The Antarctic Sun

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Photo by Alan Boudreau / Special to *The Antarctic Sun*

Canadian geologist Jean Bedard, front, shows a group of other geologists participting in the Magmatic Field Laboratory Workshop some interesting rock formations in the Dry Valleys.

Decoding magma mysteries

By Kristan Hutchison
Sun staff

Like blind men studying an elephant, geologists try to understand the inner-workings of volcanic systems based on small pieces of information.

This month, nearly 30 geologists from around the world gathered in McMurdo to get another view of the elephant, said Bruce Marsh, who used a traditional tale to explain why he organized the Magmatic Field Laboratory Workshop.

"They each have their different idea of how the elephant works," said Marsh, referring to a folk tale of blind men each feeling a different part of an elephant and trying to understand the animal based on that alone.

Most of the geologists focus on aspects of how magma forms into solid rock. Fluid dynamicists study the flow of the magma. Other specialists look at the layers of rock it forms. Isotope geochemists hone in on the chemical processes, while other geologists are more interested in the mechanics of magma forcing its way through the native rock.

By bringing all the specialists together in the field, Marsh hopes to create a

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Record-setting balloon flight

By Brien Barnett
Sun staff

Many come to Antarctica to set new records. The long duration balloon record probably isn't the first one people think of.

But it happened this week when the Cosmic Ray Energetics and Mass (CREAM) instrument passed 31 days, 20 hours afloat. That was the previous record also set in Antarctica by a project called TIGER (Trans-Iron Galactic Element Recorder). And CREAM's flight isn't over yet. The hour meter on the new record still is rolling as CREAM continues to float around the continent. The scientists who expected a typical two-week mission couldn't be happier, even if they are tired.

"A lot of work is still going on and it's exhausting," said the project's principal investigator, Eun-Suk Seo, of the University of Maryland. "The great pleasure of the ride is overriding it, I believe."

As of Saturday, CREAM had pushed the new endurance record for an LDB flight to 36 days, 7.5 hours.

"The instrument and balloon continue to function nominally," said David Sullivan of the National Scientific Balloon Facility.

CREAM started setting records not long after it arrived in Antarctica. It was set up and ready to fly in a record two weeks, Seo said. It also set the record for the most trips — three — around the South Pole. A fourth lap is unlikely because the instrument needs to be recovered before winter, said project scientist Opher Ganel.

Seo said the instrument continues to gather great data in its quest to understand the origins of high-energy cosmic rays, or particles, from deep space. CREAM features a series of particle detectors that yield information about a cosmic ray as it passes through the instrument.

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INSIDE

Quote of the Week

"Well, I guess that would be West Virginia... I spent three weeks there last summer."

— Helo mechanic answering a question about where home is

Ross Island Chronicles By Chico

Cold, hard facts

McMurdo Communications

Telephone use during a typical week:
Outbound voice lines: **17**
Number of calls: **5,549**
Total duration of calls: **1,556 hrs, 26 min, 53 sec**
Average call length: **17 min**
Inbound voice lines: **4**
Total number of calls: **750**
Total duration of calls: **131 hrs, 58 min, 9 sec**
Average call length: **10 min, 33 sec**

Computer network use:
Average number of e-mails processed daily: **12,200**
Busiest: **8-9 a.m., about 1,140 e-mails**
Slowest: **1-2 a.m., about 120 e-mails**
Total Internet bandwidth: **921.6 Kb**
Average summer inbound bandwidth use: **97% saturated**
Average summer outbound bandwidth use: **51% saturated**
It's the equivalent of 1,000-plus people using your home DSL line.

Source: McMurdo telecommunications and computer network departments

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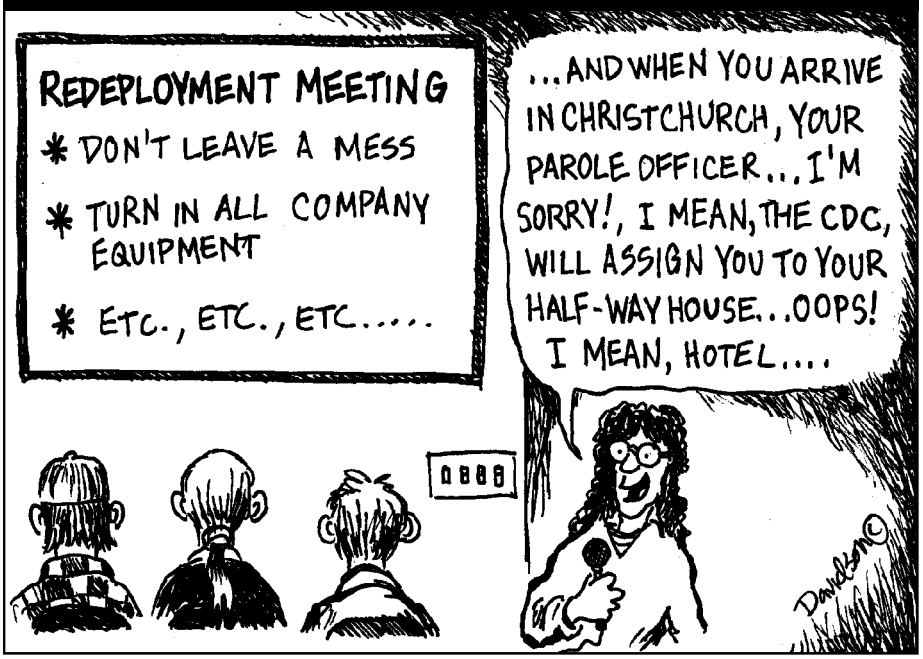
It's a Harsh Cartoon — Matt Davidson



Can starfish cross the circumpolar current?

Scientists study genetic isolation of ice species

By Kristan Hutchison
Sun staff

Starfish, worms and other echinoderms that live on either side of the Antarctic Circumpolar Current may be distant relatives, but researchers are trying to determine whether they can ever visit each other.

Many Antarctic species are genetically unique. For those that aren't, the question is how they manage to cross the swift, deep current that has isolated the continent for 30 million years to maintain their genetic contact. For years the assumption has been that they don't. The adults can't make the journey, because they live along the sea floor, which drops swiftly from a habitable 400m at the edge of the continental shelf to 4km deep in the Drake Passage, too deep for the near shore sea anenomes, starfish and other echinoderms. Scientists thought that a starfish larva drifting north from the Antarctic Peninsula would be swept into the mid-Atlantic Ocean to die and a similar larva floating down from South America couldn't withstand the sudden drop in temperature, from 5C to 2C at the polar front.

