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*Iowa Lakeside Laboratory*

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## Diatoms (Bacillariophyceae) From the Excelsior Fen-complex, Dickinson Co., Iowa, With the Description of Two New Taxa.

CHARLES W. REIMER<sup>1</sup>

This paper presents a summary list of the presently known diatom flora of the Excelsior Fen-complex and a description of two new taxa: *Navicula incompta* var. *incurva* Reim. var. nov. and *Stauroneis bobbjergii* Reim. sp. nov. Notes on some physico-chemical parameters of the habitat and on the ecology of the taxa are included.

INDEX DESCRIPTORS: diatoms, fens, diatom taxonomy, diatom ecology, *Navicula incompta* var. *incurva* var. nov., *Stauroneis bobbjergii* sp. nov.

Holte & Thorne (1962) reported on an unusual series of 27 fens in the valley floor and on the bordering slopes of Dugout Creek (Excelsior Twp., Sections 10 & 15, Dickinson Co., Iowa). In addition to a general description of the fen-complex, maps and water chemistry data, a list of 71 flowering plants was included. Of this total, 31% (22 taxa) had been reported neither from nearby Silver Lake fen nor from the "Wisconsin Fens" (Curtis, 1959).

These calcareous fens are generally circular to oblong in shape and range in size from about 10 meters to over 120 meters across. The hydrostatic pressure of the high ground-water table in this area causes year-around extrusion of water from points at, or near, the fen summits.

Some of the larger fens support a good "summit growth" of rushes (*Scirpus* sp.) which produce a thick mass of surface duff as they die and collapse. This soggy, unconsolidated mass of plant material supports good growth of mosses and occasionally liverworts. On their downhill slopes there are well developed terrace pools, some of which contain conspicuous purplish, reddish, or grayish carpets of sulfur bacteria and tufts of the green alga *Chara* sp. A few terrace pools contain the aquatic flowering plant bladderwort, identified by Holte & Thorne (1962) as *Utricularia minor* Chapm. and *U. vulgaris* L. Beneath the open water in the pools there is a quite thick deposit of first grayish, then black, calcareous muck. All of these are excellent habitats for substantial diatom growth.

The work of Holte & Thorne (1962) attracted the interest of diatomists Shobe, Stoermer & Dodd of Iowa State University and Iowa Lakeside Laboratory. In the summer of 1962 they made a series of diatom collections from Fen #11. In a report on their findings (Shobe et al., 1963) they listed 38 species, 4 varieties, 5 forms and 2 taxa identified to genus only.

Since that time, the only other published records of diatoms from this area have added the following diatom species: *Cylindrotheca gracilis* (Bréb. ex Kütz.) Grun. (Christensen & Reimer, 1968) . . . found in Dugout Creek only, and *Anomoeoneis fogedii* Reim. (1982) from fen #7.

Each summer since 1966, the author, diatom students and guests at Iowa Lakeside Laboratory have visited and made collections in Dugout Creek and the Excelsior fens. Prepared slides and identifications from this material have been incorporated in the Iowa Lakeside Laboratory (ILL) Diatom Herbarium. All fen records are now added to those of Shobe, et al. (1963) to form the basis of this summary report (132 taxa).

Two diatoms recently noted in fen collections are described here as new: *Stauroneis bobbjergii* sp. nov. and *Navicula incompta* var. *incurva* var. no.

### PROCEDURES

Specimens of Shobe et al. (1963) are deposited in the Botany

Department of Iowa State University. Slides and determinations listed as "Standpipe" and "Herb." (Herbarium) are a part of the ILL Herbarium.

Water chemistry data (Table 2) are from literature sources, as given, and from readings made by the author. All readings were taken with a Hach Portable Water Lab. (DR-EL).

Ecological-spectrum data were gleaned from Foged (1982, 1984, 1986, 1987), Lowe (1974), Beaver (1981) and from the Diatom Ecology Literature File (Diatom Herbarium, ANSP) which contains cataloged information from 68 major papers on diatom ecology. Spectrum categories for individual taxa are incorporated as a part of Table 1.

As is true of virtually all research data on a given subject, there is some disagreement in the literature on ecological category designations. The categories assigned to a few taxa had to be selected principally on amount and overall agreement of literature reports. In some cases, the author has relied on his own experience for final choice of category.

### TAXONOMIC SECTION

*Stauroneis bobbjergii* sp. nov.

Fig. 1a, 1b.

Valva linearis marginibus leniter convexis, apicibus protractis subrostratis vel rostratis, stauro et pseudoseptis apicalibus. Area axialis angusti-linearis. Area centralis rectangularis striis (una, duobis) brevibus ad margines. Raphe filiformis extremis distalibus in eodem directione deflexis. Striae radiatae ad extremitates parallelae vel sensim convergentes. Puncta parum clavis. Longitudo 14-26  $\mu$ m. Latitudo 4-4.5  $\mu$ m. Striae 18-20 in 10  $\mu$ m., ad apices circa 25-27 in 10  $\mu$ m.

