The Antarctic Sun

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December 15, 2002

Snow shaking science

By Melanie Conner
Sun Staff

What could be more exhilarating than riding snowmobiles across the Antarctic outback to conduct a science experiment? Perhaps exploding dynamite between runs.

Using a technique first developed about 100 years ago to find oil, seismologists in Antarctica this summer are probing beneath the ice by studying the echoes of explosions they set off at the surface.

Researchers hope that artificially produced seismic activity will allow them to profile the bedrock and understand the onset of Ice Stream D, a fast-flowing glacier and part of a network of streams in West Antarctica that transport ice from the continent's interior to the Ross Sea.

"We take this thing and we jam it into the snow and ice and we listen to it," said Sridhar Anandakrishnan, glaciologist and principal investigator for the National Science Foundation-funded project. "We yell 'hello' really, really, really loudly down here and it comes back at us and we listen."

Data obtained from seismic

See OnsetD on page 9

Lift off

Photo by Kristan Hutchison/The Antarctic Sun

A helicopter drops down to pick up an instrument box on the edge of Lake Bonney in the Taylor Valley. The solar-powered box was placed on the hillside, where it runs a Web camera that swivels to show people views of the glacier, camp and wind-carved rocks. See story on page 3.

Antarctic current circles the world

By Andrea Baer
Special to The Antarctic Sun

The wind-blasted Southern Ocean, an area inhospitable to people, may nevertheless have a tremendous impact on those parts of the world most inhabited.

Here gale-force gusts goad savage seas into the Antarctic Circumpolar Current, which furrows a clockwise course around Antarctica.

This global current, the world's largest, is 13,049 miles (21,000 km) in length and transports 34 billion gallons (130 million m^3) of water per second - 150 times the flow of all the Earth's rivers put together.

"The Antarctic Circumpolar Current is the only global current that flows uninterrupted, so it can actually transport heat all over the Earth by transferring it from one ocean basin to the other," said Janet Sprintall in a telephone interview from her office at the Scripps Institution of Oceanography in San Diego.

Sprintall studies heat transfer in the Antarctic Circumpolar Current which, by mixing with the Pacific, Atlantic and Indian

See Current on page 11

INSIDE

Quote of the Week

"Please tell all your people that if they have not got their packages, it's because someone doesn't love them." *—McMurdo official, noting that all personal mail has arrived*

Ross Island Chronicles By Chico

Cold, hard facts

Raytheon's on-Ice employees

Number of full-time vs. contract employees:
310 full-time, 879 contract

Percent of men to women:
65 percent men to 35 percent women

States represented on the Ice:
50 plus D.C.

States with the most people on the Ice:
Alaska – 69; Washington – 77; California – 79; Colorado – 492.

States with only one Raytheon employee each on the Ice: **Alabama, Iowa, Kentucky and Mississippi**

Only state that throws its own party at McMurdo Station: **Alaska**

Number of employees under age 21:
29

Number of senior citizens employed on the Ice: **9**

Age of oldest employee on the Ice: **74**

Age of youngest employee on the Ice:
18

Average age of Ice employees: **37**

Source: RPSC Human Resources

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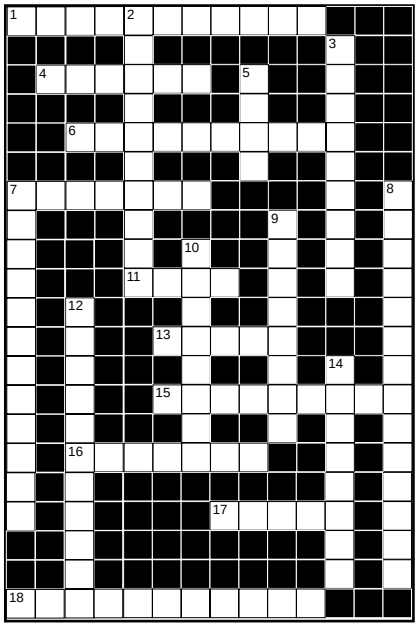
Web address: www.polar.org/antsun

Katabatic Krosswords: Geology

Across
1. Rocks formed by erosion, transport and deposition
4. A steep-sided depression caused by impact or collapse
6. Study of the Earth by quantitative physical methods
7. A time period that saw the first great mass extinction
11. Detrital, clay-rich sediment
13. A major rock fracture exhibiting relative movement
15. This era began roughly 500 million years ago
16. Mountain-building episode caused by plate collisions
17. Molten rock beneath the surface of the Earth
18. Small continental fragments

Down
2. More of these collected on the Ice than anywhere
3. The highest mountains in Antarctica
5. This mobile belt includes the Transantarctic Mountains
7. The study of previous plants and animals and their interaction with their environments through fossils
8. The theory that the Earth's crust is made up of a series of pieces (two words)
9. The process which ejects material into the atmosphere
10. Breaking of a mineral along crystallographic planes
12. These rocks dominate the East Antarctic coast
14. A large mass comprised of South America, Africa, India, Australia, and New Zealand about 180 million years ago

Solution on page 10



Squares too small? No pencil to erase your mistakes? Try our interactive online puzzle at www.polar.org/antsun

Virtual valley visit

Webcam peeks on lakes Bonney and Hoare

Story and photos by Kristan Hutchison
Sun staff

To test his newest piece of equipment, Tony Hansen ran outside the Lake Bonney Jamesway and waved at his family in California.

