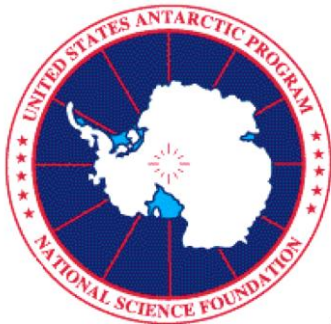




L.M. Gould 2009-03 Cruise Report

Raytheon



NSNSA

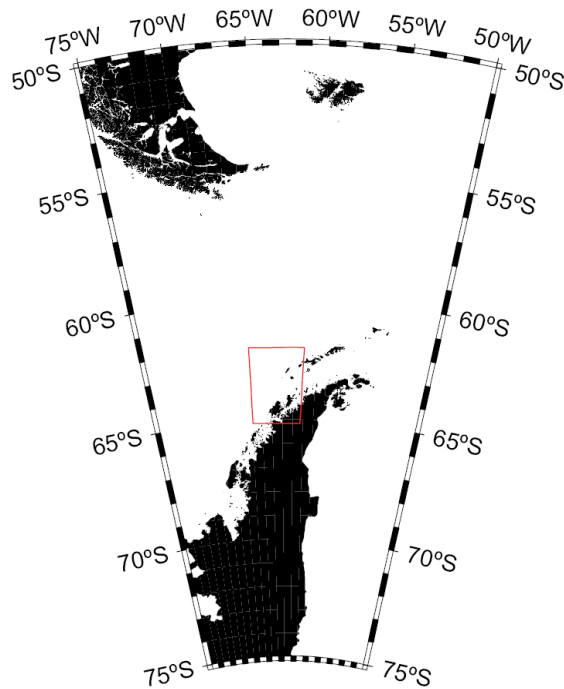


Figure 1: Photograph taken from the Duthier's Point GPS station with a view of the U.S. Antarctic Program Research and Supply Vessel *L. M. Gould* in the outer reaches of Andvord Bay, Antarctic Peninsula.

Science Cruise Participants

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Cruise Web Site: Includes daily accounts of ship board activities, deployments, and events with pictures, images and stories from LMG09-03. See: <https://hamilton.edu/news/exp/Antarctica/2009/index.html>

Cruise Summary

Cruise 2009-03 of the LM Gould departed and arrived back into Punta Arenas Chile via the Antarctic Peninsula on schedule (left 21st March, arrived late on the 9th April, 2009). In between: two ship based projects were carried out, staff and scientists were transported to and from the U. S. Palmer Station, and underway measurements of sea surface properties were collected. The two science projects consisted of a Marine Geology and Quaternary Geology project (C-515, E. Domack as PI under the LARISSA project) and a terrestrial Biology project (B-038, R. Blanchett as PI). The former project is entitled: Collaborative Research in IPY: Abrupt Environmental Change in the Larsen Ice Shelf System, a Multidisciplinary Approach-Marine and Quaternary Geosciences. Both programs involved shore based work as supported by small boat (zodiac). The underway seawater measurements were collected as part of long term Chemical Oceanography project (O-214-L/N, T. Takahashi as PI). We also collected underway water samples for filtering diatom particulate matter for Dr. Amy Leventer (part of the LARISSA project). The LARsen Ice Shelf System, Antarctica project is an interdisciplinary program funded under the auspices of the Office of Polar Programs and was initiated within the IPY. It will continue at least for the next 3.5 years. All aspects of the LMG09-03 scientific objectives were accomplished as outlined in the following sections of this report. In addition some science of opportunity was accomplished while the ship was transiting during night hours.

Scientific Goals

The continuously recording Global Positioning System stations (cGPS) deployed during this cruise are part of two cGPS networks. The first consists of six stations to be deployed across the northern Antarctic Peninsula as part of Larsen Ice Shelf System Antarctica (LARISSA see: <http://www.hamilton.edu/news/exp/LARISSA/>) This regional network of rebound stations (complimented by existing stations at Palmer Station and O'Higgins) will help constrain two aspects of the Antarctic Peninsula cryosphere. First, long term vertical motion (determined from at least three years of data collection) will be used for the following:

- 1) To constrain the configuration of the past Antarctic Peninsula Ice Sheet (APIS),
- 2) The role that the APIS played in setting boundary conditions for existing glacial systems (i.e. ice shelves), and thereby,
- 3) The response of current glacial system to rapid regional warming.

The evaluation of the data will be under the supervision of Dr. Eugene Domack (Hamilton College, Clinton New York, USA, edomack@hamilton.edu) in collaboration with UNAVCO and Dr. Matt King (Newcastle University, UK, m.a.king@ncl.ac.uk). We expect the full data analysis to be completed by late 2013 (the tri-annum of the last GPS field deployment).

The second network, to which the GPS stations will be linked, is the Antarctic-wide POLENET (see: <http://www.polenet.org/>)

connection, to which the LARISSA stations are to be fully integrated. The primary interest of our team (see above) is in the short term, inter-annual variation in crustal motion as it reflects changes in mass balance of the Antarctic Peninsula glacial systems. The overarching supervision of the POLENET program is being undertaken by Dr. Terry Wilson (Ohio State University, Columbus Ohio, Wilson.43@osu.edu). We expect the data analyses to be on-going and refined as the time series grows but hope to make a first evaluation by the second or third year of deployment (2012-2013).

