
Newsletter of the **FRIENDS**
OF THE
FARLOW

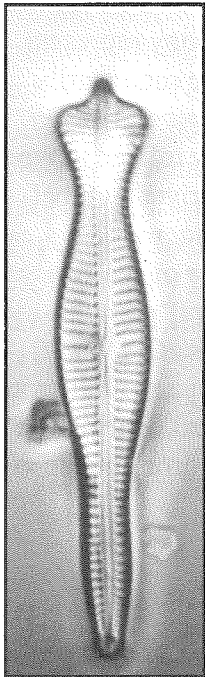
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R. K. Edgar, editor

THE "UBIQUITOUS DIATOM" REVISITED

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1 *Gomphema acuminatum*

Diatoms, with their glass cell walls, have been called "The Jewels of the Sea." They inhabit many aquatic and semi-aquatic habitats, from the stable oceans to areas where water availability is less predictable, like prairies.

Their fossil remains (the glass preserves quite well) tell us where and to what extent palaeaquatic environments existed. Their wide distribution in recent and paleoenvironments earned them the title "The Ubiquitous Diatom" (Kenneth Lohman). Diatoms play important roles in aquatic systems by contributing to the primary producer communities thereby serving as the base of the food chain.

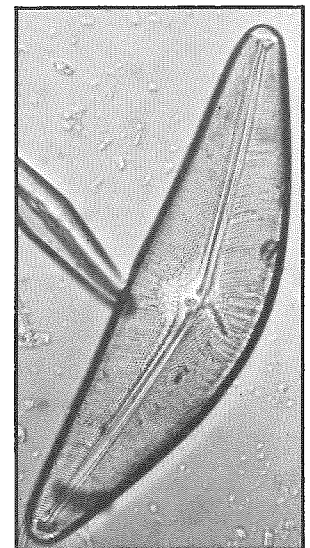
Diatoms are widely distributed in part because the earth is more than 70% water. There is a fairly sharp demarcation of diatom groups between fresh and salt water habitats; genera found in the freshwater systems rarely have representatives in marine systems and vice versa. In the freshwater realm, not only are genera of diatoms widely distributed (a key to the freshwater diatom genera would almost be equally useful to workers

in Europe, North America, Australia and Africa), but many species are considered to be cosmopolitan. Some freshwater species, like *Gomphonema parvulum*, have been reported from every continent and across extreme environmental gradients (pristine mountain streams to polluted sewage outfalls). Researchers have looked for dispersal mechanisms to account for such widely distributed genera and species, including migratory fish and fowl. It is interesting to note that diatoms found on the skin of marine mammals, animals with a great capacity for travel, are endemic to those organisms (Robert Holmes).

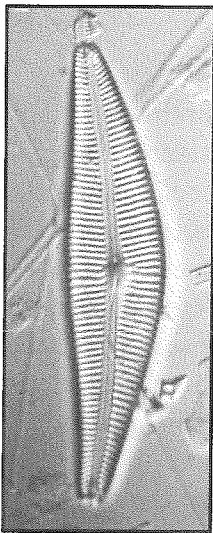
My research has focussed on a monophyletic lineage of freshwater diatoms, the cymbelloid and gomphonemoid line, and it was the investigation of this group that brought me to the Farlow in January and February of 1993 with support from the Genera Sayre Fund.

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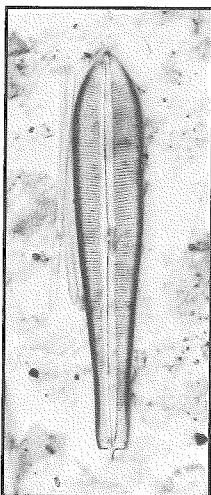
Cymbella mexicana



Most members of the cymbelloid and gomphonemoid line grow at the end of mucilaginous stalks, and all have a similar number and arrangement of their chloroplasts as well as pattern of meiosis and sexual reproduction. (There is great diversity in these attributes among diatom group). One interesting question regarding interrelationships of the genera in the two major monophyletic lineages, that is, gomphonemoids (which are asymmetrical to the broad, or transapical, axis; Fig. 1) and the cymbelloids (which are asymmetrical to the long, or apical, axis; Fig. 2), is the systematic position of the genus *Gomphocymbella*.



