The Antarctic Sun

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Photo courtesy of Jill Mikucki / Special to *The Antarctic Sun*

Jill Mikucki takes samples of water flowing from Blood Falls, the red-colored waterfall that comes out of the Taylor Glacier behind her. She studies microbes in the iron-rich water.

The bleeding glacier

By Kristan Hutchison
Sun staff

In some places, blood-red water gushing from white glacier ice would become a religious shrine, or at least a tourist destination.

In the McMurdo Dry Valleys, it became the site of intense scientific investigation. The explanation for the red waterfall involves a hidden remnant of an ancient sea harboring an isolated community of microbes deep under the Taylor Glacier.

The Taylor Glacier flows into the Taylor Valley in the Transantarctic Mountains, carrying ice from the Antarctic Plateau. It's a 30m-tall wall of sparkling ice, with deep blue fissures. When the sun hits it at the right angle on a windless day, clear water melts down in rivulets, gathering in streams at its sides.

But Blood Falls oozes, trickles or cascades down the front of the glacier on its own schedule, spreading a rusty red across Lake Bonney's frozen surface the way blood from a fresh cut seeps through a bandage.

"People have been really fascinated by it since they first discovered it," said Kathy Welch, a research scientist from the Byrd Polar Research Center. "It's such a unique feature. People want to

See Blood Falls on page 4

Ice at risk

Scientists survey West Antarctic glaciers that may be sliding away

By Kristan Hutchison
Sun staff

A cloud-shrouded and hard-to-reach piece of Antarctica may be in danger of slipping into the sea.

Satellite images from the past decade show two of the glaciers draining the West Antarctic Ice Sheet have been rapidly melting, thinning and retreating. This is changing the delicate balance that keeps the 3km-thick ice sheet stable.

"The dynamics of the ice sheet are changing. That is very significant," said David Morse, a glaciologist from the University of Texas Institute for Geophysics. He is part of a team of 15 American and British researchers trying to do an airborne geophysical survey of the Amundsen Sea Embayment, West Antarctica, or AGASEA.

Two of the fastest-flowing glaciers in Antarctica, the Pine Island and Thwaites glaciers, flow into the Amundsen Sea. They comprise the third of three major drainages for the West Antarctic Ice Sheet, and

See AGASEA on page 9

Late night dining

By Brien Barnett
Sun staff

It's long after midnight, but the bright mid-summer sun streams through the windows of the dining hall at the elevated South Pole Station as dining attendant Catherine Graciano wipes down the counters next to the beverages.

She's singing along with songs she's heard before, but doesn't know well. It's '80s night on the iPod and the night-shift kitchen crew is hard at work.

Graciano wanted to work in Antarctica, but her sister was getting married and she knew she couldn't skip the ceremony. She turned down an offer to work in McMurdo's kitchen so she could attend the wed-

See Midrats on page 11

INSIDE

Quote of the Week

"The only thing holding up this issue is the quote of the week."

- Antarctic Sun editor

Ross Island Chronicles By Chico

Cold, hard facts

B-15 iceberg

Original size (in 2000): **10,850 sq km**

Largest piece remaining: **B-15A, 3,000 sq km** (the one at the top of McMurdo Sound)

Amount of fresh water in original berg: More than **1,000 trillion gallons**

Approximate value of the fresh water in the original B-15 iceberg: **$320 billion**

How deep if spread across all of world's agricultural land: **10cm**

How old is the ice: **hundreds of years**

Thickness below water: **400 meters**

Height above water: **30 meters**

Life expectancy: **unknown**, but will be measured in years

How often do 100-mile bergs calve: **about every 10 to 15 years**

How long will it take to replace this much ice at the edge of Antarctica's Ross Ice Shelf: **20 to 40 years**

Is it the biggest berg ever? **Not sure**, since satellite tracking only began in 1976.

Source: Doug MacAyeal; AMRC, http://amrc.ssec.wisc.edu/icebergfaq.html#A1

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Matt Davidson

Test your knowledge with a science quiz

By Emily Stone, *Sun staff*

Did you know that humans and dinosaurs did not live at the same time, or that an electron is smaller than an atom? If so, congratulations. You can join the roughly 45 percent of other Americans who knew these scientific facts, according to studies conducted by Jon Miller, a professor at Northwestern University.

Miller is part of an ongoing effort to measure the public's level of "science literacy." Just under 20 percent of Americans are scientifically literate, according to his research. He defines a scientifically literate person as someone who can read and understand the *New York Times'* Tuesday science section, which is the equivalent of a college freshman level of understanding. This would give a person the knowledge needed to participate in public policy debates about science.

Here's a highly unscientific test of your Antarctic science literacy. It has not been calibrated to *New York Times'* standards, but it's the kind of information you'd learn if you went to the weekly science lectures, faithfully read your *Antarctic Sun*, and maybe even talked to a beaker or two in the dining hall.

