

PALMER STATION MONTHLY SCIENCE REPORT
July 2008



*Moon setting over Torgersen Island.
Photo courtesy of Christopher Seliga.*

NEWS FROM THE LAB

Christopher Seliga, Winter Assistant Supervisor Laboratory Operations

The beginning of July brought the *Laurence M. Gould* back to Palmer after it assisted G-183-L (Ishman) in collecting sediment samples from the northern Gerlache Strait to the southern Bransfield Strait region, as it did in April. Dr. Ishman would like to compare the sediment samples from the fall and winter seasons to see if there are any differences in the benthic foraminifera.

On station, personnel celebrated the 4th of July with a good old-fashion BBQ and were very busy getting ready for two new research groups, B-005-P (DeVries) and B-229-P (Murray), which arrived during the middle of the month. The *Laurence M. Gould* helped B-005-P conduct four fishing cruises before it headed north to Punta Arenas, Chile. Some personnel on station got a chance to get out and help on these various fishing cruises, which they enjoyed immensely. There were also chances for people to get off station and help B-229-P collect water samples from various stations around the Palmer boating area.

JULY WEATHER

Payot Scheibe, Research Associate

July temperatures were warm for this time of year, but stayed mostly below 0°C except for a storm near the end of the month which produced the high temperature of +4.9°C. The minimum temperature this month was -10.6°C. The average temperature of -3.9°C is slightly higher than the 15-year average for July (-5.4°C).

Normally July is our snowiest month, but precipitation was quite low for the month and remains low for the year. The snowfall amount was only 6 cm for July compared with 47 cm average. The snowfall this month is the lowest for July on the books, with the next lowest snowfall coming in July 1993 (17 cm). We have accumulated only 147 cm of snow so far for the year compared with the average of 202 cm. The snowstake depth stayed around 31 cm for most of the month. Melted precipitation for July measured only 23.4 mm compared to the July average of 52.7 mm, and only 389.5 mm for the year compared to the average of 449 mm.

The average sea surface temperature for the month was -1.4°C. Sea ice has been forming during most of the month, although it has broken near month's end due to windy conditions. Early southwesterly winds brought a number of impressively large bergs to the area.

The following projects conducted research at Palmer Station during July:

B-005-P: ENVIRONMENTAL, ORGANISMAL AND EVOLUTIONARY PHYSIOLOGY OF FREEZE AVOIDANCE IN ANTARCTIC NOTOTHENOID FISHES

A.L. DeVries, Principal Investigator, Dept. of Animal Biology, University of Illinois, Urbana-Champaign

Personnel on Station: A. DeVries, Chris Cheng, Paul Cizko, Grace Tiao and Kevin Bilyk

Our field season began on 17th of July with a Palmer Station orientation. The following day we departed Palmer to trawl for fish at Dallman Bay. Fishing was poor to average but we obtained sufficient specimens to begin experiments on freezing avoidance in the laboratory. Species caught included two common icefishes and one bathydraconid. Following our return to Palmer, two (Tiao, Bilyk) stayed behind to begin measurements on samples from the Dallman Bay specimens, while the other three (DeVries, Cheng, Cziko) went on the *Laurence M. Gould* to fish in the Palmer Deep where we obtained specimens of *L. squamifrons*, *G. gibberifrons* and three separate species of eel pouts.

One of the eel pouts, *Lycodapus antarcticus* had no blood antifreeze while the two other species had only small amounts of blood antifreeze. This finding is in contrast to the eel pouts of McMurdo Sound which possess high serum concentrations of antifreeze protein. The absence of antifreeze in *Lycodapus* is in accord with the fact that this genus is primarily a temperate water

genus and has most likely managed to invade the Antarctic shelf waters because of the intrusion of the relatively warm (+1°C) Circumpolar Deep water. After setting up the laboratory at Palmer we have begun analyses of the blood serum from the various species correlating the amount of blood antifreeze with the severity of their environment as well as determining the effect of warm acclimation upon blood levels of antifreeze of the various species. We have also begun the process of BAC library construction of the basal notothenioid species *E. maclovinus* acquired in Punta Arenas prior to LMG08-09 departure for comparative genomics studies on evolution of the AFGP gene locus throughout the Notothenioidei.

B-229-P: BACTERIOPLANKTON GENOMIC ADAPTATIONS TO ANTARCTIC WINTER

Alison Murray, Principal Investigator, Desert Research Institute, Reno, Nevada

Hugh Ducklow, Principal Investigator, The Ecosystems Center, MBL, Woods Hole, MA

Personnel on Station: Alison Murray, Hugh Ducklow, Matthew Erickson, Jean-Francois Ghiglione, Kristen Myers and Vivian Peng

Marine bacterioplankton are responsible for decomposing organic matter and recycling nutrients. About half of all the organic matter produced by photosynthesis in the sea is processed by bacteria in the upper 100 meters. Despite decades of field work however, we still have little idea of the phylogenetic groups responsible for biogeochemical transformations in nearshore Antarctic surface waters. We know even less about the organisms active in Winter and the strategies they have adopted for the low carbon, low light, time of year when sea ice dominates the landscape. Now, through microbial community DNA sequencing we are beginning to understand community structure and function. The objectives of our project are: (1) to describe the differences in diversity and genomic content between austral winter and summer bacterioplankton communities, and (2) to investigate the wintertime bacterioplankton growth and cellular signals (mRNA and proteins expressed) in order to understand the specific adaptations key to survival.

