The Antarctic Sun

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February 6, 2005

Where art thou, ROMEO?

Photo by Jeff Blair / Special to *The Antarctic Sun*

Divers Dug Coons and Karen Sterling prepare to put an underwater camera, called ROMEO, in place at New Harbor. The camera will stay on the sea floor for the winter taking pictures of single-celled creatures called foraminifera. *See story on page 3.*

Urchin larvae make most of a meal

By Emily Stone
Sun staff

The way Donal Manahan and his researchers see it, millions of tiny sports cars are floating around McMurdo Sound.

They're talking about sea urchin larvae, but they use the analogy to explain how fast the little creatures are when it comes to creating protein. And the larvae aren't simply speedy. They're also incredibly fuel-efficient. They use a fraction of the food that their larval cousins in temperate waters need to make the same amount of protein.

"How can you be a Ferrari and get better gas mileage than any car out there?" asked David Ginsburg, a graduate student with the group.

The scientists from the University of Southern California spent August through February at McMurdo Station studying this phenomenon in hopes of understanding how organisms are able to live in the chilly and nutrient-poor Antarctic waters.

"What is the special biology that allows organisms to grow up cold and hungry?" said Manahan, explaining the basic question at the root of his Antarctic

See Larvae on page 12

Trailblazers' long haul to the plateau

By Kristan Hutchison
Sun staff

The team marking a safe haul route to the South Pole pulled onto the polar plateau on Jan. 4.

They left four green flags and a bundle of bamboo poles at their farthest south point, 480km from the South Pole and 1,187km from McMurdo. It was farther than they expected to get this season.

"We exceeded even our 'far exceeds expectations.' We not only got onto the Leverett (Glacier), we went up the d—n thing and camped and left tracks on the polar plateau for the first time in the traverse history," said project manager John Wright. "That's a major achievement."

The goal of the South Pole Proof-of-Concept Traverse project is to test the feasibility of hauling cargo from McMurdo to Amundsen-Scott South Pole Station, in order to take some of the burden off the limited flights. The planned route crosses the Ross Ice Shelf, climbs the Leverett Glacier through the Transantarctic Mountains, then continues across the plateau to the pole. It's a total of 1,600km with 3,000m elevation gain. This season the traverse team made it three-quarters of the way.

The traverse team and planners hadn't expected to make it so far this year. Last season they faced problems with sleds wallowing in deep, soft snow on the Ross Ice Shelf and made it 684km along the route before turning back. This year the traverse team expected to make it at least that far, and continue beyond as far as half the fuel and time

See Traverse on page 16

Final summer issue

This is the last issue of *The Antarctic Sun* this season. Past issues are available at the Web site and watch for a special mid-winter edition. *The Sun* will resume weekly publication in October.

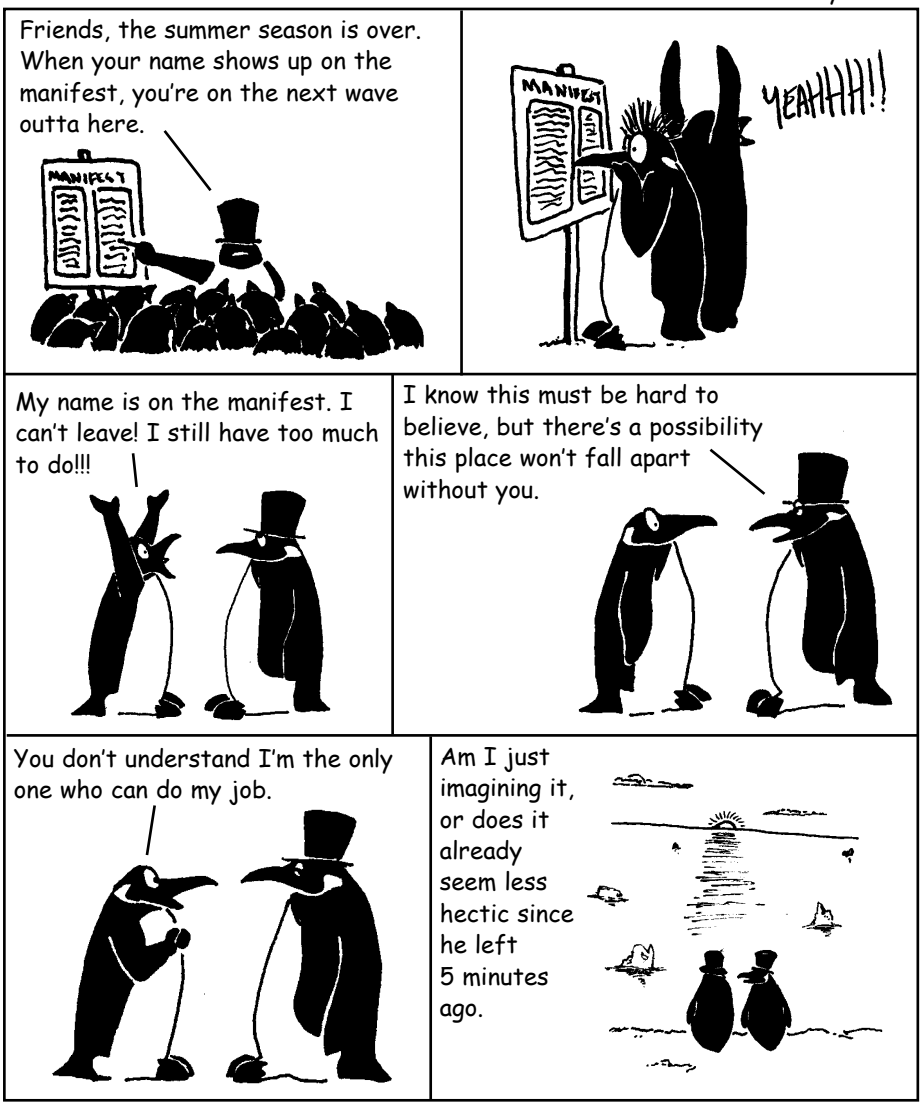
INSIDE

Quote of the Week

"Whoever created sleep didn't give enough to Antarctica."

— *A dining attendant on a camping trip, facing four hours of sleep before his next work shift*

Ross Island Chronicles By Chico



Cold, hard facts

Helicopter operations

Average number of trips per season: 1,800
Average amount of cargo moved per season: 725,000kg
Average number of passengers flown per season: 6,500
Number of helo pilots: 8
Total years of pilot experience: 175
Number of helo techs: 6
Types of helos: 3 Huey 212s, 2 A-Stars, 2 Dolphins
Helos with most range: A-Star/212 at 555km
Fastest Helo: A-Star w/o basket, 225kph
Average flight time per trip: 35 min
Average distance flown: 90km
Farthest point flown in 2005 season: Cape Kerr at 278 km from McMurdo
Most exotic flight in 2005 season: Battleship Promontory in the Dry Valleys, which features sandstone spires

Note: Numbers include Antarctica New Zealand and USCG helicopters when applicable.

Source: Monika Gablowski, helicopter operations

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It's a Harsh Cartoon — Matt Davidson

Camera keeps winter watch on voracious "forams"

By Emily Stone
Sun staff

When Sam Bowser's science group returned home last week, they left one member of their team behind – an underwater camera named ROMEO that will be clicking away on the McMurdo Sound seafloor all winter.

Bowser has studied a group of single-celled organisms called foraminifera, or forams for short, since 1984. This is the first time he'll get to glimpse what they're up to while he's gone. Even when he's at his field camp at New Harbor, there's only so much he and his divers can see, he said. The camera solves that problem.

"We'll get a time-lapse movie of things you won't see in a 30-minute dive," said Bowser, a cell biologist with the New York State Department of Health's Wadsworth Center in Albany. He's particularly interested in the forams' place in the underwater food web.

Antarctic forams are enormous and voracious by single-celled standards. Certain species are larger than one millimeter and visible to the naked eye, and feed on animals much larger than them, such as shrimp-like creatures called amphipods and juvenile starfish. Bowser estimates that 200 different species of forams live in New Harbor.

Bowser hopes the camera captures forams feeding on a scallop that the group placed in the camera's view. The scallop is tied down so it can't wander away. The tiny creatures will drill through the scallop's shell and slowly suck the nutrients from the animal. The camera will let Bowser see how exactly they feed on the much larger species.

Photo by Emily Stone / *The Antarctic Sun*

Engineer Jeff Blair puts the final touches on an underwater camera in the Jamesway at the New Harbor field camp. The camera will sit on the seafloor over the winter.

Photo by Emily Stone / *The Antarctic Sun*

Dug Coons lowers a laundry basket into a dive hole at New Harbor so he can later pull up specimens collected for Sam Bowser, who is studying a single-celled organism called foraminifera. The group put a camera in this dive hole, where it will stay for the winter.

"The idea is to be able to do telescience," said Jeff Blair, an engineer with Magee Scientific of Berkeley, Calif., which designed the camera. ROMEO stands for Remotely Operable Micro-Environmental Observatory.

