



**SNOW AND LIGHT CHEMISTRY
MAKES FOR RADICAL PRODUCTS**

Airborne pollutants can be carried by winds far from their sources to inevitably settle in pristine environments like the Arctic. There researchers thought the pollutants remained locked in the snow and ice. But according to Dr. Jack Dobb, an atmospheric chemist at the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire, the story is not as simple as was once thought. Sunlight hitting the snow's surface actually reacts with the pollutants that settle there, breaking the pollutants down to produce harmful radical compounds that are a menace to the atmosphere. "In effect, it's as if smog is being recycled by the snow," says Dobb.

In a process called photolysis, these sunlight-driven reactions produce species such as the hydroxyl radical (HO) and nitric oxide (NO), which are signature air pollutants. These radicals have a significant impact on the atmosphere right above the snow, which begs the question: How far into the atmosphere do these negative effects extend? Although Dobb does not yet know the answer to this question, he says that this phenomenon occurs wherever researchers have looked for it in snowy environments—from the Arctic to Alert, Canada, to Colorado. These reactions also affect the composition of the ice, which has major implications for researchers

that use the ice cores to reconstruct environmental and atmospheric conditions of the past.

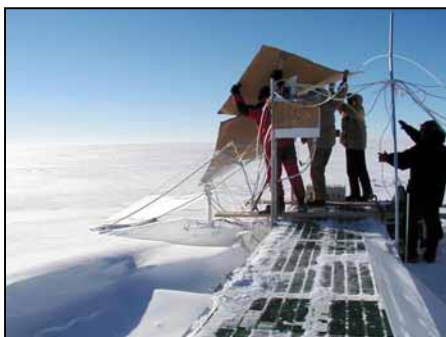
In a collaborative between researchers from eight institutions, Dobb and his colleagues recently returned from Summit, Greenland, where they worked for about two months carefully studying the photolysis process. VECO Polar Resources (VPR) set up a satellite camp for the researchers approximately a half a mile from Summit Station so that pollutant and radical samples could be obtained from as pristine an area as possible.

To that end, a 25-foot catwalk was also brought in to allow samples to be taken over a portion of untrodden snow. Moving the 11,000+ pounds of science equipment to the site was no easy feat for the researchers considering that snowmobiles were used only on the

first two and final two days of the researchers' two-month stay to limit the amount of pollution from the vehicles. At all other times, equipment, food, and water had to be transported between Summit Station and the satellite camp by dragging it along the snow with banana slides or sleds.

Bundled in very warm clothing, the team of researchers worked at Summit through -45°C days during much of March and April, well before Summit is typically opened to researchers in May, as the early spring temperatures approach the lower limit of safe aircraft and equipment operations. Nevertheless, VPR aided the scientists' endeavor to work at Summit as early in the year

as possible, making this the first-ever spring campaign at Summit Station. Jack Dobb and his colleagues wanted to take sample measurements at a time when the land was beginning to emerge from its shroud of continual winter darkness and when the snow was still very cold. "The changes over time were huge in terms of temperature and sunlight hitting the snow." Because of these, and possibly other factors, the researchers recorded a marked increase in the amount of radicals hovering above the snow as time progressed.



Assembling the shading experiment



The Firn probe team



Snow sampling

The collaborators plan to use this data to create a model that predicts the effects of snow reactions on the atmosphere, the snow itself, and the ice that is later formed. In addition, this will be a crucial component for determining accurate global measures of climate changes caused by radical pollutants—data that is currently not accounted for in many models.

--Kara Nyberg, PhD

Many thanks to Jack Dobb for providing information and to the project's web site contributors for photos. For more information about this research and all of the collaborators and project participants, check out the following:

- ✓ <http://summit.unh.edu/>
- ✓ <http://summit.ucdavis.edu/>
- ✓ http://www.arcus.org/TREC/phpb/b/portal_greenland.php

UPCOMING
GREENLAND EVENTS

Greenland Holiday
30 - 31 May

ANG Flight Period
13 - 19 June
CMI & Clauer teams in

ANG Flight Period
21 - 26 June

NGRIP Opens
22 June

Greenland

Who's in the field?

Kangerlussuaq & Remote Field

Koni Steffen's field team was pulled-out from the Petermann Glacier on 17 May, concluding their fieldwork. The Kenn Borek Twin Otter pilots planned to return the following day and pull out two cargo loads to Alert, but severe fog rolled in and the forecast called for it to remain all week. The weather was good in Thule, however, so it was decided Thule would be the safest destination. Clearance for aircraft and crew at Thule normally takes 30 days but the Denver office was able to secure permission the Borek Otter to fly to Thule in record time. The following day the field team and necessary cargo flew to Kangerlussuaq with a stop at Thule, Ummannaq, and Swiss Camp along the way.

Bill and Kurt Burnham from the Peregrine Fund arrived in Kangerlussuaq via the 109th to begin their fieldwork. Included in their northbound cargo: live pigeons and a VW van. They had a productive first week with three successful captures. To find out more about the Fund's Greenland work visit: <http://www.peregrinefund.org>.