Holotypus in coll. diatom. ILL #SP 7.

Valve linear with slightly convex margins and protracted subrostrate to rostrate ends. Stauros across valve center and a pseudoseptum at each apex. Axial area narrow linear. Central are quadrangular with one or two short striae at the margins. Raphe filiform; proximal raphe ends blunt, distal ends curved slightly in the same direction. Striae radiate becoming mostly parallel, sometimes slightly convergent, at the ends; indistinctly punctate. Length 14-26  $\mu$ m. Width 4-4.5  $\mu$ m. Striae 18-20 in 10  $\mu$ m becoming ca. 22 in 10  $\mu$ m at ends. Puncta ca. 25-27 in 10  $\mu$ m.

Holotype: ILL #SP 7. Iowa, Dickinson Co., Excelsior Fen #11. "S. edge of S. knob; in *Scirpus* shade on moss." Coll: R.L. Mitchem, July 25, 1972.

Special comment on individual features: a) The length of the pseudoseptum seems to be dependant upon valve size, i.e. in shorter valves the pseudoseptum is not as well expressed as in larger valves and is easily overlooked; b) The stauros is only moderately dense, but can be seen upon careful focusing; c) The puncta are visible under oblique lighting, but lie close together. With a valve width of about 4  $\mu$ m, enumeration of the puncta, comprising the short striae lying across a convex valve face, is difficult under the light microscope.

This diatom is similar to *Stauroneis thermicola* (Peters.) Lund

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Table 1. Cumulative list of diatoms identified from the Excelsior Fen-complex, Dickinson Co., Iowa.

Taxa	SS&D <sup>a</sup>	S-pipe <sup>b</sup>	Herb. <sup>c</sup>	H <sup>d</sup>	pH <sup>e</sup>
<i>ACHNANTHES</i>					
<i>affinis</i> Grun.	x	-	-	Oi	Aph
<i>lanceolata</i> (Bréb.) Grun.	x	-	-	Oi	Aph
<i>microcephala</i> (Kütz.) Grun.	x	-	-	Oi	Ind
<i>minutissima</i> Kütz.	-	x	-	Oi	Aph
<i>AMPHORA</i>					
<i>coffeiformis</i> (Ag.) Kütz.	-	x	-	M	Abi
<i>ovalis</i> (Kütz.)	x	-	-	Oi	Aph
<i>ovalis</i> v. <i>affinis</i> (Kütz.) V.H. ex DeT.	-	x	-	Oi	Aph
<i>ovalis</i> v. <i>pediculus</i> (Kütz.) V.H. ex DeT.	-	-	x	Oi	Aph
<i>veneta</i> v. <i>capitata</i> Haw.	-	-	x	Oi	Aph
<i>ANOMOEONEIS</i>					
<i>fogedii</i> Reim.	-	-	x	—	—
<i>sphaerophora</i> (Ehr.) Pfitz.	-	x	-	Oh	Aph
<i>CALONEIS</i>					
<i>alpestris</i> (Grun.) Cl.	x	x	-	Oi	Aph
<i>bacillum</i> (Grun.) Cl.	x	-	x	Oi	Aph
<i>limosa</i> (Kütz.) Patr. (= <i>schumanniana</i> Grun.)	x	-	x	Oi	Aph
<i>COCCONEIS</i>					
<i>placentula</i> Ehr.	x	-	-	Oi	Aph
<i>CYMBELLA</i>					
<i>affinis</i> Kütz. [= <i>parva</i> (W. Sm.) Kirchn.]	x	-	x	Oi	Aph
<i>cesati</i> v. <i>linearis</i> Reim.	x	-	-	Oi	Aph
<i>cymbiformis</i> v. <i>nonpunctata</i> Font.	-	-	x	Oi	Aph
<i>diluviana</i> (Krasske) Florin	-	-	x	Oi	Aph
<i>microcephala</i> Grun.	x	-	-	Oi	Aph
<i>microcephala</i> v. <i>crassa</i> Reim.	-	-	x	—	—
<i>minuta</i> v. <i>silesiaca</i> (Bleis. ex Rabh) Reim.	-	x	-	—	—
<i>naviculiformis</i> Auersw. ex Heib.	x	-	-	Oi	Ind
<i>norvegica</i> Grun.	x	-	x	Oi	Ind
<i>perpusilla</i> A. Cl.	x	-	-	Hpo	Acp
<i>subaequalis</i> Grun. ex Heib.	-	x	-	Oi	Aph
<i>DENTICULA</i>					
<i>elegans</i> Kütz.	x	-	x	Oi	Aph
<i>elegans</i> f. <i>valida</i> Pedic.	-	x	-	—	—
<i>DIPLONEIS</i>					
<i>elliptica</i> (Kütz.) Cl.	-	-	x	Oi	Ind
<i>oblongella</i> (Naeg. ex Kütz.) Ross	-	-	x	Oi	Aph
<i>ovalis</i> (Hilse) Cl.	x	-	-	Oi	Aph
<i>EPITHEMIA</i>					
<i>adnata</i> v. <i>saxonica</i> (Kütz.) Patr.	-	-	x	Oi	Aph
<i>argus</i> (Ehr.) Kütz.	x	-	x	Oi	Aph
<i>argus</i> v. <i>alpestris</i> Grun.	-	x	-	Oi	Aph
<i>argus</i> v. <i>longicornus</i> (Ehr.) Grun.	-	-	x	Oi	Aph
<i>emarginata</i> Andrews	-	-	x	—	—
<i>ocellata</i> (Ehr.) Kütz.	-	x	-	Oi	Aph
<i>sorex</i> Kütz.	-	x	-	Oi	Abi
<i>turgida</i> (Ehr.) Kütz.	-	-	x	Oi	Abi
<i>turgida</i> v. <i>westermanni</i> (Ehr.) Grun.	-	-	x	Oi	Abi
<i>EUNOTIA</i>					
<i>curvata</i> (Kütz.) Lagerst.	x	-	-	Oi	Ind
<i>FRAGILARIA</i>					
<i>bicapitata</i> A. Mayer	x	-	-	Oi	Ind
<i>capucina</i> Desm.	-	x	-	Oi	Aph
<i>vaucheriae</i> (Kütz.) Peters. (= <i>intermedia</i> Grun. in V.H.)	-	x	x	Oi	Aph
<i>FRUSTULIA</i>					
<i>weinholdii</i> Hust.	x	-	-	Oi	Aph
<i>GOMPHONEMA</i>					
<i>affine</i> Kütz.	-	x	-	Oi	Ind
<i>angustatum</i> (Kütz.) Rabh.	x	-	-	Oi	Aph
<i>brebissonii</i> Kütz.	-	-	-	Oi	Ind
<i>clevei</i> Fricke	-	x	-	Oi	Aph