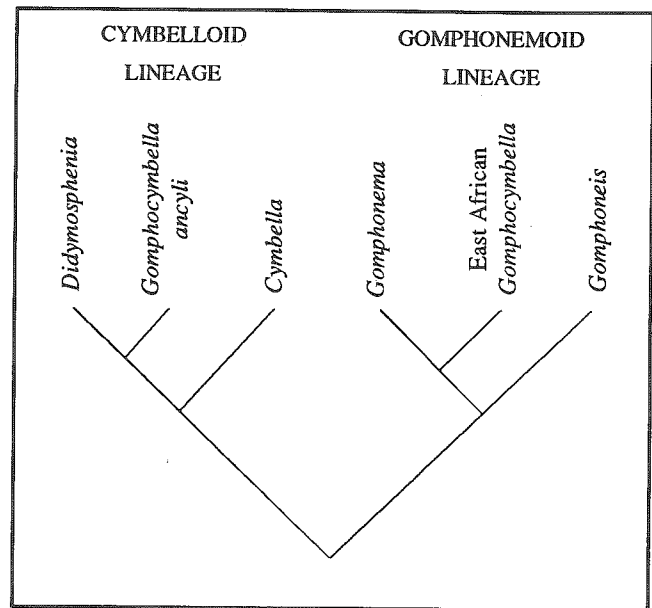
3 *Gomphocymbella becarri*



4 *Gomphocymbella ancyli*

Gomphocymbella has symmetry features of both groups, being asymmetrical to the apical and transapical axes (Fig. 3). Previous workers had considered it to have an intermediate systematic position, between the primitive cymbelloids and the advanced gomphonemoids. *Gomphocymbella* is a small genus with an interesting biogeographic distribution. Five of the six described species are found only in the Rift Valley lakes of East Africa, while a single species, *G. ancyli* (Fig. 4), is known from late glacial and recent habitats in northern Europe and Scandinavia. What historical events could have caused this broad, vicariant distribution?

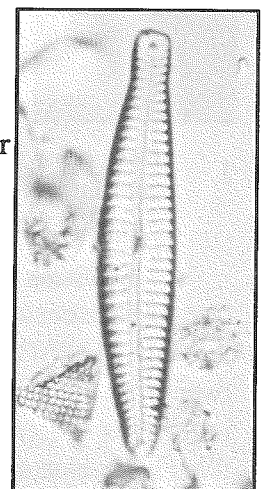
Phylogenetic analysis of relationships within the cymbelloid and gomphonemoid diatoms (Fig. 5) shows that the East African species are closely related to one another and to members of the genus *Gomphonema* in the



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gomphonemoid lineage; that is, they represent gomphonemoid diatoms that have secondarily become cymbelloid. *Gomphocymbella ancyli*, on the other hand, is more closely related to the genus *Cymbella*; it is a highly derived cymbelloid group that has secondarily become gomphonemoid. Representatives of the two different lines have converged on "gomphocymbelloidness." In other words, *Gomphocymbella* in the broad sense is not a natural group and its interesting biogeographical distribution is nothing more than an artefact of grouping unrelated taxa into a single genus.

We have shown further that East African *Gomphocymbella* share a more recent common ancestor with East African species of the large genus *Gomphonema* (Fig. 6), than either does with other taxa. That is, *Gomphonema* species from East Africa are more closely related to *Gomphocymbella* species than they are with other *Gomphonema* species. Likewise, the *Gomphonema* species in Lake Baikal are



6 *Gomphonema africanum*

more closely related to each other than they are to other members of the genus, and in Indonesia, the *Gomphonema* species appear to form a distinct monophyletic line. These results suggest there is some provincialism to diatom groups, something that has only been hinted at in the literature previously.