Data Availability

Scientific data from the cGPS stations we installed on this cruise (see below) will be transmitted via satellite communication to the UNAVCO receiving station in Boulder Colorado and will be publically available via the POLENET real time data archive as found on the UNAVCO web site: <http://facility.unavco.org/data.html>. In order to read the data archive a program such as WINRAR will facilitate the text files (meteorology data) whereas RINEX code is needed for the positioning data.

Installation Specifications

The stations themselves consist of a Trimble NetRS GPS receiver and a Trimble geodetic chocking antenna with radome, a geodetic quality monument designed for bedrock, a power supply consisting of two photovoltaic panels and batteries (11), an Iridium based data transmitter unit, and a Vaisala WXT520 weather transmitter. Far more detailed information on the schematics, operating characteristics, and support for the cGPS units is available from UNAVCO: www.unavco.org/polartechnology.

Vernadsky GPS station (VNAD)

UNAVCO acronym: VNAD

Data Link: http://facility.unavco.org/data/gnss/select_data.php?code=VNAD

Location: Latitude 65° 14' 45.6" Longitude 64° 15' 15.0"

Elevation: Geoid SL ~ 19 m

Date and time installed: 1 April 2009, 4:00 PM Local,

Installation supervision: Dr. Eugene W. Domack, Mr. Bjorn Johns, Mr. Mason Fried, and assisted by Vernadsky station staff under the supervision of Dr. Oleksandr Lyashchuk.

Geologic Context: The Vernadsky LARISSA GPS station was installed across a low relief set of small islands near the Ukrainian Antarctic base of Vernadsky, just southeast of the balloon shed (Fig. 2). The Argentine Islands (as upon which Vernadsky rests) are composed of metamorphosed volcanic rocks of the Antarctic Peninsula Volcanic Group, a pale olive, finely crystalline porphyry complex of Mesozoic to Cenozoic age. The bedrock exhibits evidence of glacial erosion with numerous whale back, roche moutonnes, and striated surfaces. Glacial erratics are common and are recognized by the white granitic compositions which contrast with the darker metamorphic rocks (Fig. 2). The pedestal monument sits upon a glacially striated bedrock rise, a roche mountonee or whaleback, which is in clear continuity with the subsurface. The solar panels were placed some 20 m to the southeast of the monument, near to former GPS survey pins located by other workers at an earlier time (Dr. Rudolf Greku, Institute of Geological Sciences of National Academy of Sciences of Ukraine, NASU).



Figure 2: Air photo of the Ukrainian base of Vernadsky on island with labels indicating the position of the VNAD GPS receiver and the power array with respect to the balloon shed.



Figure 3: Photograph looking approximately southeast toward the GPS receiver (right) and the power array (left). Note that the connecting cable between the two was bridged with iron pipe to avoid ice hazards in the small melt pond.

Maintenance and Site Visits: As part of our collaborative effort with the Ukrainian National Antarctic Scientific Center we anticipate that, should problems arise at the VNAD station, we could arrange for station personnel to attend to minor fixes. This would include some data relay issues that may require a simple un-plugging and plugging-in of the lead into the transmitter. To assist in this effort we have left at each station (inside the gray electronics box) a short list or menu of problem solving solutions. We expect to contact the director of NASC Dr. Valery Lytvynov (uac@uac.gov.ua) and Dr. Rudolf Greku (NASU; satmar@voliacable.com). To further this contingency we have forwarded copies of this document to Dr. Lytvynov and Dr. Greku for their distribution amongst the Vernadsky personnel who may be on the site in the future. Given Vernadsky's proximity to Palmer Station it is also possible that more serious repair or modification of the cGPS site could be done by interfacing and visiting the site during a Palmer Station support cruise by the *L.M. Gould*. Science interaction with the data stream should be undertaken in contact with E Domack (edomack@hamilton.edu) and Dr. Terry Wilson (wilson.43@osu.edu) or technical issues with Mr. Bjorn Johns (Johns@unavco.org).

Notes: The north arrow on the Vaisala weather transmitter is off of true north by an estimate of about 25° east of north. This variance should be taken into consideration if and when detailed evaluation of the met. data is undertaken. Care was taken to place both the receiver and the power array in areas of minimal snow cover. Yet exceptional snowfall at these sites might impact the stations performance. It

should be pointed out that the placement of the solar array is adjacent to two previous long term bench markers used in previous years to conduct GPS measurements. The array should not interfere with this independent set of measurements should they be measured again in the future. It is always possible to move the new power array if need be.

Santa Claus Rock (Hugo Island) GPS station (HUGO)

UNAVCO acronym: HUGO

Data Link: http://facility.unavco.org/data/gnss/select_data.php?code=HUGO

Location: Latitude 64° 57' 27.48" Longitude 65° 40' 3.216"

Elevation: Geoid SL ~20 m

Date and time installed: 2 April 2009, 3:00 PM Local,

Installation supervision: Dr. Eugene W. Domack, Mr. Bjorn Johns, Mr. Mason Fried, and assisted by RPS staff under the supervision of Al Hickey.

Geologic Context: Santa Claus Rock is the largest of several small rocky islets that lay northeast of Hugo Island, itself a small island but one which carries a substantial ice cap (Figure 5). The site itself lies on the northern end of the rock, just below a promontory (one of two on either end of the rock), on a set of nearly flat bedrock benches. The bedrock of the island is dark, layered gabbro which, at the highest elevations (the desired location for the GPS station), exhibited extensive jointing and breakage of loose stone. Hence we selected a slightly lower elevation where the bedrock was more contiguous and had greater integrity with basement. There were no obvious signs of glacial activity other than the overall shaping of the rock into a streamlined exposure. The post-glacial weathering and joint propagation have removed any sign of glacial abrasion or scouring on these rocks.

