POLAR RESOURCES



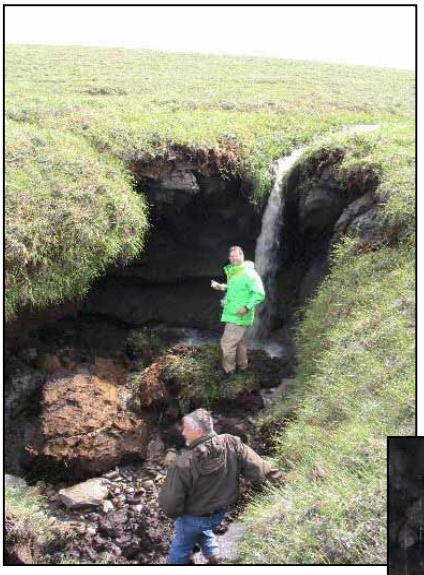

27 Jun 2004 Newsletter THIS ISSUE: What Lies Beneath, Cold cargo from Greenland, fire season in central Alaska

What Lies Beneath

There is much more to a stream than meets the eye. Deep beneath the surface under the openly flowing water exists a slower flowing, special region called the hyporheic zone consisting of mineral and organic sediment and a host of microorganisms. Like mulch is to a burgeoning garden, so is the hyporheic zone to the vitality of streams.

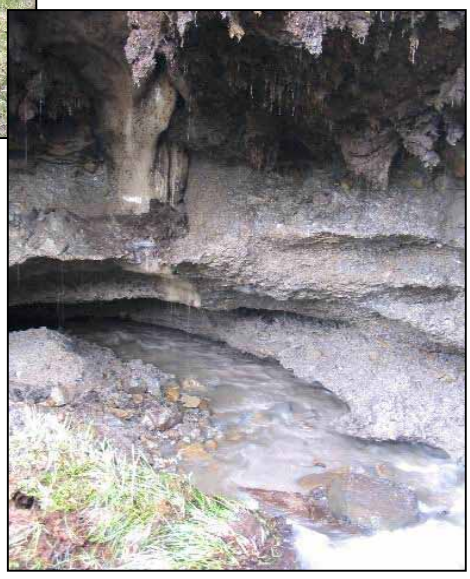
Microorganisms in the hyporheic sediment break down the organic debris to regenerate nutrients that can then be recycled by other plants and animals.

Arctic hyporheic zones have largely been ignored, because the sediment was thought to be too fine to allow water to pass through and because the frozen areas surrounding the streams (permafrost) were presumed to limit the biological diversity in the water. However, researcher Breck Bowden, the Patrick Chair in Watershed Science & Planning at the University of Vermont, and Breck's graduate student, Ken Edwardson, found these assumptions to be incorrect. In fact, nutrient regeneration within the hyporheic zone is critical for the continued health and productivity of arctic stream ecosystems and may significantly alter the way that organic matter is processed during transport to the Arctic Ocean. From this initial observation, a unique collaboration evolved between Bowden, an aquatic biogeochemist, James McNamara, a geomorphologist at Boise State University, and Mike Gooseff, a hydrologist at Utah State University. Together, this team of arctic scientists is currently assessing the role of hyporheic zones in a diversity of streams found near Toolik Field Station, Alaska.



A waterfall on the tundra, Breck Bowden is in green.

Within the Arctic, the extent of hyporheic zones is influenced by two important factors: (1) the shape of the land as influenced by water and ice and (2) the thaw bulb, or sub-stream regions of permafrost that become seasonally thawed as the energy from the flowing water above melts the frozen soil. The shape and size of the stream channel, along with other factors such as ice cover and water flow, directly impact the shape and extent of the thaw bulb. The thaw bulb, in turn, is the interface between the permafrost and the open water and creates the opportunity for the hyporheic zone to develop. These researchers hypothesize that if climate change alters the shape of streams–which is expected–then these changes may also alter the hyporheic zone and the critical processes that occur there.



The water from the above waterfall travels on under layers of soil and ice.