This has interesting implications not only for phylogeny reconstruction, but also in the way we view diatom communities. The composition of diatom communities in, say, a lake has been viewed as the result of many unrelated invasions (immigrations). Physical, chemical and biological forces are then thought to act on each immigrating species, resulting in its exclusion or, over time, establishment in the lake. Our results on the endemism in East Africa, Lake Baikal and elsewhere suggest the flora in each case is the result, at least in part, of in situ evolution. We continue to examine *Gomphonema* species and related genera on a worldwide basis, to determine if they are truly cosmopolitan/ubiquitous in their distributions or if the distributional patterns are due more to taxonomic practice than phylogenetic history. Collections like those in the Farlow will continue to play an integral role in helping to document the earth's biodiversity, and its evolutionary past.

John Patrick Kociolek holds the G. Dallas Hanna Chair in Diatom Studies at the California Academy of Sciences.

LAMB ALGAL KEY REPRINTED

The *Artificial Key to the Common Marine Algae of New England North of Cape Cod* by I. Mackenize Lamb, Martin H. Zimmermann and Edgar E. Webber (with drawings by Priscilla Fawcett) is available once again. Copies can be obtained from the Publications Office, The Farlow Herbarium, for US \$6.00 each plus \$1.50 for postage & handling.

FOF ESTABLISHES ENDOWMENT ACCOUNT

As long as there is a Harvard Corporation, the Friends of the Farlow will generate income to support the Farlow Library and Herbarium. In December 1992, \$25 000 was transferred from the Friends operating account into an endowment account maintained by the Harvard Corporation, which will grow over time through the accrual of interest. The name of the fund is the "Friends of the Farlow Fund" and the FOF Executive Committee voted that the Fund "is to be used at the discretion of the Curator of the Farlow Reference Library and Herbarium of Cryptogamic Botany, in consultation with the Executive Committee of the Friends of the Farlow, to support, promote and enhance the use, development and care of the collections of the Farlow Library and Herbarium."

FARLOW EXHIBITS IN THE CABOT LIBRARY

The FOF's exhibit during the fall of 1992 of "The Legacy of W. G. Farlow" at Harvard's Cabot Science Library was so successful that plans have been initiated to design another exhibit for this year - a photographic exhibit that explores and highlights the diversity of cryptogams. We would like to invite FOF members to participate in this exhibit. If you are interested, please contact Elizabeth Kneiper at the Farlow by mid-July, 1993.

CORRECTIONS

Newsletter no. 21 (October 1992): p. [3], The structure on the left in the "fruiting bodies" sketched by Thaxter is a myxomycete; the one on the right labelled "S2C" is the *Myxobacterium*.

Newsletter no. 19 (October 1991): p. [2], Charles Atwood Kofoid died in 1947 not 1891.

FARLOW VISITORS

(September 1992 - April 1993)
Excluding members of the Harvard
University community

J. Allen (Cambridge), F. Ayala (Irvine, CA), P. Banerjee (Albany), J. Barrett (West Roxbury), L. Berard (Cambridge), M. Bradley (Arlington, MA), A. Brisk (Boston), S. L. Cooper-Ellis (Northampton), E. L. Davis (Aurora, NY), K. & G. Davis (Holliston), S. Dayanandan (Boston), P. DePriest (Washington, DC), E. K. Dutton (Bethesda), M. Fahey (Concord, MA), J. Finer (Cambridge), N. Flather, Jr. (Newton), G. Gilbert (Balboa, Panamá), N. & S. Gunatillelce (Peradeniya, Sri Lanka), C. Jian-bin (Beijing), E. Harney (Gainesville, NY), E. J. Hebro, Jr. (South Berwick, ME), J. Hinds (Orono), B. Jacobs (Westerly, RI), B. James (Durham, NC), J. A. Kilar (Stamford, CT), E. Koppel (San Diego), P. Kocielek (San Francisco), E. Lay (Boston), R. Libert (Boston), B. Maleson (Jamaica Plain), D. L. Miller (Davis), N. G. Miller (Albany), N. Murphy (Somerville, MA), M. C. Nash (Alberta), G. Parker (Seattle), J. Piasccro (Cambridge), Z. Qiwei (Quzhou, China), E. Reardon (Oberlin), S. K. Rice (Durham, NC), W. Stone (Newton Center, MA), E. Schaechter (Boston), J. P. Tewari (Edmonton), I. Kalani Tewari (Edmonton), B. Thiers (New York), A. Thomas (Ottawa), C. Tong (Shenyang, China), and M., K. & D. Zelmen (Stoughton, MA)

Sarah Cooper-Ellis of Smith College examined herbarium specimens as part of her study of the bryophytes in old growth forests in Massachusetts.