1. What is not a type of quark: up, down, top, bottom, silly, strange, charmed?

2. Match the word with its definition:

Baryon	elementary particle with zero charge and spin, very small mass and weak interactions with matter
Neutrino	elementary particle similar to an electron but with a mass that is 207 times greater
Muon	a heavy subatomic particle made up of three quarks

3. B-15, the iceberg that calved into the Ross Sea in 2000, was the largest iceberg ever measured. How big was it?
   a. Roughly the size of Manhattan, which is 60 square kilometers
   b. Roughly the size of Long Island, which is 3,566 square kilometers
   c. Roughly the size of Jamaica, which is 11,000 square kilometers
   d. Roughly the size of Sicily, which is 25,708 square kilometers

4. Why is the Antarctic circumpolar current so important?
   a. At 21,000 kilometers, it is the world's largest current.
   b. It is the only current that touches the Atlantic, Pacific and Indian oceans.
   c. It plays a crucial role in the formation of cold, dense, nutrient-rich bottom water.
   d. All of the above

5. How much would the world's sea level rise if the entire West Antarctic Ice Sheet melted?

6. True or False: There are more meteorites in Antarctica than anywhere else on Earth.

7. More than 98 percent of Antarctica is covered in ice. This hasn't always been the case. How many years ago do some scientists believe the current glaciers started covering the continent?

8. How long, in minutes, was the longest recorded dive by an emperor penguin?

9. What percent of their body mass do female seals lose during the first 30 days after giving birth to a pup?

10. Why don't polar bears eat penguins?
    a. Penguins are too fast for polar bears to catch.
    b. Penguins taste bad.
    c. Polar bears can't digest feathers.
    d. They live at opposite ends of the Earth.

Check your answers on page 10

Page designed by Matt Davidson

Blood Falls From page 1

understand the chemistry and the physics behind it."

Seeking the source

When geologist Griffith Taylor saw the glacier's front in 1911, he wrote that "bright alga lent an unusual touch of colour." The red waterfall became known as Blood Falls. Researchers began studying it in the 1960s, when University of Wisconsin scientist Robert Black determined that the red came not from algae, but from iron.

The McMurdo Dry Valleys Long-Term Ecological Research (LTER) group has now analyzed more than 10 years of samples from the falls. That analysis suggests that the reddish salts in the water were deposits formed at the site of an ancient lake bed when the ocean receded from the valley 3 to 5 million years ago. When the Taylor Glacier advanced over the top of the lake, the seawater was trapped beneath.

Blood Falls water still smells a lot like seawater. Broken down into its chemical parts, it looks a lot like seawater too.

"The sodium, magnesium and potassium concentrations aren't exactly the same (as seawater), but the ratios are the same, so we use that to indicate that the original source of that water was probably seawater," Welch said.

Other evidence also indicates that something unusual is buried beneath Taylor Glacier. Though the Taylor and other glaciers in the Dry Valleys are all polar, dry land glaciers, the Taylor behaves more like a marine-based glacier, indicating it may have some kind of salty water at its base. Radar surveys of the glacier in the 1970s found an anomaly underneath the glacier, which could represent a pool of ancient marine water.

"It's very hard to get a smoking gun, especially when you're trying to look back millions of years in the past, but you can get multiple lines of evidence that say hey, it's worth considering," said Jill Mikucki, a graduate student working with microbiologist John Priscu at Montana State University. "Here we have physical, geochemical, possible paleohistory and microbial evidence that it might be possibly an ancient marine ecosystem."

If it is, then Blood Falls is like a tap into the oceans of the past. And that past could still be alive.

The red color of the water is a reduced form of iron, probably coming from rocks weathering beneath the glacier, Welch said. The iron-rich water turns red when it mixes with the oxygen in the air. The reduced iron is a form that some microbes can use instead of oxygen, which was what struck Mikucki's when she saw a photo of Blood Falls in a glaciology class.

Photo by Kristan Hutchison / *The Antarctic Sun*

Iron-rich water spills out of the Taylor Glacier and stains the surface of Lake Bonney. The water is thought to come from the remnant of an ancient sea trapped below the glacier.

"It's very hard to get a smoking gun, especially when you're trying to look back millions of years in the past."
— Jill Mikucki, graduate student

"The first thought that went through my head was what microbes are there, because here was a large source of free energy," Mikucki said. "You think pagan worship ceremony. I'm sure Kathy thinks, 'Ooo, chlorides and ions.' I think microbial food."

When she joined the LTER project in 2001, Mikucki set out to "put a name on these bugs."

She cloned the microbes and looked at pieces of their genetic code, called ribosomal DNA. Ribosomes are involved in protein construction. Because the building of proteins is so vital to life, the DNA that codes for ribosomes is highly conserved and thought to be unique to individual species. They represent core traits that don't go through as many changes as other genes do.

"It's like an I.D. tag," Mikucki said, "like a dog tag for microbes."

After several years of research, Mikucki found the microbes living in the falls are similar in type to microbes found in other extreme cold environments with the same food sources, including organisms from arctic and antarctic environments, marine organisms, deep subsurface organisms, sulfate reducing organisms, and organisms from environments lacking oxygen.

"We find an entourage of organisms that make sense at least hypothetically to the environment that they're in," Mikucki said.

Without drilling through 30m or more of ice, she can only sample the water that runs out of the falls, not whatever pocket of water is below the glacier. Based on the microbes she has found in the falls, Mikucki suspects there is an active community under the ice.

A few of the microbes may turn out to be new species or genus, with potentially useful traits, Mikucki said. The Dry Valleys are also similar in temperature, climate and moisture to Mars, and a Blood Falls-like environment might exist under the Martian ice caps. So the falls provide scientists a place to develop theories and techniques they will someday apply to exploring other planets.

The glacier hides other mysteries as well. Researchers still aren't sure what dynamics cause the falls to start or stop flowing, how heavy the flow is, or how large any remnant sea below the glacier might be, Mikucki said.

