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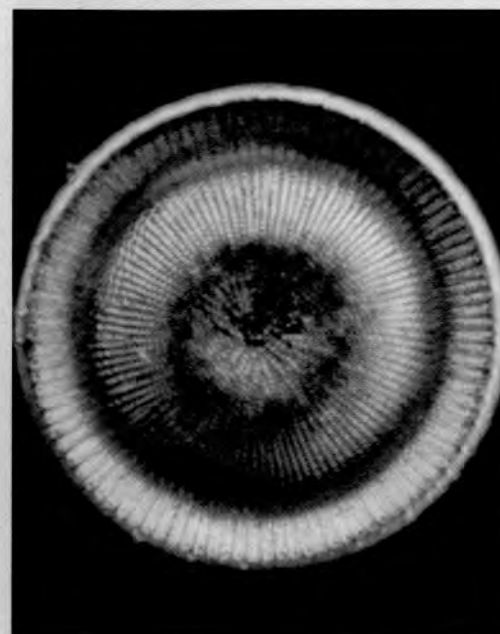
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Little Imp Publications



In this Issue:-

The Alga-Flora of Yorkshire	Page 1
The Amician Mystery	Page 31
Another Mill	Page 39
Favourite Locations - Mallorca	Page 39
Glass Needles	Page 41
Field Microscopes - Meopta	Page 43
Amici's Test	Page 45
Recording your observations	Page 49
Cleaning for fluid mounts	Page 50
Navicula pseudo-mastogloia	Page 51
An Amician Test slide	Page 52

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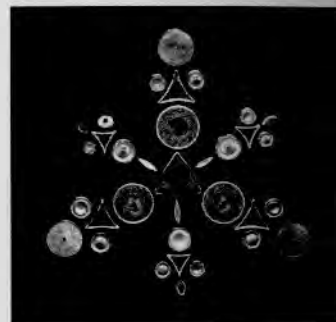
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Front cover picture: What I would like to achieve!

The Value of Lists

We have been asked why we print lists and what value they have. Conversely we have had a number of communications applauding these features and requesting more.

Transcription of the Diatom related portion of **THE ALGA-FLORA of YORKSHIRE**

By

W. West and G. S. West

Originally published in the Botanical Transactions of the Yorkshire Naturalist's Union Vol. 5. 1901.

There are one or two anomalies in the listing that the reader should be aware of.

The first concerns the location of 'Wherside'. In most records this appears in the MID West location, however, in two records - Nos. 979 and 985, it appears as a North West location. Whether this is intentional or simply an error is unclear.

Ingleby Greenhow is different to Ingleby.

Notes:- (a) Varieties have been given the same number as the species but with an alphabetic suffix. This is an addition to the original listing. (b) Collector names have been given in full where these are known. This is also an extension to the original listing.

The sites, in general, are located at places where there is a railway station, this being the most efficient mode of transport of the time. Easy access to the remote locations via steam train on day excursions will have enabled the collectors of the day to collect more widely than hitherto had been the case. In many cases it is possible to retrace their steps. On arrival at a station it is likely that the collector would be limited to the immediate area before embarking for the next collecting point down the line.

BACILLARIEAE ORDER RAPHEIDIEAE. FAMILY CYMBELLEAE. GENUS AMPHORA Ehrenb., 1831.

798. *Amphora ovalis* Kutz.

S.W. - Roche Abbey (E. Hunter). Marley, near Bingley. Cullingworth. Near Keighley. Doncaster. Askern, Cusworth and Hatfield districts; Firsby Reservoirs; Roche Abbey; Rossington (M. H. Stiles).

MID W. - South Milford (William Barwell Turner). Baildon. Moughton Fell. Malham Cove (J. M. Kirk). Malham Tarn. Kilnsey. Otley. Boston Spa. Ingleton.

N.W. - Cotterdale. Jervaulx Abbey.

N.E. - Seamer. Scarborough Mere. Whitby. Staindale. Cornelian Bay. Saltburn.

S.E. - Routh. Beverley. Tickton. Loftsme Bridge, near Wressle. Market Weighton.

798a. *Amphora ovalis* var. *affinis* Kutz.

S.W. - Cusworth district (M. H. Stiles).

798a. *Amphora ovalis* var. *Pediculus* Kutz. [Syn. *Amphora Pediculus* (Kutz.) Grun.; *Amphora minutissima* W. Sm.]

S.W. - Heaton. Hatfield district; Doncaster town water; Roche Abbey (M. H. Stiles).

N.W. - Mickel Fell.

N.E. - Staithes.

S.E. - Beverley; Cottingham; near Woodmancy; Newbald (George Norman).

799. *Amphora Normanii* Rabenh.

S.E. - Hull (George Norman). Growing on wall of greenhouse.

800. *Amphora hyalina* Kutz.

S.W. - Goole (E. Hunter).

GENUS CYMBELLA Ag., 1830.

801. *Cymbella Ehrenbergii* Kutz.

S.W. - Cusworth, near Doncaster! (M. H. Stiles).

MID W. - Malham Tarn.

N.E. - Scarborough Mere. Seamer.

S.E. - Hornsea Peat Deposit; Cottingham; Spring Ditch (George Norman).

802. *Cymbella cuspidata* Kutz.

S.W. - Greetland, near Halifax. Roche Abbey (J. Newton Coombe). Swill Hill. Ogden Clough. Liversedge! (Rev. W. Fowler). Cragg Vale, towards Blackstone Edge. Askern and Cusworth districts (M. H. Stiles).

MID W. - Adel Bog. Rombald's Moor. Harrogate! (George Norman). Near Norwood Hall, above Lindley Reservoir. Eldwick. Ribbleshead. Boston Spa. Cocket Moss, near Giggleswick. Hawksworth Springs. Ilkley.

N.E. - Levensham. Terrington. Saltersgate (George Norman).

S.E. - Beverley. Tickton. Cottingham (George Norman).

802a. *Cymbella cuspidata* var. *naviculiformis* Auersw.

S.W. - Cusworth, Hatfield, and Roche Abbey districts (M. H. Stiles).

803. *Cymbella subaequalis* Grun.

S.W. - Cusworth district, Doncaster (M. H. Stiles).

804. *Cymbella delicatula* Kutz.

S.W. - Cusworth district, Doncaster (M. H. Stiles).

805. *Cymbella affinis* Kutz.

S.W. - Marley, near Bingley. Ogden Clough. Crimsworth Dean.

MID W. - Near Buckden. Penyghent. Harrogate.

N.E. - Rievaulx Abbey.

806. *Cymbella gastroides* Kutz.

S.W. - Goole; Roche Abbey Lake (E. Hunter). Askern and Hatfield districts; Firsby Reservoirs (M. H. Stiles). Marley, near Bingley.

MID W. - Baildon. Ribbleshead. Ingleton. Simon's Fell (iv. 1892).

807. *Cymbella lanceolata* (Ehrenb.), Kirchn. [Syn. *Cocconema lanceolatum* Ehrenb.].

S.W. - Cusworth district; Doncaster town water; Firsby Reservoirs; Rossington; Hatfield district (M. H. Stiles). Askern (F. H. Allen; J. M. Kirk; M. H. Stiles). Hatfield Chase (J. M. Kirk). Roche Abbey (J. Newton Coombe; M. H. Stiles). Nab Wood, near Bingley. Bradford.

MID W. - Birk Cragg, Harrogate (George Norman). Roundhay (William Barwell Turner). Baildon. Moughton Fell. Holden Gill, near Keighley. Horton-in-Ribblesdale. Arthington. Malham Tarn Bog. Buckden.

N.E. - Staindale. Hayburn Wyke. Cleave Cliffs, north of Scalby. Carlton Bank. Stokesley.

S.E. - Beverley. Spring Ditch; Wawne; Risby Pond; Newbald; Hornsea Peat Deposit; Driffild (George Norman).

807a. *Cymbella lanceolata* var. *Boechii* Ehrenb.; Rabenh. [non *Doryphora Boechii* W. Sm. = *Breissonia Boechii* (Kutz.) Grun.].

S.W. - Roche Abbey (E. Hunter).

808. *Cymbella cymbiformis* (Kutz.) Breb. [Syn. *Cocconema cymbiforme* (Kutz.) Ehrenb.].

S.W. - Woolley. Bradford. Ogden Clough. Roche Abbey (J. Newton Coombe; M. H. Stiles). Askern and Cusworth districts; Firsby Reservoirs; Doncaster town water (M. H. Stiles).

MID W. - Roundhay (William Barwell Turner). Baildon. Moughton Fell. Wherside (1900 ft.).

N.W. - Frequent. Great Sloddale.

S.E. - Riccall Common. Beverley. Hull. Spring Ditch; Newsholme Lake (George Norman).

808a. *Cymbella cymbiformis* var. *parva* (W. Sm.) V. H. [Syn. *Cocconema parvum* W. Sm.].

S.W. - Askern district; Doncaster town water (M. H. Stiles). Goole; Roche Abbey (E. Hunter). Bradford. Bingley. Denholme.

MID W. - Baildon. Wigton Moor. Holden Gill, near Keighley. Cowside Beck, Arncliffe. Cocket Moss, near Giggleswick.

N.E. - Common. Staindale. Hayburn Wyke. Saltburn.

N.W. - Dodd Fell.

S.E. - Anlaby Road (Dr. Munroe). Hull (George Norman).

809. *Cymbella Cistula* (Hempr.) Kirchn. [Syn. *Cocconema Cistula* Hempr.].

S.W. - Bradford. Roche Abbey (J. Newton Coombe; M. H. Stiles). Askern, Cusworth, and Hatfield districts; Rossington; Firsby Reservoirs and Doncaster town water (M. H. Stiles).

MID W. - Rombald's Moor. Moughton Fell. Arthington. Staveley Dam, near Knaresborough. Cowside Beck. Arncliffe. Linn Gill. Wherside.

N.W. - Dodd Fell. Cautley Spout.

N.E. - Common. Staindale.

S.E. - Beverley! Loftsme Bridge, near Wressle. Spring Ditch; Hornsea Peat Deposit; Skirlaugh; Wawne (George Norman).

809a. *Cymbella Cistula* var. *maculata* (Kutz.) Grun. [Syn. *Cymbella maculata* Kutz.].

S.W. - Firsby Reservoirs (M. H. Stiles).

MID W. - Boston Spa.

N.W. - Lund's Fell.

S.E. - Ditch, Anlaby to Hessle Road; Beverley; Cottingham; Haltenprice; Reservoir Waterworks, Hull (George Norman).

810. *Cymbella truncata* Rabenh.

MID W. - Esholt.

811. *Cymbella helvetica* Kutz.

MID W. - Ingleton. Shipley Glen. Cowside Beck, Arncliffe, Dropping Well, Knaresborough.

N.E. - Rievaulx Abbey. Saltersgate (George Norman).

S.E. - Spring Ditch; Market Weighton Canal (George Norman).

812. *Cymbella laevis* Nag.

MID W. - Ingleton, on wet rocks, amongst *Cladophora glomerata*

GENUS ENCYONEMA Kutz., 1834.

813. *Encyonema prostratum* (Berk.) Ralfs.

S.W. - Roche Abbey (J. Newton Coombe; M. H. Stiles). Bradford. Firsby Reservoirs; Hatfield district (M. H. Stiles).

MID W. - Harrogate (George Norman). Malham Tarn (H. F. Parsons). Moughton Fell. How Hill, Markington (Rev. J. S. Tute!). Ribbleshead. Near Otley. Knaresborough. Ingleborough.

N.W. - Muker.

N.E. - Terrington, Ingleby Greenhow.

S.E. - Wawne; Reservoir Waterworks, Hull (George Norman).

814. *Encyonema turgidum* (Greg.) Grun. [Syn. *Cymbella turgida* Greg.].

S.W. - Wibsey. Denholme. Liversedge! (Rev. W. Fowler).

MID W. - Bolton Woods. Simon's Fell. Linn Gill. Rombald's Moor.

N.E. - Scalby Beck. Ingleby Greenhow.

815. *Encyonema Caespitosum* Kutz.

S.W. - Bradford. Allerton. Bingley. Mirfield. Roche Abbey (J. Newton Coombe; M. H. Stiles). Firsby Reservoirs. Rossington; Hatfield district (M. H. Stiles).

MID W. - Birk Cragg, Harrogate (George Norman). Ingleborough. Arthington. Rombald's Moor. Malham Tarn.

N.W. - Cautley Spout. Romalldkirk, Rokeby.

N.E. - Rievaulx Abbey. Malton.

S.E. - Tickton. Routh. Beverley. Wawne; Hull (George Norman).

816. *Encyonema ventricosum* (Ag.) Kutz. [Syn. *Cymbella ventricosa* Ag.].

S.W. - Coley, near Shelf.

MID W. - Ingleton! (H. F. Parsons); with sporangial valves, ix. 1898. Roundhay (William Barwell Turner).

Baildon. Ingleborough. Rombald's Moor. Ribbleshead. Boston Spa. Harrogate. Moughton Fell.
N.W. - Dodd Fell. Mickle Fell.
S.E. - Routh. Near Sutton. Beverley. Skirlaugh; Near Cottingham; Benningholme (George Norman).

817. *Encyonema gracile* Rabenh.

S.W. - Cullingworth. Cragg Vale, towards Blackstone Edge.
MID W. - Wigton Moor. Kilnsey. Cocket Moss, near Giggleswick.
S.E. - Skipwith Common.

817a. *Encyonema gracile* var. *Scotica* (W. Sm.) Van Heurck. [Syn. *Cymbella scotica* W. Sm.]

N.E. - Saltersgate (George Norman).
S.E. - Cottingham (George Norman).

FAMILY NAVICULEAE.

GENUS MASTOGLOIA Thw., 1848.

818. *Mastogloia Smithii* Thw.

S.W. - Askern district (M. H. Stiles).
MID W. - Baildon, vii. 1893.
S.E. - Near Stoneferry (George Norman).

819. *Mastogloia Dansei* Thw.

S.E. - Outlet, Hornsea Mere (George Norman).

GENUS STAURONEIS Ehrenb., 1843.

820. *Stauroneis Phoenicenteron* (Nitzsch) Ehrenb.

S.W. - Bradford. Keighley Tarn. Askern. Cusworth, and Hatfield districts (M. H. Stiles).
MID W. - Harrogate (George Norman). South Milford (William Barwell Turner). Malham Tarn. Wigton Moor. Bowland Knotts.
N.E. - Near Scarborough. Seamer. Strensall. Terrington. Pilmoor, near Thirsk. Saltersgate (George Norman).
N.W. - Jervaulx Abbey.
S.E. - Tickton. Cottingham; Skirlaugh; Risby Pond; Market Weighton; Hornsea Peat Deposit (George Norman).