"Me and mom saw you wave at us," 12-year-old Christopher Hansen wrote back on "instant messenger" from Berkeley, when his dad came in from the Antarctic cold.

Someday scientists could sit in their university offices and watch penguins or microorganisms or streams in the same way. At least, that is Tony Hansen's hope as he designs and tests the Webcam connected to a solar-powered instrument box. The instrument box, called a Transportable Autonomous Instrumentation Support Unit or TAISU, has already been tested for one field season in the Dry Valleys. The internal temperature of the box tested at Lake Hoare ranged from 68F to 86F (20C to 33C), even when the outside temperature was near freezing.

The TAISU weighs about 650 lbs. (295 kg.), with batteries and standard rack space inside to hold instruments up to 10 inches (25 cm.) high and 15 inches (38 cm.) deep. The unit puts out 50 watts of power, more than enough for most scientific instruments, Hansen said.

"Once we know what scientists need, we can wire up all kinds of stuff and use it remotely," Hansen said.

The 12-volt camera Hansen is testing is the same kind used for security in banks. He can control it over the Internet, making it swivel around to focus on the camp, the Hughes Glacier, or a wind-carved rock nearby.

Cell biologist Sam Bowser and Hansen are already funded to install a camera underwater next season to study the foraminifera at New Harbor. Bowser wrote in an e-mail that he hopes to address two important issues with the camera.

"Are the giant forams we see on the seafloor mobile, or do they just sit there all year?" Bowser wrote from Albany, N.Y. "How do they feed in the winter when the summer pulse of algae is gone?"

"Lipid analyses indicate that they eat larger critters, like juvenile starfish and small crustaceans. Can we capture this carnivorous behavior 'in the wild?'"

Hansen compares TAISU to the larger Automatic Geophysical Observatories - facilities that ran unmanned for the last decade at remote locations on the plateau. Another project is redesigning the remote stations with wind and solar power to replace the unreliable propane generators.

"That's heavy duty stuff," Hansen said. "What I would like to do is put small-sized units in the hands of any scientist."

The next goal is to create a "baby" TAISU, weighing less than 50 lbs. (23 kg) and the size of a laundry basket. At that size and weight, several could be carried in a helicopter and deployed by one person in the field. The smaller TAISU would produce about 5 watts, enough to run small instruments, such as the "Campbell" data loggers used by many field scientists, and an Iridium data phone.

"The niche I'd like to approach is the small portable unit for the field scientist who's currently measuring something and wants to just leave it," Hansen said.

Hansen also plans to try adding wind-power to his larger units next year. He aims to create a way to run instruments remotely in the Dry Valleys through the winter, or on the coldest areas of the plateau in the summer.

"Then we can all work together to have a winter-able capability without having to have people here," Hansen said. "This is like a mini-AGO for the present millennium."

The Webcam at Lake Bonney and another at Lake Hoare will be running until mid-January. Scientists and others wanting to see how they work, or just get a peek at the Dry Valleys, can e-mail TonyHansen@Mageesci.com, or visit http://www.mageesci.com/Antarctic.

Tony Hansen checks the Web camera, protected from the elements by a metal and plastic casing, as he and Joe Mastroianni set it up above Lake Bonney. The camera will broadcast views of Taylor Valley until mid-January, including the sculptural rock below, a view Hansen chose because it reminds him of photos taken by the Mars lander.

Perspectives

Children send message of healing to South Pole

By Christina Regan

I went in to work a little early last Sunday to pour some coffee into my bloodstream and get my act together. I needed the early rush of coffee this Sunday just like I did last Sunday. Today didn't seem any different from the last three months of Sundays except that every bone in my body ached from helping serve Thanksgiving dinner the day before to all of McMurdo. What I didn't know was that today was going to be different.

It's my job to keep the coffee flowing for the community on Sunday mornings. I got out to the service area to find the usual scene at five before 10 … folks lined up out to the door waiting for waffles, omelets and fresh eggs to order.

Photo by Melanie Furber Bachinski/Courtesy of Christina Regan

Fifth and sixth graders sit around an American flag on top of Cadillac Mountain in Bar Harbor, Maine, where they went to greet the sunrise on Sept. 11. The flag was then flown to San Diego for sunset the same day.

I was restocking glasses when an unfamiliar face approached. It turned out to be Lt. Col. Dave Koltermann from the 109th who is in charge of the people who maintain and fly the ski Hercs that bring us in, out and around the continent.

Dave brought me a package from my Uncle Larry. It contained a banner that belongs to 5th and 6th graders at Margaret Chase Smith School in Skowhegan and the Cornville Elementary School in Maine. My Uncle Larry teaches at both school. The package also had a video and notebook explaining their mission. The banner is hand-lettered with the words "Sea to Shining Sea." The mission of the students: "Putting a Band-Aid on the World."

At 3 a.m. on the anniversary of 9/11, the entire class set out for the top of Cadillac Mountain in Bar Harbor, Maine. They took with them a 30-by-50-foot flag to meet the sunrise. The flag was probably the first to greet the morning sun on the continental U.S. Then they put this flag on a plane with ambassadors from their class and sent them to a community in Yardley, Pa., that lost many people in the disaster.

There they were received by K through 5th grade students from Makefield Elementary School. The ambassadors from Maine passed out Band-Aids as a symbol of their mission and hope for healing. From there the flag was taken, via volunteers at United Airlines, to San Diego. In San Diego, the flag was received by students from Clairmont High School and brought to Coronado Beach in time to meet the sunset on the same day.