Water from the falls eventually seeps into Lake Bonney and settles to the bottom, so it is also possible that the ecosystem in the bottom of the lake is similar to whatever is below the Taylor Glacier.

NSF-funded research in this story:
John Priscu, Montana State University,
www.homepage.montana.edu/~lkbonney/

around the continent

SOUTH POLE

Bang! It's Christmas

By Brenda Everitt
South Pole correspondent

South Pole residents have had their minds on everything from bingo to the Big Bang.

James Brown, a sous chef at the Pole, hosted "Christmas bingo" Dec. 18 in the dining hall. It was well attended. For the grand finale, James revealed a bingo card painted on his chest that matched the winning card in the audience. The lucky winner received a gift certificate to the Tramway restaurant in Christchurch, New Zealand, worth $80. Other prizes included gift certificates to various establishments in Christchurch, as well as merchandise from Pole Mart (the station store) and the final prize of the evening, which is always the cash received from the bingo cards that night.

Large blocks of snow were quarried and left near the ceremonial south pole during the past week. On Sunday, sculptors tried their hand at various designs ranging from cars to heads to geometrical shapes. The snow sculpture contest continues throughout the week, and will be judged on Christmas Day during the annual Race Around the World.

The ceremonial pole was noticeably absent for several days while being repainted. The brightly colored pole was returned on Sunday morning, complete with Christmas decorations.

A Russian expedition will be arriving during the coming week to repair the Antonov-3 airplane that has been stored at the South Pole Station since 2002 after it broke down. A team of eight Russians will be working on the airplane. Additional specialists will be at McMurdo, ready for day-trips to the South Pole as their expertise is needed.

Prof. Bill Holzapfel, of the University of California at Berkeley, gave a rousing lecture Dec. 19, arguing that the Big Bang is the best theory to describe the beginning of the universe given the scientific evidence. He also outlined opposing theories.

Photo courtesy of Scot Jackson / Special to *The Antarctic Sun*
A South Pole resident carves a sculpture.

While blatantly selling Polies on the Big Bang theory with data from the South Pole and other cutting-edge research, Holzapfel left his audience with room for suspenseful questions about what the missing pieces of the puzzle could mean. Clues to the missing pieces—such as what are dark matter and dark energy— could drastically simplify or merely convolute the accepted view of the beginning of the universe.

Holzapfel pointed out that attempts to answer big questions by disproving other ideas and theories often leads to a better understanding of the Big Bang. He encouraged his audience to seek the truth through experimentation, as that is what drives the exciting projects at the South Pole and others worldwide.

— Katie Hess contributed to this report.

PALMER

Hanukkah and ships

By Kerry Kells
Palmer correspondent

The holiday season at Palmer Station has begun. After Thanksgiving, several community members helped prepare a Hanukkah meal of brisket, matzah ball soup, kugel, potato latkes and chopped liver followed by mandelbrot and rugelach cookies. They also played with a dreidel, the traditional four-sided top, and had a menorah, an eight-branched candelabra. The meal and celebration were a success.

In preparation for Christmas, community members hung stockings, or creative variations on stocking, in the dining room. A krill net, bird weighing bag, radio belt and large plastic graduated cylinder became stockings. On Sunday, residents decorated cookies and constructed gingerbread houses.

The cruise ship *Polar Star* arrived, not to be confused with the Coast Guard icebreaker preparing to cut a channel to McMurdo Station. Station residents greeted 99 visitors from the cruise ship at 8 a.m. Tour guides led groups around Palmer Station, to the store and to the informal reception, called "meet and greet" in the dining room. The *Polar Star* was the first cruise ship of the season. We expect many more in January.

On Tuesday, Tim Kramer presented a slide show of his travels in Papua New Guinea for our science lecture. Kramer, a former waste technician from McMurdo, is the waste specialist at Palmer. He traveled in Papua New Guinea in the spring of 2003.

Then on Wednesday, the *Laurence M. Gould* arrived at Palmer Station after a few weeks sampling for benthic marine invertebrates across the Drake Passage, south of Tierra del Fuego and along the Antarctic Peninsula. The *Gould* also supported science research sampling for salps, a macrozooplankton, at the northern edge of the peninsula. This port call was a fast, overnight turnover and left station with five Palmer members including our station manager, Joe Pettit. On the return to Punta Arenas, the *Gould* made an operational stop at Cape Shirreff. The next arrival of the *Gould* will see the beginning of the Long Term Ecological Research cruise and the arrival of the Palmer Area Director, Bob Farrell.

SHIPS

Nathaniel B. Palmer

Compiled from reports by Alice Doyle

The research vessel *Nathaniel B. Palmer* departed Lyttelton, New Zealand, on Dec. 18 and encountered bad weather right off the pier. The storm sent many passengers to

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the week in weather

McMurdo Station
High: 39F / 4C
Low: 19F / -7C
Max. sustained wind: 30mph / 48kph
Windchill: -11F / -24C

Palmer Station
High: 44F / 7C
Low: 22F / -5C
Max. sustained wind: 28mph / 45kph
Precipitation: 3mm

South Pole Station *(Dec. 17-24)*
High: -6F / -21C
Low: -18F / -28C
Peak wind: 21mph / 34kph
Max. Physio-altitude: 3,098m

Continent From page 5

their beds, while the crew was busy finishing smaller projects left from the portcall. When the winds and seas calmed the next day, faces last seen as they departed the dock in Lyttelton began to reappear.

"We are hoping for the calm seas to continue, but realize another low is on its way towards us as we continue south," wrote marine projects coordinator Alice Doyle.