821. *Stauroneis gracilis* Ehrenb.

S.W. - Hatfield district (M. H. Stiles). Doncaster.
MID W. - Shipley Glen. Langeliffe, near Settle.
S.E. - Near River Hull; Hornsea Peat Deposit; Spring Ditch; Haltenprice (George Norman).

822. *Stauroneis acuta* W. Sm. [Syn. *Pleurostaurum acutum* Rabenh.].

MID W. - Bog at the bottom of Shipley Glen, in abundance (iv. 1895).
N.W. - Great Shunnor Fell.
S.E. - Hornsea Peat Deposit; Risby Pond (George Norman).

823. *Stauroneis salina* W. Sm.

S.E. - In brackish water, near Stoneferry; outlet, Hornsea Mere; ditch near River Hull (George Norman).

824. *Stauroneis anceps* Ehrenb.

S.W. - Roche Abbey (J. Newton Coombe; M. H. Stiles). Doncaster town water; Hatfield district (M. H. Stiles). Halifax.
MID W. - Baildon. Adel. Wigton Moor. Malham Tarn.
N.W. - Mickle Fell. Jervaulx Abbey.
N.E. - Whitby. Strensall. River Derwent at Forge Valley.
S.E. - Routh. Tickton. Spring Ditch; Cottingham; Beverley; Wawne; Haltenprice; Hornsea Peat Deposit (George Norman).

824a. *Stauroneis anceps* var. *linearis* (Kutz.) Van Heurck. [Syn. *Stauroneis linearis* Kutz.].

N.W. - Jervaulx Abbey.

825. *Stauroneis Legumen* Ehrenb. [Syn. *Pleurostaurum Legumen* Rabenh.; *Stauroneis Smithii* Grun.; *S. linearis* W. Sm.]

S.W. - Rossington (M. H. Stiles). Marley, near Bingley. Shipley.
MID W. - Killinghall (George Norman). Baildon.

S.E. - Beverley; Cottingham; Market Weighton Canal (George Norman).

GENUS NAVICULA Bory (1822).

826. *Navicula nobilis* (Ehrenb.) Kutz. [Syn. *Pinnularia nobilis* Enrenb.]

S.W. - Askern district (M. H. Stiles). Marley, near Bingley. Cullingworth. Hatfield Chase (J. M. Kirk). Doncaster.

MID W. - Austwick. Baildon. Rombald's Moor. Eldwick. Moughton Fell. Cocket Moss, near Giggleswick.
N.W. - Mickle and Cronkley Fells.

N.E. - Strensall. Pilmoor, near Thirsk. Terrington. Seamer.

S.E. - Beverley. Cottingham; Hornsea Peat Deposit (George Norman).

826a. *Navicula nobilis* var. *Dactylus* (Ehrenb.) V. H. [Syn. *Pinnularia Dactylus* Enrenb.]

MID W. - Wigton Moor.
N.W. - Mickle Fell. Great Shunnor Fell.

827. *Navicula major* Kutz. [Syn. *Pinnularia major* (Kutz.) Rabenh.]

S.W. - Askern, Cusworth, and Hatfield districts; Firsby Reservoirs (M. H. Stiles). Bradford. Swill Hill. Ogden Clough. Keighley Moor. Doncaster.

MID W. - Baildon. Eldwick. Harrogate (George Norman). Malham Tarn. Wigton Moor. Ilkley. Bolton Woods. Boston Spa. Black Hill, near Settle. Bog two miles south of Clapham.

N.W. - Great Sleddale. Jervaulx Abbey. Bog near Widdale Beck. Cronkley Fell. Mickle Fell.

N.E. - Pilmoor, near Thirsk. Carlton Bank. Stokesley. Strensall. Seamer. Levisham.

S.E. - Market Weighton; Hornsea Peat Deposit; Spring Ditch (George Norman).

828. *Navicula viridis* Kutz. [Syn. *Pinnularia viridis* (Ehrenb.) Rabenh.].

S.W. - Askern, Cusworth, and Hatfield districts; Firsby Reservoirs; Rossington; Doncaster (!) town water (M. H. Stiles). Cragg Vale, towards Blackstone Edge. Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe). Greetland, near Halifax. Bradford. Oxenhope. Keighley Moor.

MID W. - Harrogate (George Norman). South Milford (William Barwell Turner). Ilkley. Kildwick. Malham Tarn. Leathley. Black Hill, near Settle. Cowgill Wold Moss, Widdale Fell. Boston Spa. Horsforth. Bowland Knotts (pure gathering). Bog two miles south of Clapham. Whernside. Penyghent. Ribbleshead.

N.W. - Penhill Beacon. Bog near Widdale Beck (with auxospores). Jervaulx Abbey. Mickle Fell. Baugh Fell.
N.E. - Saltburn. Saltersgate (George Norman).

S.E. - Beverley. Loftsome Bridges near Wressle. Near Meaux Abbey. Tickton. Near Sutton. Newsholme. Skipwith Common (Rev. W. Fowler !). Market Weighton. Cottingham; Spring Ditch; Skirlaugh; Driffeld; Haltenprice; Hornsea Peat Deposit; Reservoir Waterworks, Hull (George Norman).

828a. *Navicula viridis* var. *Commutata* Grun. [Syn. *Navicula hemiptera* auct. nec Kutz.].

S.W. - Askern district; Doncaster town water (M. H. Stiles).

829. *Navicula hemiptera* Kutz.

N.E. - Rocky stream, Saltersgate (George Norman).

830. *Navicula cardinalis* Ehrenb. [Syn. *Pinnularia cardinalis* Ehrenb.].

S.W. - Doncaster.

MID W. - Adel Bog. Baildon.

N.W. - Cronkley Fell.

S.E. - Hornsea Peat Deposit (George Norman).

831. *Navicula lata* Breb. [Syn. *Pinnularia lata* (Breb.) Rabenh.]. Rare.

MID W. - Blubberhouses (William Barwell Turner). Appletreewick. Malham Tarn. Near Buckden.

N.W. - Mickle Fell. Great Shunnor Fell. Great Sleddale. Snaizholme Fell.

N.E. - Moorland stream, near Scarborough.

832. *Navicula alpina* (W. Sm.) Ralfs. [Syn. *Pinnularia alpina* W. Sm.]. Rare.

S.W. - Cullingworth. Keighley Moor (iv. 1897).

N.W. - Mickle Fell. Bog near Widdale Beck.

833. *Navicula borealis* (Ehrenb.) Kutz. [Syn. *Pinnularia borealis* Ehrenb.].

MID W. - Bolton Woods. Ingleton.

N.E. - Carlton Bank.

S.E. - Benningholme; Market Weighton Canal (George Norman).

834. *Navicula Rabenhorstii* (Ralfs) Grun. [Syn. *Pinnularia Rabenhorstii* Ralfs; *P. interrupta* Rabenh.].
 S.W. - Marley, near Bingley.
 MID W. - Harrogate (George Norman).
 N.W. - Cronkley Fell. Great Shunnon Fell.
 N.E. - Levisham. Glaisedale.
 S.E. - Risby Pond; Wawne (George Norman).
835. *Navicula divergens* (W. Sm.) Ralfs. [Syn. *Pinnularia divergens* W. Sm.].
 MID W. - Cocket Moss, near Giggleswick.
 N.W. - Mickle and Cronkley Fells. Great Shunnon Fell.
 N.E. - Carlton Bank, Seamer.
 S.E. - Cottingham (George Norman).
836. *Navicula Hilseana* Janish.
 S.W. - Cragg Vale, towards Blackstone Edge.
 MID W. - Near Buckden. Bog two miles south of Clapham.
 N.W. - Mickle Fell.
837. *Navicula Brebissonii* Kutz. [Syn. *Pinnularia Brebissonii* (Kutz.) Rabenh.; *Pinnularia stauroneiformis* W. Sm.].
 S.W. - Manningham Park, Bradford. Cullingworth. Keighley Tarn. Cragg Vale, towards Blackstone Edge.
 MID W. - Adel Bog. Eldwick. Wigton Moor. Earl's Seat. Whernside. Cocket Moss, near Giggleswick. Bolton Woods. Bog two miles south of Clapham. Penyghent. Harrogate (George Norman).
 N.W. - Mickle Fell. Penhill Beacon. Near Keld. Cronkley Fell. Up to 2200 ft. in Swaledale. Bog near Widdale Beck.
 N.E. - Carlton. Lockton. Cleave Cliffs, north of Scalby. Terrington.
 S.E. - Tickton. Near Meaux Abbey. Beverley. Skipwith Common (Rev. W. Fowler !). Cottingham; Spring Ditch; Skirlaugh; Reservoir Waterworks, Hull (George Norman).
838. *Navicula Tabellaria* (Ehrenb.) Kutz. [Syn. *Pinnularia Tabellaria* Ehrenb.].
 MID W. - Eldwick. Cocket Moss, near Giggleswick. Bog two miles south of Clapham.
 N.W. - Great Shunnon Fell.
 N.E. - Lockton. Saltersgate (George Norman).
838a. *Navicula Tabellaria var. acrosphaeria* Rabenh. [Syn. *Pinnularia acrosphaeria* Rabenh.].
 MID W. - Eldwick.
 N.W. - Birkdale Tarn Moss.
 N.E. - Terrington.
 S.E. - Peat Deposit, Filey.
839. *Navicula gibba* (Ehrenb.) Kutz. [Syn. *Pinnularia gibba* Ehrenb.].
 S.W. - Cullingworth.
 MID W. - Boston Spa. Wigton Moor. Eldwick. Horsforth.
 N.W. - Mickle and Cronkley Fells. Great Shunnon Fell. Great Sleddale.
 N.E. - Lockton. Terrington. Pilmoor, near Thirsk. Saltersgate (George Norman).
 S.E. - Risby Pond; Haltenprice; Cottingham (George Norman).
840. *Navicula bicapitata* Lagerstedt.
 S.W. - Cullingworth.
 MID W. - Cocket Moss, near Giggleswick. Bog two miles south of Clapham
841. *Navicula appendiculata* (Ag.) Kutz.
 S.W. - Shipley. Cragg Vale, towards Blackstone Edge.
 MID W. - Linn Gill. Cocket Moss, near Giggleswick. Bowland Knotts. Giggleswick Common.
 N.W. - Bog near Widdale Beck.
 N.E. - Carlton Bank, Near Scarborough.
 S.E. - Newsholme.
842. *Navicula mesolepta* Ehrenb. [Syn. *Pinnularia mesolepta* W. Sm.].
 S.W. - Marley, near Bingley. Cullingworth. Farnley. Cragg Vale, towards Blackstone Edge. Near Shipley.
 MID W. - Harrogate (George Norman). Boston Spa, Whernside. Ribbleshead.
 N.W. - Mickle Fell.

N.E. - Near Scarborough. Terrington. Saltersgate (George Norman).
 S.E. - Tickton. Beverley. Near Meaux Abbey. Haltenprice; Hornsea Peat Deposit; Beverley Parks (George Norman).
843. - *Navicula Legumen* Ehrenb.
 S.W. - Firsby Reservoirs and Doncaster town water. (M. H. Stiles).
844. *Navicula oblonga* Kutz. [Syn. *Pinnularia oblonga* (Kutz.) Rabenh.].
 S.W. - Askern, Cusworth, and Hatfield districts (M. H. Stiles). Roche Abbey (M. H. Stiles; J. Newton Coombe). Doncaster. Bradford. Bingley.
 MID W. - Baildon. Adel. Harrogate; Malham Cove (J. M. Kirk).
 N.W. - Jervaulx Abbey.
 N.E. - Strensall. Seamer.
 S.E. - Wressle. Cottingham; Spring Ditch; Skirlaugh; Hornsea Peat Deposit (George Norman).
845. - *Navicula peregrina* (Ehrenb.) Kutz. [Syn. *Pinnularia peregrina* Ehrenb.].
 S.W. - Hatfield district; Rossington (M. H. Stiles). Goole. Coley, near Shelf. Allerton.
 S.E. - Tickton. Newsholme, near Howden. Stoneferry (George Norman).
845a. - *Navicula peregrina var. menisculus* Schum.
 MID W. - Linn Gill. Hawksworth Springs.
 N.W. - Mickle Fell.
 N.E. - Ingleby Greenhow.
846. *Navicula gracilis* Kutz.
 S.W. - Cusworth district; Firsby Reservoirs; Roche Abbey (M. H. Stiles). Shipley Glen.
 MID W. - Penyghent. Moughton Fell.
 N.E. - Ingleby Greenhow. Saltersgate (George Norman).
 S.E. - Spring Ditch; Marfleet; Ditch near River Hull (George Norman).
846a. *Navicula gracilis var. neglectum* (Thw.). [Syn. *Schizonema neglectum* (Thw.) Rabenh.; *Colletonema neglectum* Thw.; *Navicula gracilis* Kutz. var. *schizonemoides* V. H.].
 S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe).
 MID W. - Ingleton. Shipley Glen. Ribbleshead.
 S.E. - Hull; Wawne (George Norman).
847. *Navicula acuminata* (W. Sm.). [Syn. *Pinnularia acuminata* W. Sm.].
 MID W. - Adel Bog.
 N.W. - Cronkley Fell.
 N.E. - Scarborough Mere.
848. *Navicula viridula* Kutz. [Syn. *Pinnularia viridula* (Kutz.) Rabenh.].
 S.W. - Roche Abbey (J. Newton Coombe; M. H. Stiles). Askern and Cusworth districts (M. H. Stiles).
 MID W. - Killinghall (George Norman).
 N.W. - Mickle Fell. Dodd Fell.
 S.E. - Tickton. Wawne; Cottingham; Stoneferry (George Norman).
849. *Navicula radiosa* Kutz. [Syn. *Pinnularia radiosa* (Kutz.) Rabenh.].
 S.W. - Askern, Cusworth and Hatfield districts; Rossington; Doncaster (!) town water and Firsby Reservoirs (M. H. Stiles). Morley. Elslack. Mirfield. Greetland, near Halifax. Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe). Denholme.
 MID W. - Baildon. South Milford (William Barwell Turner). Harrogate (George Norman). Malham Tarn. Moughton Fell. Adel. Above Eldwick. Holden Gill, near Keighley. Otley. Bolton Woods. Knaresborough. Boston Spa. Crook Gill, one mile from Buckden.
 N.W. - Cautley Spout. Jervaulx Abbey. Great Shunnon Fell.
 N.E. - Strensall! (William Barwell Turner). Pilmoor, near Thirsk. Scarborough Mere. Scalby Beck. Hayburn Wyke. River Derwent at Forge Valley. Staindale. Ingleby Greenhow.
 S.E. - Beverley. Tickton. Near Meaux Abbey. Routh. Waghen. Newsholme, near Howden. Riccall Common. Market Weighton. Cottingham; River Hull; Haltenprice; Hornsea Peat Deposit; Reservoir Waterworks, Hull (George Norman).
849a. *Navicula radiosa var. acuta* (W. Sm.) V. H. [Syn. *Pinnularia acuta* W. Sm.].
 S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe). Cusworth district (M. H. Stiles). Near Shipley.

