The Antarctic Sun

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January 25, 2004

Photo by Beth Bartel / Special to The Antarctic Sun

Researcher Mike Willis secures a monument pin on Franklin Island as the base for a GPS antenna which will help measure the rate at which the land there is moving. An array of such measurements gives the researchers an indication of how much ice once weighed the area down during the last glacial maximum.

Depressed Earth bounces back into shape

By Kris Kuenning
Sun staff

Ten thousand years ago, McMurdo Sound was overflowing with ice. It is still on the rebound. During the last glacial maximum, the surface of the ice was 700 meters above current sea level. The landscape has changed dramatically since then, but the past can be used as an analogue for modern day temperature change.

"With global warming, we want to know how much ice loss is normal and how much is anthropogenic – how much is caused by people," said researcher Terry Wilson of Ohio State University. "The only way to know is to learn more about the natural variability."

One way to do that is by looking at the Earth's response to the last glacial cycle. The Earth's surface is like a balloon, explained researcher Mike Willis also from Ohio State University. When ice builds up on the surface, the Earth sinks under the weight. When the ice is removed, the surface bounces back.

"By knowing this rate of rebound, it is possible to figure out the amount of ice that has been removed," Willis said. "This can then be used to examine if modern day rates of change are unusual."

The crust is still bouncing back from the ice loss that started 10,000 years ago. Models based on climate and geologic information suggest that the crust should be rebounding up to 10 mm a year in the region. The data being collected by the Transantarctic Mountains Deformation Network (TAMDEF) may be

See TAMDEF on page 9

Learning from past accidents

By Kristan Hutchison
Sun staff

Lake Fryxell may clean itself of fuel still lingering in its porous ice cover.

A year ago on Jan. 17, a Bell 212 helicopter crashed on the ice-covered lake in the Taylor Valley. As soon as the pilot and passenger were both safe in a Christchurch hospital, attention turned to the 730 liters of spilled fuel.

The spill was of particular concern because the mostly ice-free Dry Valley is an environmentally protected area and the focus of a Long Term Ecological Research study. Luckily the crash site was about 300 meters from researcher John Priscu's permanent lake sampling site, which was well out of the zone of contamination.

About 45 percent of the fuel was mopped up with absorbent pads before Feb. 5, 2003, when the cleanup efforts were halted for the winter. About 340 liters to 380 liters were left at the site, according to a report by Crary Lab supervisor Steve Alexander and consultant William Stockton.

"The thing about spills is your one and only chance is as soon as you get there. After that, you can't get much," said Mark Furnish, waste operations manager. "We got half of it last year and that's pretty good by normal standards."

This year the environmental and spill response teams went to the site

See Fryxell on page 10

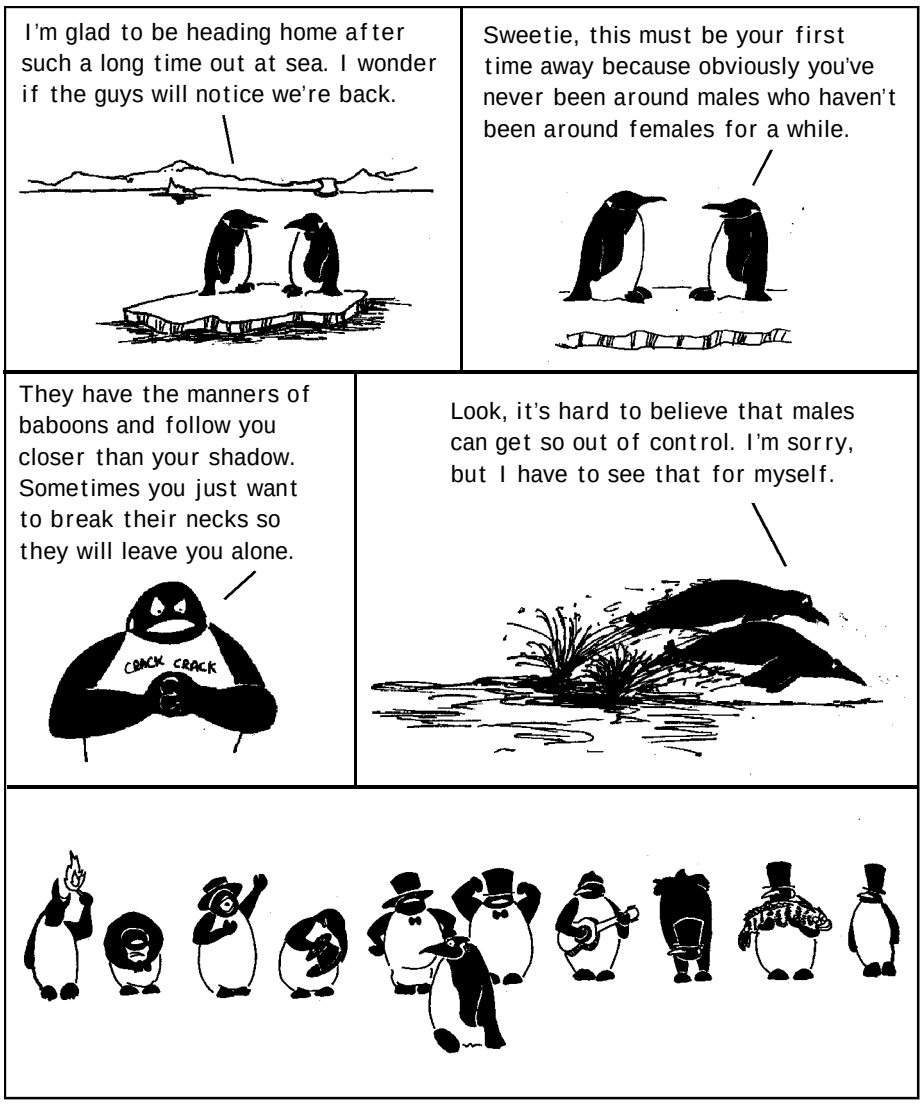
INSIDE

Quote of the Week

"We don't generally move icebergs."

- Coast Guard official on the iceberg partially blocking the channel

Ross Island Chronicles By Chico



Cold, hard facts

Lawrence H. Gianella

Type: **Fuel tanker *Champion* Class, T5s**
Builder: **The American Ship Building Co., Tampa, Fla.**
Power Plant: **1 Sulzer 5RTA 76 diesel; 18,400 hp sustained; 1 shaft**
Length: **188 meters**
Beam: **27 meters**
Displacement: **40,257.98 metric tons with a full load**
Cargo capacity: **237,766 barrels of oil fuel (37 million liters)**
Speed: **16 knots (30 kph)**
Crew: **24 civilians**
Operator: **U.S. Military Sealift Command, U.S. flagged**
Other: **Double-hulled, ice strengthened, two years without a spill, originally named for Laurence H. Gianella who died at his post aboard a torpedoed ship during WWII, tanker's name was misspelled and remains that way.**

Sources: U.S. Navy Fact File and www.newzeal.com

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Senior Editor: Kristan Hutchison
Editors: Brien Barnett
Kris Kuenning
Copy Editors: Melanie Conner
Geoff Jolley, Wendy Kober,
JD Menezes, Mark Williams
Publisher: Valerie Carroll,
Communications manager, RPSC

Contributions are welcome. Contact the *Sun* at AntSun@usap.gov. In McMurdo, visit our office in Building 155 or dial 2407.