Table 1. Continued

Taxa	SS&D <sup>a</sup>	S-pipe <sup>b</sup>	Herb. <sup>c</sup>	H <sup>d</sup>	pH <sup>e</sup>
<i>dichotomum</i> Kütz.	-	x	-	Oi	Aph
<i>gracile</i> Ehr. em. V.H. [as: v. <i>auritum</i> (Braun) Grun. in V.H.]	-	-	x	Oi	Ind
<i>intricatum</i> Kütz.	x	-	x	Oi	Aph
<i>parvulum</i> (Kütz.) Kütz.	-	x	-	Oi	Ind
<i>subclavatum</i> (Grun.) Grun.	x	-	-	Oi	Aph
HANTZSCHIA					
<i>amphioxys</i> f. <i>capitata</i> O. Müll.	x	-	x	Oi	Ind
MASTOGLIOIA					
<i>doddii</i> Stoerm. ex Hungerf.	-	-	x	—	—
<i>grevillei</i> W. Sm.	x	-	x	Oi	Aph
<i>smithii</i> v. <i>amphicephala</i> Grun.	-	x	-	Oh	Abi
<i>smithii</i> v. <i>lacustris</i> Grun.	-	x	-	Oi	Aph
MELOSIRA					
<i>granulata</i> (Ehr.) Ralfs	-	x	-	Oi	Aph
NAVICULA					
<i>abiskoensis</i> Hust.	-	x	x	Oi	Ind
<i>arvensis</i> Hust.	-	x	-	—	—
<i>biconica</i> Patr.	-	x	-	—	—
<i>capitata</i> Ehr.	-	-	x	Oh	Aph
<i>cincta</i> v. <i>rostrata</i> Reim.	-	x	x	Oh	Abi
<i>cryptocephala</i> v. <i>veneta</i> (Kütz.) Rabh.	-	x	-	Oi	Aph
<i>dicephala</i> v. <i>subcapitata</i> Grun.	x	-	x	—	—
<i>elginensis</i> v. <i>rostrata</i> (A. Mayer) Patr.	-	x	-	—	—
<i>heufleuri</i> Grun.	-	-	x	Oh	Aph
<i>heufleuri</i> v. <i>leptocephala</i> (Bréb.) Perag.	-	x	-	Oi	Aph
<i>incompta</i> v. <i>incurva</i> var. nov.	-	-	x	—	—
<i>mediocris</i> v. <i>intermedia</i> Reim.	-	-	x	—	—
<i>menisculus</i> v. <i>obtusa</i> Hust.	-	x	-	Oi	Aph
<i>oblonga</i> (Kütz.) Kütz.	x	-	x	Oi	Aph
<i>odiosa</i> Wallace	-	x	-	Oh	Aph
<i>oppugnata</i> Hust.	x	-	-	Oi	Aph
<i>pelliculosa</i> (Bréb. ex Kütz.) Hilse	-	x	-	Oi	Aph
<i>potzgeri</i> Reim.	x	-	-	—	—
<i>pseudobryophila</i> Hust.	-	-	x	—	—
<i>pupula</i> Kütz.	-	x	x	Oi	Ind
<i>pupula</i> v. <i>capitata</i> Skv. & Meyer (as: f.)	x	-	-	Oi	Ind
<i>pupula</i> v. <i>rectangularis</i> (Greg.) Grun.	x	-	-	Oi	Ind
<i>pygmaea</i> Kütz.	-	-	x	M	Aph
<i>radiosa</i> v. <i>parva</i> Wallace	-	-	x	Oi	Ind
<i>radiosa</i> v. <i>tenella</i> (Bréb. ex Kütz.) Grun.	x	x	-	Oi	Ind
<i>salinarum</i> v. <i>intermedia</i> (Grun.) Cl.	-	x	-	Oi	Aph
<i>seminulum</i> Grun.	x	x	-	Oi	Aph
<i>simplex</i> Krasske	x	x	x	Oi	Aph
<i>stankovici</i> Hust.	x	-	-	—	—
<i>subcontenta</i> Hust.	-	x	x	—	—