This is the second year of the three-year project. Last year, the group used a prototype camera to learn what they could see underwater and what the light was like, Blair explained.

Blair made some adjustments to the camera, which came back this year for more testing and preparations for its winter home, 24m below the surface of McMurdo Sound. The group also laid down 150m of fiber optic cable through a 2.5cm steel pipe under the water and ice and up the shore to a large rock.

Their goal next year is to have an antenna on that rock transmitting pictures to Bowser in Albany at regular intervals. The information would travel by radio to McMurdo, where it would be transmitted via satellite to Albany.

Bowser hopes the cable will also allow him to move the camera lens remotely from his office.

"Let's say a whole herd of starfish wanders into our point of view," Bowser said. "That's kind of boring for us. We'll want to turn it and look at forams."

The starfish can cause more than just a distraction. This year a starfish, which Bowser thinks was attracted to the light, got quite friendly with the camera, living on top of it for some time and ruining pictures. It then proceeded to eat the scallop the camera was watching. To avoid this over the winter, the group's divers placed a fence around the camera, and, "put a bunch of sacrificial scallops around it," to distract the starfish, Blair said.

Blair will work back home on a microscope that will be integrated into the camera next year. Bowser is hoping to use it to catch a second type of foram feeding on microscopic organisms.

ROMEO is programmed this winter to wake up every eight hours and take seven pictures, Blair said. It has a range of shots it takes of the scallop using different angles and levels of zoom. The pictures are stored on a 1-gigabyte memory card that the group will retrieve in October. Next year they plan to use a 4-gigabyte card. The camera will conserve batteries by going to sleep, so to speak, in between its photography duties.

The group needs to work out security and bandwidth issues before knowing if Bowser will be able to talk to ROMEO next year and move its lens around remotely via the Internet. Bowser said he's hopeful it will work and figures if we can talk to rovers on Mars, then it should be easy to talk to a camera in Antarctica.

"It ought to be possible," he said.

NSF-funded science in this story: Sam Bowser, New York Department of Health, www.bowserlab.org

Whales put on show for researchers

Photo above by Don LeRoi, at left by Wayne Perryman / Special to *The Antarctic Sun*

Left, a killer whale plays with a piece of ice in McMurdo Sound. Above, a pack of whales swim by researchers photographing them.

By Robert L. Pitman
Special to The Antarctic Sun

McMurdo has its own version of Pamplona's Running of the Bulls - the Stampeding of the Orcas. Each year the whales make their way up the ice channel that's opened in McMurdo Sound.

From our helicopter, we spot the puffy blows of at least 30 killer whales, working along the edge of a long crack in the ice. The McMurdo killer whales have distinct color patterns and habitat preferences. My colleagues, Wayne Perryman and Don LeRoi, and I think they may be a separate species. To make our case, we hope to collect biopsy samples for genetic analysis, take aerial photographs to precisely measure body length and proportions, perhaps make some feeding observations, and just get to know them a little better in their natural environment.

speaking of science...

The helicopter lands and our pilot, Wendy, signals us to get out while the rotor is still whop-whopping. We grab our cameras and crossbow, and head across the frozen ocean toward the open lead. Before we see water, a giant, black letter opener slices across our view, 200m ahead. The dorsal fin of this adult male killer whale is probably 1.5m tall and sinister looking.

We see a small cloud form over its head. A full second later the explosive sound arrives: the unmistakable gasp of an air-breathing mammal. Despite being supremely adapted to a life in the ocean, killer whales retain one of the most useless features an aquatic animal could own - a pair of lungs. It's an indication their ancestors were land animals. If you don't believe in evolution, you are not paying attention.

When we get to the lead, the water is glassy calm. Brother whale has disappeared. The overcast sky blends seamlessly with the frozen sea. The only sound now is our breathing and the occasional squeak of rubber bunny boots in dry snow.

Suddenly we are startled by a quick series of explosive breaths from the far end of the lead. A pack of killer whales has surfaced from under the ice and is charging in our direction. They are advancing along the edge of the fast ice where it is about a meter thick, so we can walk right up to the edge of their world. The water is clear and their large white eye patches are easy to follow as they glide under the water.

An adult male, maybe 6m long, surfaces a meter away. His breath forms a steam cloud in the air and he is so close that tiny droplets coat my glasses as I instinctively jump back from the ice edge. Then a cow with her new calf blast through like another car on the bullet train. The calf is young enough that it still swims with jerky motions, like a child that only recently learned to walk. It lifts its head clear of the water and appears to be trying to get a better look at the novel creatures on the ice edge. The adults seem to have urgent business elsewhere and they pass swiftly through.

On the previous day, we observed a group of whales in less of a hurry. One of the whales, probably a female, was lolling in front of us, a meter away. She circled around a couple times and then started nosing a piece of ice that was about half a meter across. At one point she lifted it up and it broke in two.

She disappeared for about a minute, and then a piece of ice about the size of a basketball started moving toward us. When our girl surfaced behind it, she arched her head forward, then snapped it back flipping the ice chunk out of the water and ahead of her. For the next five minutes she continued to make free throws as she motored around the small pond in front of us. Then she lost interest and went on her way. Maybe she thought we were talent scouts from SeaWorld.

Today, though, the whales are not dallying. Wayne hops onto an ice floe to photograph the passage head-on. The adult males look like they are about to slice his platform with their immense dorsal fins. Instead, they arch adroitly at the last second, dive under the floe and pop up on the other side. The floe rocks in the water as tons of black and white flesh go hurtling by, and the air is filled with the spray and roar of killer whales huffing and puffing.

The thundering herd takes about five minutes to blow by us. I frantically alternate between camera and crossbow as whales surface within a meter of me. The crossbow bolts bounce off the whales and land on the ice, practically at my feet. The bolts take a tiny bit of skin and blubber, and the donors continue on, as if nothing happened. We get our samples and photos.

And then silence, once again, drops around us like a curtain.

Robert Pitman is a whale researcher with NOAA Fisheries, Southwest Fisheries Science Center

around the continent

SOUTH POLE

IceCube's first hole

Compiled from reports by Katie Hess and other sources

This week begins the final crunch stage at the South Pole before the summer winds down. Amundsen-Scott South Pole Station plans to begin its winter season after the last flight on Feb. 15.

The most exciting event last week was at IceCube, a new neutrino detector project. A string of 60 digital optical modules was extended to a depth of 2,450m below the surface of the polar plateau. IceCube used hot water drilling to create a hole reaching a maximum depth of 2,517m on Jan. 27. Positioning the cable with the 60 DOMs began Friday morning as anxious hands tied the DOMs one by one onto the cable and lowered it down the hole. The hole was full of melted water up to a depth of 50m below the surface. It takes about five days to refreeze the water and solidify the modules into position. This was the first of 80 such strings that eventually will be in a grid within a cubic kilometer of ice. South Pole NSF Representative Jerry Marty activated the first DOM at 8:40 p.m. on Jan. 29 from a computer at the surface.

Conditional occupancy permits were granted for two wings of the new station. Wings B1, emergency power and dorms, and B2, which houses science, were formally approved Jan. 30. Another milestone completed.

A new cryogenics facility used to cool telescopes will be finished in the next several weeks and one last large container of liquid helium will be flown to Pole on or around Feb. 11. The new facility will house the station's transport dewars, hoses and valves to protect it from the South Pole's ambient -60C to -80C winter temperatures, which congeal lubricant and jeopardize the o-rings that seal the vacuum space of the dewar. Starting this winter, a helium liquefier also will be used to capture the helium gas that is continuously boiling off at just over -269C. Redundant computerized tracking systems will monitor any unexpected loss of helium more closely. The cryogenics facility should retain more helium through the winter than ever before. This will be "the largest cryo year in the history of the program with almost double the usage of previous years," said cryogenics technician Christina Hammock.

On Sunday, much of the station enjoyed a couple special premieres of Tom Piwowarski's "South Pole Summer 2004-2005" documentary film.

— Jerry Marty, Albrect Karle, Christina Hammock and Al Baker contributed to this story.

The first string of digital optical modules descends into the 2,450m hole at the South Pole. The IceCube project will have about 80 such holes. The detectors are used to track neutrinos, or subatomic particles, from deep space.

Photo courtesy IceCube / Special to *The Antarctic Sun*

PALMER

Tracking global warming

By Kerry Kells
Palmer correspondent

Open water and good weather have offered long days the past week for research and sampling at Palmer Station. Bird researchers report south polar skua chicks hatched on Shortcut Island. The Ocean Search and Rescue Team got out for training exercises. Humpback and minke whales visited frequently. Both the private yacht *Sarah W. Vorwerk* and the *Endeavour* cruise ship returned to station. The *Akademik Ioffe*, a Russian icebreaker turned cruise ship also visited. *The Crystal Symphony*, a new cruise ship with 716 passengers and 500 crew, arrived for an offshore lecture by station personnel. The U.S. Antarctic Program's *Laurence M. Gould* arrives this week, signifying the end of the Long Term Ecological Research cruise. Some grantees and staff will depart and some will return to station after the cruise.