MID W. - Malham Tarn Bog, Penyghent.
N.W. - Mickle Fell.
N.E. - Strensall. Near Scarborough.
S.E. - Cottingham; Skirlaugh; Risby Pond; Driffield; Wawne; Market Weighton Canal; Spring Ditch; Beverley (George Norman).
849b. *Navicula radiosa* var. *silesiaca* (Bleisch). [Syn. *Pinnularia radiosa* var. *silesiaca* (Bleisch) rabenh.].
S.E. - Beverley.
850. *Navicula cryptocephala* Kutz.
S.W. - Bradford. Cullingworth. Roche Abbey (J. Newton. Coombe; M. H. Stiles).
MID W. - Wigton Moor. Moughton Fell. Baildon. Kildwick.
N.W. - Jervaulx Abbey. Dodd Fell.
N.E. - Carlton Bank. Saltburn.
S.E. - Tickton. Waghen. Newsholme, near Howden. River Hull; Market Weighton Canal; Dairycoates (George Norman).
850a. *Navicula cryptocephala* var. *veneta* (Kutz.) V. H. [Syn. *Navicula veneta* Kutz.].
S.W. - Cullingworth.
MID W. - Shipley Glen. Boston Spa.
N.E. - Pilmoor, near Thirsk.
S.E. - Newsholme. Market Weighton.
851. *Navicula angustata* W. Sm.
S.W. - Doncaster. Greetland, near Halifax. Chellow Dean. Bingley. Worth Valley, near Keighley. Thorne Moor (George Norman). Crimsworth Dean. Ogden Clough.
MID W. - Dropping Well, Knaresborough. Moughton Fell. Holden Gill, near Keighley.
N.W. - Mickle Fell. Cautley Spout.
N.E. - Scarborough Mere.
S.E. - Near Meaux Abbey. Beverley. Tickton. Waghen. Newsholme.
852. *Navicula rhynchocephala* Kutz.
S.W. - Greetland, near Halifax. Chellow Dean. Cullingworth. Doncaster town water (M. H. Stiles). Goole; Roche Abbey (E. Hunter). Marley, near Bingley.
MID W. - Harrogate (George Norman). Pond at Horsworth. Hawksworth Springs.
N.W. - Reeth.
S.E. - Loftsome Bridge, near Wressle. Beverley. Waghen. Tickton. Near Meaux Abbey. Market Weighton. Cottingham; Risby Pond; Haltenprice; Market Weighton Canal (George Norman).
853. *Navicula Dirhyncus* Ehrenb.
S.W. - Morley.
MID W. - Adel Bog, Malham Tarn.
S.E. - Near Sutton. Routh. Beverley.
854. *Navicula humilis* Donk. [Syn. *Navicula inflata* W. Sm., non Kutz.].
S.W. - Hatfield district; Rossington (M. H. Stiles). Allerton. Cullingworth. Roche Abbey (J. Newton Coombe).
MID W. - Hawksworth Springs. Holden Gill, near Keighley. Boston Spa. Killinghall (George Norman). Kildwick.
N.W. - Mickle Fell.
N.E. - Saltburn. Carlton Bank.
S.E. - Waghen. Tickton. Beverley. Wawne; Market Weighton Canal; Beverley Parks; Cottingham (George Norman).
855. *Navicula nana* Greg. [Syn. *Pinnularia pygmaea* Ehrenb.].
S.E. - River Hull; Cottingham; near Stoneferry (George Norman).
856. *Navicula digitato-radiata* Greg.
856a. *Navicula digitato-radiata* var. *Cyprinus* (W. Sm.) V. H. [Syn. *Navicula Cyprinus* W. Sm.].
S.E. - Dairycoates; ditch near River Hull (George Norman).
857. *Navicula Reinhardtii* Grun.
S.W. - Hatfield district (M. H. Stiles).

MID W. - In River Skell, Fountains Abbey (G. Stuart; E. Grove). Ribbleshead.
858. *Navicula lanceolata* Kutz.
S.W. - Cusworth District (M. H. Stiles). Bradford. Cullingworth.
MID W. - Kildwick.
S.E. - Beverley Parks, near Woodmaney (George Norman).
859. *Navicula Gastrum* (Ehrenb.) Donk.
MID W. - Cocket Moss, near Giggleswick.
860. *Navicula tumida* W. Sm., 1853. [Syn. *Navicula anglica* Ralfs, 1861.].
S.W. - Roche Abbey (M. H. Stiles).
MID W. - Shipley. Hawksworth Springs.
N.W. - Reeth.
N.E. - Seamer. Saltburn.
S.E. - Loftsome Bridge, near Wressle. Cottingham (George Norman).
861. *Navicula Semen* Ehrenb.
S.W. - Hatfield district (M. H. Stiles).
S.E. - Cottingham; Hornsea Peat Deposit; Risby Pond (George Norman).
862. *Navicula dicephala* Ehrenb.
S.W. - Doncaster town water (M. H. Stiles). Halifax. Allerton. Marley, near Bingley. Ogden Clough. Cragg Vale, towards Blackstone Edge.
MID W. - Wherside. Malham Tarn Bog. Bowland Knotts. Hawksworth Springs. Near Buckden. Kildwick.
N.W. - Mickle Fell. Great Shunnor Fell. Dodd Fell (in great abundance in stream at 1500 ft.). Muker. Bog near Widdale Beck. Snaizholme Beck.
N.E. - Goathland.
S.E. - Near Meaux Abbey. Beverley. Routh. Waghen. Tickton. Cottingham; Haltenprice (George Norman).
863. *Navicula gracillima* Ralfs. [Syn. *Pinnularia gracillima* Greg.].
N.E. - Rocky stream, Saltersgate (George Norman).
864. *Navicula Smithii* Breb.
S.E. - Ditch near River Hull (George Norman).
865. *Navicula elliptica* Kutz. [Syn. *N. ovalis* W. Sm.].
S.W. - Chellow Dean. Marley, near Bingley. Cullingworth. Roche Abbey (M. H. Stiles; J. Newton Coombe). Ogden Clough. Askern, Cusworth and Hatfield districts; Firsby Reservoirs (M. H. Stiles).
MID W. - Baildon. Penyghent. Near Buckden. South of Cray Moss. Moughton Fell. Markington (Rev. J. S. Tute !).
N.W. - Sedbergh. Mickle Fell. Dodd Fell.
N.E. - Seamer. Moist ground, Whitenab, Scarborough. Beast Cliff. Staindale. Carlton Bank.
S.E. - Market Weighton. Hornsea Peat Deposit; Haltenprice; River Hull and Reservoir Waterworks, Hull; Newbald; Cottingham (George Norman).
865a. *Navicula elliptica* var. *ovalis* Hilse.
S.W. - Cusworth district; Doncaster town water (M. H. Stiles).
866. *Navicula pygmaea* Kutz. [Syn. *Navicula minutula* W. Sm.].
S.W. - Cullingworth. Cusworth near Doncaster! (M. H. Stiles).
S.E. - Stoneferry; ditch near River Hull (George Norman).
867. *Navicula mutica* Kutz.
S.W. - Thorne Moor (George Norman). Cullingworth.
868. *Navicula crucicula* (W. Sm.) V. H. [Syn. *Stauroneis crucicula* W. Sm.; *S. dilatata* W. Sm.].
S.E. - Ditch near River Hull; in brackish water (George Norman).
869. *Navicula integra* W. Sm.
MID W. - Hawksworth Springs.
870. *Navicula scita* W. Sm.
S.E. - Newbald; Cottingham (George Norman).
871. *Navicula elegans* W. Sm.
S.E. - Near Stoneferry (George Norman).
872. *Navicula latissima* Greg.

S.W. - Roche Abbey (E. Hunter).
873. *Navicula granulata* Breb. MS. var. *maculosa* (Donk.) V. H. [Syn. *Navicula maculosa* Donk.].
 S.W. - Rossington (M. H. Stiles).
874. *Navicula tumens* W. Sm.
 S.E. - Near Stoneferry (George Norman).
875. *Navicula lepida* Greg.
 S.E. - Very rare in fresh water, Spring Ditch (George Norman).
876. *Navicula pusilla* W. Sm. [Syn. *Navicula gastroides* Greg.].
 MID W. - Hawksworth Springs, near Shipley.
 N.E. - Whitby.
 S.E. - Tickton. Routh. Beverley. Near Meaux Abbey. Waghen. Near Stoneferry; Wawne; Market Weighton Canal; Cottingham (George Norman).
877. *Navicula Trochus* Ehrenb.
 Mid.W. - In River Skell, Fountains Abbey (G. Stuart; E. Grove).
878. *Navicula cuspidata* Kutz.
 S.W. - Askern, Cusworth, and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles), Hatfield Chase (J. M. Kirk). Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe). Elslack.
 Mid W. - Roundhay; South Milford; Blubberhouses (William Barwell Turner). Harrogate (George Norman).
 Baildon. Moughton Fell. Pond at Pool. Pond at Horsforth. Boston Spa.
 N.W. - Great Shunnor Fell.
 N.E. - Scarborough Mere. Carlton Bank. Seamer. Malton.
 S.E. - Riccall Common. Skipwith Common. Market Weighton. Loftsme Bridge, near Wressle. Wressle. Cottingham; Hornsea Mere and Hornsea Peat Deposit; Risby Pond; Spring Ditch; Stepney; Haltenprice (George Norman).
879. *Navicula ambigua* Ehrenb.
 S.W. - Rossington; Firsby Reservoirs (M. H. Stiles).
 N.E. - Strensall.
 S.E. - Market Weighton. Wressle. Stoneferry; Hornsea Peat Deposit (George Norman).
880. *Navicula sculpta* Ehrenb.
 S.W. - Askern district (M. H. Stiles).
881. *Navicula sphaerophora* Kutz.
 S.W. - Doncaster.
 S.E. - Near Meaux Abbey. Beverley. Wressle. Haltenprice; Hornsea Peat Deposit (George Norman).
882. *Navicula seriens* (Breb.) Kutz.
 S.W. - Hatfield district (M. H. Stiles). Cullingworth.
 N.W. - Mickle Fell.
 N.E. - Strensall.
883. *Navicula gargarica* Rabenh.
 MID W. - Harrogate (George Norman).
 S.E. - Cottingham; ditch near River Hull; Anlaby to Hessele Road (George Norman).
884. *Navicula exilis* (Kutz.) Grun.
 S.W. - Askern and Hatfield districts; Firsby Reservoirs; Doncaster(!) town water; Rossington (M. H. Stiles).
 Woolley. Cullingworth. Keighley. Liversedge (Rev. W. Fowler!) Coley, near Shelf. Hebden Bridge.
 MID W. - Baildon. Boston Spa. Horton-in-Ribblesdale.
 N.E. - Cornelian Bay. Saltburn. Terrington.
 S.E. - Near Meaux Abbey. Beverley. Routh. Waghen. Tickton. Loftsme Bridge, near Wressle. Newsholme.
885. *Navicula follis* Ehrenb.
 S.E. - Market Weighton Canal; Beverley Parks (George Norman).
886. *Navicula latiuscula* Kutz.
 S.W. - Hatfield district (M. H. Stiles).
887. *Navicula Amphisbaena* Bory.
 S.W. - Askern, Cusworth, and Hatfield districts (M. H. Stiles). Near Doncaster. Goole; Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe). Shipley. Near Bingley.

MID W. - Harrogate; Ripley (George Norman). Adel, Arthington.
 N.E. - Whitby. Marske. Scarborough Mere. Seamer. Strensall.
 S.E. - Waghen. Beverley. Loftsme Bridge, near Wressle. Near Stoneferry; Cottingham; Haltenprice; Market Weighton Canal (George Norman).
888. *Navicula limosa* Kutz.
 S.W. - Cusworth, near Doncaster. Askern and Hatfield districts; Firsby Reservoirs; Roche Abbey; Rossington (M. H. Stiles).
 MID W. - Cocket Moss, near Giggleswick. Hawksworth Springs. Ingleton.
 N.W. - Mickle and Cronkley Fells.
 N.E. - Carlton Bank.
 S.E. - Beverley. Market Weighton. River Hull near Wawne; Cottingham (George Norman).
888a. *Navicula limosa var. gibberula* (Kutz.) V. H. [Syn. *N. gibberula* Kutz.].
 S.W. - Marley, near Bingley. Roche Abbey (J. Newton Coombe).
 MID W. - Baildon. Eldwick.
 N.W. - Mickle Fell.
 N.E. - Staindale. Hayburn Wyke.
 S.E. - Risby Pond; Skirlaugh; Cottingham; Hornsea Mere and Peat Deposit; near Stoneferry; Wawne; Haltenprice; Spring Ditch; Market Weighton Canal (George Norman).
889. *Navicula ventricosa* (Ehrenb.?) Donkin.
 MID W. - Baildon.
890. *Navicula Iridis* Ehrenb. [Syn. *N. firma* W. Sm.].
 S.W. - Askern district and Roche Abbey (M. H. Stiles).
 MID W. - Bog two miles south of Clapham.
 S.E. - Risby Pond; Cottingham; Haltenprice; Spring Ditch (George Norman).
890a. *Navicula Iridis var. Amphigomphus* (Ehrenb.) V. H. [Syn. *Navicula Amphigomphus* Ehrenb.].
 S.W. - Shipley.
 MID W. - Harrogate (George Norman). Langcliffe, near Settle. Bog two miles south of Clapham.
 N.E. - Near Scarborough.
 S.E. - Skipwith Common. Cottingham; Wawne (George Norman).
890b. *Navicula Iridis var. Amphirhynchus* (Ehrenb.) De Toni. [Syn. *Navicula Amphirhynchus* Ehrenb.].
 S.W. - Hatfield district; Rossington (M. H. Stiles). Goole; Roche Abbey (E. Hunter). Cullingworth.
 MID W. - Roundhay (Abbott, Emsley, and Turner). Harrogate (George Norman). Adel Bog. Eldwick. Ilkley.
 Hawksworth Springs. Malham Tarn. Bowland Knotts.
 N.W. - Mickle Fell.
 N.E. - Seamer. Strensall (William Barwell Turner).
 S.E. - Beverley. Cottingham; Skirlaugh (George Norman).
890c. *Navicula Iridis var. affinis* (Ehrenb.) V. H. [Syn. *Navicula affinis* Ehrenb.].
 S.W. - Goole (J. Harrison). Roche Abbey (M. H. Stiles; J. Newton Coombe). Chellow Dean. Bradford.
 Cullingworth. Keighley Moor.
 MID W. - Adel Bog. Rombald's Moor. Holden Gill, near Keighley. Moughton Fell.
 N.E. - Common. Cornelian Bay. Saltburn. Carlton Bank.
 S.E. - Market Weighton. Spring Ditch; Cottingham (George Norman).
890d. *Navicula Iridis var. producta* (W. Sm.) V. H. [Syn. *Navicula producta* W. Sm.].
 S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe).
 MID W. - Boston Spa.
 N.E. - Marske. Strensall. Pilmoor, near Thirsk.
 S.E. - Loftsme Bridge, near Wressle. Skirlaugh; Cottingham; Haltenprice; Hornsea Peat Deposit (George Norman).
891. *Navicula bacillum* Ehrenb. [Syn. *N. bacillaris* Greg.].
 S.E. - Hornsea Peat Deposit; Cottingham (George Norman).
892. *Navicula laevissima* (Kutz.?) Grun.
 N.E. - Saltersgate (George Norman).
 S.E. - Cottingham; Hornsea Peat Deposit; Haltenprice; Wawne (George Norman).