Laurence M. Gould

Compiled from reports by Skip Owen

The *Laurence M. Gould* finished up the southernmost sampling stations and began its transit back to the Gerlache Straits where it spent another day on science. Then the ship had to transit through the pack ice in the Bismarck Channel. The scientists conducted the last few benthic stations and an overnight dive.

After a relatively busy call at Palmer Station Dec. 16 and 17, the *Gould* crossed to Croker Passage and took more samples. Then the ship went to the Cape Shirreff field camp on Livingston Island to pick up one person for the trip north. Weather was great as the ship started across the Drake Passage, with calm seas and little wind. The *Gould* arrived in Punta Arenas Dec. 22.

Polar Star

By Wendy Hart

Helicopter Aviation Detachment 161 will be flying from the U.S. Coast Guard icebreaker *Polar Star* to McMurdo on Dec. 27 to begin support for local scientists and icebreaker operations for the next six weeks.

Three air crewmembers are returning to McMurdo this year and the remaining ones are looking forward to experiencing Antarctica for the first time.

The crewmembers, stationed at Mobile, Ala., have been onboard the Star since the ship's departure from Seattle, Wash., on Nov. 4. Four pilots and 10 flight mechanics make up the detachment that will conduct a variety of missions with their two HH-65 Dolphin helicopters.

The first area missions were completed Dec. 20 when one helicopter positioned fuel drums at a cache on Franklin Island for upcoming science operations. The second conducted a medical evacuation of one of the ship's crewmembers to the McMurdo medical center.

Courtesy of Wendy Hart / Special to *The Antarctic Sun*

A Coast Guard helicopter picks a sling load off the deck.

Once the helicopters begin conducting operations from McMurdo Station, they will go to points in the Dry Valleys and near Franklin Island. In addition, the aircrews will continue to support the *Star* by flying mail, parts and arriving crewmembers to the ship while the icebreaker cuts a channel for resupply vessels to reach McMurdo.

Krasin

At last report, the Russian icebreaker *Krasin* was headed south from Vladivostok, Russia. The icebreaker is expected to arrive at McMurdo Sound around Jan. 15 and will serve as a backup to the *Polar Star* under a 100-day contract.

ALSO ON THE ICE

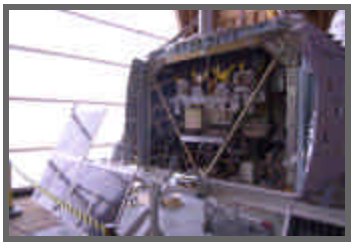
Long duration balloons

Compiled by Brien Barnett
Sun staff

One long duration balloon experiment has been cut loose and parachuted back to the ice below for recovery while another continues to circle the continent.

The BESS (Balloon-borne Experiment with a Superconducting Spectrometer) was the first balloon launched this season. It ended its mission Wednesday near Siple Dome. Recovery teams have been sent to the area to collect the data and instrument.

Meanwhile, the Cosmic Ray Energetics and Mass (CREAM) instrument had just passed 90 degrees west longitude on Thursday. The balloon carrying it is on an elliptical path above the continent, stretching from McMurdo Station around South Pole and back toward the Ross Ice Shelf, where the mission will be terminated.



Brien Barnett / *The Antarctic Sun*

CREAM before launch.

Both teams report a successful flight and believe they have recorded valuable data. Eun-Suk Seo, the principal investigator for CREAM, based at the University of Maryland, said some sample data plots are available online. Once CREAM was launched, members of the team returned within the next few days to Maryland to follow the balloon's progress and monitor data flow. There was a little drama when the science flight computer stopped communicating briefly and some data were lost. The computer was rebooted.

Both balloons were tracking incoming cosmic ray particles to learn more about the physical universe and its origins. BESS also was seeking rare antimatter particles.

Learn more about CREAM and BESS online at http://tower.nsbf.nasa.gov/ice0405.htm

South Pole Traverse

Compiled from reports by John Wright

The South Pole traverse is now at the base of the Leverett Glacier.

The traverse started out Nov. 13, making much better time than last year. Better conditions and the packed trail left from last year allowed the vehicles to pull their sled loads smoothly for the first few weeks without having to shuttle. Modifications made to the sleds this year proved successful early on, allowing the sleds to glide with less resistance and no need to stop for repairs. A fifth tractor also helped share the load with the four from last year.

The team set a routine of rising and eating breakfast before 7 a.m., when they start warming the engines. A morning meeting and last-minute chores are completed by 7:30 a.m. when the tractors and loads head south. The lunch and refueling stop is called at 12:30, and after the hour break they continue the journey.

The vehicles finally stop for the day between 5:30 and 6:30 p.m., depending on the day's needs. At that point the crew set up camp, clean the vehicle tracks and refuel all the tractors before eating dinner between 6:30 and 7:30 p.m.

They arrived at last season's farthest south point on Nov. 26, more than a month earlier than last year, with about 18,000 gallons of fuel.

"What a difference our trail construction work last year made for us this year!" John Wright wrote in one of his reports to McMurdo. "You will have done the math from our daily reports and figured that we have turned in a 50-mile day, and we followed that one by a 50 ½-mile day just to show the first one was not a fluke."

The traverse team stopped for two days of maintenance on the vehicles while waiting for a Twin Otter that swapped two members of the crew. When the team started again, they were breaking trail through virgin snow and watching for crevasses as they crossed areas where glaciers pushed into the Ross Ice Shelf.