"Sea to Shining Sea in One Day." The kids' goal was to unite us all as a people and give everyone a feeling of pride and hope for the future on that difficult day.

In June, Dave offered to bring their flag to Antarctica. Since their mission is to put a Band-Aid on the world, they want to keep the spirit of their flag moving around the globe. The logistics of getting the 30-by-50-foot flag down to Antarctica was too complicated, but on Sunday the spirit of their flag arrived at McMurdo in the form of their banner.

On Thursday night the banner was taken to Cape Evans and Barne Glacier. Then, on Saturday, Dave took the banner and the spirit of the "Sea to Shining Sea" mission to the South Pole.

Dave said it was the most beautiful, calm day he has ever experienced at Pole. Some friends helped him take pictures of the banner around Pole — with their plane at the skiway, at the Pole marker and at the Dome. When Dave returned to McMurdo he realized, by coincidence, the day that the banner traveled to Pole was another day of loss in our world's history. It happened to be Dec. 7, Pearl Harbor Day.

Sometimes I feel like the equivalent of a speck of dust that rises from Erebus and lands on the sea of ice that surrounds me; I know I am a very blessed member of humanity washing dishes here at the bottom of the world. I don't see any other purpose than to love. I arrived to the most pristine, unforgiving place on Earth a few months ago and each day I have a clearer understanding of just how small the world really is. It needs millions of Band-Aids anointed with understanding and hope.

I talked to my sister recently. I called her from a telephone in Antarctica and I reached her on her cell phone while she was driving around downtown Boston. There is a connection between the reality of that ability to communicate from one side of the Earth to the other and my responsibility to battle against the violence on our planet that feeds itself on an ignorance I don't quite understand. I thank the students of Maine, Pennsylvania, California, and Lt. Col. Dave Koltermann and Uncle Larry for showing me a way into the battle against that ignorance through compassion for others and hope for the future.

Please pass the box of Band-Aids.

Christina Regan is a dining attendant at McMurdo Station.

— Your words here —

This page is set aside for scientists and community members to share their research or Antarctic experiences in their own words. E-mail columns up to 900 words to antsun@usap.gov.

around the continent

PALMER

Backyard camping

By Tom Cohenour
Palmer correspondent

Tents popping up around Palmer Station have become an Antarctic ritual as predictable as the arrival of nesting penguins. It's a clear sign summer has arrived.

Some years it feels like a mass migration, suddenly prompted by the warming rays of sunshine. Other years, tents appear more gradually as the snow slowly recedes from the triangular point of land on which Palmer resides.

The point, bounded by Arthur Harbor on one side, Hero Inlet on the other and the glacier on the back, is nearly snow-free much of the summer. On the point between the station and the glacier is a 20-acre area of rock and glacial till known as the backyard.

Camping around Palmer Station can often mean being awakened at night. It's not uncommon for campers to find penguins noisily flapping their flippers or pecking on the tents. Elephant seals congregate en mass uttering deep-throated gurgling barks while glacier calvings rumble on periodically throughout the night.

But that's what attracts campers to the backyard.

"Getting away from the generator noise of station is one of the best things about camping out," said Wendy Kozlowski, a researcher with Phytoplankton Ecology Component (BP-016-P) of the Long Term Ecological Research project. "You can hear so many more calvings in the backyard."

Photo by Laura Hamilton/Special to The Antarctic Sun

Laura Hamilton's tent is one of several set up in Palmer's "backyard."

Wendy particularly enjoys waking up away from the station. The walk back in the morning takes less than 10 minutes, but it's a perfect transition.

"It gives me time to gradually get back to people," she said.

Tents are available on loan from station recreation supplies, but people tenting out the entire summer bring their own. UV degradation has been less damaging than high winds. Some tents have been flattened, some shredded and others blown out to sea.

Wind, rain, snow, darkness and things that go flap in the night make camping out less than inviting.

"The hardest part is getting motivated to go out when you have a nice warm comfy bed close by on station," confesses Laura Hamilton. "But as soon as I get past T-5 (the last building) I'm really glad I went out because of the beautiful sunsets."

It's not just the natural splendor or privacy that draws people to tents in the backyard. The tent crawl is part of the camping ritual that has its own appeal. Usually once or twice a summer, backyard campers cluster together at one tent site sharing jokes, stories and favorite beverages.

Slowly the party moves from one tent site to the next, each taking its turn playing host to the group.

Camping also is permitted on several of the nearby islands, although care must be taken to avoid the aggressive and agile fur seals. With articulating front flippers, they stand erect in similar fashion to a dog. Their snouts, full of sharp, canine-like teeth, also resemble those of a dog.

Though people occasionally spend a night or two on an island, only the backyard becomes home for the summer, with its incredible abundance of penguins, seals and roaring glacier calvings.

Photo by Jack Corbin/
Special to The Antarctic Sun

Mo Madding pauses in front of an antenna mast.

SOUTH POLE

Science and building

By Anne C. Lewis
Pole correspondent

Science and construction continue to be the driving forces here at the South Pole.

