Newsletter of the FRIENDS OF THE FARLOW

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Antarctica: Where Crypotogams Are King

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January 3, 1997 was perhaps the most exciting day of my life. Not only for its shear life-on-the-line adventure, but also because I fulfilled two lifetime goals in one shot.

For much of my adult life, I'd nursed two goals — one concrete, one nebulous. Goal one was to reach the South Pole, preferably as a non-tourist. Goal two was to someday, once, "get as far away from things as possible."

I had studied botany in college, but, with a Master's degree in nutrition and a job in the low-income community, reaching the South Pole seemed hopeless. I would stare out my office window and wonder, "How did I get here? All I want to do is go to Antarctica and study lichens and mosses."

In 1991 I went trekking in Spitsbergen, a high Arctic island archipelago halfway between northern Norway and the North Pole. There was a biology of plant survival going on here that absolutely intrigued me. Botany. The polar regions. I had to make this the object of my future studies.

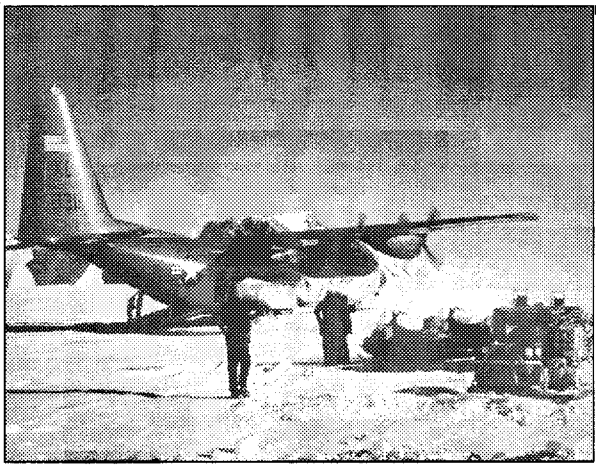
The Ends of the Earth

The Arctic and the Antarctic are not mirror images of each other. If anything, they are negative images. The Arctic is mostly ocean surrounded by land; the Antarctic is land surrounded by ocean. This largely explains why the Antarctic is much colder than the Arctic. The Arctic climate is modified by ocean currents, which transfer vast amounts of heat from southern latitudes into the Arctic basin. Additionally, the large Antarctic landmass (the size of the U.S.A. and half of Canada), which is 99.7% covered by permanent ice and snow, forms a summertime ice cap three times that of the Arctic. Because snow and ice reflect away about 80% of incoming solar radiation, while open ocean reflects only about 5%, the Antarctic receives far less solar radiative heating.

Antarctica is positively unearthly — a place like no other. In fact, NASA uses it as an analog for Mars. The average ice thickness on Antarctica is close to 2000 meters, an ice cube that constitutes 90% of the world's supply of fresh water. The Transantarctic Mountain Range is visible only by virtue of its peaks jutting above the accumulated snow of millions of years; elsewhere on the continent other mountain ranges remain completely submerged beneath the ice of the smooth polar plateau. And yet, the large central portion of the continent is a desert as dry as the Sahara, receiving about 5 cm of precipitation a year.

Clara Cummings Walk on Wachusett Mountain Sunday, April 25, 10AM - 2PM. See page 5.

The climatic difference between the Arctic and Antarctic is reflected in their respective floras. For example, about 70 - 80 species of flowering plants can be found at the northernmost spur of land in the world, in Greenland, at 83° N. Exposed land in the Antarctic supports a sparse flora whose diversity dwindles along a transect from the Antarctic peninsula in the north (at about 60° S) to the McMurdo Dry Valleys (at 77° S) and finally to the southernmost parcels of land in the La Gorce mountains (at 87° S). The Antarctic climatic influence reaches as far north as 54° S (the "sub-Antarctic" climatic zone), where the island of South Georgia supports only about 25 indigenous flowering plants. The "maritime Antarctic" climatic zone extends from the tip of the Antarctic peninsula down along its western coast and supports about 100 species of moss and approximately 260 species of lichen. The only two flowering plants in Antarctica (*Colobanthus quitensis* and *Deschampsia antarctica*) are found in this zone, each with a southernmost range of 68° S. The remainder of Antarctica has a "continental" climate where only cryptogamic and microbial vegetation is found — including 20 species of moss and 100 species of lichen.



