

PALMER STATION MONTHLY SCIENCE REPORT December 2005



The M/V National Geographic Endeavour at Gamage Point

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NEWS FROM THE LAB

Langdon Quetin, Station Science Leader

This month saw an increase in science and tourist activity. On December 1 the *Laurence M. Gould* docked at Palmer with fuel, “freshies” and fresh faces. In less than 7 hours the *Laurence M. Gould* pulled away from the Palmer Station dock and departed Arthur Harbor in the early morning. The enthusiastic group of scientists aboard lead by Dr. Ken Smith, Chief Scientist, aimed to quantitatively establish the influence of free-drifting ice bergs on the pelagic environment and communities of the Weddell Sea. December 22 the group returned and shared some of their results with people on station before departing December 23.

Early in the month we added 2 science personnel to the station population and one joined the cruise to the Weddell Sea. Late in the month 2 additional science personnel departed on the *Laurence M. Gould*, reducing the Palmer Station science population to 18 distributed among 7 projects. The Palmer Research Associate continues to oversee 13 research projects.

Due to ice conditions this month we had fewer visits by tour ships than the four planned. The *Endeavor* visited December 5 and the *Corinthian II* visited later in the month, December 29. The station and USAP were well represented by Bob Farrell (Station Manager), Cara Sucher (Lab Manager) and enthusiastic tour guides.

This season, as in 2004, our boating was limited by annual pack ice. For a period of 12 days, from December 13 to 24, due to a brief period when strong winds pushed ice into the area followed by a long period of calm, we were station bound except for brief and restricted excursions. However, since December 25 the area near Palmer Station has been relatively ice-

free. Boating and science activities are in full swing. Another occurrence of note was a very dense phytoplankton bloom of cryptomonads and dinoflagellates that developed late this month from approximately December 16 to 30. The project reports below provide more detailed accounts of these events and their impact on research activities.

The following projects conducted research at Palmer Station during November:

B-003-P

Response of Terrestrial Ecosystems Along the Antarctic Peninsula to a Changing Climate

Thomas A. Day and Christopher T. Ruhland, Co-Principal Investigators, Arizona State University and Minnesota State University, respectively

Personnel on station: Sarah Strauss, Matt Krna and Caroline DeVan

After much preparation, we began our climate manipulation treatments in plots behind Palmer Station on December 6. The plots contain tundra microcosms or cores that we collected from an adjacent island; each microcosm consists of an intact core of terrestrial plants and associated soil. We are manipulating temperature (IR heaters) and precipitation (supplemental precipitation) regimes in the plots to mimic future climate change along the Peninsula. Specifically, we are examining how these changes affect microcosm productivity, carbon balance and nutrient cycling.

We also set up dataloggers to monitor the microclimate in our plots, including air and soil temperatures and wind speed and direction. Weekly measurements of CO₂ flux from the cores continued through the month, providing us estimates of net microcosm CO₂ exchange and respiration. In conjunction with these measurements we are also monitoring evapotranspiration or water loss from microcosms. We are collecting precipitation inputs and soil leachate outputs from microcosms on a weekly basis, and will analyze these for nutrient concentrations. Persistent brash ice around station prevented the final collection of litter for litter bags until the end of the month. However, the ice moved out on December 25, and the last of the necessary litter was collected. Litter bags were placed in microcosms on December 28 to allow us to assess decomposition.

We are also monitoring growth of the two higher plant species in our microcosms, *Deschampsia antarctica* and *Colobanthus quitensis*. We completed two growth censuses this month and will continue this on a biweekly basis. This will allow us to determine leaf, shoot and flower production rates.

Litter bags, anion/cation resin bags and mineralization bags were placed along transects at several recently deglaciated areas along the coast of Anvers Island. These bags will allow us to assess nutrient cycling in the soils of these recently deglaciated areas.

We thank personnel at Palmer Station for their support assistance during the month. Special thanks to Zee Evans, Ryan Wallace and Don Paterson for assistance in preparing the climate manipulation plots in the backyard, Ryan Wallace and Paul Smotherman for assistance in the field, and Curt Smith and Sarah Kaye for assistance in resolving computer issues.