Four South Pole Facilities, Engineering and Maintenance Center employees installed the NANVLF Beacon transmitter. Billy Texter, Angie Rutherford, Pete Koson and Mo Madding spent two weeks on the 5-mile antenna line, working in –35F to –45F degree weather. They guyed 120 aluminum masts, each 16 feet high, into position 200 feet apart, and then strung the antenna cable on insulators on the tops of the masts. The VLF Beacon will enhance other Antarctic upper-atmospheric research, such as the automated geophysical observatories. Once operational, this will be the world's only VLF transmitter operating with a long horizontal antenna.

In the Quiet Sector, the Ice Core Drilling Services team commenced reaming the second hole and got ready to install the seismic vault, which will house data acquisition system electronics and receive power and fiber cables from the South Pole station. The 5-mile trench from the station to the drill camp will complete this effort.

Jeffries Solar Observatory, another Quiet Sector science project, is again at the South Pole. This project operated in 1987, 1988, 1990 and 1995. The Jeffries project observes the velocity and intensity of signals of the Sun's surface. Using magneto-optical filters, a small telescope and digital cameras here at the South Pole, Jeffries is allowed uninterrupted viewing of the sun for many days through a stable atmosphere.

In Dark Sector science, installation of the trend laser continued for the AST/RO

See Pole on page 6

the week in weather

McMurdo Station
High: 37F/3C Low:16F/-9C
Wind: 26 mph/42 kph
Windchill: -20F/-29C

Palmer Station
High: 41F/5C Low:27F/-3C
Wind: 49 mph/79kph
Melted precipitation: 21 mm
Snowfall: 5cm

South Pole Station
High: -21F/-29C Low:-32F/-36C
Wind: 16mph/26kph

Pole

From page 5

Photo by Kristan Hutchison/The Antarctic Sun

Carpenter's apprentice Jamie Whisnant from Yreka, Calif., breaks from sanding the ceiling drywall for a breath of fresh air.

project. The AASTO, Automated Astrophysical Site-Testing Observatory, is being modified slightly. The sterling engine that powered the building during the last season is being shipped to Dome C along with one of the sub-millimeter tipper instruments.

In the Clean Air Sector, data-taking continued for long-term climate modeling and diagnostics.

For additional science, let's find some meteorites! The Antarctic Search for Meteorites dropped off three field team members via Twin Otter in the La Paz Ice Field region. This search trip will take two to three days.

Engineers and construction crews are working around the clock on the new, elevated station to meet this summer's ambitious construction schedule. The new station will replace the South Pole's landmark dome. All of these workers deserve commendation on their diligent, thorough and industrious efforts.

A number of visitors came through town lately, including a group of National Science Foundation Board representatives and officers from the U.S. Embassy in New Zealand. Also visiting our station this week were two *Time* magazine reporters and a Japanese television news crew. Seems the South Pole is the place to be.

OTHER COUNTRIES

Magdalena Oldendorff heads home from Ice

By Peter Bagh

The ship *Magdalena Oldendorff* left Muskegbukta-Bay, Antarctica, where she'd been stuck since May.

She is proceeding well through the ice belt, which surrounds Antarctica and currently extends up to 500 sea miles.

The ice belt blocked the voyage of the *Magdalena Oldendorff* in May 2002. It is now decreasing steadily with the beginning of the summer. In many areas the thickness of the ice already thinned down to 30 to 100 cm. At present the local temperature is about - 5 degrees on average; the weather conditions are favorable with good visibility and moderate winds.

In view of the imminent homecoming, the mood of the crew on board the *Magdalena Oldendorff* is very good. The crew members will be flown home to their families after arrival in Cape Town. At the moment, the 17 crew members from the Ukraine, Russia, Poland, Ghana, the Maldives and Philippines, follow their usual jobs and shifts on board. Also on board is an Argentinian doctor who was transferred from the icebreaker *Almirante Irizar* to *Magdalena Oldendorff*.

In April this year the *Magdalena Oldendorff* departed to Antarctica on behalf of the Russian research institute, Arctic and Antarctic Research Institute (AARI), to supply several research stations in the South polar region with provisions and equipment and to take 79 Russian scientists back to Cape Town. Since the beginning of July, the vessel was firmly placed in the safe Muskegbukta-Bay on the border of the ice shelf. Thereupon, 89 of the originally 107 persons on board had been flown out by helicopters of the South African Air Force and were brought back to Cape Town.

Chilean airdrop

The Armada de Chile P-3 plane flew over Palmer Station on its way to the Chilean station at Carvajal, where it dropped a rubber barrel containing newspapers, magazines and a six-pack of Coca Cola.

Photo by Andras Rivera

Dropping a barrel from the P-3.

Continental Drift

If you could select an artist, writer or performer to come to Antarctica, who would it be and why?

"Sheryl Crow, because she is the Queen of Rock and Roll. She could come down for Icestock. Besides, every man needs a fantasy."
Gary Jirschele
Palmer maintenance specialist from Park Falls, Wis.

"Christo, the guy who drapes fabric on landscapes. Now that the snow is melted, the ground is brown. It needs something."
David Moore
McMurdo senior materials person from Volcano, Hawaii

"We need Marilyn Manson. He claims himself the anti-Christ and I think it could be productive to his career and music to confront the environment on the planet that is most indifferent to life."
Solan Jensen
South Pole general assistant from Juneau, Ak.

Megadunes

"The most messed-up snow on the plateau"

By Kristan Hutchison
Sun staff

Outside Ted Scambos' office hangs a playdough map of Antarctica, its surface a wavy pattern where his 7-year-old son pressed the dough into shape. Scambos and several other glaciologists just returned from investigating a similar ripple pattern on the continent itself.