Paula DePriest of the US Herbarium at the Smithsonian examined types in the lichen genus *Cladonia* and the Carroll Dodge collection.

Gregory Gilbert of the Smithsonian Tropical Research Institute in Panamá, searched the Farlow's Weston and Dodge collections from the 1920's and 1930's for records of collections from Barro Colorado Island at the eastern mouth of the Panama Canal. He is compiling a fungal species list for the island.

Jim Hinds of Orono, Maine, used the library to effect revisions on a paper on the lichen genus *Xanthoria* to be published in the new journal, *Maine Naturalist*.

Norton Miller of the Biological Survey of the New York State Museum in Albany investigated

the rarity status of the moss *Heterocladium dimorphum* in eastern North America.

Matthew C. Nash of the Botany Department of the University of Alberta has been a repeated visitor examining literature on *Ulota* as part of his doctoral research on this moss.

Steven K. Rice of Duke University searched the herbarium as part of a morphological character study in the genus *Sphagnum*. He was particularly interested in locating fruiting specimens from which data on perichaetial leaves could be derived. Steve's work at the Farlow was supported by an FOF Graduate Student Fellowship.

Cao Tong of the Institute of Applied Ecology, Academia Sinica, Shenyang, China visited for two weeks in March to work on the "Bryoflora of China" project with Ben Tan.

FOF/AMC LICHEN WORKSHOP

Barry Wulff, former FOF president, and **Elizabeth Kneiper**, current FOF president, will hold a workshop on an "Introduction to Lichens", as part of the Appalachian Mountain Club's (AMC) educational program at the Pinkham Notch Camp in New Hampshire on May 8 & 9, 1993. The workshop will focus on lichen species common to the White Mountains and will include short descriptive lectures, collecting forays around Pinkham Notch and identification exercises. Participants will develop a lichen checklist and a collection of specimens on the foray. Fees are \$70 for AMC members, \$80 for non-members. Contact Elizabeth at the Farlow for more information.

BOOK SALES

Thirty-eight members participated in the 1992 FOF Book Sale and contributed approximately \$1500 to FOF as result of their purchases. Donations of books for the 1993 sale, especially those in botany and cryptogamic botany, continue to be welcome. The 1993 Book Sale list will be mailed to members in early June.

CONSERVATION OF W. G. FARLOW'S COLLECTIONS

At its March meeting, the FOF Executive Committee voted to budget \$500 towards the cost of boxing 188 bound volumes of correspondence housed in the Farlow Archives. **Judith Warnement**, Botany Librarian, who was the invited guest of the Executive Committee described the project as one of her "wish list" items for the library. During a visit to the Farlow by **Nicolas Pickwood**, Harvard's new Chief Conservator, Judy asked his advice on preserving the correspondence volumes. And while Mr. Pickwood found the letters generally in good condition, he recommended that boxes be made to further protect them from dust and dirt that might accumulate atop these decade-old volumes. This is only one in a series of conservation activities supported by the FOF. Last year a flat file was purchased for the library for storage of large format artwork, posters, maps and W. G. Farlow's academic degree certificates. Also, the FOF annually supports treatment of rare books in the Farlow Library in cooperation with the bookbinding program at the North Bennett Street School in Boston.