B-013-P**Palmer, Antarctica Long-Term Ecological Research Project: Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment: Seabird Component**

and

B-198-P**Monitoring the Effects of Tourism and Environmental Variability on Adelie Penguins at Palmer Station**

William R. Fraser, Principal Investigator, Polar Oceans Research Group, Sheridan, MT.

Personnel on station: Kristen Gorman, Brett Pickering, Jennifer Blum, Fen Montaigne, Peter Horne

Sea ice continued to be a presence in the Palmer area through December. While the beginning of the month provided mostly open water, the ice moved back into the area on the 14th, limiting our access to local islands for several days. Despite heavy ice, we were able to continue our reproductive study of Adelie penguins and document a large number of true hatch dates for birds in our study sites on Torgersen and Humble islands. We also continued to monitor adults, active nests, depredated eggs, and snow levels on Torgersen, Humble, Litchfield, Cormorant, and Christine islands. We continued to monitor tourist activity on Torgersen Island and broadened the tourist impact study to include Adelie heart rate monitors. We deployed fake eggs with heart rate monitors in four Adelie nests on the tourist side of Torgersen. We also began diet sampling on Torgersen this month. Ice and weather conditions allowed for two visits to Dream Island to count Adelie and chinstrap penguins and to continue monitoring our snow fence experiment. We also made a trip to Biscoe to count Adelies and gentoos.

In addition to our penguin work, we continued monitoring other sea-birds in the area. Our study of south polar skuas on Shortcut Island began in early December as pairs began arriving and setting up territories. We continued monitoring all Brown skua nests in the Palmer area and documented hatch dates for several pairs late in the month. Our giant petrel work began early in the month with the deployment of satellite transmitters. The petrel work continued throughout December as we began our survey of all nesting pairs in the area. We also monitored blue-eyed shags and counted all kelp gull nests in the area. We continued marine mammal observations throughout the month.

Time on station allowed for sorting Adelie diet samples as well as blue-eyed shag diet samples from 04/05. Thanks to the FEMC crew for maintaining our telemetry hut on Humble Island. Also thanks to Bob Farrell and Toby Koffman for their field support.

B-016/032-P**Palmer, Antarctica Long-Term Ecological Research Project: Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment: Phytoplankton Ecology and Bio-Optics, Remote Sensing, Sea-Ice Components**

Maria Vernet, Principal Investigator, B-016-P, Scripps Institution of Oceanography

Raymond Smith, Principal Investigator, B-032-P, University of California, Santa Barbara

Personnel on station: Karie Sines (016), Julie Shcramm (016), Austen Thomas (032) and Boreth Eam (032)

Sampling of Palmer stations E & B occurred ten times during the month of December. Inshore station E was sampled 05, 08, 25, 27 and 30 December and station B 03, 05, 08, 13, 23, 27 and 31 December. Ice in the Palmer vicinity prevented collection at these stations from 13-25 December. During this period samples were collected from the seawater intake pump on station (02, 16 and 20 December). Experimental work conducted included three Dissolved Organic Carbon (DOC) experiments (06 December from station B, 21 December from the seawater intake pump and 28 December from station B) and two transects from Hero Inlet around to Arthur Harbor (21 and 23 December). The 21 December transect included eight CTD (Conductivity Temperature and Depth) casts, surface chlorophyll sampling, four stations with water collection at three depths and two net tows while 23 December consisted of CTDs only.

Ice in the area 13-25 December is thought to have contributed to a phytoplankton bloom in the area. Preliminary microscopy and HPLC (High Performance Liquid Chromatography) results suggest that this bloom may have been dominated by cryptomonads and dinoflagellates. During this time integrated chlorophyll levels measured 272 $\mu\text{g}/\text{m}^2$ at station B and 237 $\mu\text{g}/\text{m}^2$ at station E. Integrated Chlorophyll levels early in the month measured 78 $\mu\text{g}/\text{m}^2$ and 58 $\mu\text{g}/\text{m}^2$ for stations B & E respectively. Production at stations B & E during this period were measured at 1898 mgC/m^2 and 1692 mgC/m^2 , up from 211 mgC/m^2 at station B and 225 mgC/m^2 at station E at the beginning of the month.