By Dec. 4 the traverse team found what they were expecting — deep crevasses well-bridged with surface snow that showed up on the ground-penetrating radar sent ahead of the heavily loaded vehicles.

The traverse progress slowed while they use the ground-penetrating radar to search for a safe route around the crevasses, which they found this week.

"Putting those crevasses behind us, we made 45 miles today, crossed the 85S parallel...and are right now looking down the gunbarrel of the Leverett!" Wright wrote.

Sulfurous algae clouds the sky

By Kristan Hutchison
Sun staff

Brown clouds of algae bobbing in the Ross Sea are partly responsible for creating the white clouds floating above.

The algae, called phaeocystis, produce high levels of a compound that degrades in seawater into a particular sulfur gas. That gas moves into the atmosphere, where it is largely oxidized into sulfuric acid, which forms particles that scatter sunlight and help create clouds.

Aboard the *Nathaniel B. Palmer*, Dave Kieber and Ron Kiene are studying the processes that control the cycling of sulfur in the ocean, which ultimately determines how much sulfur gas is released into the Antarctic atmosphere.

The compound they are interested in has an eleven-syllable name that's rarely used, dimethylsulfoniopropionate.

Instead, it's called DMSP and the volatile sulfur gas it produces is DMS, dimethylsulfide.

"That's a big word, but it's actually not a really big compound," said Kiene, who is also chief scientist for the cruise.

Many kinds of algae produce DMSP, but phaeocystis produce it in concentrations 10 to 20 times those found in other algae, such as diatoms. The high levels of DMSP produced by phaeocystis lead to equally high levels of DMS in the Southern Ocean, up to 100 nanomoles per liter (0.0000001 mole/L) compared to the average in other oceans of 2.5 nanomoles per liter.

"That's a lot. You may be able to smell that as an odor," Kiene said. "If you want to know what DMS smells like, open up a can of corn right off the grocery shelf and then just take a whiff of that. You will get a big blast of DMS coming out there."

Corn has a chemical, similar to DMSP, that becomes DMS when it goes through the heat of canning. In fact, DMS is naturally present in a number of common foods, including beer, butter and milk. But DMS is most common in the ocean, which is second only to the human use of fossil fuels as a source of sulfur in the atmosphere.

"It's familiar. When you smell it, you'll know it," Kiene said. "It's part of the smell of the sea."

One of the questions Kieber and Kiene want to answer during their 38-day cruise is why the levels of DMS become so high in the Southern Ocean. Is it because DMS is being produced at a fast rate or because it is being used up very slowly, or a combination of the two?

Photo courtesy Ron Kiene / Special to *The Antarctic Sun*

Ron Kiene processes samples in the lab on the Nathaniel B. Palmer. *He is currently on the* NBP *in the Ross Sea, continuing his study of the role an algae called phaeocystis plays in the production of an important sulfur gas.*

DMS is removed from the seawater in three ways. It can simply degrade in the sunlight; bacteria and microbes can eat it; or it's drawn as a gas into the atmosphere.

"This exchange with the atmosphere is what a lot of people are interested in, because that affects the atmospheric chemistry and potentially the climate," Kiene said. "The concentration of that DMS in the seawater is controlling how much DMS gets out in the atmosphere."

In the atmosphere, the DMS becomes a sulfate aerosol compound rising several kilometers. There, it joins other aerosol particles scattering and reflecting sunlight.

Some of the sulfate particles become the core of larger particles as other tiny particles attach to them, until they are large enough for water to condense on, forming clouds. A great portion of the acidity of rain in remote areas is the result of DMS emissions.

In November 2003, Kiene and Kieber were on an abbreviated cruise that got as far as the ice edge. They were able to stop in only one spot to sample the phaeocystis and run their tests. The result was a paper by Kieber and his postdoctoral assistant, D. Toole, in the June 2004 issue of *Geophysical Research Letters*. They found the chemical transformation of DMSP to DMS was occurring at a much higher rate than other places they've studied it, including the equatorial Pacific Ocean, the Sargasso Sea and the coastal waters of the North Atlantic. The Ross Sea waters also were very rich in nitrate, one of the few inorganic chemicals in seawater that is sensitive to light. The nitrate may be playing a part, possibly forming radicals that interact with DMSP to prompt the rapid degradation of DMS.

"It made quite an interesting story, overall," Kiene said. "We're anxious this year to go back to see if we can repeat those results, but also to see how that behavior changes after the bloom of phytoplankton has already taken place and removed some of the nitrate and modified the water characteristics."

This year, the cruise is taking place almost two months later, reaching the Ross Sea when the phaeocystis bloom is well underway. Besides studying the cycle that brings DMS into and out of the seawater, the researchers will try to establish the role of DMS as a source of food for microbes and other animals.

"It should be a pretty significant part of the food web," Kiene said.

Other researchers on board will be studying other aspects of the phaeocystis. Most were also on the cruise last year and will be collecting the same kinds of samples and data, in order to compare the times of year. (For more on last year's

See Algae on page 8

Photo by Brenda Everitt / Special to *The Antarctic Sun*

Some elves got to the ceremonial marker at the South Pole a bit early and decorated it for the holidays.

Photo courtesy Ron Kiene / Special to *The Antarctic Sun*

Dave Kieber, left, and Ron Kiene on the deck of the Nathaniel B. Palmer *a year ago during their first cruise to study the role of algae in the Ross Sea in producing sulfur gases. The researchers are currently on the* NBP *again continuing their study.*

Algae

From page 7

cruise, see *Sun* story Dec. 7, 2003) Last year the cruise went at a time of year when the water was well mixed, but this time of year the water will develop into layers, sun-warmed on top and colder waters below.