For over two decades now, the orderly alphabetical juxtaposition of the noun *diatom* and the adjective *diatomic* in *Biological Abstracts'* indexes has repeatedly struck me as incongruous. At first glance, which recurs at nearly monthly intervals, my Darwinian reflexes engage at the sight of high letter-sequence similarity, and Darwin's phrase "propinquity of descent" automatically steps out of some neuron into my consciousness. At these times, I feel that if you rang a bell, I would salivate. But the reflex is misleading. Little Buttercup's warning to the *Pinafore's* (uncomprehending) captain has bearing here: "Things are seldom what they seem; / Skim milk masquerades as cream; /..."

Di-atomic describes something composed of two very small or more-or-less indivisible parts. Such *Biological Abstracts* entries generally reference diatomic molecules, such as O₂. *Diatoms* are usually introduced as cellular organisms modelled on the familiar laboratory Petri dish - a model emphasizing two more-or-less indivisible pieces of glass, overlapping one another to form the cell wall. This might make them seem *di-atoms*, but, in fact, they are *dia-toms* and take roots in other parts of the linguistic tree.

GRANTS

Sam Hammer has recently been awarded a grant from the Hardman Foundation for Evolutionary and Conservation Biology for "Continuing work in the lichen genus *Cladonia*" (one of the few they awarded in 1993).

In addition, Sam received a grant from the Massachusetts Natural Heritage and Endangered Species Program for "A comparative analysis of the extant species and historical collections of the lichen genus *Cladonia* at Myles Standish State Forest. This was the only proposal in cryptogamic botany that received an award - in a crowded field of zoology, botany and ecology-oriented proposals. This work will continue the unique Farlow studies of the collections of C. A. Robbins and G. K. Merrill around Wareham in southeastern Massachusetts.

Elizabeth Lay, Elizabeth Kneiper and Michael Davies have also received support from the Massachusetts Natural Heritage and Endangered Species Program to develop a computer database of the lichen flora of Boston and vicinity.

Their name indicates not cellular anatomy but colonial morphology. Early microscopists examined many algae, which on gross inspection appeared as filaments, as smooth and continuous threads of "pieces" [not yet interpreted as "cells"] glued face-to-face as a stack of coins might be. However, in some, adjacent "pieces" are attached at only a single corner, so that the filament appears as a zigzag sequence of "pieces" - as if the filament were being repeatedly cut (*-tome*) through (*dia-*) to effect its distinctive morphology, such as in Bory's genus *Diatoma*. Inflective evolution has never produced *diatomic* from *diatom* or *diatom* from *diatomic*; rather, these words reflect a convergence resulting from the coincidental resemblance of fusions involving distant roots.

Thus, *diatoms* (so named by S.F. Gray in 1845) are neither *di-atomic* (coined by Roscoe in 1869) nor *diatomic* (which has never arisen), but rather *dia-tom-aceous* (coined by Hooker in 1847), reflecting the broader ties of the family (*-aceae*) than the genus.

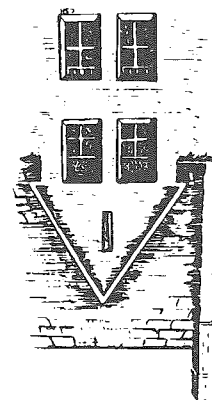
R.K.E.

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FARLOW REFERENCE LIBRARY

OF CRYPTOGAMIC

1993 ANNUAL MEETING

The 1993 Annual Meeting of the Friends of
Farlow has been scheduled for
Saturday, November 6th
at the Farlow.

Friends of the Farlow is an international group of amateur and professional botanists concerned with supporting the programs and resources of the Farlow Reference Library and Herbarium of Cryptogamic Botany of Harvard University. Membership categories are: Associate member, \$5-25; Full member, \$25; Sponsor, \$50-100; Benefactor, \$1000 or more. To join please make your check payable to the **Friends of the Farlow** and send to the address below. The membership year runs from January 1 to December 31. Members receive a discount on Farlow publications, participate in book sales, annual meetings and other events, and receive a special welcome at the Farlow. This newsletter is published twice a year, in April and October. For more information, contact the Farlow Reference Library, 20 Divinity Avenue, Cambridge, MA 02138 USA (Tel. 617-495-2369; FAX 617-495-9484).