<i>tridentula</i> Krasske	-	x	-	Oi	Ind
<i>vasta</i> Hust.	-	-	x	—	—
<i>viridula</i> v. <i>argunensis</i> Skv.	-	x	-	—	—
NEIDIUM					
<i>affine</i> v. <i>undulatum</i> (Grun.) Cl.	-	-	x	Oi	Aph
<i>iridis</i> v. <i>vernalis</i> Reich.	x	-	-	Oi	Ind
NITZSCHIA					
<i>amphibia</i> Grun.	x	x	x	Oi	Aph
<i>bryophila</i> Hust.	-	x	-	—	—
<i>communis</i> Rabh.	-	x	-	Oi	Aph
<i>commutata</i> Grun.	-	-	x	Oi	Aph
<i>denticula</i> Grun.	x	x	x	Oi	Aph
<i>dissipata</i> (Kütz.) Grun.	-	x	-	Oi	Aph
<i>frustulum</i> v. <i>perminuta</i> Grun.	-	x	-	Oi	Ind
<i>kuetzingiana</i> Hilse	-	x	-	Oi	Aph

Table 1. Continued

Taxa	SS&D <sup>a</sup>	S-pipe <sup>b</sup>	Herb. <sup>c</sup>	H <sup>d</sup>	pH <sup>e</sup>
<i>linearis</i> W. Sm.	-	x	-	Oi	Aph
<i>linearis</i> v. <i>tenuis</i> (W. Sm.) Grun.	-	-	x	Oi	Aph
<i>palea</i> (Kütz.) W. Sm.	-	x	-	Oi	Aph
<i>vitrea</i> v. <i>scaphiformis</i> Wisl. & Poretz.	-	x	-	M	Abi
PINNULARIA					
<i>abaujensis</i> v. <i>linearis</i> (Hust.) Patr.	-	-	x	—	—
<i>gentilis</i> (Donk.) Cl.	-	-	x	Oi	Ind
<i>mesolepta</i> (Ehr.) W. Sm.	-	-	x	Oi	Ind
<i>microstauron</i> (Ehr.) Cl.	-	-	x	Oi	Ind
<i>neglecta</i> (A. Mayer) A. Berg	-	-	x	Oi	Aph
<i>substomatophora</i> Hust.	-	-	x	Oi	Aph
<i>streptoraphe</i> v. <i>musciicola</i> Skv.	-	-	x	Oi	Aph
<i>subcapitata</i> Greg.	x	-	-	Oi	Ind
<i>viridis</i> (Nitz.) Ehr.	x	-	x	Oi	Ind
RHOICOSPHENIA					
<i>curvata</i> (Kütz.) Grun.	x	-	-	Oi	Abi
RHOPALODIA					
<i>gibba</i> (Ehr.) O. Müll.	x	-	x	Oi	Abi
<i>gibba</i> v. <i>ventricosa</i> (Ehr.) Grun.	-	-	x	Oi	Abi
<i>gibberula</i> (Ehr.) O. Müll.	x	-	-	M	Abi
<i>gibberula</i> v. <i>vanheurckii</i> O. Müll.	-	x	x	—	—
STAURONEIS					
<i>anceps</i> Ehr.	x	x	-	Oi	Ind
<i>anceps</i> f. <i>linearis</i> (Ehr.) Hust.	-	x	-	Oi	Ind
<i>borrichii</i> (Peters.) Lund	-	-	x	Oi	Aph
<i>bovbjergii</i> sp. nov.	-	-	x	—	—
<i>phoenicenteron</i> (Nitz.) Ehr.	-	-	x	Oi	Ind
<i>phoenicenteron</i> f. <i>gracilis</i> (Ehr.) Hust.	x	x	x	Oi	Aph
<i>phoenicenteron</i> f. <i>linearis</i> (Ehr.) Hust.	-	x	-	—	—
SYNEDRA					
<i>acus</i> Kütz.	-	x	-	Oi	Aph
<i>amphicephala</i> Kütz.	-	x	x	Oi	Aph
<i>ulna</i> (Nitz.) Ehr.	-	x	x	Oi	Ind
<i>ulna</i> v. <i>danica</i> (Kütz.) V.H.	-	x	-	Oi	Ind