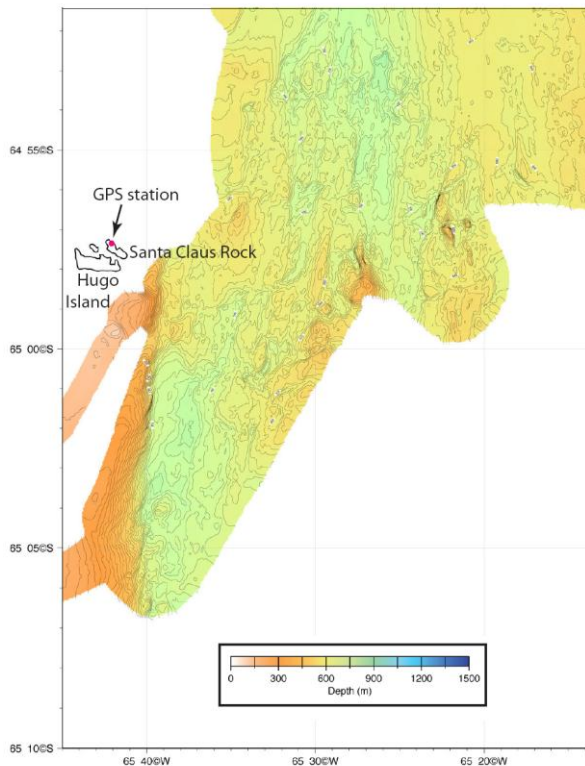


Figure 4: Multibeam swath bathymetry of region around Hugo Island showing the location of the cGPS installation on Santa Claus Rock.



Figure 5: Installation of mast for the Univ. of Wisconsin Automated Weather Station on the top of Santa Claus Rock, located above the cGPS station. The Hugo Island ice cap is in distance.



Figure 6: Photograph looking southeast with view of the cGPS station on Santa Clause Rock (*L.M. Gould* in distance).

Maintenance and Site Visits: This location is also the site of an Automated Weather Station operated by the University of Wisconsin, Antarctica Meteorology Center (Madison, WI see: <http://uwamrc.ssec.wisc.edu/realaws.html>).

During the installation of the cGPS station RPS staff attended to the reinstallation of the AWS and removed the old gear which was taken out by the elements sometime in 2003. As such there may be added value to visiting this remote location in the future to attend to both the AWS and cGPS upgrade, in need be.

Notes: The site is heavily visited by Fur Seals and Gentoo Penguins. The former may cause some disturbance to the cable connections so the co-axial cable was covered along its length with heavy stones. The site is also exposed to the open ocean and is not as high as we would have liked. Hence some sea salt corrosion on the metal components may be expected in the future.

Duthier's Point GPS station (DUPT)

UNAVCO acronym: DUPT

Data Link: http://facility.unavco.org/data/gnss/select_data.php?code=DUPT

Location: Latitude 64° 48' 17.83" Longitude 62° 49' 00.86"

Elevation: Geoid SL ~ 43 m

Date and time installed: 3 April 2009, 2:30 PM Local,

Installation supervision: Dr. Eugene W. Domack, Mr. Bjorn Johns, Mr. Mason Fried, and assisted by Raytheon Staff and NSF personnel.

Geologic Context: The point that extends along the southern shore of Aguirre Channel is a part of the mainland and consists of intrusive igneous rocks of granitic composition. The exposed bedrock is particularly extensive for the Graham Land coast and is easily accessed by small boat. The exposed face of Duthier's Point is intensely sculpted by glacial erosion into whalebacks, p-forms, and roche moutonnes. There is a fresh glacial polish on lower exposures of rock and infillings of sorted drift, capped by thin ornithogenic soils, moss and some lichen. There is a tall tower (about 10 m) high that stands to the south of the GPS installation (Fig. 8). The GPS receiver was mounted on a gently sloped, but even surface of granite well away from the tower while the power array and transmitter were placed near the tower and on a gently sloping surface of near horizontal granite. Excellent sightings to true north were obtained for both the solar panel and the weather station. The nature of the glacial sculpting indicates that the last glacial erosional episode was associated with ice that flowed down the axis of the fjord, and out into the Gerlache Strait, in a northwesterly direction (Fig. 8).

Maintenance and Site Visits: The cGPS station at Duthier's Point is in close proximity to the Chilean Base of Gabriel Gonzalez Videla located in Paradise Harbor and which is operated mostly during the summer. It may be possible for members of the Chilean Antarctic station to on occasion visit the site, and collect some digital photos as a means of monitoring the interaction of penguins and the protective stones laid across the cabling. It may also be possible for some simple repairs to be made to the cGPS if need be by the Chilean group. Toward this contingency we have contacted Dr. Verónica Vallejos Marchant at INACH (vvallejos@nach.cl) and we have provided copies of this report to her program (Research Projects & Environment Department Instituto Antartico Chileno, Punta Arenas, Chile). More serious repair could also be done on any of the Palmer Station support cruises, as the site is not far off the track to and from Palmer Station.

Notes: A large set of stones were placed across the connecting cable between the receiver and transmitter in order to avoid disturbance by Gentoo Penguins which have nested in and around the installation (Fig. 7). However the nest density was not high and did not dissuade us from relocating the site.

