

Assessing Microalgal Morphology from Century-Old Herbarium Sheets using SEM

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Traditionally, type specimens have not been deposited for most unicellular algae. There are few known holotypes and those that are available are often of limited use. Samples from taxa described before 1900 commonly consist of materials dried down on herbarium sheets or mica. Dried algal samples can be rehydrated, but preservation is very poor and little structure can be determined from them. Whether wet or dry, the amount of information that can be derived from such samples using conventional light microscopy is limited. However, we were able to derive high-resolution images from *Euglena spirogyra* cells that were dried on mica chips in October of 1899, stored in the Michigan State University herbarium and viewed on a FESEM. The overall shape of the cell body and the arrangement and ornamentation of the pellicle strips were clearly visible. Because of this success we decided to examine a variety of algal samples that had been preserved on mica. Algae such as *Staurastrum*, *Scenedesmus*, or *Mallomonas* (particularly the scales), retained the most structure while others such as *Pediastrum* and *Pandorina*, retained sufficient structure to allow their identification. We suggest that FESEM should be more broadly used for assessing structure in dried herbarium samples.

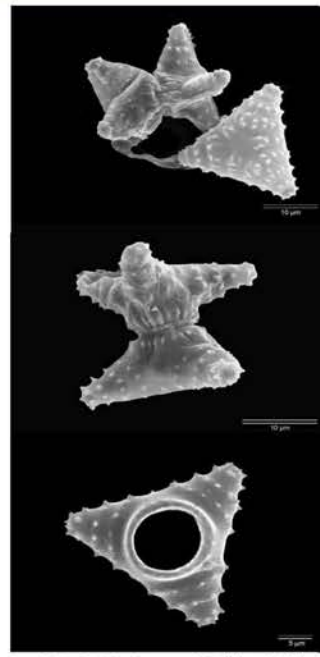
Materials and Methods

All samples were air-dried onto mica chips 75 - 105 years ago. Approximately a 3mm X 5mm sample from each mica chip was removed using a razor blade, and placed onto a SEM stub using double-sided carbon tape. Samples were gold coated and viewed on a JEOL 6300F Field-Emission SEM at 10-kV. Images were captured digitally and stored on CD-R media. Final image processing was done in PhotoShop 7 on a Macintosh computer.

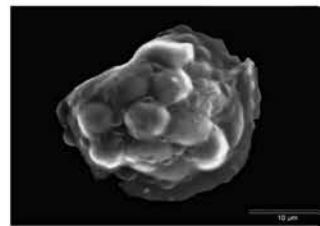
Conclusions

These results show that algae (other than diatoms) deposited in herbariums, even those deposited 100 years or more ago, can be positively identified using FESEM. This study demonstrates the potential of using dehydrated herbarium samples for resolving taxonomic issues when the original description and/or illustration(s) are inadequate, questionable or when the taxon is in need of revision.

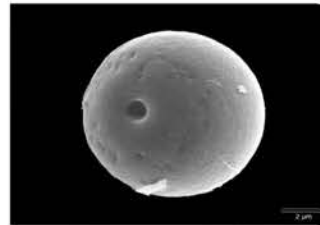
Therefore, we recommend the use of FESEM for use with microalgal herbarium specimens with two caveats. First, samples with hard, shell-like surfaces, scales or with distinctive morphologies are more easily and reliably identified. Second, while samples stored on mica chips are reliable those on herbarium paper tend to dehydrate more, retained less structure and flatten into the fibers of the herbarium paper. Thus, these samples are not useful for identification. ■



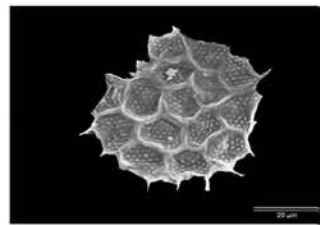
Phycotheca Boreali-Americana. Collins, Holden and Beckett.
1826. *Staurastrum alternans* Bréb.
 Brébisson in Raltz, Brit. Deum., p. 132, Pl. XXI, fig. 7, 1848.
 Wille, Deum. of the U. S., p. 125, Pl. XLII, figs. 20-28, 1854.
 De Tard, Syst. Alg., Vol. I, p. 1101, 1869.
 Round Pond, Tewksbury, Massachusetts, Sept. 21, 1911.
 CHARLES BULLARD.



Phycotheca Boreali-Americana. Collins, Holden and Beckett.
1175. *Pandorina morum* Bory.
 Wille, F. W. Algae of the U. S., p. 101, Pl. CLIII, 1857.
 De Tard, Syst. Alg., Vol. I, p. 509, 1869.
 In a tub of water, campus of the University of California, Berkeley, California, June 6, 1902.
 W. J. V. OSTERTHOFF & H. L. GARDNER.