Web address: www.polar.org/antsun

Matt Davidson

Science goes deeper with Antarctic meteorites

Large collection from Antarctica means researchers now can probe into the rocks

By Brien Barnett
Sun staff

As the Antarctic Search for Meteorites team returns this week with newfound treasures from the ice, scientists in other parts of the world are studying previously collected samples in new ways.

The United States meteorite collection has tripled in the past 10 years thanks to ANSMET, said Timothy McCoy, a geologist and curator of the Smithsonian Institution's meteorites.

"They've gotten more from Antarctica in 25 years than the previous 500." McCoy said. "It's an enormous boon to science to get this material from the Ice. And it's pristine material."

Of the 15,000 meteorites in the U.S. collection, Antarctic meteorites number about 10,000. As a comparison, the largest Antarctic collection in the world is at Japan's National Institute of Polar Research and numbers about 16,700 meteorites, according to the institute's Naoya Imae.

Until recently, techniques to conduct analysis other than visual and microscopic inspections of the surface were tightly controlled and rarely performed. The rocks were rare and the potential for different discoveries was too valuable to risk a sample being destroyed.

However, today the science of studying early solar history is advancing because of the sheer number of specimens and newly developed techniques that obtain and analyze minute samples of the sub-surface parts of meteorite.

Before the ANSMET team returned to the field late last year, Ralph Harvey, who heads the team, said the U.S. collection had now reached the point where "destructive analysis" is more acceptable as a way to learn the characteristics of a meteorite much more quickly.

McCoy said the Meteorite Working Group, the organization that oversees the U.S. collection, receives about 100 requests a year to do destructive analysis. He said about 90 percent of those requests are approved after careful study.

Kevin Righter, the new Antarctic Meteorite Curator at Johnson Space Center in Houston, said destructive analysis is actually less destructive than the phrase implies.

One of the new techniques involves firing a laser at a sample to generate a circular crater of about 50 microns in size. A micron is a scientific unit of measurement. There are about 1 million microns in a meter.

Another method is to check the sample with an ion microprobe, which generates small pits in the surface of the sample of about 15 to 20 microns in size.

With each technique, scientists analyze subsurface material and, using a mass spectrometer, measure isotope ratios that yield information about the age and origin of meteorites.

Some people study meteorites because they are basaltic and represent volcanism on another planet or asteroid, Righter said. Those scientists study elements that will tell them about volcanic processes similar to people who study volcanoes on earth. Others try to determine the age of the sample from its radioactive isotopes.

Righter said the new techniques for studying the specimens aid that quest.

"They're of great interest because they allow the determination of new isotope ratios and new elements that haven't been able to be analyzed in the past," Righter said.

In addition, the ANSMET team has recovered 12 lunar and 10 Martian meteorites. Those are particularly interesting to scientists because they are like getting a peek at those celestial bodies without having to go there. And sometimes, the meteorites spur exploration such as the current rover missions to Mars.

"We can link those missions directly to the arguments about life in an Antarctic meteorite," McCoy said. "That resulted in a billion-dollar mission to Mars."

Righter oversees the initial characterization of meteorites received from the field in Antarctica and tracks scientists studying them. The specimens themselves are first classified, then stored, some at a giant Smithsonian Institution warehouse in Suiteland, Md.

Each field season, the ANSMET team recovers several dozen to hundreds of samples. One year, about 1,000 meteorites were recovered. All of them are processed the same, careful way. Righter said his group of three researchers has a backlog of about 1,000 samples at any given time, each of which takes about a half-hour to process. His team publishes a semi-annual newsletter, *Antarctic Meteorite*, to update the scientific community as samples are processed.

The initial characterization and classification of a type of meteorite called an ordinary chondrite has relied on taking a small sample of the specimen, crushing it up and analyzing its composition under a microscope. For other specimens, thin sections are created and analyzed using a petrographic microscope and an electron microprobe.

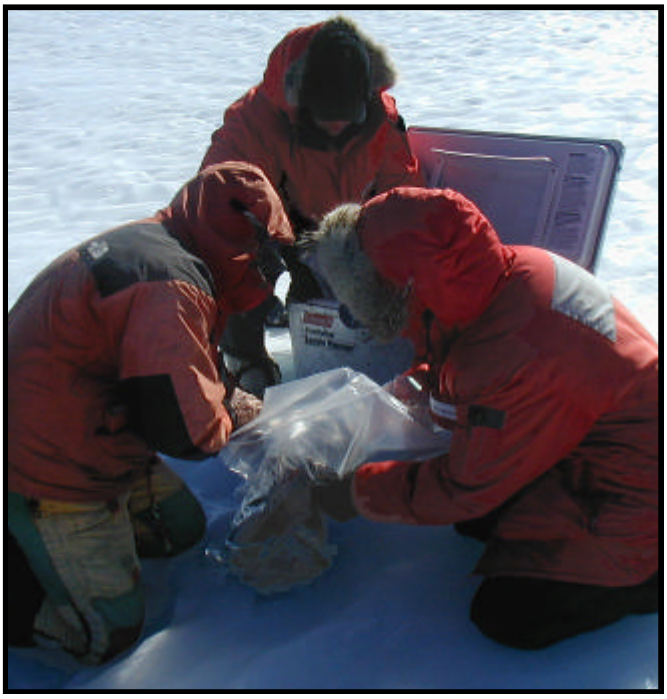
"It's been working well for over 25 years," Righter said.

The advanced techniques have also led to new discoveries on previously analyzed rocks, McCoy said.

"Over the last 25 years we've gone from not knowing they were there to knowing to being able to isolate them," McCoy said. "It's like burning down the haystack to find the needle."

NSF funded research featured in this story:

Ralph P. Harvey, Case Western Reserve University, http://www.cwru.edu/affil/ansmet



At left, members of the team carefully wrap a meteorite in plastic, along with a tag identifying the find. The meteorites are stored frozen until they return to the lab back at Johnson Space Center in Houston, Texas, where they are processed.

Below, a meteorite sits on the ice as it was found this season by the Antarctic Search for Meteorites (ANSMET) team.

Photo by Christopher Cokinos / Special to the Antarctic Sun

Perspectives

Old fire, blue ice: A cosmic harvest

By Christopher Cokinos

Chris Cokinos

Mornings began with a clatter as my tent mate and I would pump our stoves between wooden supply boxes, including one labeled "Bedlam." The entire month I was in the field with the Antarctic Search for Meteorites that sound signaled another day of harvesting meteorites for science. Instant coffee, oatmeal, check-in with Mac Ops, then "suiting up" in extreme cold weather gear rounded out the morning.