893. *Navicula Pupula* Kutz.

S.W. - Ogden Clough. Near Bingley.

MID W. - Baildon. Harrogate. Linn Gill. Hawksworth Springs. Moughton Fell.

S.E. - Wressle.

894. *Navicula binodis* (Ehrenb.) W. Sm.

MID W. - Baildon. Hawksworth Springs. Rombald's Moor.

N.W. - Mickle Fell.

N.E. - Staithes.

S.E. - Beverley; Market Weighton Canal (George Norman).

895. *Navicula Gallica* (W. Sm.) V. H. [Syn. *Diadesmis Gallica* W. Sm.]

MID W. - Near Knaresborough. Wigton Moor. Malham Tarn Bog.

N.E. - Pilmoor, near Thirsk. Terrington.

GENUS COLLETONEMA (Breb., 1849) V. H.

896. *Colletonema lacustre* (Ag.) V.H. [Syn. *Schizonema lacustre* Ag.]

S.W. - Hatfield district (M. H. Stiles).

GENUS VANHEURCKIA Breb., 1868.

897. *Vanheurckia rhomboides* (Ehrenb.) Breb. [Syn. *Navicula rhomboides* Ehrenb.; *Frustulia rhomboides* (Ehrenb.) De Toni].

Frequent in sphagnum bogs and peat bogs generally, sometimes occurring in pure gelatinous masses.

S.W. - Thorne Moor (George Norman). Greetland, near Halifax. Morley. Near Bradford. Cullingworth. Keighley Tarn.

MID W. - Milford; Blubberhouses (William Barwell Turner). Baildon. Moughton Fell. Near Buckden. Ribbleshead. Bowland Knotts.

N.W. - Baugh Fell. Penhill Beacon. Lund's Fell. Mickle and Cronkley Fells. Great Shunnon Fell.

N.E. - Carlton Bank.

S.E. - Skipwith Common (Rev. W. Fowler!).

897a. *Vanheurckia rhomboides* var. *saxonica* (Rabenh.) [Syn. *Frustulia saxonica* Rabenh., 1851;

Navicula crassinervia Breb., 1852; *Vanheurckia rhomboides* var. *crassinervia* V. H.]

S.W. - Askern (J. M. Kirk). Cullingworth. Ogden Clough. Cragg Vale, towards Blackstone Edge.

MID W. - Adel Bog. Whemside. Cocket Moss, near Giggleswick. Near Buckden.

N.W. - Mickle Fell. Cronkley Fell. Bog near Widdale Beck. Snaizeholme Beck. Dodd Fell. Cowgill Wold Moss, Widdale Fell.

N.E. - Carlton Bank. Saltersgate (George Norman).

S.E. - Beverley. Waghen. Cottingham; River Hull (George Norman).

898. *Vanheurckia vulgaris* (Thw.) V. H. [Syn. *Colletonema vulgaris* Thw.]

S.W. - Marley, near Bingley.

MID W. - Rombald's Moor. Ribbleshead. Hawksworth Springs (near Shipley).

S.E. - Market Weighton. Cottingham (George Norman).

N.E. - Carlton Bank.

GENUS AMPHIPLEURA Kutz., 1844.

899. *Amphipleura pellucida* Kutz.

S.W. - Near Doncaster. Askern and Hatfield Districts; Roche Abbey (M. H. Stiles). Cullingworth.

MID W. - Roundhay (J. Abbott). Staveley Dam, near Knaresborough. Shipley Glen. South of Cray Moss.

N.W. - Jervaulx Abbey. Mickle Fell.

N.E. - Scarborough Mere. Pilmoor, near Thirsk. Ingleby. Greenhow.

S.E. - Skipwith Common (Rev. W. Fowler!). Cottingham; Risby Pond; Botanic Gardens, Hull (George Norman).

GENUS SCOLIOPLEURA Grun., 1860.

900. *Scoliopleura Westii* (W. Sm.) Grun. [Syn. *Navicula Westii* W. Sm.]

S.E. - In brackish water, River Hull (George Norman).

GENUS PLEUROSIGMA V. H., 1853.

901. *Pleurosigma attenuatum* (Kutz.) W. Sm.

S.W. - Askern, Cusworth, and Hatfield districts; Doncaster (town water; Firsby Reservoirs (M. H. Stiles). Bradford. Marley, near Bingley. Goole; Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe).

MID W. - Baildon. South Milford (William Barwell Turner). Staveley Dam, near Knaresborough.

N.W. - Rokeby.

N.E. - Rievaulx Abbey. Carlton Bank. Stokesley.

S.E. - Beverley. Spring Ditch; Haltenprice; Cottingham; Newbald; Risby Pond; Hornsea Peat Deposit; Wawne; Reservoir Waterworks, Hull (George Norman).

901a. *Pleurosigma attenuatum* var. *scalprum* (Gaill.) Grun.

S.W. - Hatfield district (M. H. Stiles).

902. *Pleurosigma acuminatum* (Kutz.) Grun. [Syn. *Pleurosigma lacustre* W. Sm.]

S.W. - Bradford. Chellow Dean. Askern (M. H. Stiles; F. H. Allen). Roche Abbey (E. Hunter; M. H. Stiles; J. Newton Coombe). Doncaster.

MID W. - Baildon. Malham Tarn. Harrogate (George Norman). Roundhay (William Barwell Turner). Adel. Arthington. Horsforth. Ripley (George Norman). Boston Spa. Hawksworth Springs.

N.E. - Seamer. Scarborough Mere. Cornelian Bay. Saltburn.

S.E. - Hornsea Mere. Tickton. Beverley! Waghen. Loftsme Bridge, near Wressle. Newsholme. Skipwith Common. Cottingham; River Hull; Risby Pond; Market Weighton; Haltenprice; Hornsea Peat Deposit (George Norman).

903. *Pleurosigma Spencerii* (Quckett) W. Sm.

S.W. - Cusworth and Hatfield districts; Firsby Reservoirs (M. H. Stiles). Roche Abbey (J. Newton Coombe). Goole (E. Hunter). Doncaster. Fixby. Bradford.

MID W. - South Milford (William Barwell Turner). Leathley.

N.W. - Mickle Fell. Reeth.

N.E. - Seamer. Strensall. Hayburn Wyke. River Derwent. Forge Valley. Saltburn. Carlton Bank.

S.E. - Beverley. Routh. Skipwith Common. Market Weighton. Spring Ditch; Hornsea Mere; Wawne; Risby Pond; Hornsea Peat Deposit; Haltenprice (George Norman).

904. *Pleurosigma scalproides* Rabenh.

S.W. - Hatfield district (M. H. Stiles).

MID W. - Amongst *Cladophora glomerata* in stream, Ingleton.

GENUS AMPHIPRORA (Ehrenb.) Cleve., 1891

905. *Amphiprora alata* Kutz.

S.E. - Near Stoneferry (George Norman).

906. *Amphiprora paludosa* W. Sm.

S.E. - Stoneferry to Sutton; ditch, near River Hull; Anlaby Road to Hessle Road (George Norman).

907. *Amphiprora constricta* Ehrenb.

S.E. - Dairycotes; pure near Marfleet (George Norman)

FAMILY GOMPHONEMAE.

GENUS GOMPHONEMA Ag., 1824.

908. *Gomphonema geminatum* (Lyngb.) Ag.

S.W. - Askern district (M. H. Stiles).

MID W. - Roundhay (William Barwell Turner). Leathley. Moughton Fell. Ribbleshead. Bolton Woods. Buckden. Oughtershaw Moss.

N.W. - Cautley Spout. Upper Teesdale. Dodd Fell, waterfall in Gill.

N.E. - Strensall (William Barwell Turner).

909. *Gomphonema constrictum* Ehrenb.

S.W. - Askern and Hatfield districts; Doncaster(!) town water; Rossington; Firsby Reservoirs (M. H. Stiles). Roche Abbey (M. H. Stiles; J. Newton Coombe). Woolley. Heaton.

MID W. - Harrogate! (George Norman). Holden Gill, near Keighley. Shipley Glen. Adel. Boston Spa.

Staveley Dam, near Knaresborough. Linn Gill. Buckden.
N.W. - Jervaulx Abbey. Sedbergh.
N.E. - Whitby. Staithes. Scarborough Mere. Scalby Beck. Malton.
S.E. - Loftsome Bridge, near Wressle. Newsholme. Wawne; Cottingham.; Hornsea Peat Deposit; Market Weighton Canal (George Norman).
909a. *Gomphonema constrictum* var. *capitatum* (Ehrenb.) V. H. [Syn. *Gomphonema capitatum* Ehrenb.]
S.W. - Doncaster town water; Hatfield district (M. H. Stiles). Near Mirfield. Bradford. Cullingworth. Bingley.
MID W. - Malham Tarn. Boston Spa. Baildon. Ribbleshead.
N.W. - Cronkley Fell. Great Shunnor Fell. Dodd Fell. Sedbergh.
N.E. - Seamer. Terrington.
S.E. - Loftsome Bridge, near Wressle. Cottingham; Hornsea Deposit (George Norman). Anlaby Road (Dr. Munroe).
910. *Gomphonema acuminatum* Ehrenb.
S.W. - Askern, Cusworth, and Hatfield districts; Firsby Reservoirs; Doncaster(!) town water; Rossington (M. H. Stiles). Goole; Roche Abbey (E. Hunter). Askern; Hatfield Chase (J. M. Kirk). Denholme.
MID W. - Wigton Moor. Roundhay (William Barwell Turner). Markington (Rev. J. S. Tute!). Baildon. Bolton Woods. Boston Spa.
N.W. - Sedbergh. Mickle Fell. Great Shunnor Fell. Jervaulx Abbey.
N.E. - Seamer. Egton. Staindale. Pilmoor, near Thirsk. Scarborough Mere. Terrington. Malton. Carlton Bank.
S.E. - Near Stetton. Newsholme. Loftsome Bridge, near Wressle. Market Weighton. Driffield; Newsham Lake; Cottingham; Wawne; Beverley; Reservoir Waterworks, Hull (George Norman).
910a. *Gomphonema acuminatum* var. *coronatum* (Ehrenb.) V. H.
S.W. - Doncaster town water (M. H. Stiles).
911. *Gomphonema Augur* Ehrenb. [Syn. *G. cristatum* Ralfs].
MID W. - Staveley Dam, near Knaresborough.
N.W. - Cronkley Fell.
S.E. - Wressle.
912. *Gomphonema montanum* Schumann.
912a. *Gomphonema montanum* var. *commutatum* Grun.
S.W. - Askern district; Firsby Reservoirs; Doncaster town water; Rossington (M. H. Stiles).
913. *Gomphonema tenellum* Kutz.
S.W. - Marley, near Bingley. Liversedge (Rev. W. Fowler!). Heaton. Keighley. Ogden Clough.
MID W. - Whernside. Ribbleshead. Baildon. Wigton Moor. Eldwick.
N.E. - Scarborough Mere. Staindale. Cornelian Bay. Pilmoor, near Thirsk. Ingleby Greenhow.
S.E. - Near Meaux Abbey. Routh. Waghen. Beverley, Near Sutton. Newsholme. Near Stoneferry; Driffield; Skirlaugh; Hull (George Norman).
914. *Gomphonema gracile* Ehrenb.
MID W. - Staveley Dam, near Knaresborough. Cocket Moss near Giggleswick.
N.W. - Mickle Fell.
N.E. - Carlton Bank.
914a. *Gomphonema gracile* var. *dichotomum* (Kutz.) V. H. [Syn. *G. dichotomum* Kutz.].
MID W. - Shipley Glen. Pond at Horsforth.
N.W. - Cronkley Fell.
N.E. - Strensall.
S.E. - Waghen. Near Sutton. Near Meaux Abbey. Routh. Tickton. Newbald; Wawne; Market Weighton (George Norman).
915. *Gomphonema intricatum* Kutz.
S.W. - Askern, Cusworth and Hatfield districts; Firsby Reservoirs (M. H. Stiles). Ogden Clough. Morley. Goole. Elslack.
MID W. - Whernside. Baildon. Bolton Woods.
N.W. - Mickle and Cronkley Fells. Great Shunnor Fell. Dodd Fell.
N.E. - Saltburn. Pilmoor, near Thirsk.

S.E. - Loftsome Bridge, near Wressle. Market Weighton. Wawne; Anlaby to Hessele; Benningholme; River Derwent (George Norman).
915a. *Gomphonema intricatum* var. *Vibrio* (Ehrenb.) V. H. [Syn. *G. Vibrio* Ehrenb.].
S.W. - Askern district (M. H. Stiles). Ogden Clough. Cullingworth. Crimsworth Dean.
MID W. - Holden Gill, near Keighley. Baildon. Linn Gill. Near Knaresborough.
N.W. - Sedbergh.
S.E. - River Hull at Wawne (George Norman).
916. *Gomphonema ventricosum* Greg.
N.W. - Cautley Spout, with sporangial valves.
917. *Gomphonema olivaceum* (Lyngb.) Kutz.
S.W. - Rossington (M. H. Stiles). Hatfield Chase (J. M. Kirk). Bradford.
MID W. - Roundhay (William Barwell Turner). Kilnsey. Ingleton. Malham Tarn. Whernside.
N.W. - Near Sedbergh. Jervaulx Abbey. Snaizholme Beck. Dodd Fell. Mickle Fell.
N.E. - Scarborough Mere. Terrington.
S.E. - Near Sutton. Newsholme. Near Meaux Abbey. Benningholme; Cottingham; Reservoir Waterworks, Hull (George Norman).
918. *Gomphonema parvulum* Kutz.
S.W. - Marley, near Bingley.
MID W. - Boston Spa.
N.W. - Jervaulx Abbey.
N.E. - Terrington.
918a. *Gomphonema parvulum* var. *lanceolatum* V. H.
N.W. - Jervaulx Abbey.
919. *Gomphonema angustatum* Kutz.
MID W. - Cocket Moss, near Giggleswick.
N.W. - Bog, near Widdale Beck.
N.E. - Pilmoor, near Thirsk.
920. *Gomphonema insigne* Greg.
S.E. - Newbald (George Norman).