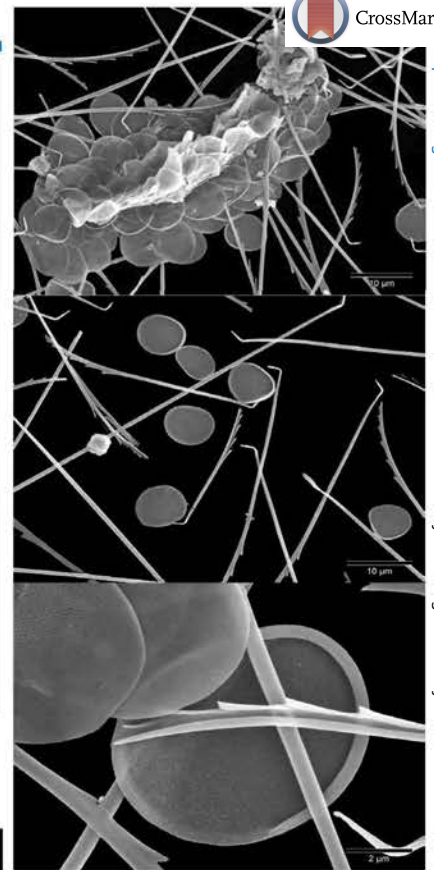


Phycotheca Boreali-Americana. Collins, Holden & Beckett.
Trachelomonas volvocina EHRB.
 Among Mougeotia in a pool in a pasture, Exeter, Rhode Island, April 30, 1911.
 F. S. COLLINS.



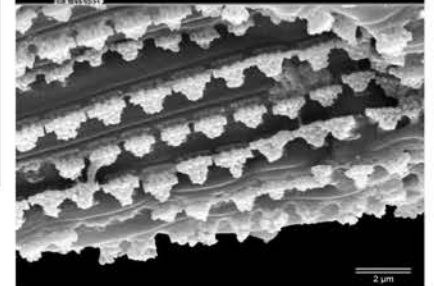
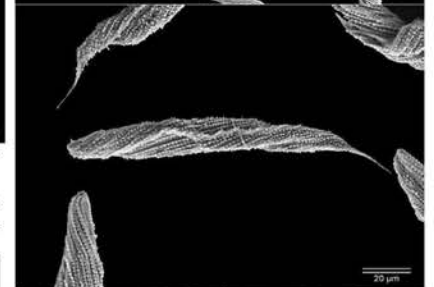
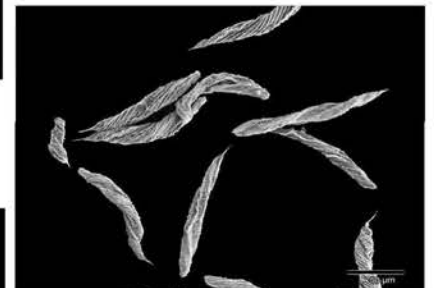
Phycotheca Boreali-Americana. Collins, Holden & Beckett.
1729. *Pediastrum boryanum* (Turp.) Meneg.
 Meneghini, Syn. Diatom., Linnaea, Vol. XIV, p. 810, 1850.
 Wille, Deum. of the U. S., 2d. ed., p. 100, Pl. LXIV, 1857.
 Collins, Green Algae of N. A., p. 157, 1909.
 Helicella Boryanum Turpin, Mem. Mus. Hist. Nat., Vol. XVI, p. 219, 1867.
 In a small pond, Sacramento St., Cambridge, Massachusetts, Nov. 02, 1910.
 CHARLES BULLARD.

This material includes colonies with cells of very different sizes, from very small young colonies, to mature reproductive colonies, part of whose cells are already empty. The older colonies have a granular appearance, agreeing with var. granulatum (Kuetz.). A. Braun; the smaller colonies are quite smooth.



W. MIGULA. Cryptogamiae Germaniae, Austriae et Helvetiae exsiccatae Fasc. 58 Algen

No. 287 *Mallomonas caudata* Iwanoff.
 Rügen: Herbarium, im Plankton.
 1. August 1928. leg. Dr. W. KRIEGER



JOSAPHINE E. TILDEN. American Algae.
304. *Euglena spirogyra* EHRB. in Stein. Pflanzl. Atlas pl. 20. f. 7-9. 1878.
 Plant (or animal) elongate, sometimes sigmoid, unilacinate, 185 mic. in length; longitudinal striae finely knobbed; paramylon-bodies large, two in number.
 Fayette, Iowa.

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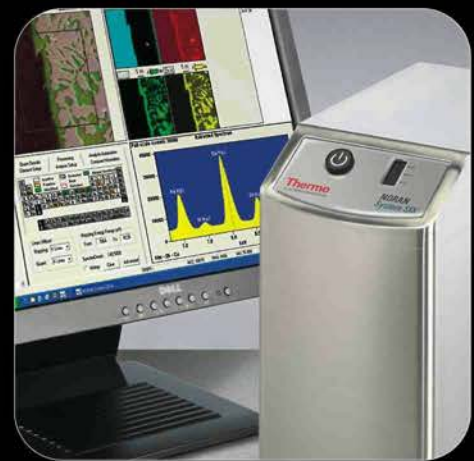
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