<sup>a</sup>SS&D = Shobe, Stoermer & Dodd (1963).

<sup>b</sup>S-pipe = Standpipe (on fen #2); microhabitat research project in progress (with C. D. McIntire). Prepared slides from ILL and ANSP Herbaria.

<sup>c</sup>Herb. = ILL Herbarium; accessioned slides.

<sup>d</sup>H = Halobion Spectrum; see Table 3.

<sup>e</sup>pH = pH Spectrum; see Table 3.

(1946). It can best be distinguished by the presence of short striae bordering the central (stauros) area and by the coarser striae. Petersen (1928, pp. 394-395) says: "striis in medio 18 in 10 u, apices versus densioribus". His illustration (fig. 20) shows the striae becoming about twice as numerous toward the apices as in the center. Hustedt (1959, pp. 800-801) says the striae are "etwa 24 in 10 u. . . an den Polen als 30 (bis etwa 36) in 10 u".

Named in honor of Dr. Richard V. Bovbjerg, Director of Iowa Lakeside Laboratory during the 24 summers of my service there. During Dr. Bovbjerg's tenure as director, Lakeside Laboratory has become an outstanding field-research, teaching and student apprenticeship haven.

*Navicula incompta* var. *incurva* var. nov. Fig. 2  
Differt a var. *incompta* per forma marginum concavarum et per strias radiatas clare praeter in apicibus. Longitudo 16-22 um. Latitudo 3 um. Striae 20-21 in 10 um., ad apices 24 in 10 um. Puncta circa 27-30 in 10 um.

Holotypus: in coll. diatom. ILL #L-6-46.

Differs from the nominate variety by the concave shape of the valve body and the distinctly radiate striae on the valve body. Length 16-22 um. Width 3 um. Striae 20-21 in 10 um, at apices to 24 in 10 um.

Holotype: ILL #L-6-46. Iowa, Dickinson Co., "Excelsior Fen. Pipettings from terrace pool". Coll: G.A. Cunningham #2. July 16, 1972.

The nominate variety (*incompta*) is described by Krasske (1932, p. 116, Taf.3, fig. 21) as being lanceolate in shape with only slightly radiate striae. Other features are not different.

*Navicula subcontenta* Hust. 1942

Fig. 3

Length 15-19 um. Width 4 um. Striae 24 in 10 um to 27 in 10 um near ends.

This diatom has not been reported from the United States. Actually, the only distribution record I can find in the literature for this taxon is the one given by Hustedt (1942) in the original