As an Artist and Writer grantee, I also used coffee time to take notes for my book on the human entanglements with meteorites–our myths about them, our scientific understanding of them and the personal connections people have to the only objects from space that we can hold in our hands. The history of trying to understand meteorites is rife with folklore connecting them to a kind of bodily sky. Meteors (the lights that flash in the sky when an object speeds through the air) and meteorites (the actual material that survives to land on earth) have been considered, variously, sperm, blood, flatulence and excrement. Given such messy matter, it may be surprising to learn that meteorites also have been worshiped as heavenly messengers long before they were scientifically accepted as rocks from space. The current ANSMET field season began in 2003–the bicentennial of the L'Aigle, France, meteorite fall, one so spectacular that the final doubters understood that rocks could fall from the sky. Today, meteorites still offer clues to such mysteries as the history of the solar system's formation and the origins of life.

Sometimes the coffee wasn't enough. On my Walkman, I'd put on the same music I'd play at home before going to teach at Utah State: AC/DC, Jimmy Eat World. A little motivation, a little warmth (from toe-tapping in the bunny boots) and plenty of irony: Headbanger mornings on a continent where men have had to sew the soles back to their feet, where they've stooped in katabatic winds to eat frozen pony blood.

I spent my first two weeks with the main party, an eight-person camp led by principal investigator Ralph Harvey at the La Paz Icefields, an area of vast blue ice rising and falling in swells that reminded me of the Smoky Hills of Kansas, not far from where I had lived for the past few years. We'd drive up and down the field in a flying-Y formation, heads turning this way and that, looking for rocks on the powder-blue ice. Finding meteorites at La Paz was easy. There were no other rocks. The meteorites, having been caught in the ice, are eventually surfaced and "stranded."

A black crust, a chocolate color, a ragged appearance–the meteorites often looked like dried-out hamburger or meatloaf. Most meteorites are stony, and most of those are ordinary chondrites. The types we yearned for were the carbonaceous chondrites (these carry organic materials), achondrites (often lighter-colored stones that have been processed in different ways on their parent bodies) and, of course, meteorites from Mars and the Moon. We all hope that among the interesting stones we found is a lunar meteorite. Ranging from fingernail-to-football size, the meteorites were carefully collected with procedures that became routine.

We would assign a field number to the rock, measure it, photograph it, estimate the amount of fusion crust (the surface melt from passage through the atmosphere), then place the rock in a plastic bag, sealing it with tape. A GPS reading was taken. At day's end, meteorites were removed from the backpack collection kits and stored in "isopods"–metal boxes once used for the Apollo moon rocks. Eventually, the meteorites will be curated at the Smithsonian and made available for research.

If we were lucky, we'd drive through pinnacles between working blue ice. Driving through them felt like skidooing on Europa – sharp waves of ice while under tread was a surface crazed with crevasses every-which-way, like cubist strands of white kelp. Apart from calm, sunny evenings warm enough to be outside in the surrounding silence, I loved most driving through pinnacles.

It wasn't all work, as we'd play French Cricket and Five-Step Football to stay warm, exercise and blow off steam. To boost morale on cold days, Ralph would tell elaborate jokes with groaner punch lines.

Two weeks into the season, I swapped out from the main team to the four-person "recce" party led by Johnny Schutt. We visited the Davis Nunataks, the Scott Icefalls and the Otway Massif, where we found a classic "strewnfield," an elliptical distribution pattern associated with larger meteorite falls. We also had to look carefully at the rocks, for we were in areas where terrestrial rocks, such as dolerites, can look superficially like meteorites. With the recce party, I was in landscapes with mountains, reminding me of my new home in Utah, where, from my backdoor, I can see the Bear River Range. Even in Antarctica, I had moved from a kind of prairie to mountains.

And I found what Ralph Harvey had told me early on was true. Driving a skidoo on blue ice, you're looking at the landscape, you're looking for rocks. And, in his words, "You look into your heart."

The box named Bedlam became emblematic. In my research into the historical characters who had become obsessed with meteorites–from a backwoodsman named Ellis Hughes to more famed names such as Robert Peary and Harvey Nininger–I had learned that outward exploration can be an interior one as well. At the end of *Walden*, Thoreau argues that the latter is far more difficult than the former.

During the day, I was blessed to explore places where no other person had ever been. I harvested old fire. Heck, I even dripped snot on a couple (accidental "contamination events" were duly noted in the field log). During the night, my explorations were more beset. What had been merely poor sleep–I thought I had gotten used to katabatic winds at "night"–became severe insomnia.

Collecting meteorites for research is ultimately an act of human curiosity about our origins, so maybe it is fitting that while doing so I also looked into my heart to learn about other things, like the origins of my sadness, my happiness and how to traverse them both.

Christopher Cokinos is the author of "Hope Is the Thing with Feathers: A Personal Chronicle of Vanished Birds." He edits Isotope: A Journal of Literary Nature & Science Writing.

around the continent

SOUTH POLE

Season winds down

By Tracy Sheeley,
South Pole correspondent

Though the end of the summer is only weeks away, you would never guess it from the pace and level of activity at South Pole Station.

Exterior construction continues on wings of the new station. The panel crew closed in the B-1 section Jan. 20. The B-1 section will house more living quarters and the emergency power section. Interior crews are working on a list of items in preparation for the design team, which was scheduled to arrive Jan. 24. The design team is coming for inspections, and to provide the final sign-off for the dining hall and living quarters and determine the conditional acceptance of the sections we have been working on all summer (and last winter).

Guests have been arriving at South Pole to help with this process, so we have no shortage of new faces, and our population has been hovering around 230. The cooks continue round-the-clock operations to keep us working and warm, as the temperatures creep down.

Our medical clinic will move to the new station this month. Under the Dome, the old weight room and freshie shack have been demolished and removed. The heavy equipment operators have cleared an enormous amount of snow from around the station, which changes the perspective.

LC-130 flights have been carrying in our fuel resupply, all of which comes in on aircraft to last the eight-month-long winter isolation. Flights have met the planned schedule, with weather cooperating both at South Pole and McMurdo.

January is a busy science month as well, as groups rotate through to do their annual maintenance and/or data gathering with their experiments.

NGA (non-government activity) has been busy recently. At one point, we had 22 visitors at Pole – some skied in and others flew in for a quicker peek. A few more ski expeditions are still making their way toward Pole, and we anticipate their arrival by the end of the month.

An open mike night was held last Saturday in the new dining hall, enabling us to see another facet of the many talented folks here. The vocal arts were favored, though a set of highland pipes made an appearance as well. The carpenters chop hosted a barbecue the same night – treating co-workers to grilled barbecued ribs.

SHIPS

Photos by Joe Stanford / Special to the Antarctic Sun.

Above, the fuel tanker Gianella *pounds through storm-whipped waves during a brief storm. Below, orcas surface next to the* Gianella *during its trip to McMurdo.*

Storm rattles *Gianella* during trip to McMurdo

By Joe Stanford
Gianella engineering assistant (QMED)

USNS Lawrence N. Gianella arrived at the ice dock Wednesday after 14 days at sea, and seven days nestled snugly in the sea ice of McMurdo Sound.

The vessel's relatively pleasant and uneventful voyage from Brisbane was interrupted on Jan. 5 by a sudden and severe storm, with wind gusts to nearly 150 kmh and 7-meter waves. Fortunately, the crew reported the storm went as quickly as it came and damage to the vessel was minimal.