"This will give us a set of contrasting pictures between a well mixed water column and a stratified water column," said Joaquim Goes, a biological oceanographer from Bigelow Laboratory for Ocean Sciences in Maine. Goes and Pat Neale from the Smithsonian Environmental Research Center are trying to understand the effects of the sun's radiation on marine life. Phaeocystis is able to withstand a particularly high amount of ultraviolet light, because it contains a class of compounds which strongly absorb UV light and hence shield the cells from UV damage.

"It is a natural sunscreen," Goes said.

At the same time, Wade Jeffrey's group from the University of South Florida will be studying how UV light damages DNA in bacteria.

"Because this work is labor intensive and all these processes are interconnected, it's good to have a big group," Goes said.

NSF-funded research in this story:
David J. Kieber, State University of New York Syracuse, http://www.esf.edu/chemistry/kieber/kieber.htm
Ronald P. Kiene, University of South, Alabama, http://www.southalabama.edu/marinesciences/fac_kiene.html
Patrick J. Neale, Smithsonian Institution, http://www.serc.si.edu/uvb/Ross_Sea_index.htm
Joaquim I. Goes, Bigelow Marine Laboratory, http://www.bigelow.org/arctic/goes/index.html
Wade H. Jeffrey, University of West Florida, http://www.serc.si.edu/uvb/Ross_Sea_index.htm

Continental Drift

How should the next International Polar Year (2006-07) be celebrated?

"All the DAs from all the stations from all the countries should get together for a barbecue."

Karl Horeis,
McMurdo Station Dining Attendant from Portland, Ore., first season

"We should all take the Polar plunge!"

Tim Kramer,
Palmer Station, Waste Specialist from Dubuque, Iowa, third season

"Taking hero shots at the South Pole."

David Bates,
South Pole Comms Tech. from Omaha, Neb., first season

Photo by Kristan Hutchison / *The Antarctic Sun*

"It's all part of an Earth system and even very subtle changes have an impact."

—David Vaughan, glaciologist

Jack Holt squeezes into the Twin Otter as 900kg of equipment is bolted into place.

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the only one that hasn't been studied extensively. The Ross Ice Shelf drains into the Ross Sea and the Ronne Ice Shelf into the Weddell Sea. But Pine Island and Thwaites glaciers are far from established research stations and difficult to reach. Bad weather delayed the construction of two camps for the researchers for three weeks.

Glaciers and ice streams do for ice sheets what rivers do for lakes, providing drainage of excess water as more precipitates down. Ice sheets exist in an equilibrium between the accumulation of snow high up on their plateau, and the slow outward flow of ice to the edge of the continent.

"It's one of the biggest self-regulating machines in the world," said David Vaughan, a glaciologist from the British Antarctic Survey. "The amount of snow in the ice sheet itself is close to constant. That means there is no big contribution to sea level rise."

But if the dynamics change and more ice slips into the sea than is accumulating on the plateau, the sea level could gradually rise. The Pine Island and Thwaites glaciers alone could raise global sea level by half a meter. The West Antarctic Ice Sheet contains enough water to raise the sea level around the globe by 6m.

Contrary to Hollywood's depiction, the change would be a slow rise in tides and increase of floods, so gradual it would be hard to notice, Vaughan said.

"It's always going to be very hard to say that particular events are a result of changes in the Antarctic," Vaughan said. "It's all part of an Earth system and even very subtle changes have an impact."

One scenario does have a Hollywood ring to it — the disintegration of the West Antarctic Ice Sheet. Unlike the East Antarctic Ice Sheet, which is grounded on bedrock above sea level, the West Antarctic Ice Sheet sits over a deep trough that extends several kilometers below sea level, making it the only marine-based ice sheet on the planet. Glaciologists hypothesize that if seawater infiltrated that weak underbelly, it could warm the ice sheet from below, causing it to disintegrate quickly.

"It seems so plausible we get hot under the collar thinking about it," Vaughan said.

The satellite photos show warning signs. Pine Island Glacier has sped up and is thinning at a rate of up to 6m per year. Thwaites Glacier has spread out and thinned 25m between 1991 and 2001.

"On a 1,500m-thick ice stream, that might not seem all that big, but over a century that can be huge," Vaughan said.

This could indicate that the grounding line, where the glaciers make final contact with the ground, has retreated. A change of a few meters could be enough to let the sea pour in. Glaciologists don't know for sure, because the only maps of the ice thickness and bedrock in that area come from traverses nearly 50 years ago and a few flights over by long-range aircraft in the 1960s, '70s and '80s.

"It's a plausible estimate of ice thickness, but it isn't really truth," Vaughan said.

To get the truth, the researchers plan to fly two Twin Otters laden with 900kg of instruments in a grid pattern over an area of 290,000sqkm, roughly the size of New Mexico. If they have no weather problems, by the time they're done, the planes would have flown 113,000km, or the equivalent of circling the world 2.8 times.

The airborne systems are among the most advanced in the world. The instruments include ice-penetrating radar, gravity meter and magnetometer. The University of Texas aircraft also carries a laser altimeter and camera. The system was set up in Crary Lab and then installed at the McMurdo sea ice runway, requiring four weeks, a dozen people and several test flights to thoroughly evaluate all of the instruments. The British Antarctic Survey aircraft was configured at Rothera, a British station on the Antarctic Peninsula.