GENUS RHOICOSPHENIA Grun., 1860.

921. *Rhoicosphenia curvata* (Kutz.) Grun. [Syn. *Gomphonema curvatum* Kutz.].
S.W. - Hatfield district; Rossington (M. H. Stiles). Bradford. Holbeck. Roche Abbey (M. H. Stiles; J. Newton Coombe). Shipley. Castleford.
MID W. - Baildon. Harrogate (George Norman). Markington (Rev. J. S. Tute). Ingleton.
N.W. - Holwick. Romaldkirk.
N.E. - Staithes. Hayburn Wyke. Scalby Beck. Saltburn. Malton.
S.E. - Newsholme. Cottingham; Reservoir Waterworks, Hull (George Norman).
922. *Rhoicosphenia fracta* (Schum.) Rabenh. [Syn. *Gomphonema fractum*.].
S.W. - Cullingworth. Kildwick.
MID W. - Adel Bog.

FAMILY ACHNANTHEAE

GENUS ACHNANTIDIUM (Kutz.) Grun., 1880.

923. *Achnanthidium flexellum* (Kutz.) Breb. [Syn. *Cocconeis Thwaitesii* W. Sm.].
S.W. - Askern district (M. H. Stiles). Bingley. Ogden Clough, with auxospores and sporangial valves. Cusworth, near Doncaster! (M. H. Stiles). Hebden Bridge.
MID W. - Dripping rocks, Shipley Glen, abundant. Dripping rocks, Holden Gill, near Keighley. Ingleton. South of Cray Moss. Adel (William Barwell Turner).
N.W. - Cautley Spout. Mickle and Cronkley Fells.
N.E. - Staindale.
S.E. - Newbald; Cottingham (George Norman).

GENUS ACHNANTHES Bory, 1822.

- 924. *Achnanthes coarctata*** (Breb.) Grun. [Syn. *Achnanthidium coarctatum* Breb.].
S.W. - Bingley.
- 925. *Achnanthes microcephala*** (Kutz.) Grun. [Syn. *Achnanthidium microcephalum* Kutz.].
S.W. - Ogden Clough.
MID W. - Chapel Allerton (J. Abbott). Baildon. Linn Gill. Penyghent. Dropping Well, Knaresborough.
N.W. - Jervaulx Abbey. Lund's Fell.
N.E. - Scarborough Mere. Terrington
S.E. - Tickton. Waghen. Routh. Hull (George Norman).
- 926. *Achnanthes exilis*** Kutz.
S.W. - Cusworth and Hatfield districts (M. H. Stiles). Roche Abbey (J. Newton Coombe; M. H. Stiles).
Mirfield. Cullingworth. Frizinghall. Coley, near Shelf. Denholme.
MID W. - Baildon. Malham Tarn. Horsforth. Arthington. Bolton Woods. Whernside. Buckden. Simon's Fell.
Boston Spa. Wigton Moor.
N.W. - Cautley Spout. Mickle Fell. Snaizholme Beck.
N.E. - Hayburn Wyke. River Derwent. Forge Valley. Beast Cliff. Saltburn. Pilmoor, near Thirsk.
S.E. - Near Meaux Abbey. Newsholme. Tickton. Beverley. Newbald; Cottingham; Hull; Wawne (George Norman).
- 927. *Achnanthes linearis*** (W. Sm.) Grun. [Syn. *Achnanthidium lineare* W. Sm.].
N.W. - Dodd Fell.
N.E. - Ingleby Greenhow.
S.E. - Cottingham; Skirlaugh; Benningholme (George Norman).
- 928. *Achnanthes lanceolata*** (Breb.) Grun. [Syn. *Achnanthidium lanceolatum* Breb.].
S.W. - Askern district (M. H. Stiles). Cullingworth. Liversedge (Rev. W. Fowler!). Shipley. Denholme.
Famley. Bingley. Doncaster. Cragg Vale, towards Blackstone Edge. Woolley. Elslack.
MID W. - Baildon. Whernside. Boston Spa. Ribbleshead. Penyghent. Moughton Fell.
N.W. - Jervaulx Abbey. Mickle Fell.
N.E. - Strensall (William Barwell Turner). Saltburn.
S.E. - Beverley. Routh. Near Meaux Abbey. Waghen. Cottingham; Wawne (George Norman).
- 929. *Achnanthes Biasolettiana*** Grun.
N.W. - Jervaulx Abbey.
- 930. *Achnanthes Hungarica*** Grun.
S.W. - Horton Park, Bradford.
N.W. - Jervaulx Abbey, vii., 1898, abundant.

Genus COCCONEIS Ehrenb, 1835.

- 931. *Cocconeis Pediculus*** Ehrenb.
S.W. - Cusworth and Hatfield districts; Rossington (M. H. Stiles). Castleford.
MID W. - Roundhay (William Barwell Turner). Wetherby. Baildon. Esholt. Holden Gill, near Keighley.
Arthington. Harrogate. Bolton Woods. Near Settle. Kilmsey. Cowside Beck, Arncliffe. Oughtershaw Moss.
Ingleton. Ribbleshead. Bog two miles south of Clapham. Moughton Fell. Knaresborough.
N.W. - Duerley Beck, near Hawes.
N.E. - Frequent. Hayburn Wyke. Scalby Beck. Terrington. Rievaulx Abbey. Malton. Stokesley.
S.E. - Beverley. Cottingham; River Hull, etc. (George Norman).
- 932. *Cocconeis Placentula*** Ehrenb.
S.W. - Askern and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles). Roche Abbey (M. H. Stiles; J. Newton Coombe). Marley, near Bingley. Ogden Clough. Doncaster. Frizinghall.
MID W. - Harrogate (George Norman). Baildon. Malham Tarn. Moughton Fell. Cowside Beck, Arncliffe.
Hawksworth Springs.
N.W. - Masham. Great Shunnor Fell. Jervaulx Abbey. Dodd Fell.
N.E. - River Derwent, Forge Valley. Scamer. Saltburn. Carlton Bank.
S.E. - Hornsea Mere. Routh. Newsholme. Beverley. Loftsome Bridge, near Wressle.
- 932a. *Cocconeis Placentula forma perpusilla*** Rabenh.
MID W. - Baildon. Ribbleshead. Moughton Fell.

ORDER PSEUDORAPHIDIEAE.

FAMILY EPITHEMIEAE.

GENUS EPITHEMIA Breb, 1838.

- 933. *Epithemia turgida*** (Ehrenb.) Kutz.
S.W. - Askern and Hatfield districts (M. H. Stiles). Cullingworth. Near Doncaster.
MID W. - Bramhope (J. Abbott). Baildon. Malham. Ingleton. Holden Gill, near Keighley. Bolton Woods.
Boston Spa. Crook Gill, one mile from Buckden.
N.W. - Cautley Spout. Jervaulx Abbey.
N.E. - Common. Levisham. Hayburn Wyke. On moist ground, Whitenab, Scarborough. Cleave Cliffs, north of Scalby. Carlton Bank. Stokesley. Malton.
S.E. - Newsholme. Market Weighton. Wressle. Peat Deposit, Hornsea; Risby Pond; Stepney Lane (George Norman).
- 933a. *Epithemia turgida var. Westermanni*** Kutz. [Syn. *Epithemia Westermanii* Kutz.].
S.W. - Ogden Clough.
MID W. - Penyghent.
N.W. - Cronkley Fell. Great Shunnor Fell.
N.E. - Staindale. Levisham.
- 933b. *Epithemia turgida var. granulata*** (Kutz.) Van Heurck. [Syn. *Epithemia granulata* Kutz.].
S.E. - Hornsea Mere; Hornsea Deposit (George Norman).
- 934. *Epithemia Sorex*** Kutz.
S.W. - Hatfield district (M. H. Stiles).
MID W. - Malham Tarn.
N.W. - Cotterdale.
N.E. - Malton. Stokesley.
S.E. - Hornsea Mere. Stepney Lane (George Norman).
- 935. *Epithemia gibba*** Kutz.
S.W. - Askern and Hatfield districts; Doncaster(!) town water (M. H. Stiles). Cullingworth. Ogden Clough.
Crimsworth Dean.
MID W. - Baildon. Adel Bog. Malham Tarn. Holden Gill, near Keighley. South of Cray Moss. Near Buckden.
N.W. - Cautley. Cronkley Fell. Great Shunnor Fell. Cotterdale.
N.E. - Scarborough Mere. Staindale. Levisham. Moist ground, Whitenab, Scarborough (with sporangial forms). Carlton Bank. Malton. Stokesley.
S.E. - Market Weighton. Risby Pond; Driffild (George Norman).
- 935a. *Epithemia gibba var. ventricosa*** (Kutz.) V. H. [Syn. *Epithemia ventricosa* Kutz.].
S.W. - Roche Abbey (M. H. Stiles).
MID W. - Moughton Fell.
N.W. - Mickle Fell. Great Shunnor Fell.
N.E. - Lockton.
S.E. - Risby Pond; Wawne; Hornsea Peat Deposit (George Norman).
- 936. *Epithemia Argus*** (Ehrenb.) Kutz.
S.W. - Near Bradford. Cullingworth.
MID W. - South of Cray Moss.
N.W. - Masham. Holwick. Mickle Fell. Great Shunnor Fell. Cotterdale. Great Sleddale.
N.E. - Moist ground, Whitenab, Scarborough. Great Ayton. Stokesley.
S.E. - Newsholme. Hornsea Deposit (George Norman).
- 936a. *Epithemia Argus var. alpestris*** (W. Sm.) Rabenh. [Syn. *Epithemia alpestris* W. Sm.; *E. Argus var. anphicephala* Grun.].
S.W. - Cullingworth. Ogden Clough, in gelatinous masses with auxospores and sporangial valves. Hebden Bridge.
MID W. - Cray Moss.

N.W. - Cautley Spout.
 N.E. - Staindale, Beast Cliff.
 S.E. - Hornsea Deposit (George Norman).
937. *Epithemia gibberula* (Ehrenb.) Kutz.
 S.W. - Cragg Vale, towards Blackstone Edge.
 S.E. - Market Weighton.
937a. *Epithemia gibberula* var. *rupestris* (W. Sm.) Rabenh. [Syn. *Epithemia rupestris* W. Sm.].
 S.W. - Crimsworth Dean.
 MID W. - Cray Moss.
 N.W. - Great Shunnor Fell.
938. *Epithemia Zebra* (Ehrenb.) Kutz.
 S.W. - Hatfield district (M. H. Stiles).
 N.W. - Cronkley Fell, Cotterdale.
 S.E. - Hornsea Mere; Driffild; Wawne (George Norman).
938a. *Epithemia Zebra* var. *proboscidea* (Kutz.) Grun.
 S.E. - Hornsea Deposit (George Norman).
939. *Epithemia Hyndmanni* W. Sm.
 S.E. - Peat Deposit, Hornsea (George Norman).
Genus EUNOTIA Ehrenb, 1837.
940. *Eunotia Arcus* Ehrenb. [Syn. *Himantidium Arcus* W. Sm.].
 S.W. - Askern and Cusworth districts; Roche Abbey (M. H. Stiles). Cullingworth. Oxenhope. Ogden Clough.
 MID W. - Cocket Moss, near Giggleswick. Penyghent.
 N.W. - Cautley Spout. Mickle and Cronkley Fells. Great Shunnor Fell.
 N.E. - Goathland.
 S.E. - Wawne (George Norman).
940a. *Eunotia Arcus* var. *minor* V. H.
 S.W. - Hatfield district; Rossington (M. H. Stiles).
940b. *Eunotia Arcus* var. *bidens* V. H.
 S.W. - Askern District; Roche Abbey (M. H. Stiles).
941. *Eunotia major* (W. Sm.) Rabenh. [Syn. *Himantidium majus* W. Sm.].
 S.W. - Cullingworth. Keighley Moor.
 MID W. - Black Hill, near Settle.
 N.W. - Cronkley Fell. Great Shunnor Fell. Bog near Widdale Beck.
 N.E. - Seamer. Carlton Bank.
 S.E. - Cottingham (George Norman).
942. *Eunotia gracilis* (Ehrenb.) Rabenh. [Syn. *Himantidium gracile* Ehrenb.].
 S.W. - Hatfield district (M. H. Stiles). Cullingworth. Marley, near Bingley. Greetland, near Halifax. Ogden Clough. Elslack.
 MID W. - Blubberhouses (William Barwell Turner). Adel Bog. Ilkley. Cam Fell. Whernside. Cocket Moss, near Giggleswick. Bog two miles south of Clapham.
 N.W. - Penhill Beacon. Jervaulx Abbey. Bog near Widdale Beck. Dodd Fell. Cowgill Wold Moss, Widdale Fell. Leeming. Mickle and Cronkley Fells. Great Shunnor Fell.
 N.E. - Near Scarborough. Ingleby.
 S.E. - River Hull (George Norman).
943. *Eunotia exigua* (Breb.) Rabenh.
 S.W. - Askern district (M. H. Stiles). Wibsey. Ogden Clough.
 MID W. - Near Buckden. Giggleswick Common.
 N.W. - Bog near Widdale Beck. Dodd Fell.
 N.E. - Carlton Bank. Malton.
944. *Eunotia pectinalis* (Dillw.) Rabenh. [Syn. *Himantidium pectinale* (Dillw.) Kutz.].
 S.W. - Firsby Reservoirs (M. H. Stiles). Bingley. Cullingworth. Ogden Clough. Doncaster. Cragg Vale, towards Blackstone Edge.