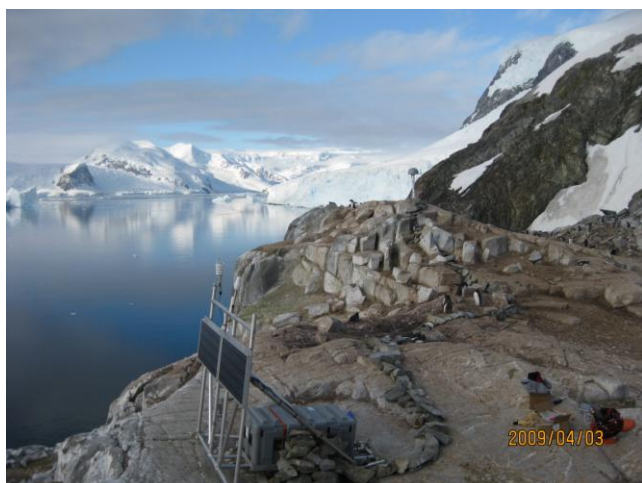


Figure 7: Photograph of the entire cGPS station on Duthier's point. Perspective is looking southeast, toward the head of Andvord Bay and Bruce Plateau, in background.



Figure 8: Photograph taken in a view back to Duthier's Point, showing nearby tower, solar panel array, and receiver antenna (both left of tower).

B-038 Activity Summary: (Ben Held and Brett Arentz for Robert Blanchett) University of Minnesota

Although weather conditions delayed our work for several days at the beginning of our trip, we are happy with our field accomplishments. We were able to spend a day and a half at Deception Island on the way south and about a half day again on the way north. We made exciting discoveries of unusual fungal growth in areas at the historic whaling station in Whalers Bay and at the site of the destroyed Chilean base in Pendulum Cove. It is not normal to see fungal fruiting structures in a polar environment. Wood samples were also collected in areas that had not been sampled before. In addition,

we were also able to take small soil samples in areas with heated soils. We are anxious to process these samples to determine what fungi are functioning in this rare ecosystem.

Once we arrived at Palmer Station we visited plots at nearby old Palmer Station, Limotroph Island and in the backyard. Different substrates were buried in the soil in those areas two and four years prior to determine changes in fungal diversity over time. At each site we collected a set of these substrates to bring back to the laboratory for processing. Based on prior data from this type of study, we anticipate positive results.

It's been a great voyage and we are thankful to all aboard that helped make it happen.

Science of Opportunity: On March 29th we had a night time transit to Palmer Station which would have put us of the base at about 3 AM (local) so we used the available time to run a test of the ship's hull mounted Knudsen 3.5 kHz chirp sonar. The line was selected in the southern end of the Gerlache Strait in order to pass over a well known sediment accumulation, the Schollaert Drift which has had a well documented set of reflection profiles previously collected (Willmott et al., 2007). In addition the line was extended to include a recently discovered grounding line system that lies at the southern end of the Gerlache Strait. This feature (known as a till delta) was revealed by re-processing multibeam data that was previously collected by the NB Palmer (99-03 and 01-07 data sets). The till delta is clearly revealed by the glacially lineated flat surface which marks the deposition of a deformable till bed the smooth sloping depositional surface that dips down to the north toward the deep Gerlache Strait proper (Fig. 9).

Figure 9: Interpreted 3.5 kHz seismic reflection profile collected (a) across a grounding line (till delta) system (b & c) in the southern Gerlache Strait. This region lies just to the left of the Panorama afforded by the view from the Duthier's Point cGPS station (d), the location of which is show by the yellow dot (b).

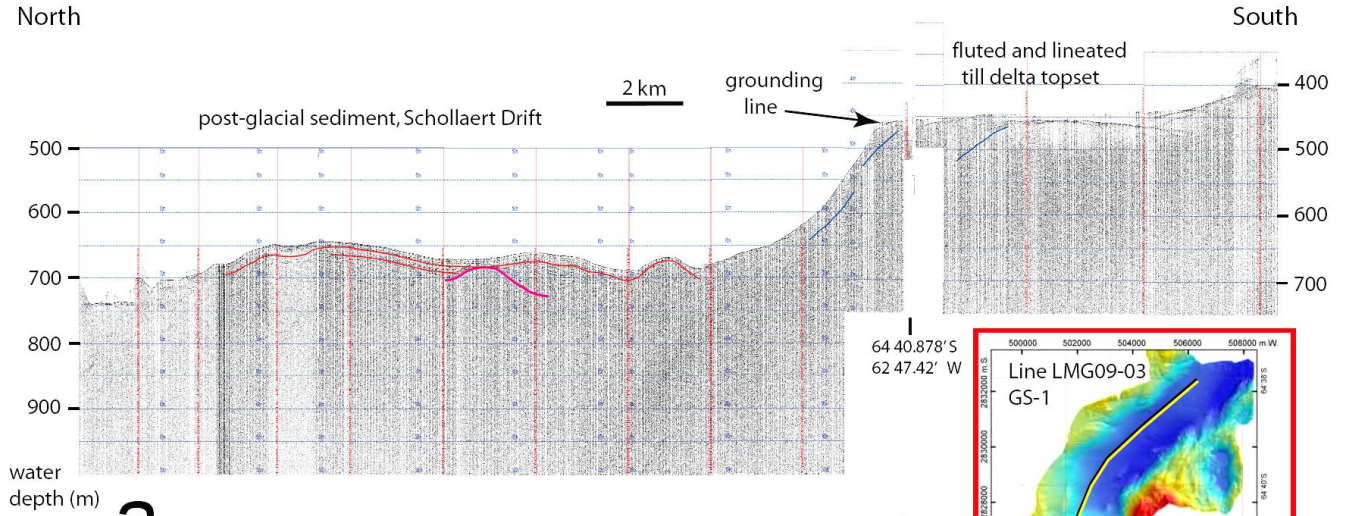
The results of the survey revealed the unique morphology of the till delta system surface (as the line was shot perpendicular to the forest contours, Fig. 9c). However acoustic resolution of internal stratification was far less than expected for both the till delta and, surprisingly, the sediment drift unit as well. This was in contrast to previous experience with the low frequency setting on the *L. M. Gould* Knudsen system, which in the past clearly revealed acoustic stratigraphy (reflections) in similar sediments of hemi-pelagic origin. Hence, there is some concern that the data acquisition and performance of the Gould's Knudsen system is not up to standards of the past. Further investigation into the performance of this system is therefore in order. This feature is important in the regional deglacial story as it marks the most recent still stand of the Gerlache Paleo Ice Stream before it receding into tributary fjords, including Andvord Bay (past the the cGPS station at Duthier's Point) and Paradise Harbor (Fig. 9b).