The phenomenon, called megadunes, was first noticed by pilots flying over the continent in the 1950s and 60s. Nobody realized how large a part of the continent the megadunes covered until a satellite image was taken in the 1980s.

"It looked like a big fingerprint," said Scambos, a glaciologist with the National Snow and Ice Data Center in Boulder, Colo. "There's one patch that's about the size of California."

Megadunes cover about 500,000 square kilometers of Antarctica, the biggest chunk being an area just west of the Transantarctic Mountains. Scambos and team members Mark Fahnestock, Mary Albert, Christopher Shuman and Rob Bauer were in that area for two weeks to set up wind and weather instruments, dig snow pits and ice cores, collect samples of the ice crystals and trapped gases, and use Global Positioning Systems and ground penetrating radar to monitor and measure the dunes themselves.

They found working out of tents in one of the coldest regions of Antarctica, with summer temperatures from –30F to –15F, more difficult than expected. The flight carrying their science instruments was delayed because of weather and by the time it arrived, the researchers had only two days left to work in the field.

Despite the problems, walking among the dunes gave the glaciologists a better understanding of the phenomenon. Even calling them "megadunes" may not be accurate, Scambos said after looking at them.

"Zebra stripes is maybe a better description," he said. "They seem to be bands of accumulation with wind-swept areas in-between."

"Zebra stripes is maybe a better description."
— Ted Scambos, glaciologist

From the air, broad bands of dark and light snow are visible. These megadunes cover much of Antarctica, but are only beginning to be studied.

The banding pattern could be seen from the air, looking like shadows cast by strips of cloud, but the sky was clear, Scambos said. Though the megadunes can be seen from the air, they are so large they just appear as patchy terrain on the ground. These dunes are 2 to 3 miles from crest to crest and up to 13 feet (4 meters) high. They can stretch 62 miles (100 km) long. The rise and fall is so gradual the dunes appear flat to a person standing in their midst.

"People had traversed it before, but they didn't recognize it because they didn't see the big picture," Scambos said.

The megadunes become important because it's quite possible that the ice chemistry, formation and layering are different than the rest of the ice. Researchers using ice cores to study the climate record could unwittingly take a core from a dune and get faulty results.

"It's sort of a curiosity," said Fahnestock, a glaciologist with the University of Maryland. "It becomes pretty intriguing, because if the snow gets reworked that much by the atmosphere, that can kind of play havoc with the climate record."

Only a few studies have discussed the megadunes before, and the glaciologists weren't sure what they'd find. They had plenty of theories, though. For one thing, they were pretty sure the gravity-driven katabatic winds that move down the plateau play a part in creating the dunes, but not in the same way wind normally creates dunes. Sand dunes generally form when the wind blows sand grains into large piles. The megadunes are too shallow to be formed that way, and there also isn't enough snow on that part of the plateau to be piled up.

Instead, Scambos and Fahnestock postulated the downward flow of the katabatic wind was initially disrupted by small hills in the ice. That may have caused the katabatic wind to begin to bounce as it flowed down the plateau,

See Megadunes on page 8

Photo courtesy of Mary Albert/Special to the Antarctic Sun

Large, wind-carved sastrugi clutter the whiter, rougher bands of snow, left, while below a glassy sheen on the downwind slopes create the darker bands.

Megadunes

From page 7

creating the even rippling effect. That high on the plateau, the winds blow steadily from 20 to 30 knots all winter.

"Right now what we think is that it's sort of a pattern of etching," Scambos said before visiting the dunes.

After returning from the dunes, he's not so sure.

"It's harder to imagine it's just the atmospheric influence," he said.

The upwind sides of the dunes have a rough surface of meter-high sastrugi, with fine snow grains. Like rock in other parts of Antarctica, the sastrugi were carved into fantastic shapes by the wind.

"It was like a day at the zoo when we went there, because they looked like dolphins and whales," Albert said.

The downwind slopes are almost the opposite, with a glassy, glazed surface a couple inches deep.

"It's not like an ice-skating rink; it's not that smooth. It's more like cement," Albert said. "Even the Twin Otter landing hardly left a mark in the snow."

Digging a snow pit below the glazed surface, the glaciologists found hoare frost going down four meters, the equivalent of 100 to 300 years. The coarse crystals were up to 0.8 inch (1 cm) across, Albert said, compared to the typical (1 mm) crystals found in other areas.

"It's because they've been exposed and weathered for so long," Albert said.

The coarse crystals may have developed from seasonal temperature changes, which allow some of the snow to turn to water vapor in the summer. The vapor would rise up through the snow pack, and then refreeze in the winter, slowly burying the coarse, recrystallized ice below, Scambos said. Albert is bringing an ice core sample home to test its permeability.

"There's no way this snow wouldn't be near record-breaking in terms of permeability," Scambos said.

The ice is porous enough that it is possible some wind is passing through the snow itself. The glazed surface was riddled with expansion cracks, and in some places open holes, like gopher tunnels, dropped into the ice, large enough to stick an arm in up to the shoulder, Scambos said.

"There's a chance there's air drifting underneath the surface,"

Photo courtesy of Mary Albert/Special to The Antarctic Sun

Scambos said.

If that's true, then the wind could be changing the chemistry of the snow.

"This is possibly the most messed up snow on the plateau," Fahnestock said.

