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

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

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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 bovbjergii* 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 bovbjergii* 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 sulfer 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 *Ultricularia 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 bovbjergii* 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 bovbjergii sp. nov. Fig. la, lb.
Valva linearis marginibus leniter convexis, apicibus protractis subrostratis vel rostratis, stauro et pseudoseptis apicalibus. Area axialis angusti-linearis. Area centralis rectangularis striis (una, duabis) brevibus ad margines. Raphe filiformis extremis distalibus in eodem directione deflexis. Striae radiatae ad extremitates parallelae vel sensim convergentes. Puncta parum claris. Longitudo 14-26 um. Latitudo 4-4.5 um. Striae 18-20 in 10 um., ad apices circa 25-27 in 10 um.

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 um. Width 4-4.5 um. Striae 18-20 in 10 um becoming ca. 22 in 10 um at ends. Puncta ca. 25-27 in 10 um.

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 um, 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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Contribution No. 439 from Iowa Lakeside Laboratory

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

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

Table 1. Continued

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

Table 1. Continued

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

[a]SS&D = Shobe, Stoermer & Dodd (1963).

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

[c]Herb. = ILL Herbarium; accessioned slides.

[d]H = Halobion Spectrum; see Table 3.

[e]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

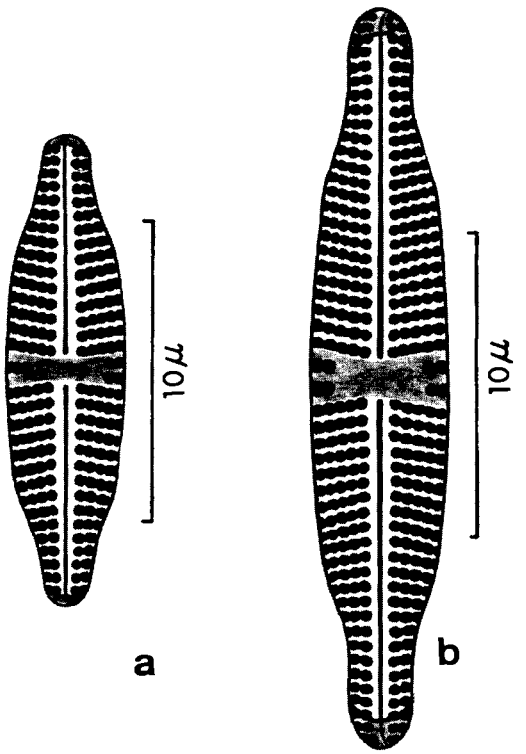

Fig. 1

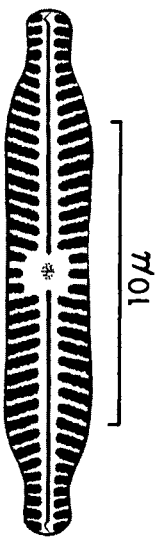

Fig. 2

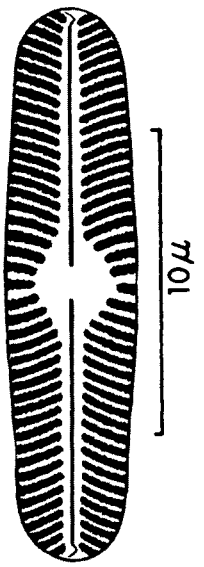

Fig. 3

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 fogedii, 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[a]	SS&D 1962	Reimer 1977[c]
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_3	0.1-40.0 ppm	0.58-0.7 ppm	1.0-1.5 ppm
SiO_2	1.0-2.0 ppm	24.5-39.4 ppm	16 ppm
PO_4	1.0-2.0 ppm	0.16-0.3 ppm	1.5 ppm
SO_4	300-7,300 ppm	880-1,000 ppm	—
Cl	5.0 ppm	0.8-3.2 ppm	—

[a]Holte & Thorne (1962)
[b]Shobe, Stoermer & Dodd (1963)
[c]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.

Halobion[a] *Spectrum*	*# 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
pH Spectrum[a]		
Alkalibiont (Abi)	11	10.0
Alkaliphil (Aph)	66	60.0
"Indifferent" (Ind)	31	29.0
Acidophil (Acp)	1	<1.0
Acidobiont	0	0.0

[a]vide: Hustedt (1956)

Dickinson Co., Caylor Prairie swale) (Reimer, 1970); (Utah, Tooele Co., Blue Lake, thermal springs & marshes) (Kaczmarska & 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 innacuracy, 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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