Water samples

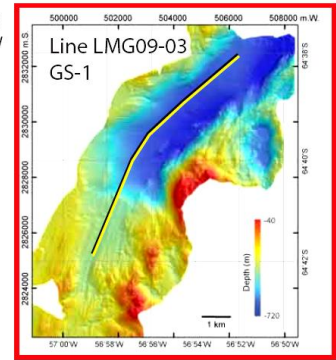
Twenty one water samples were collected from the underway seawater system (approximately every 6 hours) and were filtered for diatom analyses. This project is in support of a series of similar samples that have been routinely collected over the past several years by Dr. Amy Leventer. The survey results are part of a data base of phytoplankton communities across the Drake Passage and around the Antarctic Peninsula coast. Results of the work can be obtained by contacting Amy Leventer (aleventer@mail.colgate.edu).

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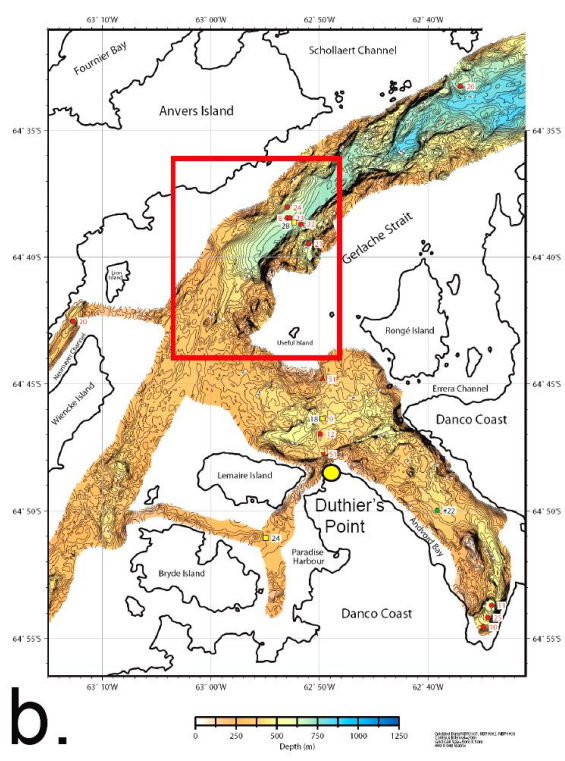
Southern Gerlache Strait 3.5 kHz seismic reflection line, GS-1



a.



c.



b.



d.

Appendix of Weekly Science Reports as submitted during the cruise.

Science Weekly reports

1st Weekly Report, Monday, March 23, 2009

It is my pleasure to provide the first weekly report, as I will do every Monday morning, from the *L. M. Gould* during cruise 2009-03. At present we are running a weather pattern in the Straits of LeMaire in order to avoid what has been called a storm with "ridiculously high seas" in the Drake Passage. Yesterday morning (3/22) we received advice and images from the Remote Weather Operations Facility (provided by Joe Kramer) that we avoid entering the Drake Passage. Predicted wave heights as the storm passed would have put us in the middle of 36 to 40 foot seas. So all due caution was exercised by Captain Joe Abshire and MPC Al Hickey and we have been running for the last 24 hours between Islas Estados and Cape Horn. Other ships have been doing the same, as we have been joined by four other vessels during the night.

We departed PA on time and in good order at 1400 hours on Saturday, March 21st. Our port call was efficient and all gear was made ready with the able assistance of RPS staff, AGUNSA, and ECO crew. We are thankful for the careful preparation of the Research Support Plan by John Evans (RPS). This cruise is multifaceted with the following objectives:

1. exchange personnel at Palmer Station and provided needed cargo (fuel and food) to the base,
2. deploy and engage three ground (bedrock) based GPS stations as the first part of LARISSA on the western part of the Antarctic Peninsula, and
3. support the work of Dr. Robert Blanchett (University of Minnesota) in the study of microfungus ecology on Deception Island and near Palmer Station.

Toward these endeavors we have been assisted ably by RPS staff. In particular, the approval to place our GPS station at Vernadsky station has been facilitated by extensive communications between the US-NSF Office of Polar Programs and the Ukrainian National Antarctic Scientific Center.