The team's objectives include monitoring the size of thaw bulbs under six streams that differ in size, shape, and extent of ice cover, among other factors. To do this, they are employing hand-held, ground penetrating radar (GPR) units to obtain data that distinguish between the thawed portions of the sediment and the frozen permafrost. This work is lead by McNamara and John Bradford, his colleague at Boise State University. These data will be confirmed using thermistors, specialized thermometers buried in the sediment that will indicate based on temperature whether the stream sediments are indeed frozen solid or thawed. The arctic hyporheic team has already performed a preliminary analysis of the GPR technique, and, encouragingly, their results corroborate extremely well with the temperature readings.

In addition to their thaw bulb investigations, the team is currently assessing the hydraulic characteristics of the hyporheic zone, or how quickly the water travels through the sediment layer. This work is being lead by Gooseff and his students at Utah State University. Using an inert tracer that they inject into the water, they can determine the size of the hyporheic zone and the degree to which the water in the open channel interacts with the water in the hyporheic zone.

(Continued on page 2)

(Continued from page 1)
By measuring the nutrient content in the hyporheic zone, such as the amount of nitrogen and phosphorous, and combining this information with the size and hydraulics of the hyporheic zone, the team will be able to determine the turnover time for nutrient cycling. This is work being lead by Bowden and his students. Ultimately, the team hopes to be able to determine how climate change alters thaw bulb and hyporheic dynamics, which may have dramatic affects on the movement of nutrients via streams. Bowden says, "If climate change affects the rate or extent of in-stream processing, then there may be important impacts on the transport of materials from land to the ocean."

-Kara Nyberg, Ph.D.

Many thanks to Breck Bowden for providing info and photos. For more about this research, visit the following: http://cc.usu.edu/%7Egooseff/arctic_proj.html

Summit staff get a demonstration on the proper use of a backboard.

Greenland Who's in the field?

Kangerlussuaq and Remote Field

The North Grip camp put-in happened on schedule on Thursday but the aircraft was unable to depart until Friday due to extraordinarily soft and sticky snow. Three successive take-off attempts failed to produce a ground speed of over 30 knots. The flight crew decided to shut down the aircraft- and APU – pull the batteries, and give NGRIP staff a chance to groom. By 0430 Friday, the ski-way had been groomed and was "setup" enough to successfully takeoff. Skier 92 departed without incident and returned to Kangerlussuaq by ~0730. For more info on NGRIP visit http://www.glaciology.gfy.ku.dk/ngrip/index_eng.htm.

With assistance from NOAA's Andy Clarke, VPR palletized 70 ice core and snow sample boxes for shipment to NY on early Saturday morning. The samples included 56 boxes of core from Joe McConnell's spring traverse, 4 boxes of snow samples from the year-round GEOSummit campaign, and 10 boxes of ice cores drilled at Summit by ICDS during the Waddington/Hawley/McConnell optical logging project. The optical loggers were interested in the borehole and didn't need the resulting core, so it was sent to Boston University instead, where a group of astronomers led by Harlan Spence will measure these "cores of opportunity" for nitrate as a paleo-solar activity record. The samples were sent south via a "cold-deck" and quickly transferred to two different freezer trucks. BU received their shipment later that day and the McConnell Reno shipment is scheduled to arrive by Tuesday.

Summit

The Swiss ETH group raised their instrument tower to 38 meters. For more visit:http://www.rereth.ethz.ch/umnw/atmosphys/ohmura/pj.06.html.

The GRIP site was vacated and science gear retrograded to Kangerlussuaq and the US. NGRIP research Simon Sheldon's winch remained on site in order for another NGRIP researcher to do additional logging of the GRIP borehole in the near future.

After last week's aircraft woes, ANG ops were back to normal and both flights this week were thankfully uneventful. Medic Katie Hess conducted a workshop on spinal injuries and the proper use of backboards and cervical collars. The carpenters switched to working nights on Sunday to complete major work on the Big House without interrupting camp and science operations.

Raven

This week all 7 scheduled missions, including two airdrops, were completed successfully. Due to rain and warm weather the upper 8 inches of runway surface are showing signs of rot, though the subsurface remains firm. In order to maintain the runway the crew is now grooming at night and the Hercs are no longer turning from the skiway into the taxiway. Instead, they are using dumbbell turnarounds to avoid ruts in the middle of the skiway.