Palmer has a longer summer season than McMurdo and South Pole, so summer activities and science will continue into March when the winter crew begins to arrive.

Tad Day, principal investigator from Arizona State University, presented "Global Warming and Antarctic Plants" as our Wednesday night science lecture. His research team this year includes Chris Ruhland, David Bryant, Sarah Strauss and Michell Thomey. Day began with an introduction to the greenhouse effect: greenhouse gasses absorb the outgoing long wave radiation and warm the lower atmosphere of the Earth. Evidence for changes in temperature included weather station measurements, historical records and tree rings. Evidence linking carbon dioxide to global warming is found in ice cores and revealed by general circulation models, which are computer models built to mimic the climates of the Earth. The predicted warming over the 21st Century will be 1.4C to 4.5C.

More warming has been seen here on the western coast of the Antarctic Peninsula than globally. Temperature records from neighboring stations show air temperature increases. Sea ice durations, ice core data and sediment cores show more evidence of global warming.

See Continent on page 6

the week in weather

McMurdo Station
High: 18F / 1C
Low: 34F / -8C
Max. sustained wind: 25mph / 40kph
Windchill: 15F / -26C

Palmer Station
High: 42F / 5C
Low: 28F / -2C
Max. sustained wind: 37mph / 59kph
Precipitation: 21mm

South Pole Station
High: -14F / -25C
Low: -35F / -37C
Peak wind: 20mph / 32kph
Max. Physio-altitude: 3243m

Continent From page 5

Day is interested in what effect this has on Antarctic tundra. Day's group studies the two higher order vascular (water transporting) plants native to Antarctica: Antarctic pearlwort or *Colobanthus quitensis* and Antarctic hairgrass, *Deschampsia antarctica*. Both plants are perennial and flowering and are recent introductions to the area, having arrived from Tierra del Fuego in the last 10,000 years.

Some of their field research on the local islands was begun in 1999 when Day placed small greenhouses over the plants on Stepping Stone Island to check for performance in warmer conditions. The two temperature treatments included small greenhouses — some that were open at the bottom and some that were entirely closed. On the open greenhouses, the daytime temperature increase from the year 1999 was 0.2C. On the closed greenhouses, the daily increase was 2.2C. Production increased for both plants and they experienced accelerated reproductive development and greater seed production.

Part of the population studies include new research begun on Point 8, an area off Bonaparte Point where the glacier has melted recently. In 1999 the area had 94 *Deschampsia* plants and 23 *Colobanthus* plants. The survey in 2004 showed an increase: 5,129 *Deschampsia* and 294 *Colobanthus* plants. Separate research at a different site, Biscoe Point, where permanent snowbanks melted and *Colobanthus* had come in and colonized, showed that the plants died out in 2004. This reduced survival is due to more winter precipitation and later snowmelt.

Behind our station is the Sun Devil Estates (named for the Arizona State mascot) which is an area of 20 plots, each with 12 patches of ground they transplanted there. Part of this project was to improve the realism in simulating climate-change scenarios. The plots are warmed day and night, which more closely follows the greenhouse effect. Infrared heaters as well as dummy heaters are used. They are heated according to the temperature and carbon dioxide-increase trends. Air and soil temperatures increased about 1 to 2 degrees Celsius under the heated plots. Another set of plots receives increased precipitation; one plot has higher precipitation with active warming and one plot has higher precipitation without warming. The researchers then measure the carbon dioxide gas flux (respiration and photosynthesis) for both day and night. Growth and production is clearly affected, as the plants in the warming process are two weeks ahead of the unheated plants. At the end of the season, they will harvest some of the cores. Tad's group will return to Palmer Station, Sundevil Estates and the local islands next year.

Those of us who return next summer will have another season to witness the snow melt, glacier calving, Antarctic plant production, seabird chicks and whales that are all part of our local area. For now, we wish McMurdo and South Pole stations, our local neighboring stations of Rothera and Vernadsky, and all Antarctic research stations a wonderful winter season!

Photo by Brien Barnett / *The Antarctic Sun*

A container is unloaded Feb. 3 from the annual resupply ship the American Tern, *which is docked at McMurdo Station.*

SHIPS

Nathaniel B. Palmer

Jan. 28 to Feb. 1

Compiled from reports by Herb Baker

After a brief portcall, the research vessel *Nathaniel B. Palmer* left McMurdo Station Jan. 28 and began drawing samples and recovering moored instruments for Walker Smith's group from the Virginia Institute of Marine Sciences. The Interannual Variability of the Antarctic-Ross Sea, or IVARS, is attempting to quantify the changes in the nutrients and concentration of phytoplankton in the Ross Sea from year to year.

"We had some deck freezing problems, but overall the recovery went smoothly," wrote Herb Baker, the marine projects coordinator.

All the moored instruments were collected by Feb. 1. The *NBP* is scheduled to arrive in Lyttelton, New Zealand Feb. 16.

Laurence M. Gould

Jan. 24-30

Compiled from reports by Andrew Nunn

In search of krill, the *Laurence M. Gould* followed the transmitters on feeding penguins to a site near Avian Island south of Palmer Station on Jan. 25. The researchers found no krill there, and had to conclude that the penguins were feeding poorly on small fish. Reports from the bird researchers on Avian Island seemed to confirm this from the bird's stomach samples. Farther offshore the *Gould* crew found a new site where there was krill and completed the sampling there.

The *Gould* returned to Avian Island overnight to retrieve the field team it had left there. The weather was poor, but it was sheltered enough in the lee of the island for the Zodiac to bring the field team and equipment to the *Gould.*

By Jan. 30 the Long Term Ecological Research cruise scientists aboard the *Gould* had completed most of the sampling except at sites blocked by heavy ice. After another stop at Palmer Station, the *Gould* headed north for Punta Arenas, where it was scheduled to arrive Feb. 6.

Polar Star

Jan. 27 to Feb. 1

Compiled by Lt. Cmdr. Don Peltonen

Ship Operations

The tanker *Paul Buck* finished offloading fuel to McMurdo Station Jan. 28 and then proceeded to ballast with sea water to bring the ship down to its ice draft.

The U.S. Coast Guard icebreaker *Polar Star* transfered oily waste to *Paul Buck* Jan. 29 and departed the morning of Jan. 30. Then the Russian icebreaker *Krasin* moored alongside *Paul Buck* Sunday morning to take on water provided by McMurdo Station and the *Paul Buck*. The *Krasin*'s crew enjoyed its first visit to McMurdo Station.

On Jan. 31 the *Krasin* departed and passed a tow line to *Paul Buck* to assist her off the pier. *Paul Buck* departed the ice pier and proceeded out the inner channel escorted by *Krasin* and *Polar Star*. After parking in the ice 27km from McMurdo to perform maintenance, the *Paul Buck* was escorted to the fast ice edge on Wednesday by the *Krasin*.

Then, the *Krasin* and *Polar Star* escorted the *American Tern* down the inner channel to the ice pier early Thursday morning and cargo offload began. Current plans have *Krasin* and *Polar Star* departing McMurdo with *American Tern*. Ship operations for the season should be wrapped up within the next several days.

Big iceberg B15a chills out

By Kristan Hutchison
Sun staff

Like an 800-pound gorilla, giant icebergs in the Ross Sea seem to be doing whatever they want.

After sitting with one end bumping against Ross Island for several years, the largest remaining remnant of what was once the largest iceberg on record has drifted northwest. B15a's ponderous pace made world headlines: "Get Ready for the Largest Demolition Derby on the Planet"..."Monster iceberg wreaks havoc."

In mid-December B15a seemed to be on a collision course with the tip of the Drygalski Ice Tongue. It came within 4.5km of the Drygalski on Jan. 10 and iceberg watchers were poised on the edges of their seats. Then it stopped. Jiggled around. Backed up a bit.

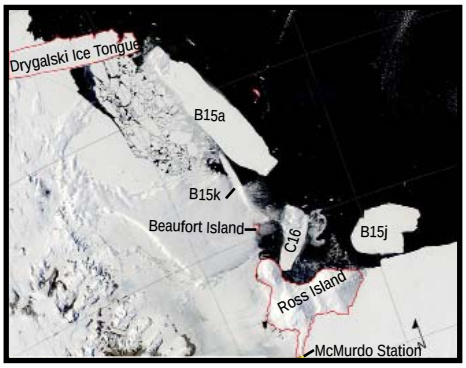
"It's scary to try to predict what will happen next. It's just as risky as predicting the stock market," said Kelly Brunt, who has been following the iceberg's movements since the original B15 broke off the Ross Ice Shelf in 2000. She started as the geographic information specialist at McMurdo Station and is now a graduate student working with iceberg researcher Doug MacAyeal at the University of Chicago. In that time the iceberg B15 has broken into a family of smaller bergs, alphabetically named.