B-016 and B-032 would like to thank carpenter Ted McKinley for all his help in cruise preparation and Sammy Merriman for his diligence with the seawater system. We would also like to thank boating coordinator Toby Koffman for zodiac maintenance. Thanks also to the whole of station for making it a wonderful place to spend the holidays!

B-028-P

Palmer, Antarctica Long-Term Ecological Research Project: Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment: Prey Component

Robin Ross and Langdon Quetin, Principal Investigators, Marine Science Institute, University of California at Santa Barbara

Personnel on station: Langdon Quetin, David Huang and Joshua Sprague
Joshua Sprague arrived December 1 aboard the Laurence M. Gould. David Huang departed on the Laurence M. Gould December 23.

We did 4 dives this month, two when the pack ice was in Hero Inlet. On no dives did we find krill juveniles below the pack ice as would be characteristic of their winter and early spring behavior. On one dive we replenished the tourist tanks with fresh invertebrates. The diving part of our program shut down at the end of the month since L. Quetin, one of the divers, will be departing the station for the LTER cruise in January/February.

Pack ice conditions from December 13-24 made it impossible for us to search for krill acoustically or tow nets. Our acoustic records indicate that krill arrived in the vicinity of Palmer Station early in the month and were increasingly abundant until the ice moved into the area and our sampling was restricted. Later in the month, Dec 16, a phytoplankton bloom of cryptomonads and dinoflagellates developed and lasted to the end of December. We have yet to find krill in the water column since we began boating again, December 25.

Of the krill collected early in the month, a few were young-of-year but most larger, 45-55 mm total length, indicative of an older population and poor recruitment the past several seasons. We continue to measure catches for length frequency, record mature females and make length and wet and dry weight measurements.

We also did a short experiment to determine the time course of Chl a and DMSP disappearance in starved krill that were well fed initially. This work is being done in collaboration with B-048-P and will be repeated as time permits.

Since this is the last SitRep of L. Quetin from Palmer for this season, I would like to thank everyone on behalf of our project. In addition to making the station a great place to work and live you are an integral part of our projects success. All the best for the rest of the season, and I hope to see you all next year. Thank you.

B-045-P

Palmer, Antarctica Long-Term Ecological Research Project: Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment: Microbial/Biogeochemistry Component

Hugh Ducklow, Principal Investigator, School of Marine Science, The College of William and Mary

Personnel on station: Nicole Middaugh and Bess Koffman

During the month of December, we continued to sample at stations B and E in the Palmer Station vicinity whenever possible. We have had to be very flexible this month, as high winds and sea ice have hampered our routine sampling schedule. Early in the month we were able to sample stations B and E. However, mid month the sea ice drifted back in and prevented sampling for about two weeks. In the meantime, we sampled from our beloved Sea Water Intake in order to maintain consistent data collection. Luckily, on Christmas day the ice cleared out and allowed us to sample station E again – a great Christmas present!

During December, we also continued with our weekly large volume seawater filtrations for organic biomarkers. They were visually consistent with previous years, showing a light brown and yellow coloring on the filter, with the exception of a bright red and extremely low volume sample taken on December 22. This sample was indicative of a dinoflagellate and cryptomonad bloom, which has subsided. We also continued to capture and freeze for later analysis DNA

using our peristaltic pump capturing system. In between sampling, December has been filled with preparations for the January 2006 LTER cruise.

We would like to thank all RPSC personnel on station for their support this month, especially Sue Novak and Marge Bolton for their delicious holiday meals and treats.