"Three degrees doesn't sound like much, but in a body of water that big that moves that quickly, it's a very pronounced difference," said Ken Halanych, a biologist from Auburn University in Alabama.

Rather than assume larvae can't cross the Drake Passage, Halanych, Rudi Scheltema from Woods Hole Oceanographic Institution in Massachusetts and a team of other biologists went to look. They scooped up samples every four hours on the month-long cruise from Argentina to the Antarctic Peninsula and back in search of larvae that might be making the same journey.

"What we're looking at is the genetic connection between Antarctic fauna and fauna that's not Antarctic," Halanych said.

As petrels and albatross glided over the waves, the crew aboard the *Laurence M. Gould* in December lowered a fine mesh net into the sea. The ship cruised slowly forward, pulling the cone-shaped net along for about 20 minutes. When they hauled it up the water drained out, leaving a greenish-brown slurry of phytoplankton behind. The researchers quickly began examining the muck under microscopes, picking out larvae with glass straws and placing them in chilled salt water for later identification and preserving. The larvae were for various types of echinoderms, some mollusks, worms and starfish. Samples were sent to Woods Hole where they will be processed and further identified under Scheltema's guidance.

Photos courtesy of Ken Halanych / Special to *The Antarctic Sun*

Researchers sort through a pile of marine samples on the deck of the Laurence M. Gould.

"We're taking whatever comes in the net, as long as it's the larval form of a benthic adult," Halanych said. "If you find them you can say a lot more than if you don't find them."

They did find a few starfish larvae in the middle of the Drake Passage, suggestingthat some echinoderms can cross the passage.

Sheltema will use molecular genetics to compare the DNA of Antarctic and South American specimens and the ones found mid-way. This will determine which ones have been interbreeding and which are genetically unique, or endemic.

"With the exception of vertebrates, this type of work really hasn't been done down there before," Halanych said. "Everybody just says everything in the Antarctic is endemic and that turns out not to be true."

Among sea cucumbers and some types of worms, the Antarctic and South American species still have a large percentage of cross-over. The amount of genetic similarity or differentiation gives researchers an idea of how long ago the gene pools were cut off from each other and how large a pool they are working with.

"We are still learning a lot about how organisms have evolved in the ocean," said Halanych. "Antarctica represents an interesting model system."

Beyond the possibility of having continued cross-fertilization with South America, there is the question of how connected populations of echinoderms are around the continent.

"Even though it is all cold and Antarctic, there are still quite a few environmental differences, like do you live all the time under an ice shelf or do you live by Elephant Island?" Halanych said.

By the end of the cruise Halanych's team had collected more than 20,000 organisms, packed and frozen into 15 boxes. They arrived at his lab at Auburn University in mid-January. It's enough to keep them busy until the next scheduled cruise in 2006, but they expect to have results on some of the genetics by September and publishable results on the plankton work by the end of the year.

"We now have probably one of the most thorough sampling of this type in Antarctica in terms of looking at a region over different seasons and getting geographic spread," said Halanych, who collected samples on two previous Antarctic cruises in 2000 and 2001.

The collection also will be used to create the genetic equivalent of a field guide to the Antarctic marine animals. The project is called the Marine Antarctic Genomic Inventory, or MAGI. A short bit of DNA from each animal will be sequenced, just enough to learn its unique genetic signature. This "barcode," as scientists call it, will be recorded so other scientists can look it up if they are trying to identify a specimen.

"There are a lot of people working on organisms in Antarctica," Halanych said. "When you hear somebody say they've collected, for example, Odontaster validus in McMurdo and it has a different physiology than an Odontaster validus they collected in Palmer, you really want to know they're really dealing with the same species."

Other specimens will be sent to scientists working on a similar but much larger National Science Foundation project, called Assembling the Tree of Life. The Tree of Life will use genetics and morphology to reconstruct the evolutionary history of major groups of organisms.

NSF-funded research in this story:
Ken Halanych, Auburn University,
www.auburn.edu/antarctica

Waiting to take a shower

By Ron Naveen
Principal Investigator, Antarctic Site Inventory

speaking of science...

Working at a remote Antarctic field camp — in my case, assessing and monitoring the penguin and seabird populations at Petermann Island in the Antarctic Peninsula — inevitably involves a large amount of waiting. Lounging time and hangin' out are simply facts of research life.

My season begins with an early November sojourn to Punta Arenas, Chile. That is where I annually try on and sign out clothes and cold weather accoutrements at the National Science Foundation/Raytheon Polar Services Co. warehouse. Then, my team and I wait for clearance to board the *Laurence M. Gould* for the long ride south across the Drake Passage, down the Bransfield Strait, through the Lemaire Channel, and — voila! — into Petermann. As the project's principal investigator, I spend much of these three days across the Drake praying and entreating the penguin gods for light, loosely consolidated ice, so the *Gould* will have no problems inserting us into Petermann.

This is the second of five planned field seasons at Petermann. All is going rather well. The Drake crossing was smooth and the penultimate, shipboard evening was an overnight at Palmer Station, 20 miles north of Petermann. It was a welcome visit with many friends and colleagues. The next morning the *Gould* departed, wended through the loose pack in Bismarck Strait, avoided the stranded berg at the south end of the Lemaire Channel, and finally got us ashore at Petermann as planned and on schedule. With assistance from many of the crew and technicians on board, we took just a few hours to bring supplies ashore by Zodiac, then sledge our hard plastic Roughneck tubs inland and erect our campsite: an arctic oven, office/cooking tent, two Scott pyramid tents, a single pup tent, and a lightweight tent to protect our generator and fuel. We've camped a hundred meters inland, west of the old refuge hut erected by the Argentines in 1955. It's presently maintained by the Ukrainians from the Vernadsky research station, located 10km south.

It's blissful to be "home." Petermann is a fantastically beautiful location, about a mile in length from north to south, a half mile wide. It's bordered on the east by the narrow, one-mile-wide Penola Strait and the high mountain peaks of the Peninsula, and on the west by open ocean.