Where iceberg B15a goes now depends on a number of factors, including tides, currents, winds, how far the ice extends below the surface and where the seafloor rises to meet it. For the moment, the last of those factors is the most important, as B15a seems to have one side lodged on a submerged volcano in the Ross Sea, Brunt said. The volcano's pinnacle hits the long iceberg about halfway down the western edge. Satellite images and GPS instruments on the iceberg show it pivoting around that point, lining up with the northbound current like a weathervane.

"One little part of it dragged on this seamount and stopped the whole iceberg, just as it was on the doorstep of the ice tongue," said NASA glaciologist Robert Bindschadler.

In one image, Bindschadler could see that the grounded portion of the iceberg is higher than the rest of the iceberg, indicating that the iceberg is bending on that point as the tides raise and lower the ends. This fluxing could cause the iceberg to break into pieces, he said. Chunks of ice are calving off in the area where B15a is grounded. If enough break off, the iceberg could be freed.

"Our attention is riveted to what it's going to do next," Bindschadler said. "I'm hoping whatever it does, it does before the sun sets."



Satellite image courtesy of NASA MODIS

The iceberg positions as of January 30.

He has two reasons for that wish. One is to be able to watch the icebergs better, because after the sun sets for the winter the icebergs will be visible only with infrared.

The other reason is that if the bergs don't move soon, they will likely freeze in place.

"If it is still grounded by the time the summer is over, then the water starts to cool down and melting starts to decrease, it's less likely to become ungrounded," Bindschadler said.

If it is freed to float again, B15a would probably continue drifting north with the current, Bindschadler said. It could bump the end of the Drygalski Ice Tongue, or it could squeak by. The question is what will happen if it does hit.

"We don't really know. These are really, in a relative sense, very thin wafers of ice," Bindschadler said. The 100km long iceberg is only about 300m thick, a ratio similar to a sheet of linoleum 10m long. "But it's still a huge piece of ice and it has a lot of mass and even a minor collision involves enormous forces."

B15a is still the big berg, but B15-K, a more slender sliver of the original berg, has almost as much effect on the sea ice. B15a and B15-K used to be side by side, but since B15a slid northward they are lined up like sliding doors closed most of the way across the entrance to McMurdo Sound.

"The only hole is at the northern end, the 5.5km or 6.5km gap between the Drygalski," Brunt said.

B15-K is pinned in place by the clockwise current which presses it against Beaufort Island and a seamount. The current's constant pressure on B15-K's exposed center could cause cracks and eventually a break, which would allow the pieces of the berg to move, Brunt said.

The icebergs have corralled the sea ice in McMurdo Sound. The ice in the sound would normally blow away at this time of year. Because it's stuck in place, the salt will drain out of the ice, then snow will fall, melt into the ice and refreeze, creating a stronger second- year ice more like freshwater ice, said John Dempsey, a professor of civil and environmental engineering at Clarkson

See Bergs on page 8

Photo by Viola Toniolo / Special to *The Antarctic Sun*

Adélie penguins access open water at Cape Crozier. Icebergs have blocked some of their feeding grounds.

Photo by Kristan Hutchison / *The Antarctic Sun*

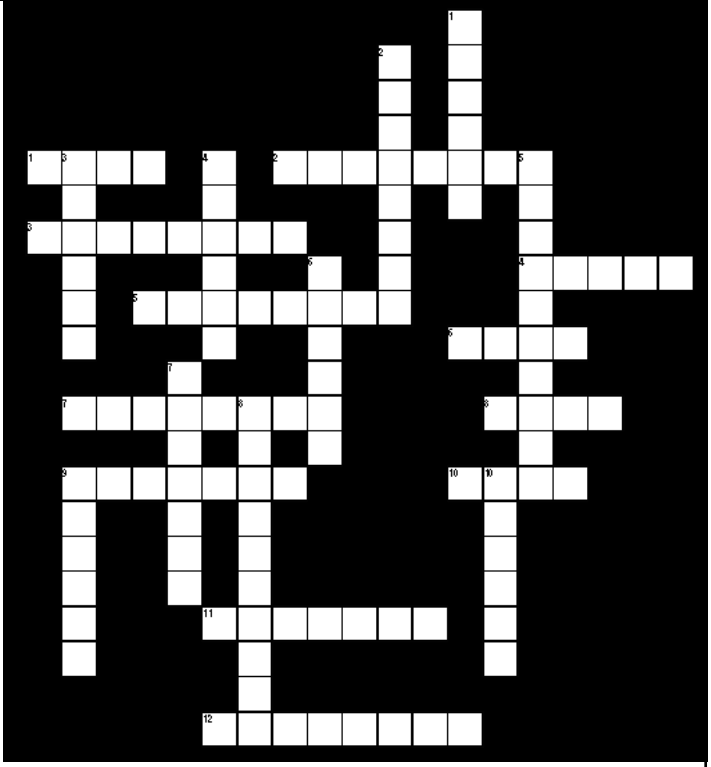
The Russian icebreaker Krasin *leads the resupply vessel* American Tern *through the channel to McMurdo Station on Feb. 3. The Coast Guard icebreaker* Polar Star *cut the channel in the sea ice, which extended farther than ever at about 150km. Icebergs at the entrance to the sound have corralled the sea ice inside.*

Snow and ice *(answer on page 17)*

By John Deaton

Across

1. Largest ice sheet in the world; the _____ Antarctic Ice Sheet.
2. A Russian word for wind-blown formations on the snow surface.
3. Occurs when a seismograph registers an iceberg rubbing against the sea floor.
4. A thick, broad ice sheet that forms on land and flows out to float on the sea.
5. A condition when blowing snow restricts visiblity.
6. The first stage in the transformation of snow crystals by compaction and compression into glacial ice.
7. The loss of glacial material by melting, evaporation, calving or sublimation.
8. Ice comprised of loose, drifting chunks; habitat of leopard seals.
9. A river or sheet of compressed snow and ice that forms when snow accumulates over a long period.
10. Ice attached to land; preferred home of Weddell seals.
11. The action of a new iceberg breaking off.
12. Deep cracks forming in ice sheets and glaciers.



Down

1. A long, narrow flow of glacial ice that extends into the sea.
2. Ice that forms and gathers on the underside of the sea ice.
3. Ice that forms on the sea floor.
4. Thick, slushy sea ice formed by ice crystals that are disturbed by ocean turbulence.
5. Dynamic, fast moving parts of a glacier ice sheet.
6. An opening in the icepack.
7. Circular, flat plates of sea ice.
8. Where the *Polar Star* is.
9. Ice that forms in open water and has a glossy sheen.
10. The reflective quality of the snow.

Bergs From page 7

University, who is studying the McMurdo sea ice. The sea ice will thicken as water freezes to the bottom.

More sea ice could be a problem for the penguins at Cape Royds and Cape Bird, where the extensive sea ice has forced the penguins to walk farther and farther in search of access to the water and their feeding grounds. The number of chicks at both colonies has decreased. Unlike last year, when open water drew many penguins from other colonies to Cape Royds, this year there were no immigrants. Instead, a quarter of the usual Cape Royds birds went to other colonies, particularly Cape Bird.

"If these conditions continue, Royds would eventually empty out to Cape Bird," said Dave Ainley, a penguin biologist studying the colonies around McMurdo Sound. The penguins are following the food. "They need to work, so they go to where the work is."

On the other hand, the number of chicks at Cape Crozier is higher than ever, Ainley said. That's not necessarily good news. Though B15a moved, B15j has continued to occupy the ocean adjacent to the Ross Sea Polyna, an area of open water that used to be a plentiful source of food for the penguins. The areas the penguins can still reach are much less productive, with few krill or small fish, Ainley said.

With icebergs still in the way and more mouths to feed, the chicks are small and many will likely die. The movement of B15a gives some hope because it was the outer block in a wall of bergs beside the colony. Now that B15a has moved, the others have more chance to move away as well. B15j rotated counterclockwise and moved eastward, along the Ross Ice Shelf.

Despite worries about the icebergs and the sea ice this year, the icebreakers and supply ships were able to approach McMurdo Station between Cape Bird and Beaufort Island. As long as the icebergs stay in place, the breakers will be able to follow the same channel next year, said Lt. Cmdr. Don Peltonen, ship operations officer for McMurdo Station.

"We'd like B15a to just sort of drift off and go away, but it's not cooperating," Peltonen said.

A hands-off effort to find life

By Emily Stone
Sun staff

Pamela Conrad wants to find signs of life in outer space.

"I guess it comes from watching a lot of Star Trek as a kid," said Conrad of NASA's Jet Propulsion Lab.

Before getting to space, she's using the McMurdo Dry Valleys as a stand-in for Mars to test machines that look for signs of life inside rocks. She and seven other scientists spent three weeks testing the machines. She hopes the machines will go to Mars.

"We're interested in how you find evidence of the clues of life on other planets," she said. "I would like to be able to do that without even touching the potential targets."