B-048-P

Complex Molecular to Global Interactions and Feedbacks in the Marine DMS cycle

Patricia A. Matrai, Principal Investigator, Bigelow Laboratory for Ocean Sciences
Co-PIs: J Dacey (Woods Hole Oceanogr, MA), G DiTullio (U. Charleston, SC), D Erickson (Oak Ridge Nat. Lab., TN), A Gabric (U. Griffith, Brisbane, Australia), W Gregg (NASA Goddard, MD), R Kiene (U South Alabama, AL), D Kieber (SUNY Syracuse, NY), R Najjar (Penn State), R Simó (Institut de Ciències del Mar, Barcelona, Spain),

Personnel on station: Patricia Matrai, Kerry McElroy, George Westby, John Dacey

December consisted of much waiting for the ice to leave. When Christmas came we had been watching for the ice to free Station E for 20 days. Meantime we have been sampling Station B and the seawater intake system on days that we could not make it out at all. While the ice was in the phytoplankton bloomed. The water has turned from the clear beautiful water we first witnessed to a mucky rust color. The DMS concentration in surface water went from 0.2 nM to 20 nM. This should change as the water undergoes mixing. We are sampling based on the light transmittance through the water column and the amount of growth has taken our sampling depth of the 0.5 % light transmittance from 70 m to as low as 11m. Exciting stuff!

John Dacey was here long enough to help us get through our backlog of samples prior to departing on the Laurence M. Gould at the end of the month. He unfortunately only made it out to Station B once and never made it out to E. But he had a great time and was a lot of help. The ice left soon after the ship departed, and this allowed us to finally make it out to Station B. We last sampled at Station B 10 days earlier. Since Christmas we have sampled many times out at Station B and E. We are back in the mode of processing and running samples but and are anxiously awaiting our large January team of Ron Kiene, Ray Najjar and Maria Vila.

Projects maintained by the Palmer Station Research Associate

G-052-P

GPS Continuously Operating Reference Station

Jerry Mullins, Principal Investigator, U.S. Geological Survey

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, 15-second epoch interval GPS data files were collected continually at station PALM, compressed, and transmitted to the NASA/CDDIS in Greenbelt, MD.

Toward the end of the month, a second instance of the Geodetic Base Station Software (GBSS) was started and the GPS receiver settings were adjusted to generate 1-second epoch interval files. These files will be used to support a cruise from January 11, 2006 to February 10, 2006. The cruise will be collecting GPS data through the Drake Passage (Polarstern ANT XXII/3) while performing a survey along the Jason track in order to provide independent sea level data. This project is associated with a scientific observation campaign of the Antarctic Circumpolar Current.

G-090-P

Global Seismograph Network (GSN) Site at Palmer Station

Rhett Butler, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

The Research Associate operates and maintains on-site equipment for the project. Station PMSA is one of more than 130 sites in the GSN monitoring seismic waves produced by events worldwide. Data files are recorded to tape and also sent real-time to the U.S. Geological Survey (USGS).

The computer terminal for the system malfunctioned and had to be replaced. The replacement terminal was different from the original terminal in several respects. A cable adapter had to be installed and several items had to be programmed into the new terminal to make it operate satisfactorily with the system. The terminal that was removed from service has severe electronic problems and will have to be returned to the grantee for repair or replacement.

O-202-P

Antarctic Meteorological Research Center (AMRC) Satellite Data Ingestor

Charles Stearns, Principal Investigator, University of Wisconsin

The Research Associate operates and maintains on-site equipment for the project. The AMRC SDI computer processes satellite telemetry received by the Palmer Station TeraScan system, extracting Automated Weather Station information and low-resolution infrared imagery and sending the results to AMRC headquarters in Madison, WI.

The system ran the entire month without incident.

O-204-P

A Study of Atmospheric Oxygen Variability in relation to annual to Decadal Variations in Terrestrial and Marine Ecosystems

Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

The station physician collects air samples on a semiweekly basis.

The goal of this project is to resolve seasonal and inter-annual variations in atmospheric O₂ (detected through changes in O₂/N₂ ratio), which can aid in determining rates of marine biological productivity and ocean mixing. The results are also used to help determine the terrestrial and oceanic distribution of the global anthropogenic CO₂ sink. The program involves air sampling at a network of sites in both the Northern and Southern Hemispheres. Palmer

Station is especially well situated for resolving signals of carbon cycling in the Southern Ocean. Samples taken from the station are sent to Scripps where the analysis of O₂ and CO₂ content takes place.