Most famously, Petermann is where the famed French explorer Jean-Baptiste Charcot spent the winter in 1909, tying his vessel *Pourquois Pas?* into the northwestern corner of Circumcision Bay, immediately north of the hut. Charcot sighted the bay on Jan. 1, which, for many, is a holy day commemorating when Christ was circumcised.

Charcot explored and mapped much of this sector of Antarctica and it is a thrill to work in his illustrious footsteps. Remnants from that Second French Antarctic Expedition include a rock cairn Charcot's team erected on the top of Megalestris Hill to the west and the rubble of signal cairns that were placed on the northeastern point of the island. Part of the background research for our work was examining Charcot's penguin and meteorological data and photographs from 1909. When our five-year study concludes, I'm looking forward to generating valuable "then-to-now" comparisons.

Photo by Ron Naveen / Special to *The Antarctic Sun*

A gentoo penguin tobogans down a snowy hill near one of the colonies Naveen visited.

At the far northern end, the Adélie penguins' breeding season was well advanced when we arrived. The nests were mostly set up and being defended, with many two-egg clutches already complete. By contrast, the gentoo penguins were still consumed with "meet and greet" ceremonies and donkey-like braying to proclaim their territories. No gentoo eggs were in sight. For this, we had to wait.

Melissa Rider, our camp manager, was pleased with the "put in." The tents were secure and we've managed to protectively stow the bulk of our food and water in the hut, which we can access when needed. Melissa, my colleague Ian Bullock, and I were anxious to reconnoiter the entire island to check on all of the more than 250 penguin subcolonies, and to see where the resident skuas, sheathbills, shags, gulls, and terns may be in their breeding cycle.

But this, too, must wait.

We were a mere five hours on site when pounding rain and wind erupted, which is highly unusual. The previous November and December, we encountered no rain at all. Unfortunately, it was a prelude to the next three weeks, a rare season when the usually strong and persistent high-pressure system over the continent has shrunk and low-pressure systems swing closer to the Peninsula, bringing us truly horrid weather. The blue sky days and alpenglow evenings of our first season were a distant memory. Occasionally, the lower temperatures at night turned the precipitation to snow, but, within hours, we were back to soggy gear and field notebooks.

Fortunately, the huge upside was that the penguins, characteristically, were totally nonplussed by the elements. They have their own, built-in Gore-Tex and blubber systems for warding off the cold and wet. They were happily tobogganing the snow slopes and appeared to be "on schedule" for a productive breeding season.

Despite the rain, the work moved forward and we were collecting data on the penguins.

I also waited for the tour ship that was scheduled to extract me and insert another of our researchers, Stacey Buckelew, to take my stead. Par for this season's course, however, Stacey was delayed 10 days because of thick ice drifting into Penola Strait from the south and west.

One afternoon, the weather broke and presented us with another upside. This time it's something that needn't be delayed. Instead it was a rare, sun-drenched moment. Best of all, the wind slacked completely and we were down to our shirt sleeves, a very welcome change. At extreme low tide, which exposes much of the cobble in the small bay south of the hut, Melissa planted a jug of hot water in the snow bank above the rocks and, seriatim, we enjoyed our first shower in weeks.

Some things are definitely worth the wait.

Ron Naveen is the founder and president of the nonprofit science and education organization Oceanites, Inc., and the principal investigator of the Antarctic Site Inventory project. He has a five-year grant from the National Science Foundation to assess and monitor the Adélie and gentoo penguins on Petermann Island.

around the continent

SOUTH POLE

Final summer push

Compiled from reports by Katie Hess, Paul Sullivan and other sources

South Pole science is entering the final stretch of the summer season with the arrival of several grantees for cosmological, space physics and aeronomy-based projects. The grantees have much to accomplish in the wake of last week's flight delays, which resulted in short stays on station. However, "optimism runs high since these scientists are seasoned veterans having been faced with limited time and resources in other field campaigns," said Paul Sullivan, science support manager. Most science projects at the South Pole operate year round, with summer the time for installing new equipment and the longer winter-isolation devoted to collecting data.

In the midst of the hard work stationwide, South Pole residents found time for a kickball games, and a barbeque. Another stellar South Pole open mike night led into performances by two volunteer bands, Squeaky Meat and Speed Carrot.

On Sunday evening the South Pole community gathered at the ceremonial South Pole for the wedding of Erica Fickeisen to Jonnie Johnstone, now Mr. and Mrs. Fickeisen. The marriage itself will be validated with the required licensing in the U.S., but the couple wanted to celebrate their union with their friends at the Pole.

"Cookie" Jon Emanuel performed the ceremony with best man and ring bearer Jeff Bechtel and bagpipe musician Bill McAfee looking on.

The union of the South Pole baker and the crane operator ended with the tossing of snow over the newlyweds during a procession from the Pole, a speech from the best man, and a beautiful cake made by the bride herself that was enjoyed at a reception in the new dining facility.

And the most certain sign of the end of the season: the first of the summer season folks are starting to redeploy during this coming week.

Photo by Robert Schwarz / Special to *The Antarctic Sun*

"Cookie" Jon Emanuel officiates the wedding of Erica Fickeisen to Jonnie Johnstone at the ceremonial South Pole near the station. Jeff Bechtel, the best man, and other station residents watch from behind. The marriage will be formalized in the United States later.

PALMER

Polar insect study

By Kerry Kells

Palmer correspondent

Twenty-six years ago, Rick Lee landed at Palmer Station as a postdoc researcher with the University of Houston to study polar insects. He returned this year for the month of January to revisit this research and begin new studies on the four abundant and common microarthropods (insects and related mites and ticks) in the Palmer vicinity. He introduced the details of his research at the Wednesday night science lecture this past week.

The insects have evolved unique adaptations for survival in the polar region of the Antarctic peninsula. The Collembola (springtail) under the scientific name of *Cryptopygus antarcticus* are hydrophobic and can function and move on the surface of water. The mite (*Alaskozetes antarcticus*) is abundant on Norsel Point. The tick (*Ixodes uriae*) is an arachnid and is found on 38 different seabird species in the two polar regions.

The midge, (*Belgica antarctica*) is a wingless fly with four larval stages and a two-year life cycle. Flying insects would be blown out to sea and not survive to reproduce, so natural selection resulted in shorter and shorter wings until the midge evolved as wingless, to keep it grounded and able to reproduce. Midges are found in mountains, islands and polar regions.