Conrad tested four machines. Another scientist from NASA, Robert Carlson, is the principal investigator on a similar project that was folded into Conrad's. His group tested a fifth machine. Together, the instruments look at many components of the rocks —how they absorb light, what molecules they hold, whether they are emitting volatile organic molecules, and what types of minerals they're made of. These factors indicate tiny organisms living inside.

Conrad's group took a small number of rocks home to study in the lab, where they will state conclusively whether the rocks are home to living things. They will then compare their results from the machines in the field with their lab tests to see how accurate the instruments were. Their goal is to say that if all the machines show substantial signs of life within a rock, then there will be life within that rock.

Photo by Cindy Dean / Special to *The Antarctic Sun*

Pamela Conrad of NASA's Jet Propulsion Lab inspects the rocks at Battleship Promontory, where she will test several instruments meant to detect signs of life within the rocks.

Photo by Heather Smith / Special to *The Antarctic Sun*

Scientists at the Battleship Promontory field camp look at the rocks they will use to test their machines. The machines look for clues of life inside rocks, and the scientists hope the instruments eventually get sent to Mars.

Despite the popular notion, NASA isn't truly looking for life on Mars, Conrad explained. Instead, scientists are looking for signs that the planet was ever or currently is habitable. This can be done by looking for evidence of substances, like water, which we believe are necessary to sustain life. Or it can be done by looking for clues that life existed or still exists, which is what the machines do.

Conrad's four machines, which never touch the rocks, are run remotely from laptops.

The first measures how much light is absorbed or reflected off a rock. The group wants to understand this because they believe there are subtle visual clues that the rocks have which suggest life inside. Conrad said scientists who study rocks can tell if a certain rock is likely to be inhabited, and are often right, but they can't articulate what it is they're looking for. This instrument might be able to help hone in on that by picking up on visual markers that humans notice but can't specify.

The second machine sends out a laser that causes the rock to become fluorescent. The color of the rock's fluorescence indicates what type of molecules the laser is hitting.

The third machine uses a laser as well. The laser subtly changes color depending on what minerals it hits.

The fourth machine "is basically a sniffer," Conrad said. It has a needle that measures volatile organic molecules in the air around the rock. These are molecules that might be given off by organisms in the rock as they go through their normal life cycle.

Carlson tested a fifth machine. It uses an infrared spectrometer to identify the molecules in the rock. He and his team are interested in particular in how iron is distributed through the different layers in the rock.

Desert rocks have iron spread across their surface, he said. His team's theory is that organisms in the rock, like lichen, dissolve a small amount of the iron on the surface. They do this to get enough sunlight to photosynthesize, but not too much so that they are vulnerable to ultraviolet rays. The dissolved iron accumulates lower down in the rock. His machine will look specifically at the factors involved in this process, like organic acids used to dissolve iron.

It is hard to imagine how rocks end up like this — with the heavier layers of iron sitting on top of the lighter ones — without help from life inside the rocks, explained Henry Sun of the Desert

See Hands-off on page 10

Covering the ionosphere from Pole

By Brien Barnett
Sun staff

An international network of radar stations that keeps tabs on what's happening in the magnetosphere above Earth is coming to South Pole.

SuperDARN, or the Super Dual Auroral Radars Network, was started nearly 20 years ago when the first transmitter was placed at Goose Bay, Labrador. Today, stations cover both the northern and southern hemispheres at points where charged particles, or plasma, re-enter the Earth's atmosphere as a result of the interaction between the solar wind and the Earth's magnetic field extended into space.

"When the plasma in the ionosphere is moving … plasma instabilities happen," said Bill Bristow, of the University of Alaska. "It's a lumpy fluid and when you transmit a radio signal into that some is reflected back."

In rough terms it's like tracking a group of airplanes. The lumpy fluids show up in the radar data and reveal characteristics such as velocity and location. The data SuperDARN collects are important, Bristow said, because solar storms and other space weather effects can severely affect human activity in space and on the ground at such places as communication satellites or power lines and plants.

"As man becomes more dependent on technology — GPS satellites, global communication, et cetera — they all are sitting in space." Bristow said. "We want to understand that environment."

Besides practical reasons, the scientists are personally curious.

"We want to understand the process of energy transfer from the Sun into upper atmosphere." Bristow said.

Photo by Danny Ratcliffe / Courtesy of SuperDARN

A SuperDARN installation in Tasmania. This one covers the southern ocean and the northern part of Wilkes Land in Antarctica.

Many experiments look at the Earth's magnetic field structure, but SuperDARN has mapped the field on a global scale.

To accomplish this, the radars must be spread strategically around both the north and south poles. The installations are fairly large because they operate using the HF, or high frequency, band. That's similar to what Antarctic field parties use to communicate with the stations.

The arrays, which cost about $300,000 to $400,000 each, consist of 16 T-shaped towers in one line, set 15m apart. About 100m away and parallel to that line of towers are another four towers, again set about 15m apart from one another.

In January, Bristow's team tested the signal at South Pole to make sure it didn't interfere with other projects at the station. Many of the astrophysical instruments are radio telescopes or rely on sensitive electronics. SuperDARN must operate at its designated band, between 8-20 Mhz, without interfering with any other instrument or station communications. Once the tests are complete, radar towers and transmitters can be brought to the station and set up, probably in the next year or two.

The station is at the geographic South Pole, but not at the magnetic South Pole, which slowly moves and is presently over Dome C. Bristow said that's because the experiment needs to cover the auroral oval, the place where incoming particles are the greatest. South Pole Station is at the poleward boundary of the southern auroral zone. The particles precipitating into the ionosphere create fantastic visual auroras that hang over Antarctica's winter residents.

"We can observe over a range of about 2,500km … and possibly farther." Bristow said. "In the northern hemisphere we can see out to 3,000km."

The South Pole Radar will fill an existing gap not covered by Southern SuperDARN radars located at the British Station Halley Bay and a new radar, which is under construction at the southern tip of New Zealand.

The project is an international collaboration with scientists from nearly a dozen countries. By agreement each country builds its own facility but uses a common data format and software so researchers can have immediate access to the data.

NSF-funded research in this story: Bill Bristow, University of Alaska-Fairbanks, http://superdarn.jhuapl.edu/

Hands-off From page 9

Research Institute in Las Vegas, who is working with Carlson.

The eight scientists spent three weeks in the field so they could test the instruments under different environmental conditions to see if temperature or sunlight affect the results.

They chose their location at Battleship Promontory because a large amount of organisms live in the rocks there. Conrad said that if the machines don't work in a place where they have a high chance of finding something, then they certainly won't work somewhere where the odds are slimmer.

The trip to the Dry Valleys is the culmination of Conrad's three-year project. Her group has tested its machines already with good results in Death Valley and in the Arctic.

Carlson, who is in the first year of his two-year project, joked about the extent of his field testing.

"We've gone as far as the JPL parking lot," he said, and has pictures to prove that the group tested the machine on a large rock in the driveway of the Jet Propulsion Lab.

Both groups applied to get their instruments on a 2009 expedition to Mars, but they weren't accepted. The scientists plan to keep trying to get them to Mars. In the meantime, the group will continue testing and perfecting the machines.

Battleship Promontory was included in the new Dry Valleys Antarctic Specially Managed Area plan, adopted last year. This means increased restrictions in terms of the work that can be done there in hopes of limiting the human impact on the area.

Conrad said this makes it an even more appropriate place to test machines that aren't invasive and won't disturb the rocks.

"If you could point to a rock and say there's life in that rock, that would be awesome because you wouldn't have to break open that rock," she said. "The longer you can sustain it without doing something to it, the longer it will be there for someone else to study."

The project is funded by NASA with support from the NSF: Pamela Conrad, NASA Jet Propulsion Lab.

New telescope looks at early universe

By Brien Barnett
Sun staff

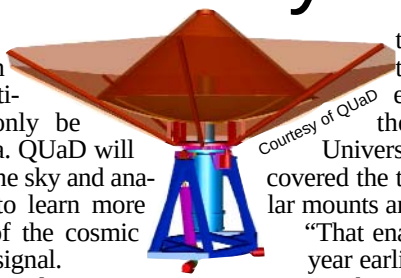
A new telescope at South Pole Station is just weeks away from probing the universe.

DASI made headlines when it became the first to detect temperature differences and later polarization in the cosmic microwave background, radiation left over from the Big Bang. The Big Bang theory states that the universe began with a period of rapid expansion called inflation, and that the universe still is expanding today somewhat like a balloon with galaxies and matter on the surface of the balloon. DASI detected remnant fluctuations in the Cosmic Microwave Background radiation from that event.

DASI answered a fundamental question about whether there was evidence for the inflationary theory, said Sarah Church, assistant professor of physics at Stanford University and member of the Kavli Institute for Particle Astrophysics and Cosmology. QUaD was built to follow up on DASI's work, Church said.

"A lot of things seemed to turn out as expected but there are some questions," she said.

Among the question are differences in theoretical models that can only be answered with more data. QUaD will look at a small piece of the sky and analyze the data in detail to learn more about the polarization of the cosmic microwave background signal.


