25579	I-161-M
Hall	Brenda	Millennial-scale fluctuations of Dry Valleys lakes: A test of Implications for regional climate variability and the interhemispheric (a)synchrony of climate change	01-24014	I-196-M
Hamilton	Gordon	Glaciology of blue ice areas in Antarctica	02-29245	I-178-M
Kreutz	Karl	Dry Valleys Late Holocene climate variability	02-28052	I-191-M
MacAyeal	Douglas	Collaborative research of Earth's largest icebergs	02-29546	I-190-M
Mayewski	Paul	A science management office for the United States component of the International Trans Antarctic Scientific Expedition (ITASE) -- South Pole to Northern Victoria Land	02-29573	I-153-M
Scambos	Theodore	Characteristics of snow megadunes and their potential effects on ice core interpretation	01-25570	I-186-M
Severinghaus	Jeffrey	How thick is the convective zone?: A study of firn air in the megadunes near Vostok	02-30452	I-184-M
Sowers	Todd	Refining a 500-thousand-year climate record from the Mt. Moulton blue ice field in West Antarctica	02-30021	I-177-M
Stone	John	Late Quaternary history of Reedy Glacier	02-29314	I-175-M/S
Thiemens	Mark	South Pole Atmospheric Nitrate Isotopic Analysis (SPANIA)	01-25761	I-165-M/S

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Oceans & Climate

Dr. Bernhard Lettau, Program Manager

PI Last Name	PI First Name	Project Title	NSF/OPP Award #	Event #
Chereskin	Teresa	Shipboard acoustic Doppler current profiling aboard the research vessel Laurence M. Gould	98-16226	O-317-L
Eicken	Hajo	Measurements and improved parameterizations of the thermal conductivity and heat flow through first-year sea ice	01-26007	O-253-M
Eisele	Fred	Antarctic Troposphere Chemistry Investigation (ANTCI)	02-30246	O-176-M/S
Firing	Eric	Shipboard acoustic Doppler current profiling aboard the research vessel Nathaniel B. Palmer	98-16226	O-315-N
Gordon	Arnold	ANSLOPE: Cross slope exchanges at the antarctic slope front	01-25172	O-215-N
Hansen	Anthony	Solar/wind powered instrumentation module development for polar environmental research	DBI 01-19793	O-314-M
Hofmann	Dave	South Pole monitoring for climatic change: U.S. Department of Commerce NOAA Climate Monitoring and Diagnostic Laboratory	NOAA/NSF agreement	O-257-S
Hofmann	David	Collection of atmospheric air for the NOAA/CMDL worldwide flask sampling network	NOAA/NSF agreement	O-264-P
Keeling	Ralph	A study of atmospheric oxygen variability in relation to annual to decadal variations in terrestrial and marine ecosystems	ATM 00-00923	O-204-P/S
Sanderson	Colin	Remote Atmospheric Measurements Program (RAMP) of the University of Miami / U.S. Department of Energy's Environmental Measurements Lab	MOU with DOE	O-275-P/S
Sprintall	Janet	The Drake Passage high density XBT/XCTD program	00-03618	O-260-L
Stearns	Charles	Antarctic Meteorological Research Center (AMRC) (2002-2005)	01-26262	O-202-M/P/S
Stearns	Charles	Antarctic Automatic Weather Station Program (AWS): 2001-2004	00-88058	O-283-M/P/S
Steffen	Konrad	AMSR sea ice validation during the R/V Laurence M. Gould's traverse to Antarctica	NASA award	O-309-L
Takahashi	Taro	Mesoscale, seasonal and inter-annual variability of surface water CO2 in the Drake Passage	00-03609	O-214-L
Walden	Von	Validation of the Atmospheric Infrared Sounder (AIRS) over the Antarctic Plateau	NASA award	O-213-M
Warren	Stephen	Solar radiation processes on the East Antarctic Plateau	00-03826	O-201-M

Mr. Guy Guthrige, Program Manager

PI Last Name	PI First Name	Project Title	Event #
Armstrong	Jennifer	Ice Through the Ages: A nonfiction young adult book	W-219-M/S
Baskin	Yvonne	Soil biodiversity book	W-220-M
Bledsoe	Lucy	Palmer Station children's novel	W-218-P
Cokinos	Christopher	The fallen sky: Eccentrics and scientists in pursuit of shooting stars	W-223-M
Conrad	Lawrence (Larry)	Field guide to antarctic features: McMurdo Sound region	W-224-M
Larson	Edward	History of science in Antarctica	W-221-M

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Projects not based at a USAP station