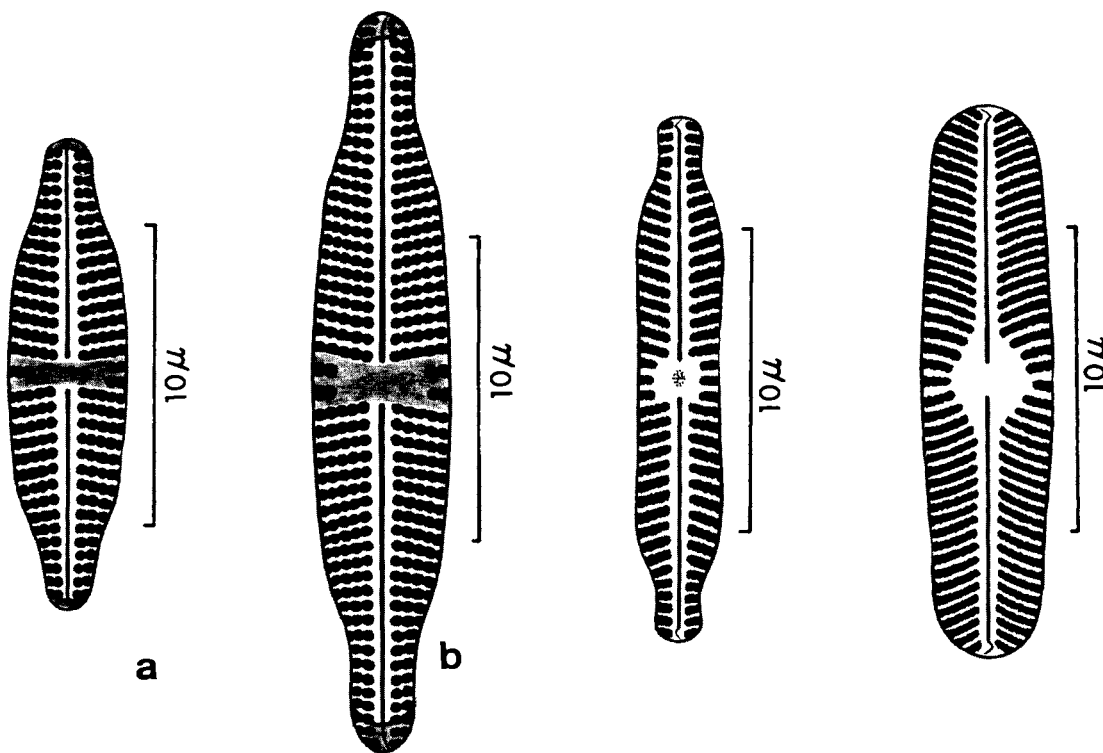


Fig. 1

Fig. 2

Fig. 3

Fig. 1-3. Fig. 1a, 1b. *Stauroneis bovbjergii* sp. nov. Fig. 2. *Navicula incompta* var. *incurva* var. nov. Fig. 3. *Navicula subcontenta* Hust.

description (Indomalayan Archipelago, Celebes).

Locality: Iowa, Dickinson Co., Excelsior Fen #11. "S. edge of S. knob. In *Scirpus* shade, on moss". Coll: R.L. Mitchem. July 25, 1972.

## RESULTS AND DISCUSSION

The taxonomic list of diatoms included in this report (Table 1) should be considered as only a part of the actual gene pool present in the Excelsior Fen-complex since: a) only about 8 of the 27 fens have ever been collected, and b) the fall, winter and spring diatom floras have not yet been examined. When we have a more complete account of the actual number of diatom taxa the fens support, we will be in a much better position to know how many are truly endemic; whether they are endemic to these particular fens, or are merely restricted to habitats with similar physico-chemical properties.

From our past experiences we can say that there are many taxa in the fens which have not been found in the myriad of habitats already sampled in Dickinson Co. Of the diatoms presently known from these fens (Table 1), there are 9 taxa which represent single records for the United States (fide: U.S. Distribution File, ANSP). They are: *Anomoeoneis fagedii*, *Navicula pseudobryophila*, *N. stankovici*, *N. subcontenta*, (Fig. 3), *N. vasta*, *N. incompta* var. *incurva*, *Pinnularia neglecta*, *P. streptoraphe* var. *musicola* and *Stauroneis bovbjergii*.

Five other fen taxa have been reported from only one or two other places in the United States. They are: *Cymbella cesatii* var. *linearis* (Indiana, Randolph Co., Cabin Creek Raised Bog) (Reimer, 1962),

*Mastogloia doddii* (Iowa, Dickinson Co., Lake West Okoboji) (Hungerford, 1982), *Navicula dicephala* var. *subcapitata* (Iowa, Marion Co., South Falls) (Stoermer, 1962), *N. mediocris* var. *intermedia* (Louisiana, Bossier Parrish, Cypress Bayou) (Kalinsky, 1982); South Carolina, Aiken Co., Upper Three Runs Creek) (Reimer, 1966), *Nitzschia bryophila* (Mississippi, Oktibbeha Co., Sessum's Creek) (O'Quinn & Sullivan, 1983) and *N. vitrea* var. *scaphiformis* (Iowa,

Table 2. Physico-chemical data from the Excelsior Fen-complex.

	H&Th 1961 <sup>a</sup>	SS&D 1962	Reimer 1977 <sup>c</sup>
Temperature	10-32°C	9.8-28.4°C	10.5°C
pH	6.7-8.3	7.3-7.9	7.5
Alkalinity (Tl.)	285-380 ppm	220-620 ppm	—
Hardness (Tl.)	515-770 ppm	870-960 ppm	660-690 ppm
(Ca)	385-620 ppm	725-850 ppm	—
NO <sub>3</sub>	0.1-40.0 ppm	0.58-0.7 ppm	1.0-1.5 ppm
SiO <sub>2</sub>	1.0-2.0 ppm	24.5-39.4 ppm	16 ppm
PO <sub>4</sub>	1.0-2.0 ppm	0.16-0.3 ppm	1.5 ppm
SO <sub>4</sub>	300-7,300 ppm	880-1,000 ppm	—
Cl	5.0 ppm	0.8-3.2 ppm	—

<sup>a</sup>Holte & Thorne (1962)

<sup>b</sup>Shobe, Stoermer & Dodd (1963)

<sup>c</sup>Reimer (unpubl. data taken in 1977)

Table 3. Summary of Halobion and pH Spectrum-categories assigned to 109 (of the 132) diatom taxa found in the Excelsior Fen-complex.