Two researchers from University of Pennsylvania arrived this week as well. Working on a National Geographic grant, the group, led by Eric Post, is studying musk ox and caribou herds in Greenland to determine the effect of climate change on their demographics. Read about the PI's related NSF work at <http://www.science.psu.edu/alert/Post11-2002.htm>

The Cryosat UK 1 team returned to Kangerlussuaq on Monday and departed for Copenhagen the following day. They will return in August. The UK2 team is still traversing to Summit and as of Sunday morning had made it 2/3 of the way. Read more at: <http://www.esa.int/export/esaLP/cryosat.html>.

After visiting Summit last week, Andy Revkin from the New York Times spent time this week visiting with Kangerlussuaq remote field projects. Read about his trips to Swiss Camp and Summit and find out what exactly the Peregrine Fund does with those pigeons at: <http://www.nytimes.com/pages/science/sciencereport/index.html>

Summit

Summit was busy with three flight days in a row this week. Three new summer crewmembers also arrived this week -- a new cook, manager, and science tech. After the planes left, training with the new staff began. All seem to have settled right in and are very excited to be here. Looks like a great summer crew.

Visit the following web sites for more information about Summit:

- ✓ <http://summitcamp.org>;
- ✓ <http://www.geosummit.org>;
- ✓ <http://summit.unh.edu> or
- ✓ <http://www.ramas.uni-bremen.de/ramastext.html>

Raven

Joe McConnell's Arctic Circle traverse team finished drilling at their third site and traversed back to Raven on Monday. From Raven they went to the nearby ACT1 site where they drilled another shallow core. On Tuesday, four field team members returned to Kangerlussuaq, while the two ICDS drillers remained at Raven to complete a few more holes for the incoming Hawley optical logging project. At the end of the week, the two drillers and their equipment returned to Kangerlussuaq, while Bob Hawley and Gregg Lamorey arrived to begin logging the three sites that the drillers prepared for them.



*Bob Hawley heads into the Science Trench at Summit.
Photo courtesy of Andy Revkin, NY Times.*

Weather

Fairly mild weather predominated in the Kangerlussuaq area with no major wind and slight precipitation, though moderately warm temps, low clouds and 20+ knot winds from magnetic west brought wet snow to Camp Raven. In northern Greenland foggy weather greatly affected the Petermann pullout plan. Another good week at Summit with clear skies most of the week. The winds were calm all week with an average of 5kts and temperatures averaging -27c in the mornings. In the evenings ice fog and diamond dust filled the Summit skies with pretty halos around the sun.

UPCOMING ALASKA EVENTS

Learn to Return Course
Toolik Field Station, AK
21 - 25 June

Alaska

Who's in the field?

The 5th International Congress of Social Sciences took place from the 19th through the 23rd. VPR Logistics Manager Marin Kuizenga took the

opportunity to meet with visiting researchers, including Deanna Kingston, who will be leading a large multidisciplinary project on King Island. For a recent article on this project visit:

http://www.boston.com/news/science/articles/2004/01/20/team_to_study_alaskan_ghost_village

Matt Nolan's work on the McCall Glacier continues. For more info visit his web site at http://www.uaf.edu/water/faculty/nolan/glaciers/drmatt_mccall.htm.

Toolik

Doug Kane's group is conducting Toolik-based snow surveys in the Imnavait Basin. <http://www.uaf.edu/water/projects/NorthSlope/northslope.html>

VPR's Construction Projects Manager Jay Burnside traveled to Toolik on Wednesday to complete safety walkthroughs of VPR's construction projects with Wayne Hibbeln, VECO Health, Safety and Environment Manager.

The Toolik construction crew is busy building a new day care facility that will offer childcare space to researchers with dependent children. For more info read the Dependents section of the Toolik Handbook: <http://www.uaf.edu/toolik/Handbook/Dependents.htm>



The new day care facility at Toolik.

Looking Ahead

- ✓ Jim McNamara, John Bradford and Troy Brosten arrive in Fairbanks on May 24. They're heading to Toolik to begin their research on how climate change affects on hyporheic processes in arctic streams.
- ✓ A helicopter will commute to Toolik on May 27th to work with several researchers. From there the helo will continue on to support the take-out from the McCall Glacier.
- ✓ Jim Dixon and crew arrive in SE Alaska to begin work at On Your Knees Cave on Prince of Wales Island
- ✓ VPR team members Naomi Whitty and Roy Stehle will travel to Toolik Field Station to set up VPR communications. Naomi will remain to coordinate the helicopter while it's at TFS for early season work.
- ✓ Toolik's first 1st TREC teacher, Karen Bejin, arrives Fairbanks on May 29th. She will travel on to Toolik to participate in the research of Anthony England.
- ✓ John Wingfield's research team arrives Toolik on May 25th to begin their bird research.



Alaska Logistics Manager, Marin Kuizenga and her husband take a break to go halibut fishing in Valdez.

Weather and Road Conditions

- ▶ For current weather conditions throughout Alaska go to: <http://pafg.arh.noaa.gov>
- ▶ For up to date road conditions visit <http://511.Alaska.gov>.



Amy uses a satellite phone in Moscow to send emails and post her journals.

TREC Updates

TREC teacher Amy Clapp arrived in Yakutsk on 24 May and is on her way to Zhigansk with the PARTNERS project.

To follow her adventures go to: http://www.arcus.org/TREC/phpbb/portal_siberia.php.
Read the Marine Biological Lab press release about the project at: http://www.mbl.edu/inside/what/news/press_releases/2004_pr_5_18.html