Lee showed photographs of all four arthropods with emphasis on the unusual *Belgica antarctica*.

The research in 1979-1980 used several environmental stress tolerance experiments on the midges including cold, heat, desiccation (dehydration), anoxia (lack of oxygen), freshwater immersion, salinity tolerance and variations in pH level. The research project for 2005-2007 is titled, "Physiological and Molecular Mechanisms of Stress Tolerance in a Polar Insect" and includes a combination of field and laboratory studies. The team will go out to the local islands and study the fluctuations in environmental conditions, including the same stresses they tested the midges for in the earlier study. (*For more on his research, see page 7.)*

Lee is here with co-principal investigator David Denlinger and three team members: Scott Hayward, Joseph Rinehart and Luke Sandro. Hayward is from the University of Liverpool and has previously worked with the British Antarctic

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the week in weather

McMurdo Station
High: 43F / 6C
Low: 16F / -9C
Max. sustained wind: 25mph / 41kph
Windchill: 29mph / 46kph

Palmer Station
High: 47F / 8C
Low: 29F / -2C
Max. sustained wind: 19mph / 31kph
Precipitation: 0mm

South Pole Station
High: -6.7F / -21.5C
Low: -22.2F / -30.1C
Peak wind: 12 mph / 19 kph
Max. Physio-altitude: 3,155m

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Survey at Rothera. Sandro is also a high school biology teacher from Dayton, Ohio.

He maintains a Web site that a number of schools in Ohio check regularly to follow the project: http://www.units.muohio.edu/cryolab/education/antarctic.htm

In other science news, research is in full swing with open water and low winds. The birders report Adélie penguin, giant petrel, cormorant and brown skua chicks and south polar skuas with unhatched eggs. Krill research continues. The plant biology group has ventured to Biscoe Island for soil and plant samples.

SHIPS

Nathaniel B. Palmer

Jan. 12-18

Compiled from reports by Alice Doyle

After weathering a storm, researchers and crew aboard the *Nathaniel B. Palmer* welcomed several days of calm, glassy seas and sunshine in the Ross Sea.

The researchers on board continued to take samples and measurements of water temperature and salinity for plankton studies. On Jan 14, the ship went to where iceberg B15-A may collide with the Drygalski Ice Tongue.

"These two massive pieces of ice were indeed impressive. We measured about 3.8 nautical miles (7km) between them," wrote marine projects coordinator Alice Doyle.

The ship followed B15-A east-southeast to Franklin Island, where it met with a U.S. Coast Guard helicopter the next afternoon. The helicopter brought radioisotopes that had missed the ship in Lyttelton.

From there, the *NBP* headed back toward the sampling site it had abandoned when the weather got bad last week. As the ship approached, the barometer began to drop and the winds and seas rose, leading the crew to dub it "bad weather station." After three days, the weather improved enough to recover floating instruments.

"A curious minke whale played off the starboard bow for awhile yesterday evening, providing a good diversion," Doyle wrote. "Very few whales have been seen on the cruise making this a real treat."

Laurence M. Gould

Jan. 10 - 15

Compiled from reports by Andrew Nunn

The Long Term Ecological Research cruise continued aboard the *Laurence M. Gould*, taking samples every 30km along a grid. The wind kicked up in the afternoon of Jan. 10, forcing the ship to skip two sampling sites and head closer to shore.

The weather improved the next day and by midnight Jan. 13 the sampling grid was completed.

On Jan. 14 the *Gould* sailed south on the inside passage east of Renaud Island to take some samplings from the sea ice. The *Gould* hit ice at 3 a.m., and by 8 a.m. the researchers had selected a site for an ice station. The divers collected krill and ice samples, then an ice party was set out on a larger berg next to the ship to collect ice cores.

"Weather was clear, calm, and spectacular. Everyone on the ship got a suntan," wrote marine projects coordinator Andrew Nunn.

The next day, the researchers collected a sediment trap that stays out for a year and put a new one in the water. They arrived at the location of the trap at 6 a.m. and triggered the release that would allow it to float up. Twenty minutes later, they spotted the floats on the surface and snagged them with a grappling hook. The recovery took less than 30 minutes. When they got the instruments on the deck, it turned out only one of the pair had responded to commands. Fortunately, one was enough.

The rest of the afternoon was spent cleaning and maintaining the instrument to send it out again. Sunny, calm weather made the work easier and at 3:30 p.m. the sediment trap was dropped over the side.

Dive team fixes *Star* leaks

By Ensign Melissa L. Hentges
USCGC Polar Star

The Coast Guard icebreaker *Polar Star* is at work again, breaking ice in the channel to McMurdo Station on Ross Island.

A dive team, led by a Naval project engineer, spent seven days repairing leaks in the controllable pitch propeller.

The leaks on the port and starboard propeller hubs were located on Dec.31 and temporary patches were installed by *Polar Star*'s dive team.

Polar Star has three controllable-pitch propellers that are each 5m in diameter and weigh 16,800kg. These propellers are built to withstand harsh icebreaking conditions, such as ice chunks the size of small cars. These conditions take a heavy toll on all the equipment.

This year while at the McMurdo ice pier, the crew noticed the port controllable-pitch propeller hydraulic oil tank level decreasing. The dive supervisor on *Polar Star*, and his dive team carried out a pier-side inspection the next morning. During this initial dive, the propeller hubs were inspected and fluid was visually observed leaking from a seam between two major sections of the propeller hub assembly. The two sections are held together by 24 cap screw-style bolts. They are 6cm- by 20cm-long and each bolt is tightened to 1,500kg and then lock-welded into place using lock wire.

Photo by Ken Staude / Special to *The Antarctic Sun*

Ken Elliot, a diver with Phoenix International, welds the lockwire to complete repairs on the Coast Guard icebreaker Polar Star.

To minimize environmental damage, the Coast Guard and NSF decided to have *Polar Star* remain at the ice pier while waiting for the contract dive team. The crew monitored the daily fluid leakage and minimized the environmental contamination using pads to absorb oil from the waters' surface. The dive team arrived from the United States via Christchurch, NZ, on Jan. 11. The team consisted of seven divers headed by Mike Dean, a Naval Project Engineer from the Naval Sea Systems Command, and contract divers from Phoenix International based in Morgan City, LA. The divers use a surface supply diving system that provides hot water to their suits through a shoreside water heating system. One dive can last for up to five hours at a depth of approximately 11m, in -1.6C water.