The data, about 50 gigabytes per survey flight, will be collected on hundreds of digital linear tapes. Together, the data should tell researchers how thick the ice is, what the internal layers look like and what kind of rocks are below it. This will allow the researchers to create a three-dimen-

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Photo by Kristan Hutchison / *The Antarctic Sun*

In November, mechanics fit computer equipment into the Twin Otter for the survey flights.

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sional picture of the geological and glaciological conditions controlling the ice sheet.

The survey area straddles three of four independently moving microplates, the deepest continental rift on the planet, and contains several geologically young volcanoes that stand high above the ice surface, said John Holt of the University of Texas, the lead investigator for the group. The researchers expect to find subglacial lakes and volcanoes, among other geological structures. Any active volcanoes or geothermal heat would change the temperature and speed of the ice.

"It's almost certain that the geology of this region plays a role in the ice sheet behavior," Holt said.

The researchers originally planned to be in the field for about nine weeks, with the assumption that a third of the time they wouldn't be able to fly because of bad weather. The Amundsen Sea Embayment is infamous for bad weather, including winds exceeding 300kph, snow and ice fog.

The weather and distance added to the challenge of this deep field project. Carpenters were delayed getting to the locations to set up the two camps 2,000km from McMurdo. A third camp was set up at Byrd Station to refuel the 41 LC-130 flights needed to set up and supply the camps.

"We couldn't get to this area if it weren't for U.S. Antarctic Program support," said Vaughan.

The British-American collaboration allows for two planes and more researchers to be in the field at one time, enhancing their effectiveness during the limited windows of opportunity they will be able to fly. When the weather's good, the Texas team will make three flights a day, operating around the clock, and the British will make one. They're aiming to publish the first results within nine months of returning from the field, "which is insanely soon," said Vaughan.

That will be just a start. Reconnaissance surveys of a similar type were done across the continent in the 1970s and spurred an entire branch of research.

"Hopefully," Morse said, "people will find interesting things to look at in this data for a number of years."

NSF-funded research in this story: Jack Holt, University of Texas, Austin, www.ig.utexas.edu/research/projects/agasea

The Answers *to the page 3 pop quiz*

1. Silly
2. Neutrino: elementary particle with zero charge and spin, very small mass and weak interactions with matter.
Muon: elementary particle similar to an electron but with a mass that is 207 times greater.
Baryon: a heavy subatomic particle made up of three quarks.
3. C, it was 10,850sqkm
4. D
5. 6 meters
6. False. Meteorites fall evenly over the Earth. They're just easier to spot on the white ice fields of Antarctica.
7. At least 20 million years ago, though mountain glaciers have probably been in place for about 40 million years.
8. 22 minutes
9. 50 percent, or about 227kg/500lbs. The pups, in turn, gain about eight times their birth weight during their first 30 days.
10. D

0-2 correct: You just took a polar plunge. Go walk around Crary. Check out a lecture. Ask people what they do. Learn more about what's going on all around you.

3-5 correct: You're on a voyage of discovery. Not bad. You've been paying attention. But there's more to learn. Start going to the Wednesday science lectures. Check a book out of the library.

6-8 correct: You are a polar star. Good job. You've got a handle on the many different types of science being studied here. Next step: a perfect score. Have lunch with a principle investigator and start reading through those journals upstairs in Crary.

9-10 correct: Congratulations, you are a heroic Antarctic explorer! If you don't already have an NSF grant to be here, then finish up your thesis and apply.

Sources: Doug MacAyeal, Paul Ponganis, Robert Garrott, Webster's New World Dictionary of Science, The Antarctic Sun *archives*

Midrats

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ding, but ended up with a contract at South Pole Station, where the summer season begins a few weeks later.

"I'm happy to be here," Graciano said while cleaning up from the night shift's lunch, or "midrats," which was coined from the U.S. Navy's term for midnight rations. "But it feels like no human being should be here."

Her co-workers in the kitchen realize that the South Pole is pretty much what you make it and they like to make it good. Her co-workers include sous chef Suz Same, production cook Joe Bayley and Erica Fickeisen, the station's lead baker.

It's no secret that night shift workers in Antarctica frequently eat the best-prepared food on station. For one thing, fewer people work at night, which means more care can be put into the preparation of the meals.

"I like it. Midrats is a community within a community," Fickeisen said.

Night-shift meals are an important social aspect for those who tend to miss out on a lot of station life. Good food makes for happier times.

"We have some freedom just because we get to decide what we want to do on more of a whim," Fickeisen said. "But we still make sure the meal gets out."

Same, the sous chef, is in her third season at Pole and will take over as the lead chef in the winter. She said it's important to create good food to keep up morale in a place where the summer still can be viciously cold.

"It's not just the food, but maintaining cohesive relations with people who can't go anywhere," Same said.

One thing the midrats crew always will agree on is the need for good tunes. It's late, they're busy cleaning up from the meal, prepping for breakfast and baking the next day's goodies. It would be easy to slump if not for good music.

"We let Joe pick it out," Graciano said. "Music has a big effect on our mood."

Station construction has changed the way the crew does its job. This is the second year of the new dining facility inside the elevated South Pole Station. It's cleaner, brighter, more spacious and comfortable than the old galley under the Dome.

"It's nice to not have your feet freeze to the floor when you're working," Same said, remembering cold days of old.