Recent communications from Dr. Scott Borg (OPP) as assisted by Dr. Kelly Falkner are most appreciated. Kelly is on board our cruise as an NSF observer. Also with us are Mr. Bjorn Johns of UNAVCO, Mr. Mason Fried (Hamilton College), Brett Arentz and Ben Held (University of Minnesota), and Mr. Dan Golden (Stanford University). Dan will be working to upgrade the VLF antenna at Palmer station which is vital to the operation of understanding ionospheric and terrestrial interaction of low frequency EMR. At present we are uncertain how long we will be delayed as we attempt to enter the Drake Passage. Alterations to the schedule will be made accordingly, once we proceed south.

Respectfully yours, at 0800 (local time) on 3/23/09

Eugene Domack
Chief Scientist, LMG09-03

2nd Weekly Science Report: LMG09-03 Week of March 22-28th

At present the *L.M. Gould* is on its way to Palmer Station after leaving Deception Island this morning at 6:00 (local). The past week has been mostly consumed with transit and holding on weather, which kept the ship at bay in the Straits of LeMaire for two days and in the Deception Island caldera for one day. Fifteen hours of science was completed ashore at Whaler's Bay and Pendulum Cove under Robert Blanchett's (B-038) program. At these locations Ben Held and Brett Arentz collected a number of

significant samples. Their study is investigating microbial colonization of soils and fungal degradation of wood structures. They hope to continue their sampling at Palmer Station and were planning on another day on shore in Deception Island on the 27th. However, in the evening of the 26th and early on the 27th a weather system moved across the Northern Antarctic Peninsula, 12 hours ahead of schedule. Winds increased within the Deception Island caldera to over 50 kn with a steady blow at 40 kn. Shore landings were out of the question and the LM Gould was not able to exit Neptune's Bellows (the entrance to Deception Island) until first light on the 29th, at which time the winds had subsided below 35 kn. During the preceding 30 hours the LM Gould ran a weather track up and down the bay within Deception caldera. Yet during this time the underway seawater system collected some interesting data. As part of a monitoring program, for dissolved carbon dioxide in seawater, pCO₂ values are measured in near continuous time. Usually the system matches atmospheric concentrations or is slightly under-saturated, as during phytoplankton blooms. Within the isolated waters of the caldera values of pCO₂ in the surface waters exceeded 550 ppmv for the first two days of calm weather. During the storm values dropped to 420 ppmv, still well above normal. We believe this represents CO₂ addition (out gassing) to the water column from the volcanic system that comprises Deception Island. Therefore, the data collected during the weather track should be of interest to chemical oceanographers.

It was during this time as well that the LARISSA team (C-515) made last minute adjustments and tuning to the GPS rebound equipment, planned to be deployed in the coming week. Science talks were also held for all ship's company in the lounge. Excellent questions and comments came from all in attendance after talks by: Dan Golden (Stanford University), Ben and Brett (University of Minnesota), Bjorn Johns (UNAVCO), Mason Fried and Gene Domack (Hamilton College).

After a rough and delayed crossing of the Drake Passage (March 21st-25th) we are looking forward to making the Palmer Station turn-around efficient and effective. We are also hopeful for some cooperative weather for GPS installations at Hugo Island, Vernadsky, and Duthier's Point. Because of the weather delays we have decided to proceed with the Palmer Station call, in order to provide sufficient time for personnel to exchange out-briefings. We have therefore delayed the GPS station put-ins despite our best intentions to up front at least one of these installations prior to the Palmer Station call. Hence, at this point in the cruise we (ECO, MPC and Chief Scientist) are contemplating a request to extend our cruise by at least 24 hours, pending the outcome of our work in the next five days.

We have had an excellent working relationship with all aboard and we will miss those who disembark at Palmer Station, we wish them a successful and happy stay on Anvers Island.

Respectfully,

Eugene W. Domack
Chief Scientist LMG09-03

Cruise LM Gould 2009-03, third weekly report (3/29 to 4/5)

At present we are north bound, 2 hours from Deception Island, having left Palmer station last night at 20:00 hours (local). The last day of science operations is planned for today with the recoup of biological sampling under the B-038 program of R. Blanchette. The last week has been eventful and productive and all the objectives of the LARISSA program (C-515) have been met with the deployment of three GPS rebound stations at: Vernadsky base (April 1), Hugo Island (April 2), and Duthier's Point (April 3). In addition, the automated weather station on Hugo Island was replaced after having been off-line since 2003. Obviously we have been blessed with unusually calm weather over the last week which allowed for safe landings on the remote rocks off Hugo Island and splendid scenery within Andvord Bay and the Argentine Islands. This progress was unexpected a week ago (3/29) when we viewed the Duthier's Point site at late dusk, using spot lights from the bridge of the LM Gould. At that point it was difficult to assess a landing location and we were due at Palmer Station for first light

on the 30th, so we departed Andvord Bay for an overnight transit to Palmer. On the way we took advantage of the available (night) time to run a 3.5 kHz seismic survey across a newly discovered grounding line zone at the southern end of the Gerlache Strait. This test of the hull mounted Knudsen chirp system included coverage of the Schollaert sediment Drift and grounding line (till delta) system, a feature recently revealed from newly processed multibeam imagery (NBP01-07 and 99-03 data sets).