<i>Halobion<sup>a</sup></i> <i>Spectrum</i>	# of taxa in fens	% of 109 taxa
Mesohalob (M)	4	3.5
Oligohalob:		
halophil (Oh)	6	5.0
"indifferent" (Oi)	98	90.0
Halophobe (Hpo)	1	<1.0
<i>pH</i> <i>Spectrum<sup>a</sup></i>		
Alkalibiont (Abi)	11	10.0
Alkaliphil (Aph)	66	60.0
"Indifferent" (Ind)	31	29.0
Acidophil (Acp)	1	<1.0
Acidobiont	0	0.0

<sup>a</sup>vide: Hustedt (1956)

Dickinson Co., Caylor Prairie swale (Reimer, 1970); (Utah, Tooele Co., Blue Lake, thermal springs & marshes) (Kaczmarzka & Rushforth, 1983, 1984).

As for the fen habitat itself, the data in Table 2 indicate that this fen complex is, indeed, an alkaline, hard water environment (principally calcium hardness). It also shows high sulfates and low chlorides, generally high phosphates and probably widely fluctuating nitrates and silicon. Measured water temperatures (summer) varied from about 10 degrees C. at or near the water extrusion sources to about 32 degrees C. in the fen pools.

It is not surprising that we find heavy incrustations on many of the aquatic plants in the fen pools. . . and also frequent "etching" of empty diatom frustules noted occasionally in our collections, indicating early silicon dissolution under alkaline conditions.

Ecological data [halobion (relative conductivity?) and pH spectra] (Hustedt, 1956, 1957) for the Excelsior Fens diatoms have been summarized in Table 3. Ninety five percent of the 109 taxa categorized (Table 1) are listed as oligohalob, 3.5% as mesohalob (!) and less than 1% as halophob. The pH spectrum shows 70% as either alkalibiont or alkaliphil, 29% as circumneutral or "indifferent" and less than 1% as acidophil.

Even with the possibility of some identification or ecological spectrum innaccuracy, the overall agreement between chemical data and taxon-spectrum reports demonstrates the use of diatoms as indicators of certain environmental parameters is justified, particularly when applied to components of an entire community (assemblage). The utility of such an approach has already been demonstrated by several others in studies on environmental assessment (i.e. Hustedt, 1957; Foged, 1982) and environmental reconstruction (i.e. DelPrete & Schofield, 1981; Smol et al., 1986; Charles, et al., 1989).

These fen habitats occupy only a minuscule part of the land mass in the state of Iowa. . . a refugium for certain diatoms and, perhaps, for other cryptogamic plants. Continued study of the diatom flora in the Excelsior Fens should be encouraged. Companion studies of other algal groups (see: Whitford, 1956) are also highly desirable as added baselines for future studies on algal community dynamics.

The fens represent a unique laboratory, ideally suited not only for diatom floristic study, but for field-laboratory study of ecological interactions that require small undisturbed biotopes for a better understanding of small-life processes.