The dive team first ground off the locking welds to free the bolts. Using a hydraulic torque wrench, the divers re-tightened each bolt in three stages to 1,600kg. When re-tightened, the ship's crew started the propeller blades and tested the hub pressure assembly for leaks. Once there were no leaks reported, the bolts were all re-welded to the locking wire. The repairs were completed January 18 and appear to be effective.

The leaking hubs caused a delay in the operational schedule, but *Polar Star* and its crew remain confident that repairs will be effective and this mission will be the 50th successful Deep Freeze operation.

Tiny, but tough

Wingless flies are Ice's heartiest residents

By Kristan Hutchison
Sun staff

Antarctic bugs survive by always being ready for the worst.

Freeze them. Dry them out. Drop them in salty brine or acidic water. Take away their air for a month. The wingless flies are ready to take it.

"They're pretty remarkable," said Rick Lee, a biologist from Miami University in Ohio, who first came to study the midges, called *Belgica antarctica*, 25 years ago. "We're trying to get a better understanding of how they can, in fact, tolerate these sorts of stresses that are routine here on the (Antarctic) Peninsula."

These midges seem to live with a constantly high level of the proteins that most organisms produce only at times of stress, according to preliminary results from research underway at Palmer Station. The heat shock proteins help cells deal with cold, heat, oxygen deprivation and other environmental stresses. These are the same proteins our bodies make when we get a fever.

"The thing that we're finding, the data that has just come in this last week, is it looks like these midges have this gene turned on all the time," said David Denlinger, a molecular biologist from Ohio State University. "They're ready for whatever's going to hit them. It's really pretty wild. Most organisms don't do it that way."

Eventually what Denlinger and Lee learn may be applied to human organs, allowing vital parts like hearts and lungs to be kept frozen until they can be transplanted. Recent cancer research also found that heat shock proteins play a role in preventing cancer.

"We may be able to find some clues from studying these organisms that allow us to develop some means for artificial cryopreservation," Lee said.

The midge has to be ready for harsh conditions because it is a permanent resident on the continent. Though barely a third the size of a mosquito, this fly is the largest land animal to live year-round in Antarctica, said Lee, who started studying the Antarctic midge during post-doctoral work at the University of Houston in 1979.

"It's not like the seals and penguins that follow the ice. These guys stay on land," Lee said. "This is the southernmost higher insect. The only other group that might be considered an insect is the springtail or Collembola."

Photo by Rick Lee / Special to *The Antarctic Sun*

Luke Sandro, left, and Dave Denlinger collect midge larvae near Palmer Station.

Lee has studied four of the common microarthropods found in Antarctica, including the springtail and a tick that lives on Antarctic seabirds. In all, about 15 microarthropods live on the edges of the continent.

The midges are found only on the Antarctic Peninsula, where they appear in spotty but diverse habitats, from the small clumps of moss and grass that grow on the peninsula to the algae growing in damp spots and the mud near penguin rookeries. Finding one species of midge in so many different microhabitats is the reverse of what happens in temperate areas. For example, a single stream in Minnesota might have 100 species of midges.

"It's a story about how by chance you become established down here," said Lee, who thinks the Belgica midge colonized the peninsula about 5,000 to 6,000 years ago. "It's a story about life on the edge."

The midges have a two-year life cycle. They spend most of it as worm-like larva, up to 6mm long, eating all the bacteria, detritus and algae they can. They molt into adults in the summer and spend three to four days mating and laying eggs, then die. The eggs hatch after a week and the new larva begins feeding.

"Any of these larval stages could be the overwintering stage. That is unusual for an insect," Lee said.

At anytime in that lifecycle, the midges can freeze and still be fine when they thaw. That flexibility is unique. The larvae can withstand other stresses, too. Lee has dried them until their bodies had 35 percent of the original mass.

"They looked like little raisins. They looked as dead as could be, but when you added water they plumped right up and swam away," Lee said. "We're trying to understand how they do that."

Their first guess is the heat shock protein. Before coming to Palmer Station, Denlinger and his post doc researcher, Joseph Rinehart, were able to extract and clone the heat shock protein from a midge specimen Lee had collected near Palmer in 1979 and preserved in alcohol in his lab.

"That was a real leg up on this project," said Denlinger, who now has been able to measure the levels of heat shock protein in some of the thousands of midges they're collecting from the field.

"We have the gene we want and we're

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Midges From page 7

looking at some very interesting and different expressions," Denlinger said.

He's surprised to find such high levels of the heat shock protein constantly present in the midges. Though the heat shock protein is highly protective, most creatures have to turn it off in order to develop. How the midge continues to move into new larval phases with high levels of heat shock protein present is one of the questions the researchers will consider as their three-year study continues.

"Frankly, we're not quite sure how an organism can keep these proteins on all the time," Denlinger said. "It's all very preliminary at this point. Those are the kinds of questions we're asking."

The researchers also wonder whether the physical response triggered by one kind of stress, such as freezing, also protects the midges from other stress, such as the dryness left when all the water freezes. At the same time, other molecules appear under stress, such as the polyhydric alcohols, glycerol and sorbitol, which may be part of a suite of physiological responses that work together to help protect the midges.

"They looked like little raisins. They looked as dead as could be, but when you added water they plumped right up and swam away."
— Rick Lee, biologist studying Antarctic midge

NSF-funded research in this project: Richard Lee, Miami University, http://www.units.muohio.edu/cryolab/education/antarctic.htm and David Denlinger, Ohio State University

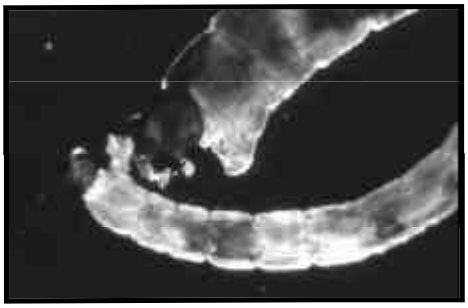
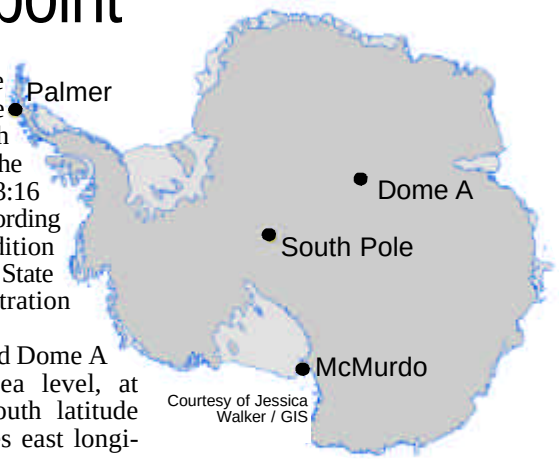


Photo courtesy of Rick Lee / Special to *The Antarctic Sun*
Larvae of the Belgica antarctica, a midge living year-round on the Antarctic Peninsula.

