

Diatoms Epiphytic on *Sphagnum* Moss in Midwestern Quaking Bogs: Use as Paleolimnological Indicators



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Purpose

We compared diatoms growing on *Sphagnum* moss to those on samples preserved in a museum for 100 years. Our goal was to determine the potential of herbarium samples to infer environmental change over time.

Background

Quaking bogs are known for thick, floating mats of *Sphagnum* moss that promote an acidic environment by uptaking cations and releasing H⁺ (Fig. 1).

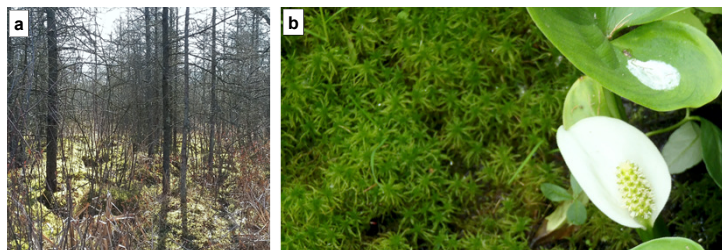


Fig. 1. a) Volo Bog in winter, showing the expanse of green, floating *Sphagnum* mat upon which Tamarack trees and other plants grow. b) Flowering *Calla palustris* growing among *Sphagnum* moss in summer.

Sphagnum absorbs water, providing moist habitats for subaerial, epiphytic algae (Fig. 2).

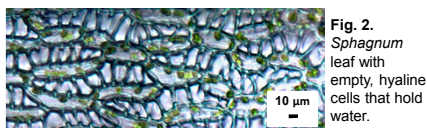


Fig. 2. *Sphagnum* leaf with empty, hyaline cells that hold water.

Methods

We collected *Sphagnum* from hummocks at three quaking bogs within 100 miles of Chicago, Illinois (Fig. 3). Epiphytic diatoms were also obtained from historical *Sphagnum* samples from Volo Bog and nearby Long Lake (Fig. 4).



Fig. 3. Volo, Beulah, and Pinhook Bogs are quaking bogs with floating mats of *Sphagnum* moss. Long Lake, the site of a historical sample, no longer has *Sphagnum*. The yellow box on the U.S. map indicates the study area, blown up to show specific locations.

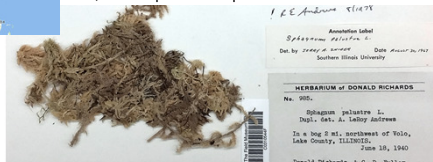


Fig. 4. Herbarium samples from the Field Museum of Natural History were soaked in water and squeezed to dislodge epiphytes.

Acknowledgements

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Results

Most specimens were from seven taxa commonly reported as epiphytic (particularly on bryophytes such as *Sphagnum*) or as acidophilic (Fig. 5, Table 1).

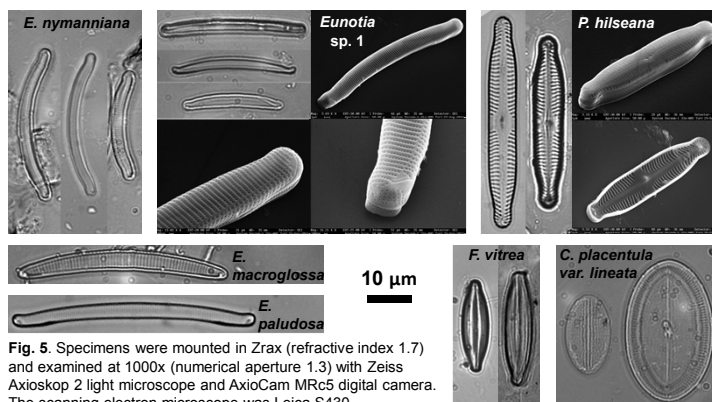


Fig. 5. Specimens were mounted in Zrax (refractive index 1.7) and examined at 1000x (numerical aperture 1.3) with Zeiss Axioskop 2 light microscope and AxioCam MRC5 digital camera. The scanning electron microscope was Leica S430.

Species composition differed among sites, but remained similar over time at Volo Bog (Table 1).

	Modern collections			Herbarium		Autecology
	Beulah Bog	Pinhook Bog	Volo Bog	Volo (1940)	Long L. (1908)	
<i>Cocconeis placentula</i> var. <i>lineata</i> (Ehr.) Van Heurck	—	—	+	—	++	Common epiphyte on aquatic plants ²
<i>Eunotia macroglossa</i> Furey, Lowe, & Johansen	—	—	+	—	—	Epiphytic on bryophytes ³
<i>Eunotia nymanniana</i> Grunow in Van Heurck	—	++	++	++	—	Epiphytic on bryophytes ³ , particularly <i>Sphagnum</i> ⁷
<i>Eunotia paludosa</i> Grunow	+	—	—	—	—	Epiphytic on <i>Sphagnum</i> ^{1,7}
<i>Eunotia</i> sp. 1	++	+	—	—	++	Unknown
<i>Fallacia vitrea</i> (Østrup) Mann (syn. <i>Navicula festiva</i>)	—	+	++	++	—	Epiphytic on bryophytes ⁶ , particularly <i>Sphagnum</i> ⁴
<i>Pinnularia hilseana</i> Janisch	++	+	—	—	++	Low-alkalinity ² or acid waters, usually bogs ⁵

Conclusions

Diatoms were extracted non-destructively from both modern and herbarium *Sphagnum* samples, showing potential for high resolution inference of recent environmental change. Other paleolimnological indicators, such as testate amoebae (Fig. 6) and chrysophyte cysts, were also commonly found.

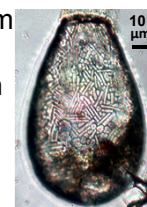


Fig. 6. Testate amoeba epiphytic on Pinhook Bog *Sphagnum*.

Literature Cited

- Buczkó, K. 2004. Bryophytic diatoms from Hungary. Eighteenth International Diatom Symposium (A. Wilkowski, ed.), p. 1-15. Biopress, Bristol.
- Camburn KE, Charles DF. 2000. Diatoms of Low-Alkalinity Lakes in the Northeastern United States. Academy of Natural Sciences of Philadelphia, Philadelphia, PA.
- Furey PC, Lowe RL, Johansen JR. 2011. *Eunotia Ehrenbergii* (Bacillariophyta) of the Great Smoky Mountains National Park, USA. J. Cramer, Stuttgart.
- Kihara Y, Sasaki Y, Arita S, Ohtsuka, T. 2009. Diatoms of Yamakado Moor in Shiga Prefecture, Japan. Diatom 25: 91-105.
- Patrick R, Reimer CW. 1966. The diatoms of the United States. Vol. 1. Monographs of the Academy of Natural Sciences of Philadelphia, 13: 1-688.
- Pouliková A, Bogdanová K, Hekera P, Hájková P. 2003. Epiphytic diatoms of the spring fens in the fishy area of the Western Carpathians. Biologia, Bratislava 58: 749-757.
- Pouliková A, Hájková P, Kintrová K, Batková R, Czudková M, Hájek M. 2013. Tracing decadal environmental change in ombrotrophic bogs using diatoms from herbarium collections and transfer functions. Environmental Pollution 179: 201-209.