Weather

Kangerlussuaq weather was stable and warm with clear skies prevailing early in the week. Calm winds and moisture provided by overcast skies produced a thin black cloud of bugs for Saturday's ice core loading that took no prisoners. Weather was good at Summit with morning temps varying from –12C to –20C. Raven had seven days of unlimited visibility, temps above zero, and relatively calm winds. The snow surface off-site is covered with a bizarre film of ice. Anyone who walks on it sinks thigh-deep through a rotten, airy, deformation layer, and it creates a sound like wind chimes.

POLAR VECO RESOURCES

UPCOMING GREENLAND EVENTS

ANG Flight Period
11 - 17 July

ANG Flight Period
25 - 31 July

Alaska
Who's in the field?

POLAR RESOURCES

UPCOMING ALASKA EVENTS

11 July
Walker project begins in Canada

Overall Alaska

Tad Pfeffer and team completed their fieldwork on glacier calving mechanisms at Columbia Glacier on June 25th. The group flew 14 hours and reports a very successful season. For more, visit http://tintin.colorado.edu/group/columbia/ColumbiaIntro.htm.

Peter Schweitzer, Andy Kliskey, and others are presently in Nome conducting fieldwork on their grant investigating climate change impacts on water resources and humans in the arctic (June 6 VPR Newsletter). This large collaborative with four teams and 10 researchers will have a presence on the Seward Peninsula through most of the summer.

Another large collaborative led by Darrell Kaufman and Feng Sheng Hu (with a total of five co-investigators and a field team of 10) continues their study of southern Alaska Holocene climate variability. Over the course of 4 summers of fieldwork, the researchers will sample lakes along a 1500km transect at 60 degrees north. The teams gathered in Anchorage to compare results and will split again – some returning to the Ahklun Mountains and some conducting sampling in the Wrangells to finish out their first full season of fieldwork, which should conclude by ~July 7.

Hot and smoky conditions persist in Fairbanks. Photo: Kathleen Wright

Jon Benstead & Heidi Wilcox of MBL, Woods Hole, MA, install a nutrient dripper at the Kuparuk River. Phosphoric acid used by the dripper was slung to the site by helicopter. Photo: Robert John Golder

Skip Walker and crew had a very successful visit to Cape Thompson on June 22nd – June 25th. They were there to re-visit long-term frost boil monitoring plots first established by Al Johnson in 1961. Al, Skip, and team were able to locate 8 of the 23 long-term plots during their three-day trip. Al has offered his dataset to the Long Term Ecological Research project.

Rommel Zulueta and Kirstin Skadberg from Walt Oechel's San Diego State University team flew into Ivotuk on Thursday, June 24th to re-install a Metek ultrasonic anemometer their autonomous tower. The team's carbon flux tower is collecting data in support of Oechel's work in elucidating the responses of plants and ecosystems to increased carbon dioxide in our atmosphere. The Metek had been out for repairs, and the team reinstalled it successfully, in advance of an approaching weather front. (http://www.sci.sdsu.edu/GCRG/)

TREC teacher Kathleen Wright is in the field with Carlos Pinkham from the Biology Dept. at Norwich University. The Pinkham team will survey macro invertebrates at the Caribou-Poker Creek Research Watershed outside of Fairbanks, though the team had to delay the start of their field season by a few days due to the proximity of fires to their sampling site – it's fire season in central Alaska. Read Kathleen's journal at: http://www.arcus.org/TREC/phpbb/portal_caribou.php

LTR students practice aviation safety, exiting a makeshift "aircraft".

Toolik

- ✓ This week at Toolik the LTER group completed the first round of their annual sampling of the "I-Series" lakes.
- ✓ VPR sponsored a series of Learn to Return Training Systems (LTR) survival seminars from June 21st – 25th. Interested researchers attended classes on Bear Safety, Aviation Safety and Remote First Aid.
- ✓ The population at Toolik Field Station hit the summer high of 82 on the 24th of June. Camp population will be in the 70s in July and August.
- ✓ Toolik Field Station has new neighbors this summer. Alyeska is operating a 40-person work camp on the north end of the lake from July 5th into September. IAB has provided Alyeska a map of study sites and has received assurances that Alyeska personnel will not walk in or disturb designated research sites, that they will allow access to all research sites, and that they will not discharge nutrients into Toolik Lake.