Chinese expedition reaches highest point



Courtesy of Jessica Walker / GIS

A 12-man Chinese expedition became the first group to reach the highest part of the Antarctic ice sheet at 3:16 a.m. on Jan. 18, according to the polar expedition office of the Chinese State Oceanic Administration (SOA).

The location called Dome A is 4,039m above sea level, at 80:22:00 degrees south latitude and 77:21:11 degrees east longitude.

The team plans to establish an interim scientific observation station at the spot to monitor the climate, measure the depth of the ice sheet and obtain ice samples, SOA said.

The team will also look for the right location to put a third Chinese scientific research station in Antarctica. That station, together with the existing Changcheng (Great Wall) and Zhongshan stations, will form a regional climate monitoring system.

The team has obtained a nearly 100m-long ice sample from about 300m below the surface. The sample should provide crucial clues to climate and environmental changes in this area.

The Chinese scientists also set up an automatic weather observation system that may function at -90C. The system, jointly developed by China and Australia, sends out real-time information by satellite on temperature, moisture, solar radiation, wind, and atmospheric pressure.

The team planned to stay two days. They will leave a commemorative mark of 13 empty oil casks with a national flag at the peak.

The Antarctic ice sheet is the Earth's largest continental glacier, and makes up 70 percent of Earth's freshwater. It has an average thickness of 2,450m.
— National Science Foundation

Satellite outage impacts Kiwi's

A satellite providing communications for some Antarctic stations suddenly and permanently shut off on Jan. 14.

New Zealand workers at Scott Base, near McMurdo Station, had their communications cut off when Intelsat 804 stopped working, said Joe Harrigan, McMurdo network engineer. Scott Base received their e-mails through McMurdo Station and had the use of one McMurdo phone line until they were able to switch to another satellite on Saturday.

The cause of the unexpected failure is not clear, but it is likely that Intelsat 804 experienced a power failure. Intelsat 804 had provided 7 to 8 years of its expected 15 years of service, said Steve Toth, Raytheon Polar Services Co. director of IT/Communications. Another Intelsat satellite experienced a premature failure in the last few months. One theory is that strong solar flare activity could be causing the failures.

McMurdo's primary communications were unaffected by the failure, because the station has been using a different satellite since November. Before then Intelsat 804 was the satellite used for primary communications from McMurdo. In November, another satellite was being retired and the decision was made to move most McMurdo communications to Intelsat 701 where tv/radio signals were being broadcast from. This move put McMurdo Station and Scott Base on different satellites and eliminated the need to replace a receiving dish destroyed by a storm.

McMurdo still relied on Intelsat 804 for a direct connection between Christchurch and McMurdo. That link was used primarily to pass weather information in support of flight operations. Since the loss of Intelsat 804, the weather information has been routed through the United States and back to Christchurch, NZ, along with all other McMurdo communications.

Toth said that as a result of the premature failure of Intelsat 804, there is even more demand on the already overloaded satellite communications link out of Black Island this season. The result will likely be reduced network performance.

CREAM From page 1

Ganel said the main goals of the mission are to gather clues as to the source of cosmic rays, learn more about how the particles are accelerated to enormous energies and fill in a data gap between what ground-based and other detectors in the atmosphere and space have found. The data will be used to test various theoretical models of the universe.

CREAM really is doing what it was supposed to, Ganel said. The instrument originally was designed to fly a 100-day mission aboard a super pressure balloon called an Ultra Long Duration Balloon. Super-pressure balloons maintain an internal pressure higher than that of the atmosphere they float through. NASA's requirements to fly with a ULDB balloon are more stringent than for an LDB.

However, the cutting-edge ULDB is still in development and CREAM had to move to the zero-pressure balloons typically used in Antarctica. In zero-pressure balloons the internal pressure never exceeds the pressure of the atmosphere outside.

The understated star of the show is the balloon carrying CREAM. It's larger than a ULDB, but is designed only for about a 30-day lifespan. Made of poyethylene film similar to sandwich bags, the balloon is taller than the Washington monument. This balloon has held up much better than expected, Ganel said, giving credit to NSBF. The facility's technicians have been on station monitoring and manipulating the balloon and preparing for the recovery mission.

At nearly 40 days CREAM will approach the minimum flight time for a ULDB. There is a risk in keeping the Long Duration Balloon afloat. The balloon and payload could be lost to an area that is difficult to reach, such as the mountains or out to sea, Ganel said. The flight is constantly tracked by satellite to ensure that operators could cut it loose if it drifted toward danger.

"When going around and around you take risk, but obviously it paid off." Seo said. "It becomes obvious that we will have pretty significant data."

CREAM was built with the unusual ability to transmit large amounts of data in flight to a ground station via a high-speed satellite connection. From there it's forwarded to Seo in Maryland. That also helped the team decide to send it around again.

The balloon could be brought down in the next few days. After tracking close to 78 degrees South latitude for about a week, the balloon veered north Friday. That means it is less likely to be recovered close to McMurdo.