Courtesy of QUaD

Rendition of QUEST telescope.

"There's a smaller signal we want to take a look at," Church said.

QUaD will be pointed at a small patch of sky for the Antarctic winter. QUaD has 62 detectors that must be super-cooled to temperatures a fraction of a degree above absolute zero. That sensitivity will allow it to "see" patterns in the polarization of the patch of sky.

Church said it's hoped that QUaD may also help shed light on the existence of the mysterious dark energy that fills most of the universe.

"It's possible that if we can understand how inflation happened we can learn more about dark energy," she said.

Like DASI, the new telescope was placed at South Pole because it offers optimal observing conditions: long periods of observing in dark, cold conditions. It paid off that the DASI mount works well for the QUEST telescope.

The DASI experiment was wrapping up and had achieved all its science goals. Meanwhile, the QUEST team was planning to design a mount, or structure, to hold the new receiver. In a conversation with the DASI team at the University of Chicago, they discovered the telescopes were using similar mounts and so began collaborating.

"That enabled us to get on the air a year earlier than planned," she said.

The project is funded by the United States and the United Kingdom. Church said both nations are interested in the same science goals. No other experiment covers the same goals and the data are of value to theorists whose models can be tested by cosmological observations, she said.

NSF-funded research in this story: Dr. Sarah E. Church, Cavli Institute for Particle Astrophysics and Cosmology at Stanford University, http://www.stanford.edu/group/quest_telescope/

QUaD is an acronym of an acronym. The previous telescope where QUaD will be located was called DASI, or the Degree Angular Scale Interferometer. QUaD stands for QUEST at DASI. In turn, QUEST stands for "Q and U Extra-Galactic Sub-mm Telescope."


Courtesy of QuaD / Special to *The Antarctic Sun*

The QUEST telescope will be placed inside the shield to the left in the Dark Sector.

RICE works with IceCube to find neutrino source

By Brien Barnett
Sun staff

An experiment at South Pole is offering a different view of neutrinos, the mysterious space particles that may hold information about the physical universe.

Dave Besson, professor of physics at the University of Kansas, is developing the $400,000 Radio Ice Cherenkov Experiment at South Pole Station. RICE is a set of detectors designed to pick up radio waves given off by the collision of high-energy subatomic particles called neutrinos with the dense, clear ice below the station.

"In principle a neutrino telescope is giving us a new way of looking at the universe. It's a new map," Besson said.

The kind of neutrinos sought by RICE and the $270 million IceCube project, also at South Pole, come from far outside our solar system and may help space physicists learn more about the formation of the universe. As complementary projects, IceCube uses optical detectors to gather visible light in the ice while RICE seeks radio waves. The collision of a neutrino with an ice molecule creates both visible light and radio waves.

The first RICE array was installed in the 1997-1998 season and monitored through 2000. It consisted of radio receivers and was intended to demonstrate the feasibility of the technique. However, without a known source of neutrinos, the project hasn't found any of the specific neutrinos his team is seeking, Besson said. Co-deploying with IceCube will extend the array and make detecting one more likely, he said.

"We realized that the first generation experiment was going to be a prototype experiment," Besson said. "The second generation experiment should actually see neutrinos from active galactic nuclei, but if after this we didn't see anything then that would present a problem with our model."

Besson said the RICE team has been a "nominal" participant in IceCube to this point, but is becoming more involved as the benefits of incorporating multiple technologies, including radio and acoustic detectors, seems to make more sense.

RICE and other experiments would serve two purposes in helping IceCube, Besson said. The first is to gather its own data, but then secondly to confirm any neutrinos detected in the system. If the visible light detectors see something, then the radio and acoustic detectors may as well.

RICE isn't the only project searching for neutrino-based radio waves, but Besson said it's the first to incorporate the ice.

"There was a group based at Berkeley that went to Antarctica and took (radio) measurements, but we were first to take data," Besson said.

A long-duration balloon test project that was flown last season, Anita-lite, used the same concept as RICE. The key difference between the two was Anita-lite used the entire Antarctic ice sheet as its filter. No data has yet been released from the balloon project.

NSF-funded research in this story: David Besson, University of Kansas

Photos by Emily Stone / *The Antarctic Sun*

David Ginsburg, a graduate student at the University of Southern California, carries a cooler across the ice at New Harbor toward his dive hole to collect sea star larvae he found during a dive. Below, Ginsburg chips ice away from the dive hole. He's part of a group of scientists studying sea star and sea urchin larvae.

Larvae From page 1

research since 1983.

The scientists know the larvae use about 25 times less energy to create roughly the same amount of protein as temperate species. And Antarctic larvae eat with an efficiency that is nearly off the charts. About 95 percent of the protein the larvae consume turns into body mass. Most organisms, including warm-water sea urchins and humans, hover around 40 percent.

"I liken them to little body builders," said Allison Green, a graduate student focusing on the larvae's eating patterns.

The Antarctic larvae need to be such efficient eaters because they don't always get a lot of food. So when they do eat, they want to use the food as best they can. They are so efficient, Green said, that the larvae can live a full year off the nutrients given to them in their mother's eggs without anything new to eat.

"They can say, 'You know it's not looking good this year, I think I'll hang around and see if more food comes along next year,'" she said. Temperate species would last about a month without new food.

Green can tell how efficiently the larvae are using protein by measuring how much protein they amass while eating algae in the lab. This year she's started looking at how the larvae use fat, which she thinks they are burning as energy.

Ginsburg's research this year looked at other echinoderms to see if the biological

patterns of the sea urchin hold true with similar animals. He focused primarily on sea stars, and dove for samples around McMurdo Sound. So far, the research shows that the sea stars and sea urchins have similar protein synthesis rates, meaning they make protein at roughly the same speed, Ginsburg said.

The scientists focus on these Antarctic animals for several reasons.

About 80 percent of the habitable space on Earth is cold ocean water with temperatures similar to your refrigerator, Manahan said. Yet little is known about the organisms that live there. It is important to understand these species in order to make any generalizations about life on Earth, he said.

The larvae are also easy to get. Scuba diving in Antarctica is simple compared to taking a submarine to the bottom of the ocean. And the animals release huge amounts of eggs at once, so researchers can easily collect eggs to bring to the lab to monitor as they grow.

"It's not that we're deeply in love with sea urchins or sea stars," Manahan said. "These are model organisms because they give us hundreds of thousands of babies."

The research focuses on proteins because they are crucial building blocks for any organism. All organisms must constantly make new protein as older protein degrades.

"Even if we just sit here and do nothing all day, 30 to 50 percent of our energy would go to resynthesizing protein," said Douglas Pace, a post-doctoral researcher with the group.

Pace is focusing on the larvae's protein-making machines. The machines, as Pace dubs them, are ribosomes inside cells. He takes the cells apart to study the number of ribosomes per cell and the rate at which they make protein. The Antarctic larvae have far more ribosomes per cell than temperate species do, Pace said.

See Larvae on page 13

Larvae From page 12

One theory for why the Antarctic larvae make so much protein has to do with the way proteins fold in order to become useful, Pace said. Proteins are like sticky strings, and if they fold wrong they become, "a hopeless mess," he said.

Temperate species have little protein chaperones that guide the proteins into the right formation. This expends a lot of energy. Pace said the Antarctic sea urchins might simply make a lot of protein and assume the odds are that eventually some proteins will fold correctly.

Photo by Rob Robbins / Special to *The Antarctic Sun*

David Ginsburg collects sea stars from McMurdo Sound.

The group's research could have practical uses in helping doctors understand human ailments, such as weight gain and obesity, which are often related to metabolism. Manahan said understanding highly efficient metabolisms could also help in agriculture because it's beneficial for livestock to use their food efficiently so they can grow quickly and produce a lot of meat.

The scientists are also hoping to expand biologists' understanding of Earth's organisms. Most of what scientists know about metabolism or other basic biological functions is based on the study of warm weather animals, particularly mammals. With so many of the planet's creatures living in the cold, perhaps heat-loving animals are the exception and species like those in Antarctica are the rule. Maybe life in Antarctica isn't so harsh after all.

"It's only extreme because we're cold when we're down here," Pace said.

NSF-funded science in this story: Donal Manahan, the University of Southern California.

Marshians back again

After first year, study of cold invertebrates leads to several papers

By Brien Barnett
Sun staff

The Marshians returned to Crary Lab this year seeking clues to how sea urchins and starfish have adapted to the cold environment of McMurdo Sound.

Principal investigator Adam Marsh of the University of Delaware and his team of graduate students dove at various places near McMurdo Station to gather specimens. The sperm and eggs from the specimens were used to create embryos that were analyzed to determine the growth rates of the embryos. This will give the researchers much-needed clues about the development of the sea creatures and the genetic switches that control their growth.

