Phycological Trailblazer No. 7 Erzsébet Kol

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In terms of traveling to the hinterlands, namely, remote mountain ranges in Europe and North America, the Hungarian phycologist Erzsébet Kol (1897-1980) certainly deserves to be counted in the ranks of phycological trail-blazers. Her specialty was the snow algae, and her legacy is an impressive list of publications treating their systematics, biology, and ecology based upon collections ranging from the Alps, Greenland, Spitsbergen, and Alaska to New Guinea, Patagonia, and the Antarctic. Many of these collections she made herself, but she also was the grateful recipient of collections made by others. Her publications started appearing in the mid-1920s, treating the algal flora close to home, which was Szeged, Hungary (1925). One early paper (1927) was a detailed study of the movement of desmids and their production of slime trails. But this early research also included alpine algae (1926), the subject matter of most of her research attention for the next 50 years. Although her early publications were in Hungarian, later papers were in English, French, or German. She held a position in the Botany Dept. of the Museum of Natural Sciences in Szeged, a city in southern Hungary. She later held a position in the Botanical Department of the National Museum of Hungary in Budapest. Her botanical explorations around Europe were to mountain ranges, including the Alps (1934a & b, 1961) and the Carpathians (1949a & b, 1959b) as well as peaks in Transylvania (1935b, 1947), Greece (1957b), Bulgaria, and even nearly inaccessible Albania (1958). She also collaborated with F. Chodat in Geneva (Chodat & Kol, 1934) in studying 48 strains of unicellular green and yellow-green algae, determining their ability for heterotrophic growth and growth under anaerobiosis.

Dr. Erzsébet Kol in Ann Arbor, 1936 (photo taken by W.R. Taylor).

In 1936 Kol was the recipient of a Crusade International Fellowship awarded by the American Association of University Women. This fellowship enabled her to travel widely in North America, carrying out extensive field work. It also allowed her to visit academic institutions and meet a host of contemporary phycologists. Having access to a report she wrote to the AAUW, I am able to relate some of her adventures and experiences. Upon arrival in New York City she met M.A. Howe at the New York Botanical Garden and Tracy Hazen at Columbia Univ. She had access to their libraries to prepare herself. In Washington, D.C., she met with personnel of the National Park Service of the Dept. of the Interior to arrange for her collecting in several national parks. The Smithsonian added another $700 to her budget to enable Kol to extend her cryobiological research to Alaska. She proceeded to the Univ. of Michigan and spent some time in the lab of W. R. Taylor, where she studied his collections of snow algae from the Canadian Rocky Mountains (Kol, 1938).

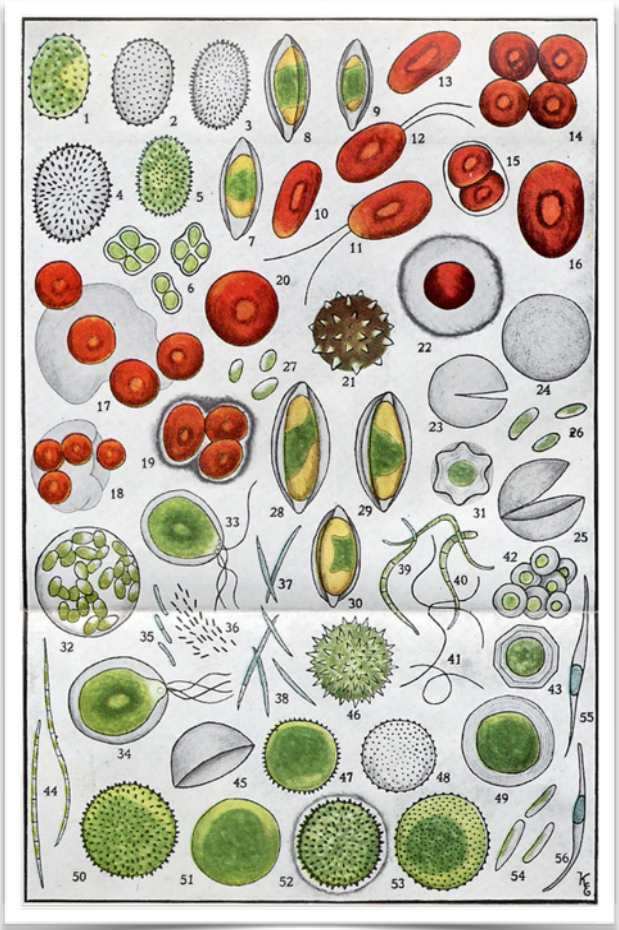

Fig. 1. Various snow algae of Greenland
[pl. 2 in Kol, 1959a]

The next stop was St. Louis to take advantage of the rich library at the Missouri Botanical Garden. The field season finally started in June in Colorado, where Kol carried out research on the snowfields at various altitudes around Pike Peak, Leadville, Independence Pass, and Fremont Pass. Her observation of a snowfield covered with green snow in Yellowstone Park in Wyoming was the first such to be noted in North America. At Glacier National Park in Montana, Kol worked on snowfields on the Grinnel and Sperry Glaciers and found the cryo-vegetation of the area most exciting. Her hosts had anticipated her visit and had started collecting the snow and ice algae earlier in the summer. By mid-July she was conducting field work in Mount McKinley Park in Alaska. Despite the very difficult traveling conditions of the Park at that time, she still was fascinated with the rare and interesting snow algae occurring there. Then she was on her way to Fairbanks, where she watched gold-dredging operations, and by bus to Chitna, passing snow-covered peaks, glacier-fed rivers, Indian villages, and silver-fox farms. The next stop was the Kennicott Glacier, where more snow algae were gathered. She reached Valdez, where she took a motor boat out to the Columbia Glacier. The ice there was covered for square miles with ice algae, including *Ancylonema*, which formed pleasing purple-yellow- brown ice blooms. The cryo- vegetation of coastal glaciers proved to be different from that of glaciers of the interior. The interesting red snow on Thompson Pass near Valdez differed in color from anything she had seen before and formed a patch 2-ft. deep. She also reached Juneau and checked out the Mendenhall Glacier and other snowfields of the area.