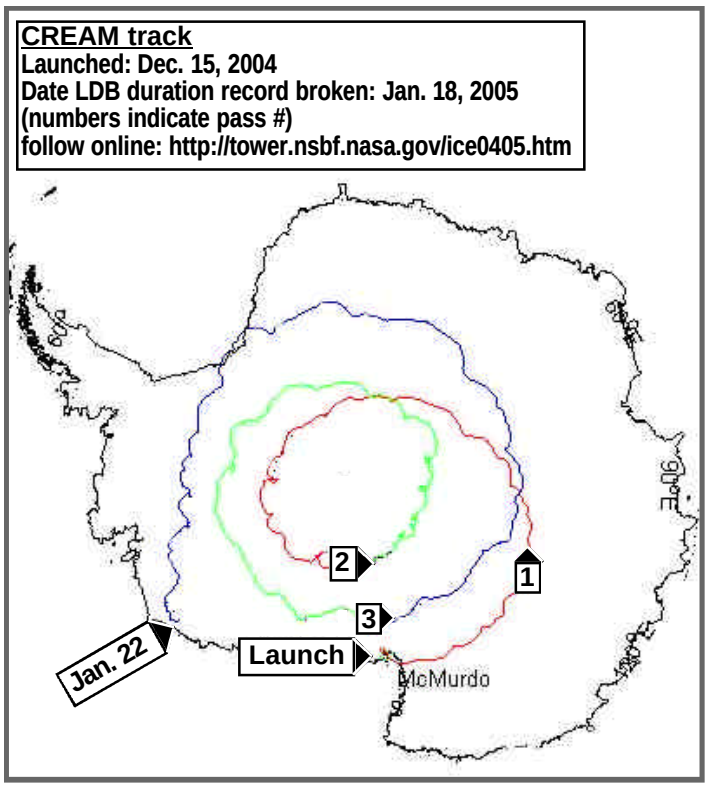
But if it does lands near enough for the team to just load it up and fly it home, that would save the team time, effort and money, Ganel said. A recovery from a distance farther away would mean the data discs would be retrieved first, then the instrument dismantled and flown home in pieces.

Once back in the shop the instrument would need to be reassembled for a future flight. A second version of CREAM is being readied for Antarctic flight in 2005. The team hopes to fly CREAM or CREAM2 for multiple seasons until enough data is gathered. This year's flight only improves the chances for future flights, Seo said.

Seo gave credit to her team and thanked the NSBF, the National Science Foundation and Raytheon Polar Services Co. for their assistance in preparing, launching and monitoring the balloon.

"I'm very impressed by their support and hope that it continues to the end of recovery," she said.

CREAM is funded by NASA with support from the National Science Foundation:
Eun-Suk Seo, University of Maryland
Institute for Physical Science and Technology,
http://cosmicray.umd.edu/cream/cream.html



Continental Drift | How has Antarctica inspired you?

"It has taught me tolerance."

Dan "Sparky" Weisblatt,
Palmer Station electrician from Denver, Colo. seventh season

"Antarctica has really given me more self-confidence in the things I can do. And I have a new appreciation for things back home."

Ray Cornett,
McMurdo lineman from Ocala, Fl, first season

"People here are really hard-working and focused. I want to keep up with these guys."

Erik Lund,
South Pole materials handler from Estes Park, Colo. third season

Photo by Alan Boudreau / Special to *The Antarctic Sun*

Geologists in the Magmatic Field Laboratory Workshop set up camp at Bull Pass with the Ferrar dolerites behind them. In this photo, workshop organizer and geologist Bruce Marsh of John Hopkins University is in the center with the white ball cap and facing the camera.

Magma

From page 1

fuller picture of how the rocks we see at the surface develop from the molten interior.

"They're different worlds. We're trying to put these worlds together because it must be all one process," Marsh said. He has high expectations for the workshop, which was cut from three weeks to two when bad weather delayed the geologists in Christchurch, New Zealand. Marsh is aiming for a grand unification theory of magma.

Like the blind men, geologists can't actually see the process at work, because it mostly occurs deep in the Earth.

"The processes that go on in the volcanic system are just inferred," Marsh said.

But in the McMurdo Dry Valleys, Marsh thinks he's found a way to help the blind see. Rocks known there as Ferrar dolerites were exposed by uplift and 180 million years of erosion, revealing the magma plumbing system. The lack of water and vegetation means the rock structures are basically unchanged and easy to see.

"It's like a beautiful magmatic museum over there," said Marsh, who first saw the area in 1992, after doing geological research in Iceland, Indonesia, Africa, Japan, Canada and the U.S. "You don't see this anywhere else."

The Ferrar dolerites offer 11 horizontal layers of rock exposed over 4km, from granite at the bottom to basalt at the top of the mountains. The magmatic mush column pushes through the layers like a postmodern tree, with the magma rising up the main trunk, then occasionally spreading out between rock layers into bulbous branches. The rock layers include four of these horizontally spreading branches, called sills. One of the sills goes from 300m thick on one end of the Taylor Valley to 2.5cm at the other end.

"We think it kind of slides in like a sheet of plywood being shoved under carpet in your house," Marsh said.

Marsh uses the mush columns in the Ferrar dolerites to support his controversial theory that the planet's inner plumbing is comprised of a system of these small, vertical, interconnected chambers. This flies in the face of the accepted teaching, which is that the Earth's outer layer formed when crystal-free magma oozed to the surface from giant, subterranean chambers.

But the Ferrar dolerites could represent more of an exception than a rule, said Alan Boudreau, a geologist who usually studies much larger systems in South Africa.

"Every place sort of has its own particularities," Boudreau said. "Sometimes it's the odd one that kind of kicks off an idea that applies every place else."

Though it may not be universally applicable, Boudreau believes Marsh's interpretation of what formed the Ferrar dolerites is mostly correct.

"Some of the details, that's what we're here to agree or disagree with." Boudreau said. "We're not shy about telling him."

Another key to decoding the hidden processes may be the Dais intrusion near Bull Pass camp. An intrusion is where the magma pushes into the native rock. Intrusions are fairly common, but most are larger. The one Boudreau studies in South Africa is about 9km thick. The Dais intrusion is small, about 600m to 700m thick, which allowed it to cool rapidly, preserving the texture and crystals of the rock layers. The layers of the Dais intrusion mimic the layers of rock in the Earth, and therefore can help geologists see the original crystal structure within those layers, Marsh said.

"That's one of the things that's interesting to me, is they look like fairly big systems, but they're not going through a lot of change," said Boudreau.

The geologists in the workshop spent most of their time walking around the Dry Valleys looking at the rock and taking samples.

"The idea is for people to go out and

See Magma on page 11

Magma From page 10

make their own impressions," Marsh said.

Because a week was lost to weather, the geologists had little time to work at Crary Lab. A few used the time to cut rock samples into domino-sized pieces, glue them to a glass microscope slide and grind the rock samples down to "thin sections" that are 30microns thick.