Last year's work resulted in two papers. One has been published and one is in review. Marsh and postdoctoral candidate Kevin Fielman co-authored a paper titled, "Molecular Development and Evolution," which will appear in the Journal of Experimental Zoology. Their paper examines some basic conclusions about the genetic switches that lead to development in the creatures. Former graduate student Tracy Szela and Marsh have written a paper that is being reviewed by the journal Marine Ecology Progress Series. That paper discusses a new technique developed as a result of the work in the Antarctic. The technique, involving a plate with 384 individual wells, is a test for respiration, or how fast oxygen is being consumed by each embryo. Other respiration techniques are more precise, but require much more time to process.The new technique lets the scientists know where they should focus their research, said Paul Ulrich, a graduate student at the University of Delaware who was working with Marsh's group to develop other analysis methods.

Courtesy of Lindsay Kendall / Special to *The Antarctic Sun*

A larvae under the microscope.

The lead graduate student this year, Lindsay Kendall, was back for her second season. Kendall has been trying to find the specific points at which the genes in the embryos switch on and off. Those points are related to temperature, which relates to the question of how the organisms live where they do.

The team returns next year for one more season. After that, the group hopes to test samples from warmer climates and compare them with the Antarctic research.

NSF-funded research in this story: Adam Marsh, University of Delaware, http://marsh.cms.udel.edu/~amarsh

Continental Drift

Besides packing, what do you plan to do on your last day in Antarctica?

"I'm going to take one last hike up Ob Hill, look in every direction, then eat all the chocolate I've been hoarding."

Bill Jirsa,
McMurdo
IT trainer
from Denver,Colo.,
first season

"Try to stop seeing insect larvae every time I close my eyes."

Luke Sandro,
Palmer Station
research assistant
from Dayton, Ohio,
first season

"There is no last day in Antarctica. I'm always coming back."

Robert Schwarz,
South Pole
QUaD scientist
from Germany,
fifth season

Up, up & away

Balloons keep tabs on weather

John Gallagher is on a schedule. Twice a day, he or one of several other meteorologists at South Pole Station report to the Balloon Inflation Facility to launch the day's weather balloons.

Above left, a radiosonde is prepared for flight. The small packge weighs less than 500 grams. Above right, John Gallagher ties off the weather balloon as it lifts a weight off the table. At right, Gallagher rolls up the computer calibration tape that came with the radiosonde.

Story and photos by Brien Barnett / *The Antarctic Sun staff*

In the winter, it's just done in the morning. All launch times are coordinated so data from around the world are ready at the same time. Many of the bases in Antarctica, including McMurdo Station, also have weather balloon launches.

Researchers across the world have access to the data gathered by the instruments, called radiosondes, attached to the balloons. The sondes track temperature, pressure, altitude, wind direction and speed, and relative humidity. Sometimes special sondes are sent up to search for such things as ozone, which is a key part of Earth's protective atmosphere. The data are used to form models for both that week's weather and climate history.

Launching the balloon is a process that starts with organizing and preparing various pieces of equipment and ends with confirmation that the data is being captured as the balloon rises.

On this day, Gallagher, who is in his fourth season at Pole, removed the sonde from its packaging and prepped the battery by activating it in water. Once the battery was working, he placed the sonde outside to adapt to the temperature so it would take accurate readings. While the sonde was outside, Gallagher turned on a receiver. He took a strip of punched paper that came with the sonde and ran it through the receiver. This calibrated the receiver to that

See Balloons on page 15

Above, John Gallagher leaves the Balloon Inflation Facility. At right, Gallagher, a meteorologist checks the data stream as it comes in after the launch. Far right, the balloon rises above South Pole Station.

Balloons

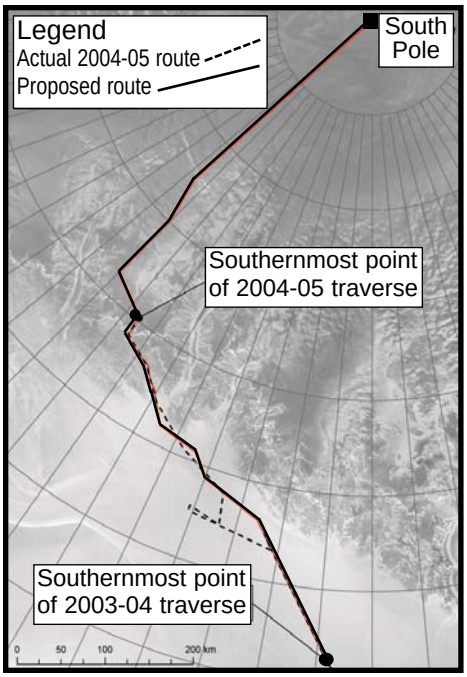
From page 14

specific sonde. Once it was running, he checked to see that it was recording incoming data from the sonde sitting outside. If the sonde wasn't working he could get a new one from the supply of 600 sent down each season.

The mylar balloon is about a meter in diameter. It is filled with helium inside a large room in the building until the balloon lifts a 500g weight that is tied to it. The weight is approximately the same as the sonde. Once the balloon was filled, the sonde was attached and Gallagher called Comms to make sure no air traffic was planned for the next 15 minutes. He opened the large double doors and walked outside. There, he took a moment to check the wind, then released the balloon. As the balloon rose it pulled the sonde with it. It went up quickly at first, then it hit a small pocket of quiet air and rose slowly, only to catch a little wind and rise quickly again, nearly out of sight.

Gallagher returned to the facility, closed the doors and went to check the incoming data. After a few moments, data started rolling in every few seconds.

The flight terminated at about 35,000m when the balloon burst because the pressure of the expanding helium became too great. The sonde started descending until it was lost. The U.S. Antarctic Program has a permit that allows it to launch the balloons and sondes, which are nearly impossible to recover. But the data the sonde captured that day will go into the permanent record of Antarctic weather for future research.



Map by Jessica Walker / *The Antarctic Sun*

Photo by John Penney / Special to *The Antarctic Sun*

Above, the South Pole Traverse camps on the Antarctic plateau, after having climbed the Leverret Glacier. This photo was taken using a remote-controlled airplane John Penney brought along. The map at left shows the route followed by the traverse, which covered terrain nobody has crossed before and had to adjust the planned route to avoid crevasse fields.

Traverse From page 1

allowed before returning to McMurdo.

Before this season, the sleds were modified based on the collective ideas of the traverse crew. The crew consisted of a team of Raytheon Polar Service Co. equipment operators, mechanics and mountaineers, along with engineers from the U.S. Cold Regions Research and Engineering Laboratory (CRREL). The curve of the ski tips was changed and some of the skis were widened and lengthened. On some sleds the skis were also moved farther apart, to run to the outside of the tractor tracks.

"The improvements all worked as well as we hoped, except one set of improvements that worked much better than we hoped," said Jim Lever, a mechanical engineer from CRREL, who has been involved with the traverse for three years.

The improvements that worked better than expected were the wider and longer skis with elliptical-shaped noses under the tank sleds. These were initially configured for two sleds to ride side-by-side, so the skis ran outside the tractor tracks. But the skis glided so well the sleds were able to run in line with the tractor ruts without plowing into them.

"That was unexpected," Lever said. "Those new skis worked so well they seemed to not have this problem of running into chewed up snow and in the ruts. They just happily pulled along."

With the improved skis and a fifth tractor helping to pull the 13 sleds of fuel, cargo and living modules, the traverse team reached its farthest-south point from last year in 17 days and kept going across the Ross Ice Shelf.

"Driving across the Ross Ice Shelf — the size of Texas — at 5 MPH is one long, slow, grind," said Richard "Stretch" Vaitonis, one of the heavy equipment operators. "Books on tape kept me awake."

Three days up the planned route, approaching the base of the Transantarctic Mountains, the traverse team found crevasses. The crevasses were invisible at the surface, which was a flat plain of snow, broken by white waves of sastrugi. But ground penetrating radar suspended out in front of the lead vehicle revealed patterns below the surface, warning of crevasses. This was used to search systematically for a safe way through the crevasse maze, but at every turn it showed more crevasses.

"We would see 10 in a mile at times," said Susan Detweiler, a Field Safety Training Program mountaineer, who read the radar screen.

Crevasses were expected in that area, but not in the quantity that were found — hundreds ranging in size from 10cm cracks to 40m caverns.

"At some point we made the determination this is no place for the traverse to go," Wright said.

As the traverse team scouted for safe ways around the crevassed barrier, National Science Foundation operations manager George Blaisdell contacted two NASA glaciologists, Robert Bindschadler and Patricia Vornberger, for assistance. They were able to request more detailed images from a new satellite instrument that hadn't been available during the preplanning, called ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer). The satellite coverage only extends to 84 degrees south latitude, but that was just far enough to show the area the traverse was trying to cross. Bindschadler and Vornberger used the imagery to trace what they thought would be a safe route across the crevasse field. Blaisdell and GIS specialist Jessica Walker refined the route. With the help of those "eyes in the sky," the traverse team tried the new "ASTER route" and the ground penetrating radar confirmed it was indeed crevasse-free.