After that it was smooth sailing, with a relatively easy passage through the sea ice, which the vessel entered on Jan. 8. Robert Mills, who served as Ice Pilot for this voyage—a sort of co-captain brought along especially for ice passages—reports this is the clearest he has seen the ice on his four trips into McMurdo. For the vessel's master, John Giacchino, this voyage was his second.

After arrival in what came to be known as the "parking spot" in McMurdo Sound, the monotony of being stuck in the ice was broken frequently by several groups of visiting penguins and killer whales.

The vessel will depart sometime this week. Having completed their discharge of cargo—36 million liters of aviation fuel (JP-5 and AN-8), and nearly a million liters of gasoline—the ship and its crew now awaits orders before returning to Brisbane, Australia.

Polar Sea, Polar Star

By LCDR April Brown
Mac Ship Ops/Coast Guard Liaison

Polar Star has been double-parked alongside the fuel tanker *Gianella*, despite the fact that there's only one parking spot, (not as bad as in Boston where triple parked is considered normal) the answer is simple really.

Polar Star is offloading more than 150,000 liters of oily waste, "slops" as it's called to the tanker, and then taking on about 1.5 million liters of JP-5 fuel. Doing it concurrently with the fuel offload to McMurdo is more efficient in the long run.

Unfortunately for *Star*'s crew, there was too much ice between the two ships, and they couldn't tie up close enough to get a gangway across so the crew is a captive audience.

See Continent on page 6

the week in weather

McMurdo Station
High: 37 F / 3 C Low: 12 F / -11 C
Wind: 24 mph / 39 kph
Windchill: -21 F / -31 C

Palmer Station
High: 45 F / 7 C Low: 28 F / -2 C
Wind: 62 mph / 100 kph
Windchill: 16 F / -9 C

South Pole Station
High:-8 F / -22 C Low:-28 F / -33 C
Wind: 24 mph / ?? kph
Highest physio-altitude: 3,267 m

Photo by Alex Herbert / Special to the Antarctic Sun

The cargo ship American Tern *takes on more shipping containers at the port of Lyttelton, New Zealand, late last week. The ship is bringing supplies to Ross Island for McMurdo Station, Scott Base and South Pole.*

Continent

From page 5

After *Polar Star* backs out, *Polar Sea* will be in line to do the same thing.

The fuel offload to the station went extremely well, and it is good to see that black hulk of a fuel tanker at the pier after last year's close call when we had to offload fuel and pump it in from some three miles away.

Once *Polar Sea* is done taking fuel, they will back out and probably put a tow line over to *Gianella* to give her a little assist backing out. *Polar Sea* will then slide back in and pick up gear for the Marble Point refueling operation. We plan on delivering about 380,000 liters of JP-5 there towards the end of the month. The break-in to Marble has been difficult at best, fighting that hard, 3.6-meter thick multiyear ice, but *Polar Sea* has triumphed thus far, and is now only a mile off the beach. We have not been able to do that job for the last two seasons now, and this will take a lot of pressure off the winter crew having to otherwise traverse small amounts of fuel across the ice.

The cargo vessel *American Tern* still is scheduled to arrive here on Feb. 1 for a seven- or eight-day offload, so after that we all can button up the shop and depart, leaving the winter support staff to their "get the heck outta here" party. Keep your fingers crossed!

Laurence M. Gould

Compiled from reports by Andy Nunn, Marine Projects Coordinator

The *Laurence M. Gould* is on its annual Long Term Ecological Research cruise. On Jan. 16 the *Gould* arrived at the first site where instruments anchored to the seafloor needed to be retrieved and redeployed. After some initial confusion over the correct frequencies the crew issued the release command. Although they never got an acknowledgement from the releases, the floats were spotted on the surface about an hour later. Deck operations went very smoothly and they finished the recovery phase of the operation before lunch.

The releases were covered in heavy mud, possibly explaining the difficulty in getting responses out of them.

"Since the mooring had all floats intact, and the rest of the line looked clean, I am at a bit of a loss to explain why the releases ended up on the sea floor," wrote Andy Nunn. "The releases were supposed to be located 22 meters above the anchors. It's possible the mud at the deployment location is so soupy and thick the anchors sank 22 meters into it, or maybe there was a tangle in the line below the releases so that they were right above the anchor."

They added two more 43 cm glass floats to the mooring when they redeployed it to improve the buoyancy. Deployment took about one hour, then the *Gould* then headed south to the next mooring site. It was scheduled to arrive at Avian Island to land a field party on Jan. 23.

Nathaniel B. Palmer

Compiled from reports by Ashley Lowe, Marine projects coordinator

The *Nathaniel B Palmer* docked at the McMurdo ice pier for two days last week. McMurdo residents were able to tour the ship on Sunday. The *Palmer* departed McMurdo Station with a new group of scientists at 12:30 on Jan. 19.

"We made a transit to the open water between icebergs B-15A and B-15K," Ashley Lowe reported.

The scientists are mapping the sea floor, looking for tectonic activity, assessing ice conditions between the two icebergs and determining an appropriate location to begin a seismic survey. Seismic surveys use acoustic shock waves to determine the detailed structure of the rocks under the sea floor.

PALMER

Hidden treasures

By Kerry Kells
Palmer Station correspondent

The last two weeks at Palmer Station have seen a whirlwind of activity in the way of cruise ship and yacht visitors, science, and the return of the *Laurence M. Gould* to within sight of the station. The Long-Term Ecological Research cruise continues on the *Gould*, and we are given daily photos and reports from one of the seabird researchers on board. Our two krill researchers on station boarded the ship for a full day of sampling. Fen Montaigne and Peter Essick of the National Geographic went out to the *Gould* to collect material for their story about climate change.

Floating in front of our station near Gamage Point was an unusual bird visitor, a black-necked swan. Native to South America, this swan has a long, black neck, a white body, and a red lobe on the base of the beak.

Arrivals included three Raytheon Polar Services Company environmental technicians. The group is cleaning up the last two old dumpsites behind Palmer Station. Half buried under rock and ice, these dumps were retired in the late 1980s. Environmental technicians Tonya Edwards and Mike Robinson are new to the Antarctic program. Geoff Gilbert was an environmental supervisor at McMurdo Station the last two summers. All are geologists. Using the Bobcat, jackhammers and manual labor, the crew segregates debris by type and puts it in plastic cubic-yard transport bins.

Cleanups in 1996 and 1999 removed shipping containers and drums full of debris from dump site 2 behind the helo pad. This year's team works on dump site 1 behind the shipping containers along the road and dump site 3 near the old freshwater pond. So far, the team has filled 110 bins. Both the expected and the unusual have been found—old and rusty hammers, shovels, crowbars, drill bits, plates, tracks, and a flash boiler. Edwards, dubbed "the trash historian," mentions liquor bottles, canned food, a doorknob, eyeglasses, and a dartboard ring. Robinson has brought in old beer cans, rusted cans of frozen concentrated milk and soda cans to decorate our windowsill.

The group has brought good humor and new stories. An amusing list on our white board suggests what to do with the cleaned-up space: volleyball court, skate park, swimming pool, greenhouse, health club, even commemorative statues of Gilbert, Edwards and Robinson, for their tireless efforts.

