

Antarctica Proposal 1: Where Rivers Run Uphill

There is a place here on Earth where water does strange things. As though it has a mind of its own, it spurts from one lake to another, and back again—sometimes it actually flows uphill to jump from one valley to another. If it were just a few teaspoons of water, it might be dismissed as a fluke. But it's not. Instead, it's hundreds of cubic miles of water behaving in this strange way.

Everywhere else on Earth, water obeys one cosmic principle—gravity—which guides it from snowmelt high in the mountains to oceans hundreds of miles away. But here is a place where water bows and bends beneath the demands of different god—pressure. Thousands of pounds of pressure per square inch forcing it, sometimes, to run uphill.

The place where this happens is Antarctica. Ninety-nine percent of the continent is hidden from human view, shrouded in ice sheets that range from half a mile to nearly 3 miles thick. Hidden beneath that ice are entire mountain ranges, with peaks as high as 9,000 feet, that have never been seen by human eyes—instead, only glimpsed through remote sensing methods such as ice-penetrating radar.

But scientists are especially interested in the liquid water that lies between the ice and the continent below. They are becoming increasingly convinced that an entire system of lakes and rivers is hidden below the ice throughout Antarctica, with the water constantly shifting this way and that in response to the pressures from the mile-thick ice above.

This water seems to lubricate the movement of vast swaths of ice sheet over the surface of the continent. Scientists believe this is what allows some parts of the ice sheet—ice streams that are 50 miles wide, hundreds of miles long, and up to a mile deep—to slip toward the ocean 50 times more quickly than other parts of the ice sheet. What's more, changes in this lubricating layer—which scientists are currently observing—is altering the flow of these ice streams, and could ultimately threaten the stability of large ice shelves that hang off the edge of the continent and float on the ocean. One small ice shelf, called Larsen B, disintegrated into icebergs in 2002. If the West Antarctic ice sheet disintegrated into the ocean, it alone could raise sea level by 15 feet.

The rate of movement of Antarctic ice sheets and ice shelves has been mapped in recent years by satellite. The presence of water streams and lakes beneath the ice was first identified through ice-penetrating radar and seismic measurements. Researchers have also measured the rise and fall in the ice sheets as they are lifted up and then set down again by moving water. Most

recently, holes have been drilled through half-mile deep ice, and cameras lowered down to directly observe the water below.

In November 2007, a team of U.S. and Canadian scientists plan to visit a region of the West Antarctic Ice Sheet which seems, based on satellite data, to be showing the greatest rate of change. This will be one of the first times that this region has been visited. In addition to making measurements to the ice sheet's movement and the conditions below the ice sheet, they'll drill ice cores that will help to produce a past record of climate in the region may help to predict the ice shelf's stability with rising temperatures.

Key researchers involved in the effort include:

- Robert Bindshadler (NASA Goddard Space Flight Center)
- Ian Joughin (Applied Physics Lab, University of Washington)
- Slawek Tulaczyk (University of California at Santa Cruz)
(Dr. Tulaczyk is my contact)

I propose to visit the West Antarctic Ice shelf with the team and observe their work first-hand. This will involve being flown to a remote location and then camping with them on the ice sheet for a period of days.

Given the long lead time for this trip, it is entirely possible that some aspects of the trip, such as the exact field observations and experiments to be performed, will change. However, regardless of such changes, scientifically interesting results are likely to come out of the research that is conducted. Plans and expectations regarding writing / stories that might come out of the trip can be adjusted as the time nears.

Possible end-products for *Discover* Magazine would include the following:

- Feature story focused on the work that is being done and the issue of Antarctic ice sheet stability, global warming, and possible sudden rises in sea level.
- Additional, shorter news stories covering other research occurring during that field season in Antarctica (since I would be down there for weeks, and would necessarily spend some time at the main American coastal outpost, McMurdo station).
- Daily or weekly BLOG (for Discover.com) on research and happenings in Western Antarctica, McMurdo, and elsewhere—*as permitted by connectivity infrastructure!*