Messed up as it is, the snow may be similar to what glaciologists like Richard Alley of Penn State find when they look back millions of years into the ice core record from Vostok, Siple Dome and Taylor Dome. Those areas appear to have had periods of extremely low accumulation with large crystal formation too. Studying how the climate signal gets put down in the megadunes, an area of extreme dry and cold, could help glaciologists read the past better.

"I just think they're doing really fundamental research," Alley said. "Let's go to one of the most extreme places in Antarctica and make sure we understand it."

It will take a couple more visits before the glaciologists do understand the megadunes.

"They're there and they're something like what we thought, but we still don't have the big answers," said Scambos, whose grant includes another field season. "It's still hard to imagine how these things are formed."

Photo by Melanie Conner/The Antarctic Sun

Driller Jay Johnson talks with a Raytheon Polar Services Co. employee at Onset D field camp. The drillers, scientists and camp crew work together to coordinate logistics of drilling, conducting science and living in the field.In the background drillers monitor a drill rig as it penetrates the ice.

OnsetD

From page 1

echoes help scientists study bedrock and other geologic phenomena.

"(We may find) information about layers beneath the ice or even tidbits about history," said glaciologist Don Voight.

Researchers are looking for changes in reflections that help them "see" beneath the thick ice sheet and into the sediment on the Earth's surface.

"Rock will sound different than mud," said Anandakrishnan, "and crystal rocks will also sound different."

Some ice streams in East Antarctica flow over crystalline rock that creates enough friction to inhibit the rate of flow. In West Antarctica, however, many streams lie on slippery surfaces of mud, allowing them to flow faster than if they had crystallized surfaces.

In addition to obtaining bedrock information, researchers can determine the thickness of the ice based on the time it takes for the vibrations to travel from the surface of the ice to the rock or mud below the ice.

Photo by Melanie Conner,/The Antarctic Sun

Snow extracted by the drill forms balls that resemble hail stones.

> "There is no plume of snow, but it creates a 'ka-umph' sound."
>
> — Shridar Anandakrishnan, glaciologist

Speeding through ice at 2.5 miles (4 km) a second, the sound takes about one second to travel down and return to the surface if the ice is 1.2 miles (2 km) thick. In comparison, the speed of sound echoing through the air is 980 feet (300 m) per second.

"(The speed of sound in ice) is faster than in the Grand Canyon," said Anandakrishnan.

At 300 meters a second, an echo would cross a 900-meter canyon in three seconds and then take another three seconds to return, he said.

In-the-field

Before the explosions begin, a five-member team from Ice Core Drilling Services traverses the 62-mile (100-km) wide Ice Stream D, stopping to drill holes for dynamite.

Working ahead of the scientists, the drillers make their way along the three pre-determined lines that cross Ice Stream D, making holes every 984 feet (300 m). Each line takes about two weeks, and once finished, the holes average 30 to 40 meters deep.

See OnsetD on page 10

OnsetD

From page 9

"It shouldn't be a problem (for the scientists) finding the holes," said Melissa Rider, assistant manager for field science support. "The scientists have their precise GPS locations and the holes are marked with bamboo flags and covered with a plywood cover."

The scientists travel along each line, lowering dynamite-packed cylinders about an inch in diameter into the holes and then setting them off.

Researchers want to send energy deep into the ice, suppressing loud booms or spraying snow.

"You can't really see the blasts, but if you stand nearby you can feel it and hear it," said Anandakrishnan. "There is no plume of snow, but it creates a 'ka-umph' sound."

Seismic waves are produced by a sudden jolt of energy, such as an earthquake. But Anandakrishnan and his colleagues are looking for phenomena a few meters away from the source of seismic activity.

"You can wait for an earthquake, but those characteristics are not good for looking at 'big picture' stuff," said Anandakrishnan. "You need a local source of energy of your own. You have to use a short, sharp crack to produce energy useful to us."

When the dynamite explodes, the reflection data is stored in the hard drives of nearby computers connected to geophones by a cable emerging from the ice. Inside the baseball-sized geophones, or seismic recorders located just under the snow, sensitive instruments react to the explosions. Sensors measure how much the instruments move.

Walking along a row of holes with shovels, digging up and replanting geophones for the next blasting site, the team members more closely resemble gardeners planting potatoes than scientists profiling the Earth's surface beneath the ice stream.

"It's very labor intensive," said Anandakrishnan. "We walk up and down the line digging them up and reburying them. We're planting geophones."

Arduous as the work may be, scientists hope that bed profiling will help them understand how the streams are affecting the stability of the West Antarctic Ice Sheet.

"To the naked eye, it all looks very similar. We just want to know why this and this are moving fast and this is not," said Anandakrishnan. "That's all we're doing."

Photo by Melanie Conner/The Antarctic Sun

John Robinson, driller for Ice Core Driller Services for the University of Wisconsin, drills a hole into Ice Stream D. The drillers work ahead of scientists, who follow with explosives to conduct seismic research.

Last chance to enter

the Antarctic photo and writing festival

4 **Photo** categories: **Scenic, wildlife, people, other**

4 **Writing** categories: **Poetry** (up to 30 lines)
microfiction (short stories up to 300 words)
non-fiction (true stories, essays, journal entries, letters home, memos...up to 300 words)
haiku (traditional 5-7-5 syllable poems)

One entry per person per category
E-mail to AntarcticSunMcMurdo@McMurdo.gov
by **7 a.m. Monday Dec. 16**

No time to procrastinate!