Photo by Scott Craig / Special to The Antarctic Sun

Researchers collect soil samples from New Harbor. Yeast samples are cultured from the samples at the lab at McMurdo Station.

Yeastie Boyz find fungi everywhere

By Kris Kuenning
Sun staff

If it weren't for yeast, we'd all be dead. The fungi are not only used to make beer, wine, bread and cheese, they are also critical to the natural ecosystem.

"We'd be up to our eyeballs in leaf matter," said researcher Regina Redman from the University of Washington.

Yeast, and fungi in general, are decomposers. They break down dead material, and process the nutrients to be transported back up the food chain. Fungi also detoxify heavy metals and absorb carbon.

Studying yeast species in the simple ecosystem of Antarctica allows scientists to learn more about the role yeast plays in the world as a whole.

Researchers are growing thousands of yeast colonies in the McMurdo laboratory from samples of soil collected in the Dry Valleys and around McMurdo Sound.

Seemingly lifeless dirt sprouts streaks of pink yeast that line the Petri dishes like punk graffiti. Other species grow in orange or tan florets.

"It's exciting to go out there and bring back soil that looks like there's nothing growing in it and there's stuff growing everywhere," said project leader Laurie Connell from the University of Maine. "(Yeast) are out there apparently thriving, although we have to do more tests."

Connell is working with Rusty Rodriguez and Regina Redman from the University of Washington and Scott Craig from the University of Maine to learn more about how yeast function in the extreme polar environment.

Connell first studied marine yeast off the Antarctic Peninsula in 1993, but the large, dynamic ecosystem made it hard to focus on the role of yeast.

In the Dry Valleys, there is a very simple food web made up of just three groups of soil organisms – bacteria, yeast and tiny worms called nematodes.

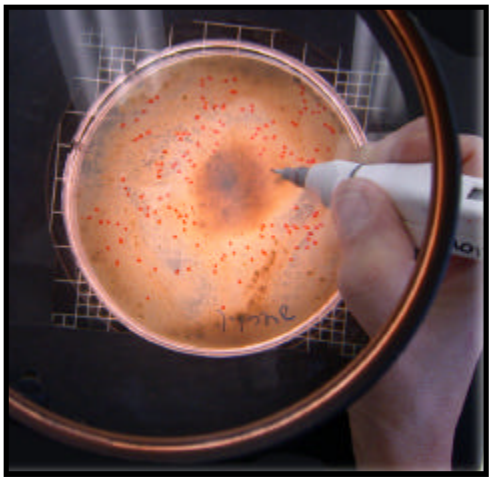
"Compared to a temperate ecosystem, there are between 100 to 10,000 fewer organisms in a gram of soil," Craig said.

Fungi and bacteria were found in the Dry Valleys more than 70 years ago ,but some of the fundamental questions about how these organisms function

See Yeast on page 8

Photo by Scott Craig / Special to The Antarctic Sun

Researchers Regina Redman and Rusty Rodriguez process soil samples from the Dry Valleys. Yeast colonies are grown in the lab at McMurdo.



Photos by Scott Craig / Special to The Antarctic Sun

Above: Yeast colonies, visible as dots, are counted to measure the number of yeast per 100 grams of soil.

Right: Researchers Laurie Connell, left, and Regina Redman count yeast colonies in the Crary Lab.

Teachers join Yeastie Boyz

Two teachers are helping the group of researchers who call themselves the Yeastie Boyz.

Amy Stoyles is an eighth-grade science teacher from Florida. She is in Antarctica through the National Science Foundation funded project, Teachers Experiencing Antarctica. While she snowmobiles across McMurdo Sound or collects soil samples in the Dry Valleys, her students are following her adventures online. The students are collecting their own soil samples around the school and processing samples to grow yeast colonies, just as the team of researchers is doing in the laboratory at McMurdo.

"Hopefully, this can be that inspiration for my own students. It's definitely been an experience I'll remember for my entire life," Stoyles said.

Barbara Schulz also came to Antarctica as part of Teachers Experiencing Antarctica, in 1996. This time she is working on an educational outreach aspect of the soil yeast project, headed by Laurie Connell from the University of Maine.

Schulz, who works for the National Academies in Washington, D.C., is creating lesson plans for teachers around the world to use.

Her goal is to help teachers and kids understand the inquiry side of science. The process of asking questions and chasing down the answer, she said, is one that is not as easily taught or assessed as the fact-based learning that is more commonly used in classrooms.

http://tea.rice.edu/tea_stoylesfrontpage.html

Yeast

From page 7

in the food web have not been fully answered.

Researchers believe the yeast are a pivotal part of this miniature ecosystem because they extract phosphorus from the soil. Phosphorus is required by all organisms but don't effectively accumulate it, Rodriguez said. Yeast also make a lipid, known as ergosterol, that is required by nematodes.

In temperate ecosystems, plants provide these, but in Antarctica, researchers believe yeast is the only source for nematodes.

"Yeast are unicellular, multitalented organisms," Craig said.

This is the second and final field season for the three-year grant from the National Science Foundation.

Samples collected from the Taylor Valley will be analyzed to see how the yeast survive multiple freeze-thaw cycles and how it uses and stores phosphorus.

Extracting DNA from the samples will yield information about how the yeast species have evolved in the Dry Valleys. The researchers will compare the DNA of Antarctic yeast with similar species found worldwide.

Additional samples from Minna Bluffs below Mount Discovery, Black Island, Wright Valley and Mount Erebus provide comparative information about what soils are most hospitable to yeast, how abundant they are and how they are distributed.

The team is analyzing the physical and chemical make-up of the soil and extracting DNA from it. They are studying the distribution of yeast by sampling along grids at high, middle and low elevations.

So far, research shows that the yeast are widely distributed in the soils, even in areas of high alkalinity and salinity, and are capable of surviving repeated freeze-thaw cycles, as well as low moisture.

The researchers want to know if the number of yeast in an area is related to how much water is available and they want to know whether the yeast is dormant or active in the environment.

Work in the Taylor Valley involves collecting samples from sites at three different times in the summer season. If yeast are active in the ecosystem, the team expects to see changes in their numbers and populations as the summer season progresses.

By studying the role of yeast in the polar deserts, researchers hope to pave the way for incorporating the fungus into models of more temperate environments.