Photo by Brien Barnett / *The Antarctic Sun*

Joe Bayley checks on a ball of naan dough while talking with baker Erica Fickeisen, who is finishing a birthday cake for a station resident.

Her first winter, Same cooked for about 60 people in the winter, about the same as summer midrats this season. This coming winter, with construction in full swing, she expects to feed about 100 daily. The larger kitchen is key, she said.

Fickeisen, the baker, has been working on the next day's breads and pastries while building a birthday cake from scratch. The cakes and pies are her favorite to make, mostly because of the immediate reaction from those receiving the goodies.

Creating foods from scratch at the South Pole has many challenges. The most important is the altitude of the station, which at over 2,700m feet means most recipes must be altered or completely rethought.

"Lemon meringue is impossible. I can't get it to work to save your life," Fickeisen said.

As a first-year production cook, Bayley has been successful based on tips from Same and Fickeisen. "Less leavener, more starches," he noted.

That night he was trying to bake a small test batch of naan, the Indian bread. It seemed to go well, though larger batches may be more difficult to control. After some initial frustration, Bayley said he was settling in as a chef at the world's southernmost kitchen.

"Pole makes every other station look like summer camp," he said while sweeping the floor.

Photo by Brien Barnett / *The Antarctic Sun*

Lead midrats chef Suz Same wipes down a counter as she prepares ingredients for another meal in the South Pole station kitchen.

Profile Ice got in Banks' blood early

By Brien Barnett
Sun staff

Few people can say they've spent five seasons in Antarctica. Fewer still are just 23 years old

Forest Banks fancied himself a photographer before he started working with the U.S. Antarctic Program at 19. It was the chance to photograph the last unexplored continent that brought him to the Ice and a job coordinating South Pole cargo.

"I wanted to photograph wildlife, anything I could get my hands on that would be different," Banks said while at McMurdo Station earlier this season.

Not one for college, Banks had left the states for New Zealand to see the world and work on his photography. He heard about Antarctic jobs and had applied that first year as a janitor or general assistant. Instead he was given the cargo job. He credits good luck.

"The only experience I had was managing a Mailboxes Etc. store," Banks said. "I think my resume landed on top."

It was a position of responsibility and he wanted to make the most of it.

Photo by Rahman Amanullah / Special to *The Antarctic Sun*

Forest Banks, who is working with a hot water drilling team at the South Pole, started working in cargo at South Pole Station when he was 19.

Banks' tenacity got him through that year, and kept him coming back for the next several years, at McMurdo, then Pole, and back to McMurdo last season. While at Pole, Banks met and befriended scientists and other people working on science projects and let them know he was interested in working with them in the future.

He said he enjoyed working for cargo but wanted a new experience. Then a death in his family drew him back home quickly after the season. Once family matters were settled, Banks did some traveling and then pursued another love: filmmaking.

Banks enrolled in a course to learn how to direct films. It's something he's wanted to do for a while. Two years earlier he began organizing a film project about people who put it all on the line, from family and money to bodies and souls, for the next big adventure. It was still in his mind when he packed his bags for his first trip to the East Coast and Boston to attend the New York Film Academy's intensive directing course.

"The only experience I had was managing a Mailboxes Etc. store. I think my resume landed on top."

– Forest Banks, on being offered his first job in Antarctica five years ago.

The class was taught on the campus of Harvard University. Once there, Banks wandered around the Ivy League campus amazed by the renowned institution.

"It felt more chill than I expected," said Banks, who has been sporting funky dreads in his blond hair this season. "I found Boston to be really cool and friendly."

At the film school, Banks made several short films and said he learned a lot. He plans to use that soon if his plans come together early in 2005 for an adventure film set in Antarctica.

The project, which Banks said is finalizing its funding, is tentatively called "Songs of Drifters," and will feature snowboarders, skiers and others who will make the voyage by sailboat across the Drake Passage from South America to the fjords and islands of the Antarctic Peninsula.

"They are un-sponsored, have a passion for life and adventure and for some reason are willing to leave their lives, work, families and pets at home while they play in the world's wonderlands," Banks said, describing the people he hopes to feature in the film.

Back on the Ice, Banks had an offer to return to his cargo position. During the summer, however, Banks received an invitation to work with a team of hot water drillers out of Madison, Wisc. They will be working on IceCube, a planned particle detector buried in the glacial ice at South Pole that will require dozens of 2km-deep holes to be drilled there.

He weighed whether to return to "the lifestyle at McMurdo that I've grown accustomed to and enjoy" or take the job at Pole. In the end, he decided that a new Antarctic experience, better pay and a return to the Pole were worth it and decided to work with IceCube, becoming its youngest member.

"The day after my last class, I hopped in my Volvo and headed for Madison to work with IceCube," Banks said.

"It's quite a step up for a young man," said Jeff Cherwinka, of Triad Project Management, who played a part in hiring Banks.

"Forest had experience on the Ice and had good positive attitude and really wanted to be here," Cherwinka said.

The goal of the IceCube drillers this season is to get all their gear sorted, tested and working so they can drill at least one and as many as four test holes before the summer season ends. It will be a rush to the end.

"I'll learn most on the spot," Banks said.

Two months into the job and Banks said in an e-mail that, just as he suspected, he's been enduring and cracking jokes about his youth. However, he said he loves his work and working with the crew there.

"Being a part of such an amazing project, full of wonderful people and tons of learning to be had, is just what I needed this season," Banks wrote. "Life's just good. I'm enjoying it fully!"