Current

From page 1

oceans, redistributes heat, salt and other properties. The amount and intensity of heat transferred from the equator to the poles by this mega-current influences temperature and rainfall, so understanding the Antarctic Circumpolar Current is important for global climate studies.

Sprintall's studies focus on the Drake Passage, located between the northernmost tip of the Antarctic Peninsula and the southernmost tip of South America. The Drake Passage is significant because it is one of the few choke points for the current. A choke point is a channel capturing the entire flow of a current and is considered a prized phenomenon in oceanographic circles. All water going around in the Southern Ocean has to pass through the Drake Passage, thereby yielding a valuable cross-section of the Antarctic Circumpolar Current.

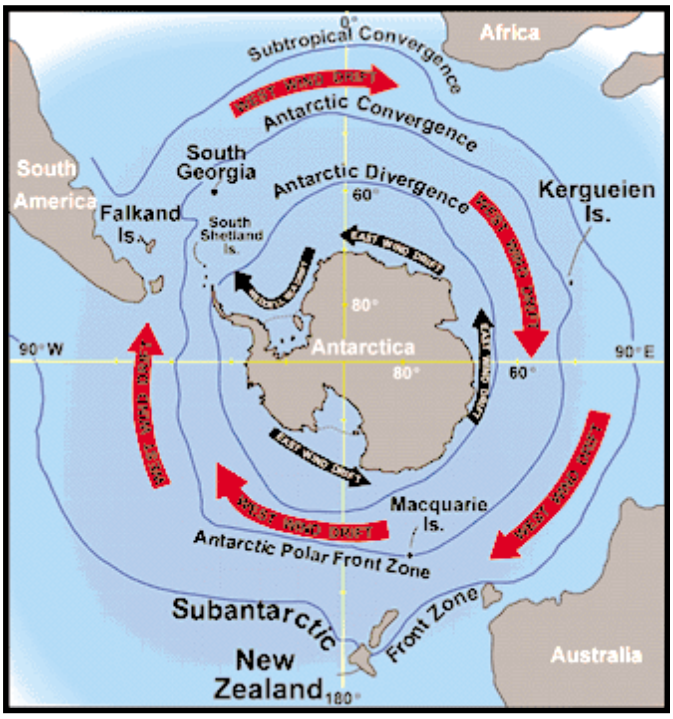


Illustration from the Byrd Polar Research Center

The route of the Antarctic Circumpolar Current and its three zones.

Sprintall utilizes instruments on board two United States Antarctic Program research vessels, the *Laurence M. Gould* and the *Nathaniel B. Palmer*. For information on current temperatures, foot-long, "torpedo-like" Expendable Bathythermographs, or XBTs, are sent down from the *Gould*. Attached to a 3,300-foot-(1,000 m.)-long copper wire, the probes send data back to a computer onboard as the ship continues to move, until the wire eventually snaps.

The structure of the upper currents of the Antarctic Circumpolar Current is also of interest to Sprintall. The velocity of these currents is gauged using hull-mounted Acoustic Doppler Current Profilers. The Acoustic Doppler Current Profiler sends down a pulse of four directed sonar beams and measures the frequency of the pulses reflected back. Changes in travel time are related to water density changes and thus shifts in ocean currents. The "ping data" generated by the Acoustic Doppler Current Profiler is monitored remotely and used to map the structure of the Antarctic Circumpolar Current.

Three distinct bands of water make up the Antarctic Circumpolar Current, the SubAntarctic Front, the Polar Front and the Southern Antarctic Front. Maps of eddy energy are included within research objectives since eddies, sometimes reaching up to 93 miles (150 kilometers) in diameter, mix momentum and heat across the current.

With seven years of data, Sprintall said they are only now getting to the point where they can begin to build any kind of big-picture scenario, although to look at anything with regard to long-term climate change requires at least a decade of data, she cautioned.

While the *Gould* crosses the 435-mile (700 kilometers) Drake Passage, the *Palmer* can be anywhere in the circumpolar region, and falls primarily under the domain of leading ocean current expert, Eric Firing, conducting his work out of the University of Hawaii at Manoa.

"We are taking advantage of whatever tracks and travels these ships have," said Firing of the *Gould* and the *Palmer*, which are used to support a wide range of oceanographic studies, including the delivery of supplies and transportation of personnel.

"Before this program, there were very few current measurements in the circumpolar region. We are simply grabbing some measurements very cheaply that might turn out to be interesting, especially in the aggregate."

Included in these measurements is thermosalinographic data, because heat and salinity are critical for the vertical movement of fluid, or convection, a primary mode of heat redistribution. The colder and more saline a body of water is, the denser it is. This cold, dense water sinks in the polar regions and is replaced by fresh water. A balance between saline water and fresh water keeps the conveyor alive and well and is necessary for redistribution of heat from the equator to the poles, so there is a threshold for just how much fresh water any ocean current can take without it turning into a wishy washy affair.

An increase in fresh water caused by global warming, for example, could lead to a reduction in circulation by threatening to reduce the salinity of the surface waters. Computerized models for a doubling of heat-trapping carbon dioxide in the atmosphere depict a reduction in circulation in the Antarctic Circumpolar Current from 20 to 50 percent. A weakened circulation also dilutes the capacity of the ocean to absorb carbon dioxide and other greenhouse gases, further compromising the climate system's ability to bail humans out. While it is possible global warming has a natural component, the dramatic increase correlates more substantially with the 31 percent boost in tropospheric levels of carbon dioxide since pre-industrial times as well as the outstanding heat-trapping prowess of carbon dioxide.