In Seattle Kol met with T. C. Frye of the University of Washington. She also visited the University of British Columbia and got out to Vancouver Island to visit the Pacific Biological Station at Nanaimo and the famous Butchart Gardens (still a popular tourists' stop). From Vancouver the trip next took her to the Canadian Rockies, where she worked on the snowfields and glaciers around Glacier, B. C., until the snows began (in September). She headed southward again to Seattle and then made a quick trip to Mount Rainier National Park, where she took her microscope out into the field. She found abundant red snow on Mt. Rainier and noted the need to culture these snow micro-organisms, research that was later undertaken by Ron Hoham (1974, 1979, 1980). In a letter Kol wrote to Hoham, then just starting his studies, that her main advice was to recognize that studying snow algae required extreme patience. It later became recognized by culturing work that many of the cell types described in the cryoflora had been misinterpreted and most cryophilic taxa assigned to *Scotiella*, *Cryocystis*, *Cryodactylon*, and *Carteria* are merely zygotic stages (planozygotes or resting zygotes) of *Chloromonas* (Hoham, 1975; Hoham & Mullet, 1977; Hoham et al., 1979).

Kol' s busy itinerary included further stops at Moose Jaw, Saskatchewan; Minneapolis (where she met with Josephine Tilden); Madison (where she met with limnologists E. A. Birge and C. Juday); Chicago (gymnosperm authority C. F. Chamberlain gave Kol photos of plants to take back); and Niagara Falls, where more algal collections were made.

The AAUW made a wise selection in awarding Kol their fellowship in that she surely had a productive year in North America (1938, 1939a, 1941, 1942). She came with a solid background on snow algae of Europe, and her research allowed her to compare that flora with the cryo-vegetation of North America. She also had the broader goal of attempting to understand the broad-scale biogeographical patterns and how this information impacts on theories concerning past connections between Europe and North America. Her 1942 publication best represents her ability to synthesize her research experience.

Back in Europe, Kol spent some time in London, holed up in the British Museum studying her collections. She had the good fortune of meeting with Prof. F. E. Fritsch and Dr. Nellie Carter of London Univ. Fritsch turned over to Kol collections of snow algae made 15 years earlier from the Antarctic. By coincidence two other holders of fellowships from the I. F.U.W. happened to be staying at Crosby Hall in London, Mary Pocock of South Africa (Trailblazer No. 4) and Elizabeth Flint of New Zealand. Kol's meeting with Flint resulted in their collaboration on some Antarctic collections (Kol & Flint, 1968).

Snow algae from other areas were also reported on by Kol, thanks to collections made for her, such those as by Captain Robert Bartlett on his expedition to western Greenland (Kol, 1959a) (Fig. 1). S. Eurola from Tromso, Norway, supplied her with his collections from northern Finland (1973) and Spitsbergen (1974). Prof. P. Arnaud from Marseilles sent to Kol his collections from eastern Antarctica (1971), while a pair of Hungarian meteorologists, E. Titkos and K. Visy, collected for her also from Antarctica (1968, 1973). Soil samples taken in an Antarctic valley by A. Heine of Wellington were cultured by Kol and the resulting algae analyzed (1970).

Kol' s research (1942) on snow and ice algae led her to classify these cryobionts based on their preferred environments: 1) "glacialis-cryobionts" are those on ice but never on snow; 2) "nivalis-cryobionts" are those on snow and "firn" [= the snow above the glaciers, which is partly consolidated by alternate thawing and freezing but has not become glacier ice] but never on ice; 3) "mixo-cryobionts" are those adapted to both snow and ice; 4) "cryoxen" are not genuine cryobionts but stray from their usual habitats. From her work in Europe and North America Kol (1934b,c, 1941) proposed the "silicotrophic-calcitrophic theory," which stated that the composition of the snow algal floras was correlated with the pH of the melt water. Thus, occurrences of "red snow" were associated with underlying silica rock and acidic media (pH 4.5-5.8), whereas occurrences of "green snow" were associated with underlying limestone rock and relatively more alkaline media (pH 6.0-6.5). In his study of the cryoflora in Japan, however, Fukushima (1963), disputed this theory, concluding that the intensity of illumination was the significant determinant of the distribution of these cryophilic organisms. Garric (1965), studying snowfields of the Pacific Northwest, also disputed this theory.

Kol described several new genera, including *Smithsonimonas* (1942), *Chodatia* (1934d), and the xanthophyte *Groenlandiella*, with *G. nivalis* and *G. brevispina* (1959a). With Chodat (Kol & Chodat,1934), she described *Cryococcus, Chromochloris*, and *Chlorellopsis*. She described new species in *Trochiscia, Carteria, Oospora, Raphidonema, Chloridella*, and *Kentrosphaera* among others. She had a remarkably productive career and managed to remain active despite the impediments of World War II, or, as she referred to that period, " ... the storms that passed over our heads." She and her work are to be remembered. *Koliella*, proposed by Hindák (1963) as a segregate of primarily unicellular species from filamentous *Raphidonema*, was later shown by Hoham's

(1973) cultures of *R. nivale* not to warrant generic status.

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Michael J. Wynne
University of Michigan, Ann Arbor