MID W. - Wetherby (F. A. Lees). Baildon. Near Knaresborough. Earl's Seat. Kilnsey. Cray Moss. Ribbleshead. Giggleswick Common. Ingleton.
 N.W. - Mickle and Cronkley Fells. Great Shunnor Fell. Great Sleddale.
 N.E. - Beast Cliff. Terrington. Staindale. Carlton Bank. Scarborough. Saltersgate (George Norman).
 S.E. - Cottingham (G Norman).
944a. *Eunotia pectinalis* var. *ventricosa* Grun.
 S.W. - Hatfield district; Doncaster town water (M. H. Stiles).
944b. *Eunotia pectinalis* var. *undulata* (W. Sm.) Ralfs. [Syn. *Himantidium undulatum* (W. Sm.)].
 S.W. - Roche Abbey (M. H. Stiles). Cullingworth.
 MID W. - Blubberhouses (William Barwell Turner); Hawksworth (E. Hunter). Whernside. Adel Dam. Baildon.
 N.E. - Goathland. Near Scarborough. Saltersgate (George Norman).
945. *Eunotia Faba* (Ehrenb) Grun. [Syn. *Himantidium Soleirolei* Kutz.].
 S.W. - Kildwick. Ogden Clough.
 MID W. - Ingleton.
 N.W. - Cotterdale.
 N.E. - Ingleby.
946. *Eunotia Veneris* Kutz. [Syn. *E. incisa* Greg.].
 S.W. - Ogden Clough. Near Shipley.
 MID W. - Giggleswick Common.
 N.W. - Mickle Fell.
 N.E. - Carlton Bank.
 S.E. - Riccall Common. Skipwith Common.
947. *Eunotia praerupta* Ehrenb.
947a. *Eunotia praerupta* var. *bidens* (Ehrenb.) Grun. [Syn. *E. bidens* (Ehrenb.) W. Sm.].
 MID W. - Holden Gill, near Keighley.
 S.E. - Riccall Common. Newsholme, near Howden.
948. *Eunotia monodon* Ehrenb.
 S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe).
 N.W. - Mickle Fell.
949. *Eunotia robusta* Ralfs.
949a. *Eunotia robusta* var. *tetraodon* V.H.
 S.W. - Doncaster town water (M. H. Stiles).
 N.E. - Strensall. Lockton.
950. *Eunotia triodon* Ehrenb.
 MID W. - Roundhay (William Barwell Turner).
951. *Eunotia diodon* Ehrenb.
 MID W. - Ilkley. Near Buckden.
 N.W. - Cronkley Fell.
 N.E. - Strensall.
952. *Eunotia Smithii* Gutw., 1895. [Syn. *E. gracilis* W. Sm.; non *E. gracilis* (Ehrenb.) Rabenh.].
 S.W. - Saltaire, in great abundance among *Microspora floccosa* in boggy field.
 MID W. - Baildon.
953. *Eunotia lunaris* (Ehrenb.) Grun. [Syn. *Synedra lunaris* Ehrenb.].
 S.W. - Doncaster town water; Firsby Reservoirs; Hatfield district (M. H. Stiles), Cullingworth. Chellow Dean. Mirfield. Elslack. Keighley Moor. Ogden Clough.
 MID W. - Wigton Moor. Baildon. Adel Bog. Penyghent. Eldwick. Ilkley. Bolton Woods. Boston Spa. Black Hill, near Settle. Cam Fell. Whernside. Cocket Moss, near Giggleswick. Bowland Knotts. Bog, two miles south of Clapham.
 N.W. - Sedbergh. Great Sleddale. Jervaulx Abbey. Lund's Fell. Bog near Widdale Beck. Cronkley Fell. Mickle Fell. Great Shunnor Fell.
 N.E. - Staindale. Terrington. Carlton Bank. Malton.
 S.E. - Skipwith Common (Rev. W. Fowler!). Market Weighton.

953a. *Eunotia lunaris* var. *bilunaris* (Ehrenb.) Grun.

MID W. - Cocket Moss, near Giggleswick.

N.W. - Mickle Fell.

S.E. - Beverley. Market Weighton.

953b. *Eunotia lunaris* var. *undulata* Rabenh.

N.E. - Goathland.

954. *Eunotia flexuosa* Kutz.

954b. *Eunotia flexuosa* var. *bicapitata* Grun.

S.W. - Hatfield district (M. H. Stiles). Cullingworth.

GENUS CERATONEIS Ehrenb., 1840.

955. *Ceratoneis Arcus* (Ehrenb.) Kutz. [Syn. *Eunotia Arcus* (Ehrenb.) W. Sm.].

MID W. - Whenside. Holden Gill, near Keighley. Simon Seat.

N.W. - Calf Beck, Howgill Fells. Cautley Spout. Great Shunnor Fell. Muker. Hunter's Hole, Craydale Moor (1900 ft.). Mickle Fell. Cowgill Wold Moss, Widdale Fell.

955a. *Ceratoneis Arcus* var. *Amphioxys* (Rabenh.) De Toni. [Syn. *Ceratoneis Amphioxys* Rabenh.].

MID W. - Whenside. Leathley. Holden Gill, near Keighley. Harrogate. Oak Beck.

N.W. - Calf Beck, Howgill Fells. Lund's Fell.

FAMILY SYNEDRAE.

GENUS SYNEDRA Ehrenb., 1831.

956. *Synedra pulchella* Kutz.

S.W. - Doncaster town water; Firsby Reservoirs; Hatfield district (M. H. Stiles). Bingley. Liversedge (Rev. W. Fowler!). Keighley. Shipley. Farnley.

MID W. - Baildon. Whenside. Arthington. Otley. Kilsney. Boston Spa. Harrogate. Ribbleshead.

N.W. - Mickle Fell. River Ure.

N.E. - Hayburn Wyke. Rievaulx Abbey. Ingleby Greenhow. Malton.

S.E. - Tickton. Loftsome Bridge, near Wressle. Riccall Common. Reservoir Waterworks, Hull (George Norman).

956a. *Synedra pulchella* var. *acicularis* (W. Sm.). [Syn. *Synedra acicularis* W. Sm.; *S. Smithii* Ralfs; *S. pulchella* var. *Smithii* (Ralfs) V. H.].

S.W. - Mirfield.

956b. *Synedra pulchella* var. *minutissima* (W. Sm.). [Syn. *Synedra minutissima* W. Sm.; *S. pulchella* var. *lanceolata* O'Meara].

MID W. - Buckden.

N.E. - Scarborough Mere. Hayburn Wyke. Scalby Beck. River Derwent. Forge Valley.

S.E. - Newsholme. Near Stoneferry (George Norman).

957. *Synedra Vaucheriae* Kutz.

S.W. - Mirfield. Allerton. Frizinghall. Cragg Vale, towards Blackstone Edge. Halifax.

MID W. - Baildon. Hawksworth Springs.

S.E. - Newsholme. Loftsome Bridge, near Wressle.

958. *Synedra Ulna* (Nitzsch) Ehrenb.

S.W. - Askern, Cusworth and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles). Roche Abbey (M. H. Stiles; J. Newton Coombe). Woolley. Doncaster. Bingley. Fixby. Denholme. Bradford. Mirfield. Morley. Ogden Clough.

MID W. - Markington (Rev. J. S. Tute). Ripley; Harrogate! (George Norman). Blubberhouses (William Barwell Turner). Baildon. Kildwick. Ilkley. Otley. Holden Gill, near Keighley. Leathley. Above Eldwick. Bolton Woods. Boston Spa. Menston.

N.W. - Cautley Spout. Great Sleddale. Mickle and Cronkley Fells. Great Shunnor Fell.

N.E. - Peat Deposit, Filey. Scalby Beck. River Derwent Forge Valley. Staindale. Rievaulx Abbey. Pilmoor, near Thirsk. Malton! (George Norman). Ingleby.

S.E. - Loftsome Bridge, near Wressle. Beverley. Waghon. Haltenprice. Wawne; Reservoir Waterworks, Hull; Hornsea Peat Deposit (George Norman).

958a. *Synedra Ulna Forma. salina* (W. Sm.). [Syn. *Synedra salina* W. Sm.; *S. Ulna forma marina* Rabenh.].

S.E. - Market Weighton Canal (George Norman).

958b. *Synedra Ulna* var. *splendens* (Kutz.) Brun. [Syn. *S. splendens* Kutz.; *S. radians* W. Sm.].

S.W. - Firsby Reservoirs (M. H. Stiles). Askern (Rev. F. H. Allen). Woolley. Bradford. Bingley. Doncaster. Goole. Roche Abbey (J. Newton Coombe). Farnley. Elslack.

MID W. - Roundhay; South Milford (William Barwell Turner). Austwick. Baildon. Malham Cove (J. M. Kirk). Boston Spa. Knaresborough. Bell Busk.

N.W. - Sedbergh. Mickle and Cronkley Fells.

N.E. - Malton. Scarborough.

S.E. - Beverley. Routh. Spring Ditch; Risby Pond; River Derwent; Cottingham; Newbald; Wawne; Reservoir Waterworks, Hull (George Norman).

958c. *Synedra Ulna* var. *subaequalis* (Grun.) V.H.

S.W. - Hatfield district (M. H. Stiles).

958d. *Synedra Ulna* var. *aequalis* (Kutz.) Rabenh. [Syn. *S. aequalis* Kutz.].

S.E. - Riccall Common.

958e. *Synedra Ulna* var. *longissima* (W. Sm.) Grun. [Syn. *S. lomgissima* W. Sm.].

S.W. - Wilsden.

MID W. - Rombald's Moor.

958f. *Synedra Ulna* var. *amphirhynchus* (Ehrenb.) V. H. [Syn. *S. amphirhynchus* Ehrenb.].

S.W. - Doncaster town water (M. H. Stiles).

958g. *Synedra Ulna* var. *obtusa* (W. Sm.) V. H. [Syn. *S. obtusa* W. Sm.].

N.E. - Egton.

958h. *Synedra Ulna* var. *oxyrhynchus* (Kutz.) V. H. [Syn. *S. oxyrhynchus* Kutz.].

S.W. - Cullingworth.

959. *Synedra Acus* (Kutz.) Grun.

S.W. - Hatfield district; Rossington (M. H. Stiles). Greetland, near Halifax. Fixby.

MID W. - Kilsney. Bell Busk. Wigton Moor. Bolton Woods. Harrogate. Ilkley.

N.E. - Pilmoor, near Thirsk. Ingleby. Malton.

S.E. - Loftsome Bridge, near Wressle. Newsholme. Near Meaux Abbey. Skipwith Common.

959a. *Synedra Acus* var. *delicatissima* (W. Sm.) Grun. [Syn. *S. delicatissima* [W. Sm.].

S.W. - Fixby. Marley, near Bingley.

N.W. - Jervaulx Abbey.

N.E. - Scarborough Mere. Strensall. Terrington. Malton.

S.E. - Market Weighton.

960. *Synedra radians* (Kutz.) Grun.

S.W. - Askern. Cusworth, and Hatfield districts (M. H. Stiles). Doncaster. Ogden Clough.

MID W. - Rombald's Moor. Near Buckden.

S.E. - Market Weighton. Skipwith Common.

961. *Synedra capitata* Ehrenb.

S.W. - Askern and Hatfield districts (M. H. Stiles). Hunslet (J. Abbott). Goole; Roche Abbey (E. Hunter). Near Shipley.

MID W. - South Milford (William Barwell Turner). Malham Cove (J. M. Kirk). Staveley Dam, near Knaresborough.

N.E. - Strensall. Near Scarborough.

S.E. - Beverley. Spring Ditch; Risby Pond; Reservoir Waterworks, Hull; Hornsea Peat Deposit (George Norman).

962. *Synedra famelica* Kutz.

MID W. - Harrogate. Hawksworth Springs. Bog two miles south of Clapham. Malham Tarn.

N.W. - Cautley Spout. Snaizeholme Beck.

963. *Synedra affinis* Kutz. var. *fasciculata* (Kutz.) V. H. [Syn. *S. fasciculata* Kutz.].

MID W. - Outlet to lake, Ripley (George Norman). [*S. hamata* W. Sm., recorded for the outlet of the lake, Ripley Castle, is probably a variety of *S. affinis* Kutz.].

964. *Synedra amphicephala* Kutz.

MID W. - Ingleton, on wet rocks., amongst *Cladophora glomerata*.

GENUS ASTERIONELLA Hass., 1850.

965. *Asterionella formosa* Hass.

S.W. - Askern district (M. H. Stiles). Greetland, near Halifax.

MID W. - Ripley Castle (George Norman). Cowthorpe. Penyghent. Holden Gill, near Keighley. Wigton Moor. Moughton Fell.

N.W. - Mickle Fell. Romalldkirk.

N.E. - Strensall.

FAMILY FRAGILARIEAE.

GENUS FRAGILARIA Lyngb., 1819.

966. *Fragilaria virescens* Ralfs.

S.W. - Not uncommon about Bradford. Marley, near Bingley.

MID W. - Hawksworth Springs (H. F. Parsons). Bowland Knotts.

N.E. - Terrington.

S.E. - Cottingham; Wawne; Inglemire Lane (George Norman).

967. *Fragilaria capucina* Desmaz.

S.W. - Cusworth and Hatfield districts; Rossington (M. H. Stiles). Askern (J. M. Kirk; M. H. Stiles). Hatfield Chase (J. M. Kirk). Roche Abbey (J. Newton Coombe; M. H. Stiles). Bradford. Cullingworth. Doncaster. Bingley. Denholme. Oxenhope. Worth Valley and Keighley Tarn.

MID W. - Chapelton; Roundhay (William Barwell Turner). Malham Cove (J. M. Kirk). Adel Bog. Holden Gill, near Keighley. Whernside. Arthington. Ilkley.

N.W. - Sedbergh. Mickle Fell.

N.E. - Lockton. Egton. Strensall. Scarborough Mere. Terrington. Malton. Stokesley.

S.E. - Tickton. Near Meaux Abbey. Newsholme. Beverley. Loftsme Bridge, near Wressle. Hull; Cottingham; Inglemire Lane (George Norman).

967a. *Fragilaria capucina* var. *mesolepta* Rabenh.

S.W. - Firsby Reservoirs (M. H. Stiles).

MID W. - Cocket Moss, near Giggleswick.

N.E. - Lockton.

968. *Fragilaria construens* (Ehrenb.) Grun. [Syn. *Odontidium Tabellaria* W. Sm.].

S.W. - Cusworth, near Doncaster. Doncaster town water; Hatfield district; Rossington (M. H. Stiles).

MID W. - Langcliffe, near Settle. Malham Tarn Bog.

S.E. - Beverley. Hornsea Mere; Risby Pond; Wawne; Hornsea Peat Deposit (George Norman).

968a. *Fragilaria construens* var. *binodis* Grun. [Syn. *Odontidium parasiticum* W. Sm., pro parte].

MID W. - Pond at Horsforth! (Miss J. Town), attached to *Surirella biseriata* and *Cymatopleura Solea*.

S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe).