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## REFERENCES

- BEAVER, J. 1981. Apparent ecological characteristics of some common freshwater diatoms. Ministry of the Environment, Ontario, Canada. 517 pp.
- CHARLES, D., R. W. BATTARBEE, I. RENBERG, H. VAN DAM and J. P. SMOL. 1989. Paleocological analysis of lake acidification trends in North America and Europe using diatoms and Crysophytes. Acid Precipitation, Vol. 4. Soils, Aquatic processes and lake acidification, 207-275. Springer Verlag, NY, NY.
- CHRISTENSEN, C. L. and C. W. REIMER. 1968. Notes on the diatom *Cylindrotheca gracilis* (Breb. ex Kütz.) Grun: Its ecology and distribution. Proceedings of the Iowa Academy of Science, 73:36-41.
- CURTIS, J. T. 1959. The vegetation of Wisconsin. University of Wisconsin Press, Madison, Wisconsin, 657 pp.
- DEL PRETE, A. and C. SHOFIELD. 1981. The utility of diatom analysis of lake sediments for evaluating acid precipitation effects on dilute lakes. Archiv für Hydrobiologie, 91(3):332-340.
- FOGED, N. 1982. Diatoms in Bornholm, Denmark. Bibliotheca Phycologica, 59:1-175.
- FOGED, N. 1984. The diatom flora in springs in Jutland, Denmark (Springs III). Bibliotheca Diatomologica, 4:1-119.
- FOGED, N. 1986. Diatoms in Anholt, a danish island in the Carregat. Nova Hedwigia, 42(2-4):553-589.
- FOGED, N. 1987. Diatoms from Viti Levu, Fiji Islands. Bibliotheca Diatomologica, 14:1-195.
- HOLTE, K. E. and R. F. THORNE. 1962. Discovery of a calcareous fen complex in Northwest Iowa. Proceedings of the Iowa Academy of Science, 69:54-60.
- HUNGERFORD, J. 1982. Diatoms (Part IV): Identification. Iowa Science Teacher's Journal, 19(3):29-33.
- HUSTEDT, F. 1942. Süßwasser-Diatomeen des indomalayischen Archipels und der Hawaii-Inseln. Internationale Revue der gesamten Hydrobiologie und Hydrographie, 42:58-59, fig. 105.
- HUSTEDT, F. 1956. Kieselalgen (Diatomeen), Kosmos Verlag, Franckh'sche Verlagshandlung, Stuttgart, 70 pp., 4 p.
- HUSTEDT, F. 1957. Die Diatomeenflora des Flusssystemes der Weser im Gebiet der Hansestadt Bremen. Abhandlung herausgegeben vom Naturwissenschaftlichen Verein zu Bremen, 34(3):181-441.
- HUSTEDT, F. 1959. Die Kieselalgen Deutschlands, Österreichs und der Schweiz unter Berücksichtigung der übrigen Länder Europas sowie der angrenzenden Meeresgebiete. in: Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Österreich und der Schweiz, 7(2):6:800-801.
- KACZMARZKA, I. and S. R. RUSHFORTH. 1983. The diatom flora of Blue Lake Warm Spring, Utah, U.S.A. Bibliotheca Diatomologica, 2:1-123.
- KACZMARZKA, I. and S. R. RUSHFORTH. 1984. Diatom associations in Blue Lake Warm Spring, Tooele Co., Utah, U.S.A. Proceedings of the Seventh International Diatom Symposium, 345-358. Otto Koeltz, Koenigstein.
- KALINSKY, R. G. 1982. Notes on Louisiana diatoms. II A preliminary checklist of the diatom flora of Cypress Bayou Reservoir, Bossier Parrish, Louisiana. Proceedings of the Louisiana Academy of Science, 45:124-127.
- KRASSKE, G. 1932. Beiträge zur Kenntnis der Diatomeenflora der Alpen. Hedwigia, 72(3):116, pl. 3, fig. 21.
- LOWE, R. 1974. Environmental requirements and pollution tolerance of fresh water diatoms. U.S. Environmental Protection Agency, EPA 670/4-74-005, 334pp.
- O'QUINN, R. and M. J. SULLIVAN. 1983. Community structure dynamics of epilithic diatoms in a Mississippi stream. Journal of Ecology, 19(2):123-128.

- PETERSEN, J. BOYE. 1928. The aërial algae of Iceland, in: *The Botany of Iceland*, 2(2)8:394-395, text fig. 20. J. Frimodt, Copenhagen.
- REIMER, C.W. 1962. Some aspects of the diatom flora of Cabin Creek Raised Bog, Randolph Co., Indiana. *Proceedings of the Indiana Academy of Science for 1961*, 71:305-319.
- REIMER, C.W. 1966. Consideration of fifteen diatom taxa (Bacillariophyta) from the Savannah River including seven described as new. *Notulae Naturae* #397:1-15.
- REIMER, C.W. 1970. Some diatoms (Bacillariophyceae) from Cayler Prairie, *Beihefte zur Nova Hedwigia*, Heft 31:235-249.
- REIMER, C.W. 1982. Four unreported diatom (Bacillariophyceae) taxa from Northwest Iowa. *Beihefte zur nova Hedwigia*, 73:267-273, fig. 1a, 1b.
- SHOBE, W.R., E.F. STOERMER and J.D. DODD. 1963. Notes on Iowa diatoms IV, the diatoms in a Northwest Iowa fen. *Proceedings of the Iowa Academy of Science*, 70:71-74.
- SMOL, J.P., R.W. BATTARBEE, R.B. DAVIS and J. MERILAINEN. 1986. Diatoms and lake acidity. Reconstructing pH from siliceous remains in lake sediments. Dr. R. W. Junk, Dordrecht, Boston, Lancaster, 307 pp.
- STOERMER, E.F. 1962. Notes on Iowa diatoms II. Species distribution in a subaerial habitat. *Proceedings of the Iowa Academy of Science*, 69:87-96.
- WHITFORD, L. A. 1956. The communities of algae in the springs and spring streams of Florida. *Ecology*, 37(3):433-442.