NSF funded research in this story: Laurie Connell, University of Maine, School of Marine Sciences

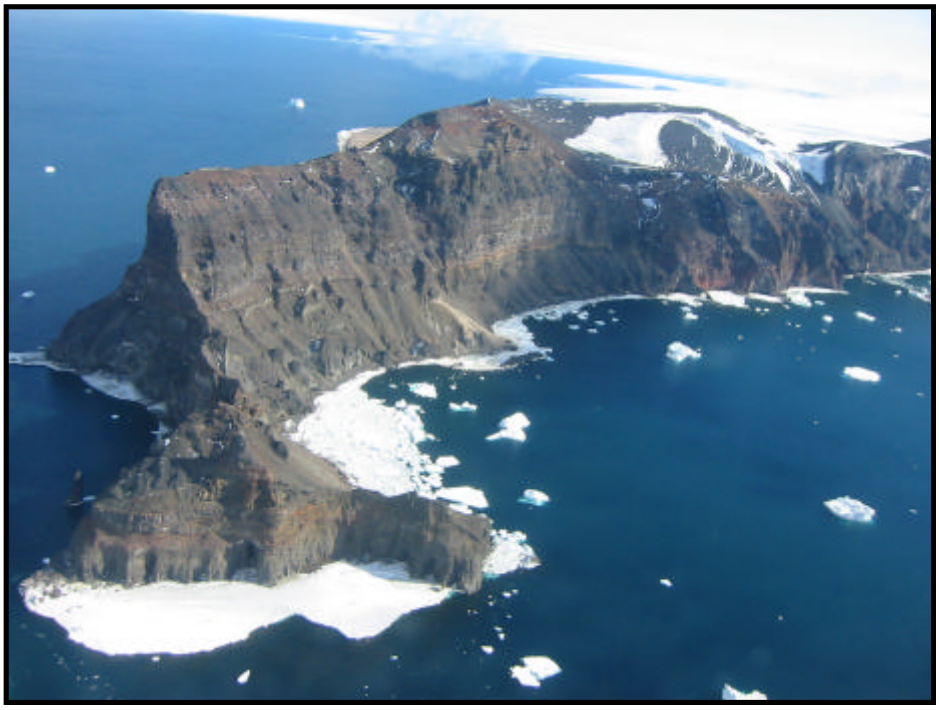


Photo by Beth Bartel / Special to The Antarctic Sun

Photo by Michael Willis / Special to The Antarctic Sun

Above, the team discusses a problem they encountered while setting up the GPS system, which included an antenna seen in the foreground and electronics box and solar panels in the background. At left, Franklin Island spikes up out of the Ross Sea.

TAMDEF

From page 1

able to test these models.

Wilson's team is determining the extent of this rebound in order to calculate the amount of ice that was lost. Using Global Positioning System (GPS) technology, TAMDEF is measuring the vertical and horizontal motion of the Earth's crust.

There are 35 TAMDEF GPS sites in the Transantarctic Mountains and on islands in the Ross Sea. Measurements are taken in 15-second intervals and six of the stations take measurements all year round.

Such precise measurements, yielded by modern GPS technology, have accelerated the project.

"In the past, it would have taken a long time to discover any movement," Willis said. "Originally, we thought this would be a 10-20 year project."

At the year-round sites, small, low-power GPS receivers using large banks of batteries and solar panels provide measurements that can be used to accurately characterize vertical motion and provide strong reference points for the rest of the network. One receiver collected data for 800 days in a row.

"We can get a more accurate picture of how the crust of the Earth responds to load changes if we take the measurement over and over," Willis said.

The sensitive GPS measurements can record even the slightest sag in the crust – caused by the weight of a single snowfall. In the U.S., a large network of GPS stations can track depressions in the land caused by low-pressure systems moving across the country.

Wilson said most of the upward movement around the Ross Sea is probably attributed to the crust bouncing back from the weight of ice removed since the last ice age. The whole Antarctic plate is moving east-southeast at about 14 mm a year in this region and the project has identified a rift in the Ross Sea that is slowly breaking the continent apart by about 4 mm a year. Some of this horizontal movement can be attributed to the rebound effect, but the researchers are attempting to identify other reasons for the rifting between Ross Island and the mainland. Willis's calculations show that stations on the westward flank of the mountains are moving slower in an easterly direction than those on the islands of the Ross Sea.

The geology of the two areas is different. In the west, the crust is thicker and colder, while in the east, the crust is thinner and volcanic activity on Ross Island is one sign that the mantle is warmer. Researchers predict that the thinner crust would have a faster elastic response to the loss of ice. In terms of tectonic plate movement, the geological discrepancy suggests a break in the continent.

"There is an obvious boundary under the mountains," Wilson said. "The one enigma is that if the rift area is active, and the faults are moving, there should be earthquakes."

The movement between the mountains and the islands is about one-tenth of the horizontal movement seen between tectonic plates near the California coast, where there is a lot of seismic activity. So far, not much seismic data is available in Antarctica.

This year, Wilson is looking for evidence of faults in the Ross Sea aboard the research vessel *Nathaniel B. Palmer.* Detailed mapping of the ocean floor will help her identify young faults that cut through the sediments.

Other team members have spent the season flying to the various GPS sites, where equipment is set up and left for up to two months. From the rocky peaks of Franklin Island to the towering cliffs of the Warren Range, the work involves a combination of lugging heavy batteries uphill and fiddling with small screws in the cold. Every site has been drilled into bare rock.

"We needed more Sherpas and less delicate girls," said researcher Jane Turner. At the continuously operating sites, the data is stored on memory cards, which must be retrieved when full. In the future, wireless Internet connections will send the information to McMurdo instead.

"Some of these sites have a lot of penguins nearby so the less impact the better," Turner said.

Eventually, TAMDEF hopes to expand its network even further. Wilson is working with the Scientific Committee on Antarctic Research (SCAR) to develop international collaboration for the network.

Willis said the GPS sites would be useful to other researchers as well, giving them an opportunity to correlate and correct their readings.

NSF research featured in this story:
Terry Wilson, Ohio State University
*http://www.geology.ohio-*state.edu/TAMDEF

> "If the bugs eat it in our lab, then they'll probably eat it in the ice down there as well."
>
> *Researcher John Priscu*

Fryxell From page 1

twice to do additional cleanup and evaluations. They mopped up almost 20 gallons more fuel and filled about four drums with debris. Beyond that, they broke open the ice covering pools of spilled fuel to help it evaporate.

"At this point, it's up to nature," said Furnish.

Fuel for study

Scientists researching in the Dry Valleys decided to turn the spill into another opportunity to learn about the unique environment. They have four interrelated grants to do a comprehensive study of the effects of the spilled fuel on the ice.

"I'm hoping that we will learn a lesson about potential contamination, and what it could do," said Priscu, an environmental scientist at Montana State University. "Our experiments will tell you if the fluid could reach the liquid water of the lake and if it could change the microbial community and if there is natural bioremediation going on in the ice."

Back in his lab in Bozeman, Mont., Priscu and postdoctoral researcher Christine Foreman will add fuel to ice cores taken from the lake to see how the microbes living in them react. After incubating them for several weeks, he expects the microbial population will shift in favor of microorganisms that thrive on hydrocarbons.

"If the bugs eat it in our lab, then they'll probably eat it in the ice down there as well," Priscu said.

Potentially the fuel-eating bacteria native to Antarctica could be used to clean up future fuel spills naturally.

Researcher Peter Doran and his crew at the University of Illinois at Chicago will examine the fuel even more closely to see whether the bacteria are eating only certain parts or types of the fuel.

"We'll see if the bacteria are chomping down on select portions of the fuel," Priscu said.

As a baseline, last year Alexander collected 262 ice cores and water samples from around the crash site to determine the extent of the spill.

"The crash site was at the edge of a heavily melted area with a complex series of interconnecting pools, channels and sub-surface chambers," Alexander wrote in his report.

The spilled oils dispersed through the labyrinth of ice, reaching 19 meters away from the crash itself. The entire area had a strong fuel odor, detectable up to 40 meters from the wreckage. Fragments of paint, aluminum, Plexiglas and plastic littered the area.