We arrived at Palmer Station as expected on Monday, March 30th and the next two days were spent with personnel transfer, cargo and fuel offload. Exceptional co-operation between the ship and Palmer Station staff allowed this stay to proceed efficiently and without delay. We departed Palmer with last light on Tuesday 31, March and proceeded to the Ukrainian base Vernadsky. There, by prior arrangement between NSF (Dr. Kelly Falkner) and the National Antarctic Scientific Center, we met the station manager Dr. Oleksandr Lyashchuk, and his staff. We were ably assisted by the Ukrainian station personnel and installed the GPS monument and power array near the base. The Argentine Islands archipelago are a series of low lying rocks composed of Antarctic Peninsula Volcanic Group (metavolcanics) and intrusives. We placed our monument on a bedrock rise, clearly sculpted by glacial abrasion, and near several large granitic boulders, erratics, left by the receding ice sheet some several thousand years ago. This site will help constrain rates of coastal rebound near the center of a paleo ice dome of the last Ant. Peninsula Ice Sheet and the results will be integrated with pre-existing GPS measurements collected by the NASC.

Upon the completion of the Vernadsky GPS site, weather reports were reviewed by Captain Joseph Abshire and under his astute recommendation we proceeded overnight to Hugo Island. Dawn gave us cooperative seas and low winds, essential elements for landing on the small islands some 45 miles west of the mainland. One zodiac was sent out to recon for a safe landing site, four persons jumped ashore, and a suitable location for offload of additional personnel and gear was located on the north end of Santa Claus rock, (). This tiny cove offered: protection from the swell, a deep entrance, and a convenient bedrock ledge, all affording safe offload of equipment. An excellent location for the GPS station was located on flat bedrock about half way up the northern promontory of SC rock. Here, on dark banded gabbro (intrusive rocks rich in Fe and Mg) we installed the second of our GPS monuments and power arrays. Up on the hill RPS staff, under the direction of Mr. Kevin Pedigo, installed a new Automated Weather Station to replace the one taken down by elements sometime in 2003. As there were no prominent landmarks to mark due north and we needed to direct the solar panels on our GPS power array toward the best light, the LM Gould was directed to relocate due north of our position on SC rock. The bridge obliged in typical proficiency, our line of site was established, and we finished the GPS installation by 15:00 local time. An additional two hours were required to complete the AWS install during which time we removed the corroded remains of the old AWS and staged our tool kits for easy removal at the landing site. By 17:00 all hands were back on deck, boats were secured, and we set course for Duthier's Point. At this moment the new AWS is transmitting data back to the University of Wisconsin Antarctic Meteorology center and a vital peg has been reset in the collection and evaluation of weather data in this valuable location.

After a night transit we arrived off Duthier's Point on Friday, April 3rd. A first boat was sent to the shore to locate a safe landing spot and ascent route to a prominent rock ledge, upon which we hoped to station the GPS. An absolute flat calm sea made the landing selection easy and B. Johns and E. Domack climbed up about 150' to the rock ledge which supports an old iron tower, presumably erected as a navigation aid for the entrance to Paradise Harbor. A site was located on the nearly flat granitic outcrop which has been sculpted into prominent whalebacks and rouch moutonnes. Nearly 1500 lbs. of gear was transported up a relatively steep but stepped ascent. The equipment was transported in good humor by Kelly Falkner (NSF) and RPS staff, including: Al Hickey, Alden Strong, Paul Queiro, Russell Freeman, and Cindy Dean. We were extremely grateful for this assistance, it was a challenge, but was accomplished safely and without any significant risk. The GPS install was completed by 14:30 (local). The view from the point was spectacular even by Antarctic standards. We believe this site will provide the highest rebound rates in our network, as it clearly lies close to the ice center of the Bruce Plateau, it may even provide insight into short term accelerations in rebound due to ice mass unloading events by the nearby outlet and valley glaciers.

We completed three GPS station put-ins in three days which was quite a good run, and so we put into Palmer Station on the morning of April 4th. At that time the station was expecting a north bound departure at AM on April 6th. Since the Blanchett team of Ben Held and Brett Arentz did not complete their three days of work at Deception Island (see first weekly report) we requested that the departure date from Palmer be moved from early on the 6th to late on the 5th. There was congenial discussion of the matter with station staff, science reps and the

ship's master. A consensus was reached to accommodate the science northbound with a slightly earlier departure, as the weather continued to be in our favor. We left Palmer Station after dinner last night.

So, a good week aboard the LM Gould which once again proved itself to be a reliable platform with diverse capabilities for both marine and terrestrial field work. I sincerely hope that this ship can remain in the USAP fleet for years to come, as its true potential to support integrated science and supply needs in the Antarctic Peninsula region is just now being fully realized.

Respectfully,

Eugene W. Domack
Chief Scientist, LMG09-03
eugene.domack@lmg.usap.gov



Mark Gisclair
Operations Manager
Edison Chouest Offshore
Galliano, LA

April 7th, 2009

Dear Mark,

It is a pleasure to write to you with my regards and appreciation for the fine experience we just had of completing cruise 2009-03 of the *L.M. Gould* to Antarctica. On behalf of all the LARISSA investigators and especially Mr. Bjorn Johns of UNAVCO we wish to express our thanks for the hard work of ECO personnel during our project. I was particularly pleased with the manner in which ECO interacted with RPS and the science parties on-board.

The bridge crew of Ship's Master Mr. Joseph Abshire, Mr. John Higdon, and Mr. Ernest Stally III were a constant and reliant team which allowed us to steer toward our goals in an enjoyable and safe manner. I would look forward to working with Mr. Abshire again, perhaps on next year's LARISSA cruise aboard the *N.B. Palmer*, if possible.