Research with regard to the Antarctic Circumpolar Current will eventually include the Antarctic Circumpolar Wave, which has been shown to occur at the same time as the El Nino - Southern Oscillation. It has also been linked with weather patterns over the major land masses in the Southern Hemisphere. The Antarctic Circumpolar Wave is a cycle the current goes through in its approximately eight-year journey around Antarctica. Recently discovered through satellite imagery, the wave rides on and in the same direction as the Antarctic Circumpolar Current. It is characterized by a slight rise in sea surface temperature and pressure.

Besides predicting weather variations around the globe, future research on the Antarctic Circumpolar Current may provide information to better ascertain the effects human-induced warming may wield on the Antarctic Circumpolar Wave, and thus climate change, in the long run.

Andrea Baer is a journalist from Honolulu with a BS in biology from the University of Hawaii. She is working this season as a dining attendant at McMurdo Station.

Profile

Daisy, Dasi, show me your telescope do

By Kristan Hutchison/*Sun staff*

Photo by Melanie Conner/The Antarctic Sun

Allen "Daisy" Day stands in front of the DASI telescope at Amundsen-Scott South Pole Station.

With a nickname like Daisy, it seemed predestined that Allan Day would end up working on the telescope of the same name at the South Pole.

Daisy gained the nickname as a boy in Engonia, a small town near the Queensland border in Australia where his parents raised sheep. The district contained about 20,000 square miles (51,800 square kilometers) and 500 people.

"There's a store and a race course there. That's it," Daisy said. "The store sells fuel, everything - milk, bread."

The district had no school. The only options were to send kids away to boarding school or homeschool with the "School of Air" curriculum broadcast over the radio.

"We got sent to boarding school," Daisy said. "That's pretty rough when you're about 6."

It was too tough. Daisy's parents ended up moving to Sydney so the children could attend school while living at home. The transition from the country to the city was difficult for Daisy and every chance he had he would go back to the bush.

"It's trouble for a kid from the country who doesn't wear shoes to go to a school where you have to wear hats and gloves and ties and blazers," Daisy said.

When he graduated 15 years ago, Daisy got a job making "bits and pieces" for Australian Telescope National Facility, a government-funded radio astronomy agency. With time he became the cryogenics expert and was moved to Narrabri in New South Wales to work on the compact array telescope at the Paul Wild Observatory there.

With 7,000 people mostly farming wheat, cotton and sheep, Narrabri suited Daisy fine.

"We don't have traffic lights. We just upgraded to three roundabouts," Daisy said. "To have a job that works with real high-tech things and be in the country is just the ultimate. You can't ask for better."

Daisy spends most of his time working on the telescope array 15 miles (25 km) from town or riding his Australian spot horse, Vespa, around his 600-acre (240 hectare) ranch. He has 60 hereford cows, nine horses and whatever wild animals decide to visit.

"Kangaroos, parrots, emus, all the Australian animals live there, helping themselves to whatever they can find," Daisy said.

To better cover the country's wide-open distances, Daisy recently earned his pilot's license.

"I've got a runway and a hangar and a windsock, but I haven't got a plane yet," said Daisy, who plans to build his own someday.

The telescope Daisy works on in Narrabri has six 22-meter dishes on a track 2 miles (3km) long, so the configuration can be changed depending on what is needed. It works on the same principle as the DASI telescope, which is why he was hired last summer to work on the DASI telescope. He found he liked the South Pole.

"I like quiet sort of places," said Daisy. "It's not all that different from home. It's just really cold instead of really hot."

The Pole's –76F (–60C) ambient temperatures are something of a relief after the 118F (48C) heat at home, which cools to 95F (35C) at night.

"It's harder to come home than it is to come here, to get used to the heat," Daisy said.

Though some know him by his nickname, Daisy, many at the Pole just know him as "the Aussie."

"Allan Day sparkles. I just think he's a gem," said Bob Morse, the principal researcher for the AMANDA project, who works in the Mapo building with Daisy. "He brings a sense of humor, levity, insanity. Aussies seem to be infected with a sense of good spirit."

Even when he isn't trying, Daisy's broad brogue and Australian sayings crack people up.

"I don't really know what I say that's so funny, but everybody laughs a lot," Daisy said. "I get a lot of vacant looks from things I say."

On the other hand, he can't always understand the American accents, particularly over the loudspeaker.

"I'm forever asking, 'What did she say?'" Daisy said.

He has plenty of time to figure it out, since Daisy is staying for the winter this year.

"I want to see the Southern auroras, like everyone else does," he said.

He may be better off for now at South Pole station than at home. The week he arrived at the South Pole a storm ripped the roof off his home, back on the ranch. The next week a lightening storm started a fire that burnt 50 acres (20 hectares) of his land.

"Not much you can do, is there, even if I was home," Daisy said.

Over the winter he plans to make a model of Capt. James Cook's ship, the *Endeavour*, and to learn to type properly. He will also be creating next year's marker for the geographic South Pole, which has to be replaced each year as the ice moves.

"I told Bill (Henriksen) I was going to make it out of frozen Vegemite," Daisy said. "Everyone seems to think Vegemite is terrible stuff here. I love it."