Safely landed on the Robison Glacier at 87° latitude South.

Life in the Freezer

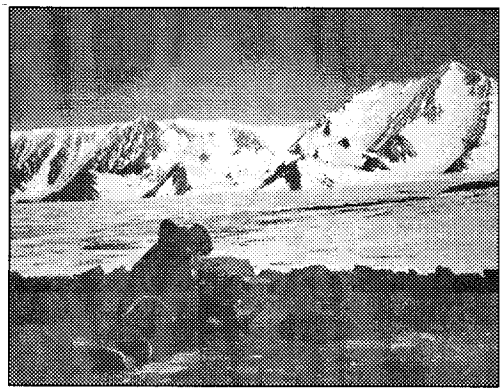
Antarctic flora is alternately described as either fragile or hardy. Fragile, perhaps, because a mere footstep can compromise tens, possibly hundreds, of years of slow steady growth. Hardy because these organisms survive in the continental climatic zone, where monthly mean air temperatures are never above 0° C. To accomplish this, they use every trick in the book.

It is not low temperatures, however, that limit life in Antarctica. The limiting factor is the availability of free water. In spite of year-round sub-zero air temperatures, radiative heating on the surfaces of rocks and soil creates favorable micro-climates, refugia where life can flourish.

The McMurdo Dry Valleys is a mere helicopter drop from the bustling American McMurdo Station (2000 summer inhabitants). The Dry Valleys, often described as "the harshest terrestrial environment on earth", is an ice-free area that is constantly scoured by cold, desiccating winds from the south. To the naked eye it appears devoid of life. Not even lichens are visible in the Dry Valleys — unless you know where to look. The apparently lifeless surface of sandstone rocks and boulders provides a protective barrier for lichen that lives within the very fabric of the rock. Crack open one of these rocks, and 2 mm below the surface you will find a dark layer of lichen that, deeper in the rock, separates into layers of phyco- and mycobionts. These lichens receive moisture (from melting snow) and sunlight which penetrate the granular sandstone particles. In the soil, microfungi, nematodes and bacteria have adapted to long periods of desiccation and spring to life whenever a dusting of snow provides a modicum of moisture. Cyanobacterial felts and isolated patches of moss can be found in favorably situated rock crevices fed by melt-water and in riverbed channels that carry drainage from Dry Valleys lakes when conditions allow the flow of water.

At the sub-cellular level, special biochemical adaptations enable Antarctic terrestrial flora to survive the constant low temperatures. Under such conditions, lipid constituents of cell

membranes are modified to contain higher amounts of polyunsaturated fatty acids, helping maintain membrane fluidity and a continued exchange of nutrients. Cells also produce



The author taking a soil sample from a small moist patch at the edge of a frozen pond.

sugar alcohols which act not so much as antifreezes but rather as compounds that protect enzyme function, allowing for continued cell metabolism.

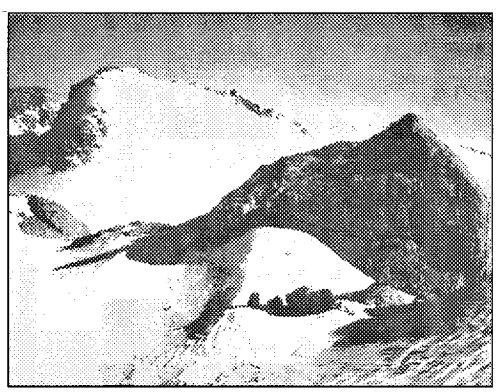
January 3, 1997

In spite of what is commonly said, however, the Dry Valleys habitat is not the harshest terrestrial environment on earth. The Transantarctic Mountain Range extends another 10 degrees latitude (approximately 700 miles) farther south than the Dry Valleys, to the La Gorce Mountains at 87° S, with exposed land and moraine at 7000 feet elevation. *This* is the harshest terrestrial habitat on earth. It has been visited only twice by microbiologists: once in 1970 (for a couple of hours only) and again, for an 18-day expedition that began on January 3, 1997.