S.E. - Market Weighton Canal; Beverley Parks (George Norman)

969. *Fragilaria Harrisonii* (W. Sm.) Grun. [Syn. *Odontidium Harrisonii* W. Sm.].

S.W. - Cusworth district (M. H. Stiles). Roche Abbey (J. Newton Coombe; M. H. Stiles).

MID W. - Langcliffe, near Settle.

S.E. - Haltenprice; Spring Head; Hornsea Peat Deposit; Spring Ditch; Cottingham; near Hull (George Norman).

970. *Fragilaria mutabilis* (W. Sm.) Grun. [Syn. *Odontidium mutabile* W. Sm.].

S.W. - Cusworth district (M. H. Stiles). Marsden. Cullingworth. Roche Abbey (M. H. Stiles; J. Newton Coombe). Fixby.

MID W. - Holden Gill, near Keighley. Baildon. Staveley Dam, near Knaresborough. Ribblesdale.

N.W. - Howgill Fells. Great Shunnor Fell.

N.E. - Saltburn. Scarborough.

S.E. - Beverley. Waghon. Loftsme Bridge, near Wressle. Risby Pond; Wawne; Market Weighton Canal; Cottingham; Spring Ditch (George Norman).

FAMILY MERIDIONIDAE.

GENUS MERIDION Ag., 1824.

971. *Meridion circulare* (Grev.) Ag.

S.W. - Cusworth and Hatfield districts; Roche Abbey; Doncaster town water (M. H. Stiles). Woolley. Saltaire. Marley, near Bingley. Elslack. Coley, near Shelf (pure gathering).

MID W. - Near Norwood Hall, above Lindley Reservoir. Kilnsey. Malham Cove. Malham Tarn Bog. Horton-in-Ribblesdale. Ribblesdale. Whernside. Boston Spa. Baildon. Eldwick.

N.W. - Lund's Fell. Dodd Fell. Howgill Fells. Widdale Fell. Mickle Fell. Great Shunnor Fell. Hawes.

S.E. - Beverley. Routh. Loftsme Bridge, near Wressle. Tickton. Near Meaux Abbey. Haltenprice. Cottingham; Market Weighton; Driffield (George Norman).

971a. *Meridion circulare* var. *constrictum* (Ralfs) V. H. [Syn. *Meridion constrictum* Ralfs].

S.W. - Keighley.

N.W. - Cronkley Fell. Great Shunnor Fell. Cotterdale.

S.E. - Spring Ditch (Dr. Munroe).

FAMILY DIATOMAE.

GENUS DIATOMA DC., 1805.

972. *Diatoma vulgare* Bory.

S.W. - Cusworth district; Rossington; Roche Abbey (M. H. Stiles). Askern (George Norman; M. H. Stiles). Hatfield Chase (George Norman). Roche Abbey (J. Newton Coombe). Shipley.

MID W. - Harrogate (George Norman). Arthington. Near Norwood Hall, above Lindley Reservoir. Holden Gill, near Keighley. Bolton Woods. Otley. Oughtershaw Moss. Whernside. Ripley; Knaresborough (George Norman).

N.W. - Winch Bridge. Mickle Fell.

N.E. - Whitby. Lockton. Strensall (William Barwell Turner). Hayburn Wyke. Scalby Beck. Malton (George Norman).

S.E. - Loftsme Bridge, near Wressle. Skipwith Common. Wawne; Reservoir Waterworks, Hull (George Norman).

973. *Diatoma elongatum* Ag.

S.W. - Cusworth and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles). Roche Abbey (J. Newton Coombe; M. H. Stiles). Shipley. Doncaster Liversedge (Rev. W. Fowler!). Fixby. Goole. Heaton.

MID W. - Ripley (George Norman). Blubberhouses; Roundhay (William Barwell Turner). Holden Gill, near Keighley. Adel. Buckden. Staveley Dam, near Knaresborough. Hawksworth.

N.W. - Winch Bridge.

N.E. - Whitby. Scarborough Mere. Strensall! (William Barwell Turner). Scalby Beck.

S.E. - Beverley. Newsholme. Loftsme Bridge, near Wressle. Skirlaugh. Reservoir Waterworks, Hull; Market Weighton (George Norman).

973a. *Diatoma elongatum* var. *Ehrenbergii* (Kutz.) V.H. [Syn. *D. Ehrenbergii* Kutz.; *D. grande* Sm.].

S.W. - Trough near Shipley.

MID W. - Markington (Rev. J. S. Tute). Malham Tarn Bog.

S.E. - Hull (George Norman).

974. *Diatoma hiemale* (Lyngb.) Heib. [Syn. *Odontidium hiemale* (Lyngb.) Kutz.].

S.W. - Wilsden. Greetland, near Halifax. Crimsworth Dean.

MID W. - Blubberhouses (William Barwell Turner). Holden Gill, near Keighley.

N.W. - Mickle Fell. Sedbergh. Howgill Fells.

N.E. - Lockton. Scarborough Mere. Rievaulx Abbey. Carlton Bank.

S.E. - Beverley.

974a. *Diatoma hiemale* var. *mesodon* (Kutz) V. H. [Syn. *Odontidium mesodon* Kutz.].

S.W. - Bradford. Roche Abbey (J. Newton Coombe). Worth Valley, near Keighley. Denholme. Ogden Clough. Crimsworth Dean. Hebden Bridge.

MID W. - Blubberhouses; Roundhay (William Barwell Turner). Shipley Glen. Holden Gill, near Keighley.

Malham Cove. Wherside. Kilnsey.

N.W. - Mickle Fell. Holwick. Dodd Fell. Great Shunnor Fell. Calf Beck, Howgill Fells.

975. *Diatoma anceps* (Ehrenb.) Grun.

N.W. - Bog, near Widdale Beck, abundant, iv. 1898.

GENUS DENTICULA Kutz., 1844.

976. *Denticula tenuis* Kutz.

S.W. - Askern, Cusworth and Hatfield districts (M. H. Stiles). Crimsworth Dean.

MID W. - Holden Gill, near Keighley, Shipley Glen. Simon's Fell. Ingleton.

N.W. - Cautley Spout.

N.E. - Beast Cliff.

S.E. - Wressle. Wawne (George Norman). Anlaby Road (Dr. Munroe).

976a. *Denticula tenuis* var. *crassula* (Nag.) [Syn. *D. crassula* Nag., 1849; *D. inflata* W. Sm., 1856].

MID W. - Ingleton.

N.W. - Great Shunnor Fell.

S.E. - Newbald (George Norman).

977. *Denticula elegans* Kutz.

S.W. - Ogden Clough.

FAMILY TABELLARIAEAE

GENUS TABELLARIA Ehrenb, 1839.

978. *Tabellaria fenestrata* (Lyngb.) Kutz.

S.W. - Cullingworth. Greetland, near Halifax. Skelmanthorpe. Keighley Moor.

MID W. - Blubberhouses (William Barwell Turner). Ilkley.

N.W. - Baugh Fell. Mickle Fell. Cotterdale.

N.E. - Carlton Bank.

S.E. - Skipwith Common.

979. *Tabellaria flocculosa* (Roth.) Kutz.

S.W. - Bradford. Doncaster town water; Hatfield district (M. H. Stiles). Keighley Moor. Cragg Vale, towards Blackstone Edge. Cullingworth.

MID W. - Blubberhouses; Horsforth (William Barwell Turner). Black Hill, near Settle. Near Buckden. Cam Fell. Ilkley. Cocket Moss, near Giggleswick. Bowland Knotts. Giggleswick Common.

N.W. - Sedbergh. Baugh Fell. Wherside. Mickle and Cronkley Fells. Great Shunnor Fell. Hawes.

N.E. - Pilmoor, near Thirsk. Saltersgate (George Norman). Scarborough.

S.E. - Riccall Common. Cottingham; Spring Head; Spring Ditch; Risby Pond (George Norman).

979a. *Tabellaria flocculosa* var. *ventricosa* (Kutz.) Rabenh.

S.W. - Cullingworth.

MID W. - Wigton Moor. Rombald's Moor. Baildon. Adel Dam.

N.W. - Leeming. Mickle Fell. Great Shunnor Fell.

N.E. - Scarborough Mere.

GENUS TETRACYCLUS Ralfs, 1843.

980. *Tetracyclus rupestris* (A. Br.) Grun. [Syn. *Gomphogramma rupestris* A. Br.].

S.W. - Goole (J. Harrison).

981. *Tetracyclus lacustris* Ralfs.

MID W. - Roundhay (William Barwell Turner).

FAMILY SURIRELEAE.

GENUS CYMATOPLEURA W. Sm., 1851.

982. *Cymatopleura elliptica* (Breb.) W. Sm.

S.W. - Askern, Cusworth, and Hatfield district; Rossington (M. H. Stiles). Goole; Roche Abbey (E. Hunter).

Heaton. Cullingworth. Fixby.

MID W. - Roundhay; South Milford (William Barwell Turner). Hawksworth. Baildon. Malham Tarn Bog.

Bolton Woods. Near Settle. Staveley Dam, near Knaresborough.

N.W. - Cronkley Fell. Dodd Fell.

N.E. - Levisham.

S.E. - Routh; Risby Pond; Wawne; Haltenprice; Hornsea Deposit; Cottingham; Spring Ditch; Beverley; Market Weighton Canal (George Norman).

982a. *Cymatopleura elliptica* var. *constricta* Grun.

S.W. - Goole.

982b. *Cymatopleura elliptica* var. *Hibernica* (W. Sm.) V. H. [Syn. *C. Hibernia* W. Sm.]

S.W. - Firsby Reservoirs; Hatfield district (M. H. Stiles). Marley, near Bingley.

MID W. - Hawksworth.

983. *Cymatopleura Solea* (Breb.) W. Sm.

S.W. - Cusworth and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles). Goole (E. Hunter). Roche Abbey (M. H. Stiles; E. Hunter). Askern (M. H. Stiles; F. H. Allen). Hatfield Chase (J. M. Kirk). Doncaster.

MID W. - Roundhay (William Barwell Turner). South Milford (F. Emsley). Hawksworth. Moughton Fell. Penyghent. Wherside. Pool. Malham Tarn Bog. Baildon. Horsforth. Boston Spa. Harrogate.

N.W. - Cronkley Fell. Great Shunnor Fell. Hawes Junction.

N.E. - Levisham. Saltburn. Rievaulx Abbey. Malton. Carlton Bank.

S.E. - Beverley. Tickton. Newsholme. Routh. Loftsome Bridge, near Wressle. Market Weighton. Skipwith Common. Skirlaugh; Hornsea Deposit; Wawne; Reservoir, Hull; Cottingham; Haltenprice; Spring Ditch; Beverley (George Norman).

983b. *Cymatopleura Solea* var. *apiculata* (W. Sm.) Ralfs. [Syn. *C. apiculata* W. Sm.].

S.W. - Marley, near Bingley. Roche Abbey (M. H. Stiles; J. Newton Coombe). Horton Park, Bradford.

N.W. - Mickle Fell.

S.E. - Cottingham; Skirlaugh (George Norman).

GENUS SURIRELLA Turp., 1827.

984. *Surirella biseriata* Breb.

S.W. - Cusworth, near Doncaster (M. H. Stiles). Roche Abbey (J. Newton Coombe; M. H. Stiles). Cullingworth. Marley, near Bingley.

MID W. - Blubberhouses; Roundhay; South Milford (William Barwell Turner). Baildon. Eldwick. Saltaire. Adel Bog. Leathley. Cocket Moss, near Giggleswick.

N.W. - Leeming. Mickle Fell. Great Shunnor Fell.

N.E. - Scarborough Mere. Staindale. Carlton Bank.

S.E. - Beverley. Cottingham; River Hull; Market Weighton Canal; Wawne (George Norman).

985. *Surirella linearis* W. Sm.

S.W. - Roche Abbey (J. Newton Coombe; M. H. Stiles). Marley, near Bingley. Cullingworth. Greetland, near Halifax. Ogden Clough. Cragg Vale, towards Blackstone Edge.

MID W. - Adel Bog. Eldwick. Kildwick. Appletreewick. Leathley. Black Hill, near Settle.

N.W. - Wherside. Mickle and Cronkley Fells. Great Shunnor Fell. Lund's Fell.

N.E. - Staindale. Terrington. Carlton Bank.

S.E. - Cottingham; Beverley Parks; Wawne; Hornsea Peat Deposit; Market Weighton Canal (George Norman).

985a. *Surirella linearis* var. *constricta* Grun.

N.W. - Baugh Fell.

986. *Surirella elegans* Ehrenb. [Syn. *Campylodiscus elegans* (Ehrenb.) Rabenh.].

MID W. - River Skell. Fountains Abbey (G. Stuart; E. Grove).

S.E. - Hull (George Norman).

987. *Surirella robusta* Ehrenb. [Syn. *S. nobilis* W. Sm.].

MID W. - Cocket Moss, near Giggleswick. Bowland Knotts.

N.W. - Mickle Fell.

N.E. - Terrington.

S.E. - Hornsea Peat Deposit; Stoneferry; Cottingham; Market Weighton Canal (George Norman).

987a. *Surirella robusta* var. *splendida* (Ehrenb.) V.H. [Syn. *S. splendida* (Ehrenb.) Kutz.].
S.W. - Doncaster town water; Rossington (M. H. Stiles). Horton Park.
MID W. - Markington (Rev. J. S. Tut). Harrogate.
N.E. - Strensall. Scarborough Mere.
S.E. - Beverley. Spring Ditch; near Stoneferry; Market Weighton Canal (George Norman).

988. *Surirella striatula* Turp.
S.W. - Goole (J. Harrison).
S.E. - Near Stoneferry; Market Weighton Canal (George Norman).

989. *Surirella ovalis* Breb.
S.W. - Askern and Hatfield districts; Doncaster Town water; Firsby Reservoirs (M. H. Stiles). Roche Abbey (J. Newton Coombe). Goole. Farley.
MID W. - Baildon. Saltaire.
N.E. - Seamer. Staithes. Beast Cliff.
S.E. - Near Stoneferry; Hornsea Peat Deposit; Anlaby to Hessle Road (George Norman).

989a. *Surirella ovalis* var. *ovata* (Kutz.) V. H. [Syn. *Surirella ovata* Kutz.].
S.W. - Rossington (M. H. Stiles). Chellow Dean. Bingley. Goole. Near Shipley.
MID W. - Roundhay; South Milford (William Barwell Turner). Harrogate (George Norman).
N.E. - Strensall. Whitby. Staindale.
S.E. - Routh. Beverley. Near Meaux Abbey. River Hull; Skirlaugh; Dairycotes; Cottingham (George Norman).