The galley staff of Mr. Romeo Agonias and Mr. Leandro Polante outdid themselves, and I mean the meals were outstanding in all aspects of nutrition and palatable enjoyment. Congratulations to them for their their most important contribution to this cruise.

Once again I had a great experience in working with the Bosun, Elfren Prado and Seamen, Araon Arnulfo, Roberto Cortez, and Samuel Guillermo. These guys never tire of all the things that need attention on-board.

In no small way the chief engineer Michael Brett and his assistant Trevor Rafferty continued to keep us on an even keel even when we were being bounced by the rough seas in the Drake Passage. The Oilers, Noli Tamayo and Lloyd Aguirre, were cheerful and attended to the Gould's needs with dedication.

Thank you for staffing this vessel with such capable individuals and for the great teamwork they exhibited.

Sincerely,

Eugene W. Domack

Eugene W. Domack
Chief Scientist, *L.M. Gould*, Cruise 2009-03

xc. Dr. Scott Borg, NSF
Dr. Alex Isern, NSF
Dr. Kelly Falkner, NSF



Robert Farrell and Dan Herlihy
Marine Operations
Raytheon Polar Services
Englewood, Colorado

April 8th, 2009

Dear Robert and Dan,

I wanted to drop you this letter to let you both know how much I appreciate the great work that your staff did during the 2009-03 cruise of the *L.M. Gould*. We return to Punta Arenas gratified that we were able to accomplish 100% of our science objectives—a rare accomplishment in my past experience. This was possible in no small way by the excellent planning effort given by Mr. John Evans prior to the cruise and the conscientious and proactive support provided by Mr. Al Hickey, as our Marine Projects Co-coordinator. I have rarely had a cruise that went so well, and which was relatively “easy” regarding the day to day adjustments and deployments. This was a different sort of cruise from that which I am accustomed, and so I particularly appreciated the way in which Al and his technical staff worked with ECO and the science team to make sure we got the job done safely and efficiently. Mr. Hickey communicated effectively and was a pleasure to work with.

We did quite a bit of small boat work with heavy loads and potentially difficult landing situations. The boat handlers, Ms Elizabeth Glass and Mr. Jacob Greenberg, took us from ship to shore and back with professionalism and skill which was appreciated by all involved. They also gladly helped with the transfer of cargo to our GPS sites. I would gladly work with any of them again if possible.

Although our electronic needs were minimal, regarding the direct science operations, Mr. Kevin Pedigo did his usual exemplary job of connecting us to shore via the e-mail system. Attended to some special science of opportunity projects and was very easy to work with. We had some special printing needs that were met with efficiently and I was pleased that he was able to install the new meteorology station back near Hugo Island; I know the Univ. of Wisconsin folks are as well.

Cindy Dean did a great job of securing our lab and shore safety, as well as effectively applying the environmental standards we needed to follow with our shore landings. She also helped out while ashore with our gear transfer. I would be pleased to be able to work with Cindy again if the opportunity arose in the near future.

I was also pleased with the help provided by Russell Freeman, Alden Strong, and Paul Queior, who helped with offloading and transfer of 1500 lbs of gear at each of our three GPS stations. The Palmer Station managers (Eric Pohlman and Kenneth Kennan) worked effectively with Al Hickey to arrange changes in the Palmer Station schedule that helped us to accomplish our stated scientific objectives.

It was a privilege to work with this team and I thank you for providing us with the personnel support for this first phase of the LARISSA project.

Sincerely,

Eugene W. Domack

Eugene W. Domack
Chief Scientist, *L.M. Gould*, Cruise 2009-03

xc. Dr. Scott Borg, NSF
Dr. Alex Isern, NSF
Dr. Kelly Falkner, NSF



Charles Meertens and Meghan Miller
UNAVCO
6350 Nautilus Drive
Boulder, Colorado 80301

April 8th, 2009

Dear Charles and Meghan,

As part of our nearly completed cruise 2009-03 of the *L.M. Gould* we have successfully installed the first three, of six planned, bedrock GPS stations in the Antarctic Peninsula. It was a distinct pleasure and privilege to be able to work with Mr. Bjorn Johns during this field work. This installation has laid an important foundation for future investigations of the state of the cryosphere in the Antarctic Peninsula (LARISSA) and will increase the growing links between the polar science community and UNAVCO (POLENET). With the support of the Office of Polar Programs and UNAVCO we have now established a strong field component for the LARISSA project which will continue next season with three additional GPS installations on the eastern side of the Antarctic Peninsula. Mr. John's work this season was instrumental in assuring that this future GPS campaign can be carried out next year without direct UNAVCO participation in the field, but with the same level of quality control as this year. Additionally we were able to demonstrate the effectiveness of ship to shore deployment in the coastal environment of Antarctica, experience that will certainly be important in years to come.

As Hamilton College is now a participating member of the UNAVCO consortium I look forward to working more closely with your organization in the near future. Thank you for providing the engineering skills and equipment needed to have successfully launched the LARISSA project. Bjorn was a great person to have on-board and he represented your organization with high standards and congenial interaction, you are fortunate to have him on your team as I am sure you are aware.

Sincerely,

Eugene W. Domack

Eugene W. Domack
Chief Scientist, *L.M. Gould*, Cruise 2009-03

xc. Dr. Scott Borg, NSF
Dr. Alex Isern, NSF
Dr. Kelly Falkner, NSF