There were four of us on this expedition — two microbiologists, a geologist and a field leader. We flew first to South Pole Station for refueling. (Bang! — lifetime goal number one!) After our Hercules C-130 transport plane (fitted, of course, with skis) conducted two full-speed, full-weight-on-ice "test landings" to test for crevasses, we were landed on a glacier. To our south was flat polar plateau. To our north, however, were protruding mountain peaks and areas of moraine. For 18 days we, the most remote humans on planet earth (Bang!), traveled by sledge over crevassed terrain to those nearby areas of exposed land where we took soil samples and searched rock faces for signs of lichen.

Our first day out, within minutes, we found lichen — two species (*Lecidea cancriformis* and *Carbonea vorticosa*) growing together on the north face of a boulder. At 87° 29' S, this is the farthest south occurrence of lichen ever recorded. Amazingly, however, these were the last lichens we saw for the remaining 17 days.

In spite of air temperatures that never warmed above -10° C, radiative heating resulted in many small areas of muddied mineral soil, sufficient habitat for our sampling regime. From these soils we cultured ten algae, six cyanobacteria and two mycelial fungi (one of which, interestingly, grows in culture like a lichen mycobiont).



Location of the farthest south lichen ever found. Patches were found on the large rock (foreground, right) and on the smaller rock (middle foreground, left). Photo is looking south.

Perhaps the most remarkable message here is that life will find a way. It persists right to the ends of the earth, even if it has to crawl into a rock to do so. Our comfortable little niche here in the middle temperatures fosters a mesocentric view of the world that does not do justice to the wonderful diversity of life.

News of the Farlow

Devens Survey

This past summer and autumn, several FOF members were involved in a crytogamic survey of that part of the former Fort Devens lying south of Route 2 and west of the Oxbow National Wildlife Refuge in Worcester County, Massachusetts. This area features a burn-managed inland pitch pine forest and a tamarack-black spruce bog. Professor Donald Pfister led the fungal survey team including FOF members and volunteers from the Boston Mycological Club. Sarah Cooper-Ellis and Raymond Abair surveyed the bryophytes. Elisabeth Lay, Elizabeth Kneiper, and Philip May inventoried the lichens.

Farlow Hosts High School Students

In February 54 honors biology students from Weston High School were given a behind-the-scenes tour. Donald Pfister, Scott LaGreca and Christine Liebson displayed herbarium collections to highlight both historical and current uses of the Farlow's holdings. Lisa DeCesare's Farlow lobby exhibit of Dodge memorabilia was used to outline how field collections are made. Judy Warnement discussed our library's importance to researchers; and David Hibbett showed the students the laboratory he uses to gather molecular data and related his work on fungal molecular systematics to the students' studies in evolution.

Visiting Researchers

Dr. Teuvo Ahti and his graduate students Ilona Oksanen and Kati Karkkainen, from the University of Helsinki, Finland, were here in November working on revisions of the lichen family Cladoniaceae. Dr. Gayle Hansen, from Newport, Oregon, visited in January to study the marine macroalgae of the Pacific Northwest. Karen Hansen, Ph.D. student from the University of Copenhagen, is here through the summer, working with Don Pfister on the fungus family Pezizaceae, particularly the complex genus *Peziza*. She joins the two other graduate students working on fungi, Zhihong Zhong and Kris Peterson. During March another prospective graduate student visited, Brian Perry, from San Francisco State University.

Microscope Slide Collection of Carroll W. Dodge

Scott LaGreca

Dr. Carroll W. Dodge, Curator of the Farlow Library and Herbarium from 1924 to 1931, supervised the move to 20 Divinity Avenue and doubled the herbarium holdings by purchase and collection. He was a broadly trained mycologist whose interests included medical mycology, hypogaeous fungi, and lichenology. For a time, he was the American authority on both tropical and Antarctic lichens. Shortly before his death in 1988, Dr. Dodge bequeathed his extensive library and herbarium (over 76,000 specimens, including almost 700 types) to the Farlow.