Event #	NSF/OPP Award #	PI Last Name	PI First Name	Project Title
G-065-E	99-08856	Blake	Daniel	Global climate change and the evolutionary ecology of antarctic mollusks in the Late Eocene
G-061-E	00-03844	Case	Judd	Evolution and biogeography of Late Cretaceous vertebrates from the James Ross Basin, Antarctic Peninsula
B-212-E	03-36469 SGER	Frazer	Thomas	Complex pelagic interactions in the Southern Ocean: Deciphering the antarctic paradox
G-067-E	02-28842	Grew	Edward	Boron in antarctic granulite-facies rocks: Under what conditions is boron retained in the middle crust?
B-025-E	02–34570 SGER	Hunt	George	Food web structure across a large-scale ocean productivity gradient: Top predator assemblages in the southern Indian Ocean
B-086-E	02-30069	Naveen	Ron	Long-term data collection at select Antarctic Peninsula visitor sites
B-035-E	02-29775	Nevitt	Gabrielle	The development of olfactory foraging strategies in antarctic procellariiform seabirds
B-040-E	01-25985	Trivelpiece	Wayne	Foraging behavior and demography of Pygoscelis penguins

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2003-2004 USAP Field Season

2003-2004 USAP Field Season

Palmer Station LTER: Climate migration, ecological response and teleconnections in an ice-dominated environment

Project Manager:

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List of 2003-2004 Palmer Station LTER projects

The Palmer Long Term Ecological Research (LTER) project is focused on one major ecological issue: To what extent does the advance and retreat of sea ice each year physically determine spatial and temporal changes in the structure and function of the antarctic marine ecosystem?

Evidence shows this dynamic variability of sea ice to have an important (perhaps determinant) impact on all levels of the food web, from total annual primary production to breeding success in top predators. For example, variability in sea ice may affect prey and predators directly by controlling access to open water or preferred habitats. That variability may affect prey and predators indirectly as changes in the sea ice cover affect other species that serve as food. Four hypotheses drive current Palmer LTER research:

- The timing and magnitude of seasonal primary production,
- The dynamics of the microbial loop and particle sedimentation,
- Krill abundance, distribution and recruitment,
- Survivorship and reproductive success of top predator

These factors probably differ for key species since the magnitude and timing of sea ice changes can have specific local impacts. What remains unclear are the implications for the whole antarctic ecosystem. As one of the basic examples, greater sea ice areal coverage promotes more available krill which enhances the survivorship and reproductive success of Adelie penguins.

General objectives of the Palmer LTER project are:

- Document the interannual variability of annual sea ice and the corresponding physics, chemistry, optics, and primary production within the study area,
- Document the life history parameters of secondary producers and top predators,
- Quantify the processes that cause variation in physical forcing and the subsequent biological response among the representative trophic levels,
- Construct models that will link ecosystem processes to environmental variables and which will also simulate spatial/temporal ecosystem relationships,
- Employ those models to predict and validate ice/ecosystem dynamics.

A key challenge for the Palmer LTER project is to characterize and understand the many cross-linkages that have developed in the antarctic ecosystem. Environmental phenomena vary over time and across areas, having both physical and biological consequences. These changes in turn can develop other loops and linkages that influence each other.

Principal Investigator	Institution	Event Number	Component
Hugh Ducklow	College of William and Mary	B-045-L/P	Project Manager
William R. Fraser	Polar Oceans Research Group	B-013-L/P	Seabird
Douglas G. Martinson	Lamont-Doherty Earth Observatory	B-021-L	Modeling
Robin Ross	University of California Santa Barbara	B-028-L/P	Zooplankton
Raymond Smith	University of California Santa Barbara	B-032-L/P	Bio-optical
Maria Vernet	Scripps Institution of Oceanography	B-016-L/P	Phytoplankton ecology

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2003-2004 USAP Field Season

McMurdo Dry Valleys LTER: The role of natural legacy on ecosystem structure and function in a polar desert

Project Manager:

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List of 2003-2004 McMurdo LTER projects

The largest ice-free area in Antarctica can be found in the McMurdo Dry Valleys on the western shore of McMurdo Sound. Among the most extreme deserts in the world, the Dry Valleys are the coldest and driest of all LTER sites. Consequently, the biological systems are limited to microbial populations, microinvertebrates, mosses, and lichens. Yet complex trophic interactions and biogeochemical nutrient cycles develop in the lakes, streams, and soils of the Dry Valleys. In the austral summer, solar energy produces glacial melt water, providing vital water and nutrients that are a primary influence on the ecosystems. Such material transport and climatic influences shape all ecosystems, but nowhere is this more apparent than in the McMurdo Dry Valleys.

In 1993, this region was selected as a study site for the National Science Foundation's Long Term Ecological Research (LTER) program. During the first six years, investigators studied the perennially ice-covered lakes, ephemeral streams, and extensive areas of soils to assess the role of physical constraints on the structure and function of the ecosystem. Clearly, the production of liquid water in both terrestrial and aquatic portions or this environment is a primary driver in ecosystem dynamics. Thus, the role of present-day climate variation is extremely important. However, one of the most significant discoveries was that past climatic legacies strongly overprint the present ecological conditions in the McMurdo Dry Valleys.

The McMurdo LTER project focuses on the aquatic and terrestrial ecosystems in the Dry Valleys landscape as a context to study biological processes and to explore material transport and migration. During the second phase of this LTER project, the LTER researchers will continue to investigate the McMurdo Dry Valleys as an "end-member" system, hoping to better ascertain the role of the past climatic legacies on ecosystem structure and function. They will test a series of eight hypotheses in three major focus areas -- hydrology, biological activity/diversity and biogeochemical processes.