"They gave selflessly of their time in the holiday season and in between traveling to conferences in their schedule, and helped us solve our problem," Wright said of the work done by Bindschadler, Vornberger, Blaisdell and Walker. "We probably would have found this eventually, but we would have wasted a lot of time in doing it."

By Christmas Day the traverse had crossed the crevasse fields and was within 30km of the base of the Leverett Glacier. From there they continued up, three times finding their way around smaller crevasse fields. The last was a heart-shaped section of crevasses at the headwall of the glacier. They arrived at 1 p.m. Jan. 4 and parked for lunch, sending a four-person prospecting team ahead up the steep grade. At 6 p.m. the scouting party returned to the rest of the traverse team and Wright said "Break camp...we're going to the top."

By 8:30 p.m. all the tractors had climbed the last rise and were on the polar plateau, in time for mechanic Russell Magsig to celebrate his Jan. 5 birthday.

See Traverse on page 17

Photo courtesy of John Wright / Special to *The Antarctic Sun*

The South Pole Traverse team poses at their farthest-south point. They left four green flags and the bundle of bamboo poles behind, awaiting their return next year. Kneeling from left to right: Judy Goldsberry, John Penney, Jim Lever, and Russell Magsig. Standing from left to right: Brad Johnson, John Wright, Richard "Stretch" Vaitonis and Allen O'Bannon.

Traverse From page 16

The team celebrated both the ascent and the birthday with balloons, ice cream and chocolate cake topped with bulldozer-shaped candles.

"It would have been nice to go farther," said Magsig.

Parked on the flat plateau, Magsig wasn't the only one to feel the pull of the Pole. Though the traverse team already made it much farther than expected for this season, the overall purpose of the traverse is to determine whether it is feasible to drive the route on a regular basis as a way to deliver supplies to the South Pole. While they had enough fuel left to reach the Pole, the traverse would need an additional 11,300 liters to complete a round-trip back to McMurdo.

"We and everybody else associated with the traverse were surprised with this success, but we stood on the polar plateau, and we were ready to spring the question," Wright said. "We called in and said, 'We are here on the polar plateau. We have the will, we have the time, we need additional support, but we believe we can go all the way to South Pole this year and return to McMurdo if support is available.'"

When the request came through, McMurdo Station was caught in a spate of bad weather that was halting flights at a very busy time of year. The weather put the U.S. Antarctic Program 40 flights behind to the South Pole, and it wasn't prudent to add two more fuel flights to the backup, Blaisdell said. Every plane would be needed when the weather cleared to catch up with the critical supplies for Pole's eight-month winter isolation. The traverse team was instructed to turn around and return to McMurdo.

The situation underscored the purpose of the traverse. During the 10 days that planes couldn't fly, the traverse tractors still were able to drive. They made the trip back in 12 days.

"What we have established from McMurdo to a point 738 miles (1,187km) away from McMurdo is a crevasse hazard-free route that is marked by green flags every quarter of a mile," Wright said.

Next year the traverse team will follow the route again and continue on to the Pole, Blaisdell said. They will likely carry cargo, possibly including a trailer needed to move snow at the South Pole. Based on the success so far, a 10-tractor traverse could run two round-trips to the Pole each season, replacing 30 to 60 LC-130 cargo flights, Blaisdell said.

South Pole Traverse team 2004-2005

"This year, among the field crew, there's not one person to single out," said team leader John Wright. "Rather, the combination of all people, the team itself, was the hero, better than ever before."

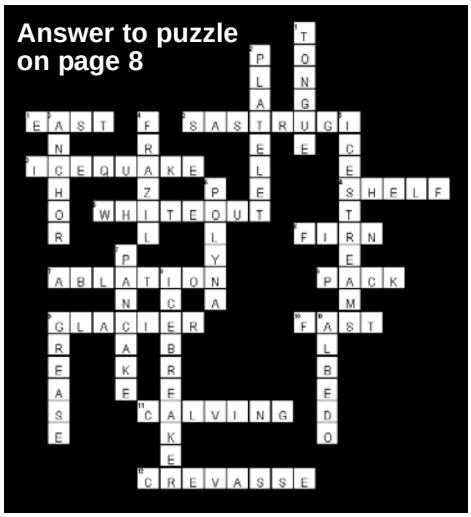
Cold Regions Research and Engineering Lab: Jim Lever, Jason Weale and Russ Alger

Heavy equipment operators: Richard Vaitonis, Judy Goldsberry and Brad Johnson

Vehicle maintenance mechanics: Russell Magsig, John Penney and Project Manager John Wright

Field Safety Training Program mountaineers: Mike Roberts, Susan Detweiler, Allen O'Bannon

Answer to puzzle on page 8



Profile Teacher eyes Mars from McMurdo

By Bill Jirsa
Special to The Antarctic Sun

Dani DiPietro didn't find her first stay in Antarctica last summer season tough enough.

"The whole reason I went to Pole was because I wanted a bigger challenge. I thought (McMurdo) was way too cush. It really bugged me."

DiPietro complained that her habits from the U.S. were largely unaltered because there wasn't a lack of anything at McMurdo Station like showers, laundry, communications, or even warm weather. ("It's not cold," she said flatly.)

"…So then I went to the Pole, and now that I've been there, I'm not sure it was hard enough."

Where do you go next if the austerity of the Amundson-Scott South Pole Station seems a bit soft? Space, of course.

"I will have no problem going to Mars," she confided. Her aim is to make it to space as part of NASA's astronaut-educator program. Dozens of participants train to be among the few selected for shuttle missions. She was among the top 500 selected in previous years, and once she returns to teaching, she intends to apply again.

Photo by Brien Barnett / *The Antarctic Sun*

Dani DiPietro takes a break and reads the newspaper in the new South Pole Station dining hall.

For DiPietro, part of the draw of going to places like Antarctica, or even leaving the planet, is bringing it all back to the classroom.

"I get to come back and I get to teach kids about it," DiPietro said, smiling. Originally from Pennsylvania, she's been living and teaching in Seattle for seven years, at all levels between first grade and high school. She has also worked at places like the Seattle Science Center where she ran the planetarium. She looks forward to making topics personal to her students via her Antarctic experience when she eventually returns to teaching.

"I actually think that's what kids remember the most," she says. "They don't really care how fast the speed of light is… That's not what makes a class experience stick out... I think if you can personalize something and actually give it more ownership and make it more relevant, I think that's the way that you actually get things across."

> "The whole reason I went to Pole was because I wanted a bigger challenge. I thought (McMurdo) was way too cush."
>
> – Dani DiPietro, about her summer at South Pole

DiPietro will work this winter in McMurdo as a labor allocator with Facilities Engineering Maintenance and Construction. Before her job in McMurdo this winter, she spent the summer at the South Pole, where her avid correspondence with classrooms in the U.S. usually revolved around a lively approach to questions of science.

"I'm a goof-ball about that," she said. "I think science is a lot of fun."

If she's not at the South Pole telling 3rd graders whether spit actually freezes before it hits the ground (it doesn't, unless you're on an elevated platform), she's used to being in a classroom turning things different colors or blowing stuff up to teach some science. As with everything, she looks to arrive at an "ah-ha" moment through humor and exploit. Spend some time with DiPietro and you're bound to experience her infectious laugh.

Does that mean she is attracted to extremes?

"I'm the kid that likes all the roller coasters at the amusement park," she beamed.

Her favorite volunteer work in Antarctica was the time she served as guest blaster, helping a team prepare the way for construction. In other words, she got to blow stuff up.

Her sense of adventure extends to her volunteer gig playing music on McMurdo's radio station, where her approach to programming is spontaneous.

"Sometimes I also do the old look through the book, see the name of somebody I've never listened to in my life, and play that," she said. "Just because that way you get to know more music."

Her pluck has also lead her to teach abroad. DiPietro spent a year in Ecuador teaching science, where she learned to handle threats from natural disasters to taxi strikes, as well as the valuable lesson that she could survive in a country where the language and the culture are completely new.

It was in Quito, Ecuador that she ran into a former student and had one of those moments that every teacher lives for. Turning at the familiar sound of her teaching name in a foreign capital, she found one of her first eighth-graders standing there, now a college student on a college-exchange year.

During their subsequent conversation, the former student revealed that DiPietro's teaching had influenced her choice of study.

"'My second major is biology because of you.'" DiPietro said the student told her. "Being a teacher, that's probably the greatest compliment anybody could ever give."

DiPietro hopes to teach next in Thailand or Tunisia. That would further her goal of living on all seven continents. With Antarctica under her belt, and counting her year in Ecuador, she's visited five, and she's lived on three.

Throughout her travels, DiPietro stays connected to her family, friends, and former students via her bi-weekly e-mail newsletter. It now goes to over 400 people, and she is gathering more readers all the time. She just learned that reading her newsletter is extra-credit for a group of 6th, 7th and 8th graders in Maryland.

She seems to make friends just as easily as she gains new readers. "I try to make the most of where I am," she said, as she looked forward to a winter in McMurdo.