"We could collect cores that were just a few inches from each other and when we pulled them up the ice characteristics would be completely different," said Kathy Welch, who went out last year and again this year to collect the shallow ice cores. "I was kind of amazed at how variable it was at such a close spatial distance, so it's really hard to predict where the fuel might go."

Photo by Jeff Miller / Special to The Antarctic Sun

From left to right, Heather Smith, RPSC environmental supervisor, Kathy Welch with Berry Lyons research group, and Kaneen Christensen, RPSC environmental remediation tech drill in search of sediment in the ice.

Welch found less fuel when she returned this year to collect samples of ice and water for the researchers.

"You could see the sheen on the surface of the water, but it wasn't as if there were big puddles there," Welch said. "They did a really good job of cleaning up all the debris from the helicopter."

Even so, some splinters of the wreckage remained on the ice, potentially absorbing fuel and carrying it down into the water with them as they melt in, Welch said. Being lighter than water, fuel normally would float on top. But on ice, the caramel-colored fuel absorbs sunlight and ice around it melts, said Priscu. He is working with Ed Adams, a civil engineering professor at Montana State University, to study how fuel moves through ice.

Adams is setting up experiments in a cold lab, placing fuel on top of 50 cm by 30 cm blocks of ice under solar radiation. In preliminary tests, the fuel has melted into and through the ice, dropping down. Being lighter than water, the fuel should stop and float when it hits the layer of liquid water within the ice itself, Adams said. But if the fuel attaches to sediment or some other solid item, like the debris, it might sink even farther into the lake, Adams theorizes.

"Even though it's more buoyant, the fuel still can go down," Priscu said. "That concerns us because one of the first things we thought of when this helicopter crashed was did these fluids go into the liquid water column of the lake, because once they're in there they'll never get out."

See Fryxell on page 11

Photo by Jeff Miller / Special to The Antarctic Sun

Flags mark the location where a helicopter crashed Jan. 17, 2003 on Lake Fryxell, spilling fuel onto the uneven and porous ice cover. Heather Smith, RPSC environmental supervisor, Kathy Welch of Berry Lyons research group and Kaneen Christensen, RPSC environmental remediation tech were back on the lake to take samples.

Fryxell

From page 10

When the helicopter crashed, the ice was close to its melting temperature and sodden with water. That helped keep the fuel from sinking into the ice, Priscu said.

"I think most of the fuel stayed up near the surface, in the upper meter to 2 meters and it's going to eventually evaporate and biodegrade," Priscu said. "Over a three-year period you won't even see it anymore."

Priscu watched that happen with previous spills. In 1984, fuel drums fell onto Lake Vanda, spilling more than 200 liters of fuel. Priscu recalls burning the spill and then chipping away the sooty debris.

"After a year it wasn't noticeable anymore," Priscu said.

Following an initial clean-up, a 90-liter spill on Lake Bonney was left to study, and it disappeared on its own in three years, Priscu said.

"I'm hoping that the fuel will stay at the surface and our experiments should answer that question," Priscu said.

The lake ice has about a 15-year cycle of turnover anyway, Priscu said. Each year about 30 cm of ice forms on the bottom of the lake while an equal amount evaporates from the top of the average 5.3 meter thick ice cover.

"It's like a conveyor belt. It's always moving up," Priscu said. "In 3 years you will have moved about one meter of ice up and sublimed it away."

While scientists study the spill, the Antarctic program is studying ways to avoid future spills. A Raytheon Six Sigma study is underway to better identify the causes and types of spills. This year a major awareness and training effort is planned to reduce spills caused by human error, as well as equipment. Early this season, an expert from the American Petroleum Institute visited to make recommendations on improving fuel handling equipment and procedures.

"RPSC and NSF are currently making efforts to modernize our fuel handling systems (tanks, piping, dispensing) to prevent future spills," wrote Environmental Health & Safety Director, John Feldman.

Over the winter, 22 new fuel tanks for heating buildings will be installed. The new tanks are double-walled with over-fill spill prevention to replace antiquated ones now in use. Over the next several years, all the heating fuel tanks will be replaced. Additional protection will be added around tanks and fuel supply lines to prevent damage from vehicles. Next year, three new bulk 1 million liter fuel tanks will be built to replace ones that are almost 40 years old.

Many field camps already have plastic spill guards around fuel drums and hand pumps fitted with caps on each end to prevent drips.

"Our goal is zero spills," wrote Feldman.

NSF funded research featured:
Fabien Kenig, Peter Doran, Berry Lyons, Anne Carey, Edward Adams and John Priscu, http://www.homepage.montana.edu/~lkbonney/

Scum of the Earth

Pond growth may be a source of nutrients for the Dry Valleys

By Kris Kuenning
Sun Staff

Researchers are looking at the possibility that pond scum helps sustain life in an Antarctic polar desert.

Life in Antarctica's Dry Valleys is minimal, consisting of a few fungi, bacteria and tiny, soil-dwelling worms, but the simple ecosystem still needs a carbon source.

Carbon is one of the chemicals necessary for life. But because it is in limited supply on earth, it must be continually recycled. Scientists have been studying the cycle of carbon in the Dry Valleys for about 10 years. This year, researcher Maria Uhle, from the University of Tennessee, is looking at what's growing in coastal ponds to find another source of carbon to the Dry Valley's system.

The ponds are rich with thick, spongy mats of single-celled bacteria and algae. In the ponds, the living mat is usually several inches thick and consists of bright orange, green, purple and black layers. Pinnacle mats grow up from the pond, while prostrate mat spreads itself flat across the pond. Mats of single-celled bacteria are believed to be one of the first forms of life on Earth.

Later, when plants evolved, the mat had to compete for sunlight and nutrients. Now, the mats are found mostly in extreme environments, where severe temperatures, dryness or saltiness make life hard for other plants and animals.

The Dry Valleys are cold and ice free. The wind whips away the ice and snow from the rocky valleys, but glacial melt feeds a system of lakes and rivers that run in summer. The lakes are home to bacteria and algae, which are sources of carbon for the simple ecosystem.

Nearer to the coast, ponds have formed in the rocky landscape. The soil sits on top of a bed of ice, which melts and shifts the ponds around. As the ponds change position on the landscape, they leave a trail of carbon-rich mats.

In two separate areas near the Ross Sea, Uhle's group sampled both living microbial mat from the ponds and dead mat that had been left behind on the soils.

Over the winter, the ponds freeze solidand the frozen mat lies dormant, but doesn't die. When the ponds thaw, they allow for a period of growth each year.

"There is a lot of activity going on in a place like that – just waiting for water and radiant energy," Uhle said.

Even after the mat dies, it is useful to the ecosystem. Uhle suspects the dried mat is blown from the coastal areas into the Dry Valleys, where it can be used to establish more mats in other ponds or be used as a carbon source for other forms of life in the soils

Photos by Maria Uhle / Special to the Antarctic Sun

Researcher Melissa Hage collects information about the pond water that hosts microbial mats.

The layers of a coastal pond: ice floats on the top while the living mat grows underneath. The banks of the pond contain dead mat.

"The ponds have never been looked at before," Uhle said. "We're trying to understand if these ponds are a significant source of carbon for the Dry Valleys."