At that point the rock is invisible to the naked eye, nothing more than a smudge on the glass. But under a microscope, viewed with triple polarization, the rock becomes a kaleidoscope of color and crystal shapes.

"This is the innermost intimate workings of the magma," Marsh said. "This is equivalent to an astronomer with a telescope looking out to the stars."

To his seasoned eye, the small and large crystals tell the history of the rock. One type of crystal shows up like black fragments of charcoal under the microscope, larger than most of the other crystals. Called orthopyroxene or OPX crystals, these form deep in the Earth and are carried up with the magma, Marsh said. Because of their size, they can only be carried when the magma moves at a certain strength. Think of water flowing down a stream bed. If the water is slow it will carry tiny particles of silt but will run over stones without disturbing them. If a dam bursts upstream, the sudden rush of water picks up stones and boulders and carries them downstream.

By tracing the distribution of the OPX crystals through rock in the Dry Valleys, geologists can reconstruct the flow of magma, Marsh said. During the workshop, participants were able to display magnified views of thin sections on a screen so everyone could view and discuss the same crystal structures.

"This is a new concept, where we actually bring the laboratory to the field," Marsh said.

The geologists are hauling home boxes of rock samples to work on at their own labs. They're also making plans to reconvene in a year or so at a meeting in the U.S. where they can compare what they found.

Marsh hopes that someday this workshop may be considered a turning point in the field. His dream is that by becoming more aware of how the magmatic plumbing system works, the geologists involved will be able to apply the knowledge as they look at pieces of it in other parts of the world.

"Geology texts will say we went away from this to different parts of the world and said now we understand what kind of elephant we're dealing with."

NSF-funded research in this story: Bruce Marsh, Johns Hopkins University Morton K. Blaustein Department of Earth and Planetary Sciences

Photos by Alan Boudreau / Special to *The Antarctic Sun*

Above, Canadian geologist Jean Bedard stands on a rock as he examines the sand patterns on a hillside. Below, geologists in the Magmatic Field Laboratory Workshop discuss the rock structures in the McMurdo Dry Valleys.

Profile Intern leaves Idaho to explore Ice

By Emily Stone
Sun staff

Paul Hamlett's first step toward securing a job offer in Antarctica was getting an answering machine.

"I actually went out and bought an answering machine so I wouldn't miss the call," he said.

The call came. He got the message, and six months later, Hamlett started work as a general assistant in McMurdo Station's heavy vehicle maintenance shop. He's one of 11 college students working at McMurdo this season in the Antarctic intern program.

Hamlett, 23, initially tried to come to Antarctica in 2000 through the Boy Scout program. He tried again after learning about the intern program while a senior at the University of Idaho. He figured there was no way he was going to afford to come to Antarctica as a tourist, so the only way to get here was with a job.

"I don't come from a rich background," said Hamlett, who grew up in Twin Falls, Idaho. "This was going to be my opportunity and I wasn't going to miss it."

Before coming to Antarctica, the farthest Hamlett had been from Twin Falls was a trip to Iowa with the Boy Scouts.

"This is completely, bam! — right out of Idaho to a whole new world," he said.

Beyond the lure of the unexplored continent, Hamlett was drawn to Antarctica because of the scientific research done here. His studies reflect this interest.

Hamlett has a semester of college left before graduating with a dual degree in wildlife management and conservation biology. He spent his first three years of school at the College of Southern Idaho where he earned three associates degrees in fish and wildlife science, environmental science and range science. He's working on his senior thesis while at McMurdo, analyzing the station's ecological impact by studying fuel use and getting soil sample data from scientists.

He's a regular audience member at weekly science lectures, and often asks questions afterward. He's volunteered as a dive tender with a science group, and makes a point of taking any scientists up on offers to tour their labs or learn more about their projects. Hamlett said he'd like to return to Antarctica in a job that uses his science skills.

In the meantime, his work in the heavy vehicle shop entails filling oil drums, handling the hazardous waste, keeping the space clean and helping the mechanics with whatever they need.

His boss, John Van Vlack, said Hamlett is a pleasure to have around. He's always smiling and upbeat, and is a hard worker. Hamlett's knowledge of everything happening on station earned him the nickname, "Answer Man."

"He keeps the spirits up in the shop, even if everybody's down," said Van Vlack, the vehicle maintenance facility supervisor. "We're really glad to have him onboard."

To many, Hamlett is probably best known as "the guy who decorated the hall." He spent the 15 days leading up to Christmas making a mural on paper that he taped to the wall outside his dorm room in Building 155. He colored a full, nearly life-size Yuletide living room scene, complete with fireplace, Christmas tree, and cookies and milk for Santa.

"My roommate brought home a coloring book from skua. ... It escalated from there," he said by way of explanation. He figures he spent more than 100 hours on the project, which culminated in a reading of "'Twas the Night Before Christmas." He said the effort was worth it and he enjoyed seeing people smile as they walked by him in the hall.

Hamlett said that even when he's having a bad day, he reminds himself of how lucky he is to be here.

"It's not everyone who can wake up and see the mountains of Antarctica in your backyard," he said.

His advice to other potential Antarctic interns, or anyone who wants to come here, is simple: "Don't ever let anything get in your way. I never thought I'd be in Antarctica and I proved myself wrong. And for once, I was happy I proved myself wrong."

Photo by Emily Stone / *The Antarctic Sun*

Paul Hamlett works in McMurdo Station's heavy vehicle shop as a general assistant. His job responsibilities include handling the shop's hazardous waste, filling oil drums, and general maintenance.

Paul Hamlett is one of 11 college students working at McMurdo Station this summer as part of the polar intern program. Here are the other interns:

Zachary Andrews: General assistant, Facilities, engineering, maintenance and construction department; University of California-Davis
Ariel Barquero: General assistant, Vehicle maintenance facility; University of Puerto Rico
Elizabeth Beckel: Dining attendant; Colorado College
Victor (Patrick) Fitzjarrald: General assistant, Fuels; Colorado College
Mike Mangual: Shuttle driver; University of Puerto Rico
Natalie Martin: Science cargo handler; University of Colorado
Kathleen McCammon: Cook; Johnson & Wales University
Daniel Simas: General assistant, Facilities, engineering, maintenance and construction department; California State University-Fresno
Jennifer Szarkowski: Dining attendant; University of Idaho
Brianna Templin: Janitor; University of Idaho