This experiment was scheduled to be moved to the new Terra Lab building. The grantee has expressed concerns about how such a move will affect the validity of his data. He is in the process of applying for funding to install a second collection station in the Terra Lab. The two stations would then operate in parallel for a period of time to validate the new installation. When that validation is completed, the old equipment would then be removed from service.

O-264-P

Collection of Atmospheric Air for the NOAA\CMDL Worldwide Flask Sampling Network
David Hofmann, Principal Investigator, Climate Monitoring and Diagnostics Laboratory,
National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) Climate Monitoring and Diagnostics Laboratory continues its long-term measurements of carbon dioxide and other climate-relevant atmospheric gases. The Palmer Station air samples are returned to the NOAA laboratory for analysis as part of NOAA's effort to determine and assess the long-term buildup of global pollutants in the atmosphere. Data from this experiment will be used in modeling studies to determine how the rate of change of these parameters affects climate. The station physician collects air samples on a weekly basis.

O-283-P

Antarctic Automatic Weather Stations (AWS)
Charles Stearns, Principal Investigator, University of Wisconsin

The Research Associate monitors data transmissions for the project. AWS transmissions from Bonaparte Point, Hugo Island, and Racer Rock were monitored using the TeraScan system, with only Bonaparte Point currently operational. AWS data received was also forwarded to UCSB for B-032-P (Smith).

A-306-P

Global Thunderstorm Activity and Its Effects on the Radiation Belts and the Lower Ionosphere
Umran Inan, Principal Investigator, Stanford University

The Research Associate operates and maintains on-site equipment for the project. The Stanford equipment receives and records Very Low Frequency (VLF) radio waves in order to study natural ionospheric and magnetospheric phenomena, as well as to study the distribution of the lightning strikes that are a principle source of natural VLF signals. Broadband synoptic data was recorded on a schedule of three out of every 15 minutes each day, and broadband continuous data was recorded for at least nine hours per day. Narrowband continuous data was collected for 12 hours each day.

Additional data recordings were collected this month in support Terrestrial Gamma-ray Flash (TGF) events.

The posts supporting the signal cable and the antenna installation were inspected twice during the month to assess the impact of the snow and ice melting. Pictures were taken and transmitted to Stanford. The system remains stable at this time.

The signal cable support posts for the previous installation are being pulled from the ice as thawing occurs. These posts will be transported off of the glacier.

The VLF_NB computer has encountered problems in transmitting data back to Stanford during the holiday period. The machine has been rebooted twice and now appears to be operating normally; however, the data transmissions remain erratic.

T-312-P

TeraScan Satellite Imaging System

Dan Lubin, Principal Investigator, Scripps Institution of Oceanography

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, the TeraScan system collected, archived, and processed DMSP, NOAA, and ORBVIEW-2 satellite telemetry, capturing approximately 25-30 passes per day. A weekly 85GHz SSM/I ice concentration image was produced and transferred to UCSB for B-032-P (Smith).

Multiple ice concentration images were provided to the LTER group for cruise planning. MODIS image requests were adjusted to obtain images suitable for LTER cruise support.

TeraScan was set up to generate two new images for the AMLR cruise which will occur in the same time frame as the LTER cruise. Preliminary images were provided to the scientists for their approval.

Both MODIS images from NASA and TeraScan images were provided on a daily basis to support LMG05-14A until December 23.

A-357-P

Extending the South American Meridional B-Field Array (SAMBA) to Auroral Latitudes in Antarctica

Eftyhia Zesta, Principal Investigator, University of California Los Angeles

The three-axis fluxgate magnetometer is one in a chain of longitudinal, ground-based magnetometers extending down through South America and into Antarctica. The primary scientific goals are the study of ULF (Ultra Low Frequency) waves and the remote sensing of mass density in the inner magnetosphere during geomagnetically active periods. Palmer's magnetometer is also a conjugate to the Canadian Poste de la Baleine station, allowing the study of conjugate differences in geomagnetic substorms and general auroral activity. The station Research Associate maintains the on-site system.