Great weather and outstanding support got us off to a quick start after a smooth Crossing and arrival at Palmer Station on July 17. Our principal field activity has been collection of large-volume (400-1000 liters) surface seawater samples for ecological and genomic analyses and setting up 8-12 day seawater experiments. The large water samples are concentrated by tangential flow filtration to collect microbial biomass for nucleic acid and protein studies.

We have completed one experimental mesocosm and are in the middle of a second experiment in which seawater is kept in the environmental rooms and subjected to different treatments. Multiple 50-liter carboys are monitored over ca 10 days to determine the factors influencing bacterial recovery and growth during the winter-to-spring seasonal transition in Antarctic marine waters. In our first experiment, we tested the response of the bacterioplankton community to different organic matter sources of increasing chemical complexity. Subsequent experiments will examine effects of light, temperature, phytoplankton blooms and other factors. During the course of these experiments samples are collected for subsequent analysis of microbial DNA and RNA, from which the species composition of the community of organisms is reconstructed.

We thank all RPSC personnel on Station for supporting our research. In this report we especially thank Boating Coordinator Lily Glass for getting us right out on the water, and the Palmer Sky-Trak crew of Webster Coates, Katherine Moloney and Jordan Murphy for picking our sample carboys out of the Zodiac and delivering them to our doorstep. Likewise, the lab staff (Chris Seliga and Amber Bates) helped make the move in a ramping up of our field season start without a hitch. Thanks everybody!

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G-295-P GPS CONTINUOUSLY OPERATING REFERENCE STATION.

Bjorn Johns, Principal Investigator, UNAVCO

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-JPL in Pasadena, CA.

The project operated normally for the month.

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 143 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 terminal screen was blank one day, requiring reboot of the system. On the final day of the month there was a loss of power that automatically rebooted the system.

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 weather station collected data without trouble during the month.

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 goal of this project is to resolve seasonal and interannual 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.

Samples were taken on both the new and old systems every two weeks for intercomparison purposes.

O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD WORLDWIDE FLASK SAMPLING NETWORK

Dr. David Hofmann (Principle Investigator), National Oceanic and Atmospheric Administration / Global Monitoring Division; Boulder, CO

The NOAA ESRL Carbon Cycle Greenhouse Gases (CCGG) group makes ongoing discrete measurements to document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle.

The Halocarbons and other Atmospheric Trace Species (HATS) group quantifies the distributions and magnitudes of the sources and sinks for atmospheric nitrous oxide (N₂O) and halogen containing compounds.

Palmer Station is one of many sites around the world providing data to support these projects. The Palmer Physician collects weekly air samples for Carbon Cycle Greenhouse Gases Group and fortnightly samples for Halocarbons & other Atmospheric Trace Species Group.

All sampling occurred with no problems.

O-283-P ANTARCTIC AUTOMATIC WEATHER STATIONS (AWS).

Charles Stearns, Principal Investigator, University of Wisconsin

The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point. AWS transmissions from Bonaparte Point are monitored using the TeraScan system and the Data Ingestor system. Data collected from this station is freely available from the University of Wisconsin's AMRC website.

The station transmitted data normally during the month.

A-306-P GLOBAL THUNDERSTORM ACTIVITY AND ITS EFFECTS ON THE RADIATION BELTS AND THE LOWER IONOSPHERE.

Umran Inan, Principal Investigator, Stanford University

Stanford University has been operating a Very Low Frequency (VLF) receiver antenna at Palmer Station since the 1970's. By receiving naturally and manmade signals between 1 and 40 kHz, the Stanford VLF group is able to study a wide variety of electromagnetic phenomenon in the ionosphere (uppermost layer of the atmosphere ionized by solar radiation) and magnetosphere (the area surrounding the earth dominated by the Earth's magnetic field and particles trapped by it). Many of these studies relate to the energetic releases associated with lightning. For example, Palmer Station's unique location enables it to pick up small bits of radiation from lightning strikes as far away as Africa, the USA, or the Pacific Ocean.

One of the data writing computers locked up on two occasions, requiring reboot, but with no loss of data.

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 and NOAA 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).

The NASA MODIS subset for Palmer was increased to enhance scientific activities on and around the peninsula. This subset is available via the internet for science groups on and off the ice.

One of the data writing drives quit responding. The drive was swapped out and connections were checked, but the problem still persists at the conclusion of the month.

Cruise support SSMI images generated by the system were sent to LMG scientists daily.

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 though 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.

The magnetometer operated well during the month.

B-390-P: THERMO-SALINOGRAPH

Vernon Asper, Principal Investigator, University of Southern Mississippi

Sea water is pumped continuously through a thermosalinograph (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 was disassembled and cleaned during the month, with improved salinity measures seen after the cleaning.

T-513-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK (UVSIMN)

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>.

The UV monitor operated normally throughout the month.

T-998-P: IMS RADIONUCLIDE MONITORING

Michael Pickering, 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.

The monitoring station operated normally during the month. A special sample was prepared for shipment at the request of the PI.

TIDE GAGE

The Research Associate operates and maintains on-site equipment for the project. Tide height and seawater temperature are monitored on a continual basis by a gauge mounted at the Palmer Station pier. Although salinity (conductivity) is also recorded by the tide gauge, the measurements are incorrect and should not be used. Correct salinity data can be found on the TSG system.

The tide gauge equipment has operated normally this month.

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 three hours by the Palmer Meteorological Observing System (PalMOS) and emailed to the NOAA for entry into the Global Telecommunications System (GTS).

Isobaric charts were sent to R/V LAURENCE M. GOULD in support of the current cruise.

All instruments performed normally during the month.