At Garwood Valley and Hjorth Hill, Uhle was surprised to find different types of communities in the ponds. Algae bloomed in the ponds near Hjorth Hill, while bacterial mats were more common in Garwood. "I didn't expect the sites to be so different," Uhle said. "The Garwood mats were more complex and interesting."

With the samples collected this season, Uhle's team will analyze the chemistry of the mat to determine which of the species of bacteria live in the different layers of the mats and which ones appear to be most actively producing or degrading organic compounds.

She expects it will take until June to process all the samples they have collect-

See Ponds on page 13

Ponds From page 12

ed.

"My grad students spend a lot of time in the lab," she said.

The researchers want to know how the organisms are structured and layered in the ponds and what role each layer plays.

The top layers bring energy into the system by converting sunlight through photosynthesis. As the light changes deeper in the mat, the chemical environment changes.

Water samples from the ponds will reveal the nutrient and salt level of the ponds. The water chemistry gives clues about where the water originated.

The second part of the research focuses on the mat that is left behind when the pond shifts. Collecting samples of the dried mat, Uhle may be able determine how long it has been dead.

"You can think of it as a big, juicy hamburger. If it's just out of the oven, it's more likely to be munched," Uhle said.

This was the first field season of Uhle's three-year grant from the National Science Foundation. Uhle described this field season as a success. It started as an adventure. The group of four was delivered to its first camp at Hjorth Hill in early December. Before all the gear could be delivered, a storm grounded helicopters at McMurdo. The team lived out of survival bags for several days. One tent pole snapped in the fierce winds and they were running out of food. Just as Uhle was considering a 12-hour walk to the seasonal camp at Marble Point, the weather cleared and supplies were delivered.

Two automated meteorological stations have been left behind to monitor weather around the ponds until the team returns next year. Next year's research will focus more on the ponds than the dried mat. Uhle said the team will come later in the year next time to allow the ponds more time to melt and become active. Discoveries here will provide a greater understanding of the role of microorganisms in polar environments.

The biology and chemistry of these cold-dwelling algae and bacteria can be compared to those living in opposite extremes, like the hot springs of Yosemite.

Uhle said those comparisons might discover similarities between the organisms. "Or we might find they have a unique way of surviving," she said.

National Science Foundation funded research featured in this story: Maria Uhle, University of Tennessee.

Photo by Maria Uhle / Special to the Antarctic Sun

Ponds near the coast may be an undiscovered source of carbon for the simple ecosystem of the nearby Dry Valleys. Researchers tested water and microbial mats from these ponds for the first time this season to learn more.

Continental Drift

What question should be on the winter-over psych exam?

"If part of your psych exam was to bring someone to Palmer Station to make amends with, who would it be and why?"

Mike Terminel
LMG Second mate from Seabring, Florida, first season

"Why are you here?"

Terry Colling
Pole operations management from Griffin, Georgia, first season

"Have you lied on any of these questions?"

Zoe Vida
McMurdo materials person from Portland, OR, two summer seasons and one winter.

Profile Doc on diverse journey

By Kris Kuenning
Sun Staff

Molly Hutsinpiller has worked in emergency medicine for six years. Now the South Pole doctor spends most of her time helping people through the sniffles.

"I like emergency medicine because you're confronted with a problem, you do something about it and you move on," she said.

It also gives her more flexibility than a regular practice would.

"It's a field of medicine you can leave and come back to. Which gives the illusion of not having a full-time job," Hutsinpiller said.

There are no illusions about just how full-time it is to be a doctor at the South Pole. Hutsinpiller lives and works in the same building, tucked down a passage at the mouth of the old dome. Either she or the physician's assistant, Troy Wiles, are always on call.

To escape, Hutsinpiller runs, reads and volunteers around station.

"Among this incredible group of people, she stands out," said dining attendant Navah Levine. "She's one of the most helpful people on station."

The energetic doctor plays down her contribution. "Everyone volunteers. It's not a big deal. It's nice to interact with other people," she said. Dressed for jogging, Hutsinpiller jumps up every few minutes during our half-hour conversation with an apology.

She is sending medical data to be analyzed in Denver before her daily run. "I have to do it while the satellite's up."

In the first weeks of the summer season, BioMed was busy with a steady stream of cold and flu patients. The viral sickness, commonly referred to as the crud, travels quickly among the community.

Altitude sickness is another common ailment. Traveling from sea level at McMurdo to the South Pole, which feels like between 2,740 and 3,200 meters, depending on the barometric pressure, is a tough transition for most people, Hutsinpiller said.

"But luckily, if people just take it slow for a few days, their bodies acclimate. We do have oxygen, a Gamow bag and various medications to help those that are suffering from the altitude," she said.

Photo by Kris Kuenning / The Antarctic Sun

South Pole doctor Molly Hutsinpiller helps out in the kitchen.

Like McMurdo, the South Pole has telemedicine capabilities.

They send X-rays and ultrasounds to a consulting radiologist in Denver for interpretation. The clinic also has live video conferencing ability. It can transmit images of skin lesions, and images of what is being looked at through the ophthalmoscope and the microscope.

Hutsinpiller has been to the Antarctic continent before. Answering an advertisement in a medical journal, she was hired as the Palmer station doctor during the summer of 2000-2001.

The small club of doctors who have worked in Antarctica get together for regular reunions. It was at one of these "Ice Doc reunions" that Hutsinpiller found out there was a summer position available at the South Pole.

"I had to think about it for a while," Hutsinpiller said. One of the big draws was the chance to travel through New Zealand on the way home.

The mountainous landscape at Palmer was much more familiar to Hutsinpiller than the flat expanse of the Pole. She spent most of her career in Washington state and Alaska.

"It certainly is wide open. I think most of us are used to more topography," Hutsinpiller said. "The station seems out of place with all this nothingness. It seems a little funny."

Ironically, it was a seven-week canoe expedition in the Arctic that first excited her traveling spirit. After graduating with a Mechanical Engineering degree from the University of Washington she went to Barrens in Northern Canada.

"I loved it so much I returned to the Barrens for two more summers. Then I had the bug bad, so I went to work for the Outward Bound schools," she said.

Hutsinpiller lived in Colorado and New Mexico for 10 years before going to med school.

"My passion is still to be outside a lot, be healthy and to live a simple life. When I was 17, my mom encouraged me to experience the highs and lows, colds and hots, happy and sads. I'll always be grateful," she said.

Hutsinpiller said life at the pole feels good. "It took longer than I expected to settle in. It took a month," she said. The people have impressed her the most.

The medical department is scheduled to move into the new station at the end of this season, along with the store, post office, computer lab and greenhouse.

Whether or not Hutsinpiller comes back to use that new facility remains to be seen.

"I never say never … but I'd be surprised."

Hutsinpiller is planning to give up medicine in a couple of years.

"I think 10 years of anything is probably enough," she said. "There is just so much to see, do and learn in the world."

Being at any one of the U.S. Antarctic Program stations is a great reminder of this, she said.

"So many of the folks used to do something else or are looking forward to a transition. I'm not sure what is next for me, maybe just some wandering around the U.S. taking in the miracles of nature."