Late in the month, a problem arose with the Z-axis data channel. The channel will spontaneously go dead and then come back to life at erratic time intervals. The detector and data cable have been examined, but no damage was noted. Rebooting the system appeared to fix the problem, but the erratic behavior returned in less than a day. The problem is still under investigation.

B-390-P

Thermo-Salinograph

Vernon Asper, Principal Investigator, University of Southern Mississippi

Sea water is pumped continuously through a TSG sampling system, recording the temperature, conductivity, salinity, and fluorescence. The real-time data, including graphs and web camera images of the ocean in the vicinity of Palmer Station, are compiled by a local server into web page format and relayed to a mirror site at Woods Hole Oceanographic Institute, which is a collaborator in the project. The URL for the WHOI mirror site is <http://4dgeo.whoi.edu/tsg/>.

The system ran the entire month without incident.

T-513-P

Ultraviolet Spectroradiometer Network

Charles Booth, Principal Investigator, Biospherical Instruments, Inc.

The Research Associate operates and maintains on-site equipment for the project. A BSI SUV-100 UV spectroradiometer produces full sky irradiance spectra ranging from the atmospheric UV cutoff near 290nm up to 605nm, four times per hour, while the sun is above the horizon. A BSI GUV-511 filter radiometer, which has four channels in the UV and one channel in the visible for measuring Photosynthetically Active Radiation (PAR), is located next to the SUV-100. Data from the GUV-511 instrument is made available on a daily basis on the project's website at <http://www.biospherical.com/nsf>.

One single lamp absolute calibration scan and one triple lamp absolute calibration scan were completed. The system was essentially problem free during the month.

T-988-P

IMS Radionuclide Monitoring

Erik Swanberg, Principal Investigator, General Dynamics

The International Monitoring System (IMS) radionuclide sampler is part of the Comprehensive Test Ban Treaty (CTBT) verification regime. The automated Radionuclide Aerosol Sampler and Analyzer (RASA) unit pumps air continuously through a filter for 24 hour periods, collecting particulates in the .2-10 micron range. The filter is then tested for particulates with radioisotope signatures indicative of a nuclear weapons test. The station Research Associate operates and maintains the instrument.

RASA completed its seven day background count and was rethreaded and put online. Remote testing revealed that the system was operating with a Full Width at Half Maximum (FWHM)

parameter of 2.98. The value of this parameter needs to be below 2.5 and preferably in the 2.00 to 2.20 range. Items that affect this parameter are ground loops, shielding configuration, and vibration.

The RASA system was checked for anything that could cause ground loops. Nothing was found. The lead shielding was then removed, examined, and carefully replaced to meet all system requirements. Finally, the system was tested with the fan running and with it off. The value of was greatly improve when counting with the fan off. Therefore, detector vibration was determined to be the problem. Equipment in the cabinet was rearranged and remounted in an effort to reduce the vibration being coupled from the cabinet to the detector. The last local test found FWHM to be 2.10 at 20,000 total counts. This value has not yet been verified by remote testing.

Tide Gage

The Research Associate operates and maintains on-site equipment for the project. Tide height, seawater temperature, and salinity are monitored on a continual basis by a gage mounted at the Palmer Station pier.

The system ran the entire month without incident.

Meteorology

The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. At the end of the month a summary report is prepared and sent to interested parties. Weather data collected using the automated electronic system is archived locally and forwarded twice each month to the University of Wisconsin for archiving and further distribution. Synoptic reports are automatically generated every six hours by the Palmer Meteorological Observing System (PalMOS) and emailed to the NOAA for entry into the Global Telecommunications System (GTS). Current weather observations for all Antarctic stations, including Palmer, are available on the web at: <http://www.wunderground.com/global/AA.html>.

The PalMOS system was inspected and cleaned twice during December and regenerated desiccant packets were installed. A recently calibrated barometric sensor was installed so that the operating sensor could be sent back for calibration. However, the new sensor would not communicate on its serial link. The original sensor had to be put back into service.

Historical weather data was provided to the Antarctic Sun for a special weather extremes article.