In association with his herbarium, Dr. Dodge donated 431 boxes of microscope slides. Many slides were made from his herbarium specimens, as evidenced by the specimen numbers on their labels. This makes them an integral part of the Dodge herbarium.

As part of the ongoing NSF-funded renovation of the Farlow, Harvard sophomore Chan Park is preparing an inventory of the estimated 33,000 slides (31,000 made from lichen material). He is continuing the work of Gennaro Cacavio, who, years ago, inventoried the first 81 boxes. Ultimately, the genus and geographic origin of source material for every slide will be entered into a computer database. This accessible cross referencing will allow curatorial staff to find microscope slides associated with specific Dodge herbarium specimens and greatly augment the scientific value of the Dodge collection.

For more information about Carroll W. Dodge, see the current display in the Farlow lobby prepared by Lisa DeCesare.

1998 Annual Meeting: Laboulbeniales with a PCR Twist

Elizabeth Kneiper

Alex Weir visited the Farlow this past fall and presented "From Roland Thaxter to PCR: Patterns of Species Richness, Specificity, and Phylogeny Amongst the Insect-fungi" at our FOF Annual Meeting. While in Cambridge, Alex studied Roland Thaxter's collections of Laboulbeniales housed in the Farlow Herbarium, presented a Harvard University Herbaria Seminar, and discovered a cache of infected insects in the Museum of Comparative Zoology's holdings.

FOF Financial Report

July 1, 1997 - June 30, 1998

Beginning Balance	**$ 8,224.00**
Income	
Membership	3,380.00
Book Sale	1,430.00
Note Cards	131.00
Total	4,941.00
Expenses	
Library projects:	
archivist salary & benefits	1,277.00
Clara Cummings Walk	35.00
Rollins Memorial Reception	40.00
Cabot & Farlow Library Displays	86.00
Book Sale	238.00
Christmas Cards	58.00
Annual Meeting	337.00
Newsletters (2)	460.00
Total	2,531.00
Closing Balance	**$ 10,634.00**
Endowment	
Balance 7/1/97	**$ 31,106.00**
Interest	1,764.00
Balance 6/30/98	**$ 32,870.00**

[Note: Harvard pays interest on endowment accounts in late August. We therefore have received another $2,011 which is not reflected in the above figures.]

Phil May, Treasurer

Clara Cummings Walk on Wachusett Mountain Sunday, April 25

Phil May

Members and friends are invited to the Clara Cummings Walk at Wachusett Mountain State Reservation on **Sunday, April 25**, from **10 AM to 2 PM**.

We will meet at the North Road parking area on Princeton Road. The walk (a hike!) will go on and off trail through the secondary-growth forest in the lower part of the Reservation, gaining about 500 feet in elevation. Parts of the walk are steep and rocky. Participants should bring a 10x magnifier, water, and lunch and dress appropriately for mountain conditions and the weather. Collecting is not permitted.

The Massachusetts Department of Environmental Management is cosponsoring the event this year. We therefore expect a larger group than usual. As many may have little knowledge of cryptogams, this year's walk is aimed at beginners. We will see a cross-section of lichens and mosses typical of central Massachusetts, plus whatever fungi are out in late April. The forest is pleasant on Wachusett Mountain, and we will pass through some open areas with views of the region, eating lunch at one of them.

Leaders will be Raymond Abair, bryologist, Philip May, lichenologist, and Gary White, interpretive ranger for Wachusett Mountain (phone: 978-464-2987). Other knowledgeable folks, including someone for fungi, will be along to help.

Directions: Take Rt 2 W past Fitchburg. Rt 140 S towards Princeton. In about 2 mi, right onto Mile Hill Rd (at reservoir, signs point to Wachusett Mountain Ski Area). In approx. 1/2 mi, just before the ski area, right onto Bolton Rd. Left at end onto Lanes Rd. First left at fork (about 0.4 mi) onto gravel Princeton Rd. North Road gate and parking area is 0.4 miles on the left. Allow 1 1/4 hours driving time from Rt 128/I95 intersection with Rt 2.