Understanding the structure and function of the McMurdo Dry Valleys ecosystem requires understanding hydrological response to climate -- both now and in the past. Current patterns of biological activity and diversity reflect both past and present distributions of water, nutrients, organic carbon, and biota. Biogeochemical processes responsible for the transport, immobilization, and mineralization of nutrients and other chemicals provide the linkages between the region's biota and the physical environment. The timing, duration, and location of biogeochemical processes in the past and present are controlled by water availability. The LTER researchers continue to focus on the integration of the biological processes within and among the lakes, streams, and terrestrial ecosystems that comprise the McMurdo Dry Valleys landscape. The interdisciplinary research team will continue to use modeling and other integrative studies to synthesize data and to examine the McMurdo Dry Valleys ecosystem.

Principal Investigator	Institution	Event Number	Component
Peter T. Doran	University of Illinois, Chicago	B-426	Paleoclimatology, paleoecology, meteorology
Andrew G. Fountain	Portland State University	B-425	Glacier mass balance, melt and energy balance
W. Berry Lyons	Ohio State University	B-420	Chemistry of streams, lakes, and glaciers
Diane M. McKnight	University of Colorado Boulder	B-421	Flow, sediment transport, and productivity of streams
John C. Priscu	Montana State University Bozeman	B-422	Lake pelagic and benthic productivity and microbial food webs
Ross A. Virginia	Dartmouth College	B-423	Soil productivity
Diana H. Wall	Colorado State University	B-424	Soil productivity

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2003-2004 USAP Field Season

Study of consequences of a January 2003 hydrocarbon spill on the ice cover of Lake Fryxell, McMurdo Dry Valleys

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Principal Investigators:

Fabien Kenig and Peter Doran
University of llinois, Chicago — NSF/OPP 03–46316

John Priscu and Edward Adams
Montana State niversity, Bozeman — NSF/OPP 03–46272

W. Berry Lyons and Anne Carey
Ohio State University — NSF/OPP 03–47219

Taylor Valley in the McMurdo Dry Valleys of East Antarctica is the site of a Long-Term Ecological Research (LTER) project. The pristine Taylor Valley has three major closed-basin, perennially ice-covered lakes (Hoare, Fryxell and Bonney). On 17 January 2003, a Bell 212 helicopter crashed on the 5-meter-thick ice cover of Lake Fryxell, spilling about 730 liters of diesel fuel, as well as small amounts of synthetic lubricants and hydraulic fluids. Although cleanup efforts by personnel based at McMurdo Station began within four days of the crash, at least half of the spilled fluids could not be recovered because of the condition of the ice and the unavoidable close of the field season in early February, which precluded further access to the site. These fluids will remain trapped in the ice until the spring melt season starts in December 2003. The site will become accessible in November 2003, when ice cores and water samples can be collected for detailed analyses. .

This coordinated research effort is aimed at documenting the fate and transport of hydrocarbons within the ice and water of the lake. Our goals are to understand the physical, chemical, and biological changes that have occurred since the spill and what, if any, its longer-term impact will be. The results of our research will also provide important information to help improve accident response policies in the Dry Valleys.

Components:

Fabien Kenig and Peter Doran
University of Ilinois, Chicago

NSF/OPP 03–46316

Study of natural attenuation of contaminants derived from a January 2003 helicopter fluids spill at Lake Fryxell (McMurdo Dry Valleys), a Long-Term Ecological Research site

In this component of the project, we will document the natural attenuation of helicopter fluids in the lake ice. We have two major objectives:

- Assess the level of disturbance in the lake ecosystem by evaluating the changes in the lipid constituents of Lake Fryxell ice caused by this crash. Over a 2-year period, we will compare lipids analyzed in preaccident lake water and surface sediments with the contaminant (jet fuel, lubrication oil, and transmission fluids), as well as postaccident ice-cover samples, lake water samples, and surface sediments.
  Quantify and evaluate the level of natural attenuation (evaporation and biodegradation) of the composition of spilled fluids in the ice cover of the frozen lake. Graduate students will participate in this research.

- Quantify and evaluate the level of natural attenuation (evaporation and biodegradation) of the composition of spilled fluids in the ice cover of the frozen lake. Graduate students will participate in this research.

John Priscu and Edward Adams
Montana State niversity, Bozeman

NSF/OPP 03–46272

Physical and biological consequences of a hydrocarbon spill on the ice cover of Lake Fryxell

In this component of the project, we will conduct a variety of physical and biological experiments to determine the fate of hydrocarbons within the ice and their influence on biological activity and diversity. Undergraduate, graduate, and postdoctoral students will participate in this research.

W. Berry Lyons and Anne Carey
Ohio State University

NSF/OPP 03–47219

Field sampling coordination and mathematical modeling of a hydrocarbon

spill on the ice cover of Lake Fryxell

In this component of the project, we will coordinate the field sampling in the 2003–2004 season, integrate the data, and develop a mathematical model to better predict hydrocarbon movement within the ice cover of the lake.

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