989b. *Surirella ovalis* var. *minuta* (Breb.) V.H. [Syn. *Surirella minuta* Breb.].
S.W. - Bradford. Allerton. Marley, near Bingley. Goole. Heaton. Fixby. Coley, near Shelf. Liversedge! (Rev. W. Fowler).
MID W. - Above Eldwick. Bolton Woods. Harrogate. Baildon.
N.W. - Mickle Fell. Reeth.
N.E. - Strensall. Seamer. Scalby Beck.
S.E. - Routh. Beverley. Newsholme. Tickton. Near Meaux Abbey. Waghen.

989c. *Surirella ovalis* var. *salina* (W. Sm.) V. H. [Syn. *Surirella salina* W. Sm.].
S.E. - Waghen.

989d. *Surirella ovalis* var. *angusta* (Kutz.) V. H. [Syn. *Surirella angusta* Kutz.; *S. apiculata* (W. Sm.)].
S.W. - Cusworth, near Doncaster(!) (M. H. Stiles). Chellow Dean. Keighley Moor.
MID W. - Rombald's Moor. Near Otley. Moughton Fell.
N.W. - Rokeby.
N.E. - Marske. Strensall.
S.E. - Near Meaux Abbey. Stoneferry Lane (Dr. Munroe).

989e. *Surirella ovalis* var. *pinnata* (W. Sm.) V.H. [Syn. *Surirella pinnata* W. Sm.].
S.W. - Rossington (M. H. Stiles). Near Bradford. Chellow Dean. Bingley. Ogden Clough. Near Shipley. Farley.
MID W. - Eldwick. Adel Bog. Oughtershaw Moss.
N.E. - Strensall. Dalton. Seamer. Scalby Beck. Rievaulx Abbey. Malton.
S.E. - Beverley. Routh. Newsholme. Market Weighton. Risby Pond; Cottingham; Hornsea Peat Deposit; ditch near river Hull

989f. *Surirella ovalis* var. *panduriformis* (W. Sm.) [Syn. *Surirella panduriformis* W. Sm.].
S.W. - Allerton.
MID W. - Harrogate (George Norman).
N.W. - Mickle Fell. Rokeby.
S.E. - Tickton. Skirlaugh; Market Weighton Canal (George Norman).

989g. *Surirella ovalis* var. *Crumena* (Breb.) Van Heurck. [Syn. *Surirella Crumena* Breb; *S. Brightwellii* W. Sm.].
S.W. - Firsby Reservoirs; Rossington (M. H. Stiles).
MID W. - Birk Cragg, Harrogate (George Norman).
N.E. - Saltersgate (George Norman).
S.E. - Outlet, Hornsea Mere; Hornsea Peat Deposit; River Hull; near Stoneferry; Reservoir Waterworks,

Hull; Market Weighton Canal; Haltenprice (George Norman).

990. *Surirella spiralis* Kutz. [Syn. *Campylodiscus spiralis* W. Sm.].
S.W. - Roche Abbey (E. Hunter). Askern district (M. H. Stiles). Cullingworth. Marley, near Bingley. Hebden Bridge.
MID W. - Baildon. Hawksworth.
N.W. - Cronkley Fell. Dodd Fell.
N.E. - Staindale. Carlton Bank.
S.E. - Haltenprice; Skirlaugh (George Norman).

991. *Surirella Craticula* Ehrenb.
S.E. - Hornsea Peat Deposit, very rare (George Norman).

GENUS. CAMPYLODISCUS Ehrenb., 1841.

992. *Campylodiscus Hibernicus* Ehrenb. [Syn. *Campylodiscus costatus* W. Sm.].
S.W. - Cusworth(!) and Askern Districts (M. H. Stiles). Cullingworth.
MID W. - Baildon. Malham Tarn. Horton-in-Ribblesdale. South of Cray Moss.
S.E. - Spring Ditch; Cottingham; Haltenprice; Newbald; Hornsea Peat Deposit; Market Weighton Canal (George Norman).

FAMILY NITZSCHIEAE.

GENUS HANTZSCHIA Grun., 1877.

993. *Hantzschia amphioxys* (Ehrenb.) Grun. [Syn. *Nitzschia amphioxys* (Ehrenb. W. Sm.)].
S.W. - Askern and Cusworth districts; Doncaster (!) town water; Rossington (M. H. Stiles). Roche Abbey (M. H. Stiles; J. Newton Coombe). Goole. Bradford. Chellow Dean. Shipley.
MID W. - Killinghall; Harrogate (George Norman). Baildon. Bolton Woods.
N.W. - Mickle Fell. River Ure.
N.E. - Strensall. Scarborough Mere. Rievaulx Abbey. Saltburn. Carlton Bank.
S.E. - Routh. Near Meaux Abbey. Waghen. Benningholme; Wawne; Cottingham; Market Weighton Canal (George Norman).

GENUS NITZSCHIA Hass., 1845.

994. *Nitzschia punctata* (W. Sm.) Grun.
Syn. Tryblionella punctata W. Sm.].
S.E. - Market Weighton Canal; Pond, Stepney (George Norman).

995. *Nitzschia Tryblionella* Hantzsch. [Syn. *Tryblionella gracilis* W. Sm.].
S.W. - Goole (J. Harrison). Roche Abbey (M. H. Stiles; J. Newton Coombe). Doncaster town water; Firsby Reservoirs; Rossington (M. H. Stiles).
N.E. - Saltburn.
S.E. - Market Weighton. Stoneferry; Hornsea Peat Deposit (George Norman).

996. *Nitzschia angustata* (W. Sm.) Grun. [Syn. *Tryblionella angustata* W. Sm.].
S.W. - Roche Abbey (M. H. Stiles; J. Newton Coombe).
S.E. - Newsholme. Beverley!; Market Weighton Canal; Anlaby (George Norman).

997. *Nitzschia constricta* (Kutz.) Pritch. [Syn. *N. Dubia* W. Sm.].
S.W. - Goole (J. Harrison).
MID W. - Boston Spa. Hawksworth Springs. Bolton Woods. Ribbleshead.
S.E. - Beverley. Lofsome Bridge, near Wressle. Tickton. Routh. Near Meaux Abbey. Waghen. Market Weighton. Cottingham; near Stoneferry; Wawne; Haltenprice; Dairycotes; Anlaby to Hessle Road; Skirlaugh; Stepney Lane (George Norman).

997a. *Nitzschia constricta forma minor* Rabenh.
MID W. - Baildon.
S.E. - Market Weighton.

998. *Nitzschia plana* W. Sm.
S.E. - Brackish ditch, near River Hull (George Norman).

999. *Nitzschia parvula* W. Sm.

Often found on damp ground and amongst damp moss.
 S.W. - Doncaster Roche Abbey (J. Newton Coombe). Ogden Clough.
 MID W. - Boston Spa. Bolton Woods. Holden Gill, near Keighley.
 N.W. - Great Shunmor Fell.
 N.E. - Strensall. Marske. Rievaulx Abbey.
 S.E. - Riceall Common. Beverley. Waghen. Market Weighton. Withernsea; Cottingham (George Norman).
1000. *Nitzschia apiculata* (Greg.) Grun. [Syn. *Tryblionella apiculata* Greg.].
 S.E. - Patrington (George Norman).
1001. *Nitzschia acuminata* (W. Sm.) Grun. [Syn. *Tryblionella acuminata* W. Sm.].
 S.W. - Goole (J. Harrison).
 S.E. - Cottingham (George Norman). Timber Pond, Hull (R. Harrison).
1002. *Nitzschia circumscuta* (Bail.) Grun. [Syn. *Surirelia circumscuta* Bail.; *Tryblionella scutellum* W. Sm.].
 S.W. - Goole (J. Harrison). Askern district (M. H. Stiles).
 MID W. - Roundhay (William Barwell Turner).
1003. *Nitzschia bilobata* W. Sm.
 S.E. - Outlet of Hornsea Mere; Dairycoates; ditch near River Hull (George Norman).
1004. *Nitzschia Denticula* Grun. [Syn. *Denticula obtusa* W. Sm.].
 MID W. - Malham Cove (J. M. Kirk). Bingley. Holden Gill, near Keighley.
 N.E. - Beast Cliff. Near Scarborough.
1005. *Nitzschia sinuata* (W. Sm.) Grun. [Syn. *Denticula sinuata* W. Sm.].
 S.W. - Askern district (M. H. Stiles). Ogden Clough.
 MID W. - Baildon. Holden Gill, near Keighley. Cowside Beck, Arneliff.
 S.E. - Market Weighton. Cottingham; Beverley Parks (George Norman).
1006. *Nitzschia paradoxa* (Gmel.) Grun. [Syn. *Bacillaria paradoxa* Gmel.].
 S.W. - Goole.
 S.E. - Near Stoneferry; Market Weighton Canal (George Norman).
1007. *Nitzschia vivax* W. Sm.
 S.E. - Near Stoneferry (George Norman).
1008. *Nitzschia dissipata* (Kutz.) Grun. [Syn. ? *N. minutissima* W. Sm.].
 MID W. - Roundhay (William Barwell Turner). Baildon. Hawksworth Springs. Malham Tarn.
 N.W. - Mickle Fell.
 N.E. - Whitby. Seamer. Rievaulx Abbey. Strensall (William Barwell Turner).
 S.E. - Near Hull (George Norman).
1008a. *Nitzschia dissipata var. media* Van Heurck.
 MID W. - Hawksworth Springs. Penyghent.
 S.E. - Market Weighton.
1009. *Nitzschia Sigmoidea* (Ehrenb) W. Sm.
 S.W. - Abundant in the Bradford, Halifax, and Keighley districts. Cusworth and Hatfield districts; Firsby Reservoirs; Rossington (M. H. Stiles). Askern; Hatfield Chase (J. M. Kirk). Roche Abbey (J. Newton Coombe). Doncaster. Wibsey. Allerton.
 MID W. - Malham Cove (J. M. Kirk). Arthington. Bolton Woods. Staveley Dam, near Knaresborough. Whernside.
 N.W. - Dodd Fell. Mickle and Cronkley Fells.
 N.E. - Seamer. Near Scarborough. Malton. Carlton Bank.
 S.E. - Beverley. Routh. Market Weighton. Skipwith Common. Cottingham; Risby Pond; Wawne; Haltenprice; Spring Ditch; Beverley (George Norman).
1010. *Nitzschia vermicularis* (Kutz.) Grun.
 S.W. - Hatfield district (M. H. Stiles).
1011. *Nitzschia Brebissonii* W. Sm.
 MID W. - Gordale.
 S.E. - Near Stoneferry (George Norman).
1012. *Nitzschia Sigma* (Kutz.) W. Sm.
 S.W. - Goole (J. Harrison).

1013. *Nitzschia curvula* (Ehrenb.) W. Sm.
 S.W. - Doncaster town water (M. H. Stiles). Allerton. Cullingworth.
 MID W. - Adel Bog. Cocket Moss, near Giggleswick.
 N.E. - Rievaulx Abbey.
 S.E. - Stoneferry to Sutton (R. Harrison). Routh. Beverley. Waghen.
1014. *Nitzschia fasciculata* Grun.
 S.W. - Hatfield district (M. H. Stiles).
1015. *Nitzschia obtusa* W. Sm.
1015a. *Nitzschia obtusa var. scalpelliformis* Grun.
 S.E. - Loftsome Bridge, near Wressle.
1015b. *Nitzschia obtusa var. nana* Grun.
 MID W. - Hawksworth Springs.
 S.E. - Skipwith Common.
1016. *Nitzschia linearis* (Ag.) W. Sm.
 S.W. - Hatfield district (M. H. Stiles). Goole. Doncaster. Woolley. Denholme. Farnley. Shipley. Frizinghall.
 MID W. - Holden Gill, near Keighley. Gordale. Above Eldwick. Boston Spa. Cray Moss. Baildon.
 N.W. - Jervaulx Abbey. Mickle Fell.
 N.E. - Hayburn Wyke. Saltburn.
 S.E. - Beverley. Tickton. Routh. Near Meaux Abbey. Haltenprice; Cottingham (George Norman).
1016a. *Nitzschia linearis var. tenuis* (W. Sm.) Grun. [Syn. *N. tenuis* W. Sm.].
 S.W. - Bradford. Chellow Dean. Allerton. Doncaster. Cragg Vale, towards Blackstone Edge.
 MID W. - Moughton Fell. Gordale. Pond at Pool.
 N.E. - Rievaulx Abbey. Malton.
 S.E. - Beverley. Newsholme. Loftsome Bridge, near Wressle. Tickton. Routh. Market Weighton. Haltenprice; Spring Ditch; Cottingham (George Norman).
1017. *Nitzschia vitrea* Norman.
 S.E. - Near Stoneferry in brackish ditch (George Norman).
1017a. *Nitzschia vitrea var. recta* (Hantzsch.) V. H.
 S.W. - Hatfield district (M. H. Stiles).
1018. *Nitzschia lanceolata* W. Sm.
 S.W. - Roche Abbey (E. Hunter). Near Mirfield.
 MID W. - Roundhay; South Milford; Killingbeck (William Barwell Turner).
 N.E. - Strensall (William Barwell Turner).
1019. *Nitzschia Palea* (Kutz.) W. Sm.
 S.W. - Hatfield district (M. H. Stiles). Allerton. Crimsworth Dean. Cragg Vale, towards Blackstone Edge. Marley, near Bingley.
 MID W. - Rombald's Moor. Boston Spa. Near Buckden. Bog, two miles south of Clapham. Malham Tarn Bog. Moughton Fell.
 N.W. - Mickle Fell.
 N.E. - Pilmoor, near Thirsk. Ingleby Greenhow. Saltburn.
 S.E. - Market Weighton. Wressle. Newsholme, near Howden. Cottingham; Stoneferry (George Norman).
1019a. *Nitzschia Palea var. fonticola* Grun.
 MID W. - Baildon. Harrogate.
1019b. *Nitzschia Palea var. debilis* V. H.
 S.W. - Saltaire. Cullingworth.
 MID W. - Rombald's Moor.
 N.W. - Jervaulx Abbey.
1019c. *Nitzschia Palea var. tenuirostris* V. H.
 S.W. - Horton Park, Bradford. Near Shipley.
 N.W. - Jervaulx Abbey.
1020. *Nitzschia communis* Rabenh.
 S.W. - Allerton. Horton Park, Bradford.
 N.W. - Jervaulx Abbey.

- 1021. *Nitzschia amphibia*** Grun.
S.W. - Near Bingley.
N.W. - Mickle Fell
- 1022. *Nitzschia longissima*** (Breb.) Ralfs.
1022a. *Nitzschia longissima* var. *Closterium* (W. Sm.) V. H. [Syn. *N. Closterium* W. Sm.].
S.E. - Beverley.
1022b. *Nitzschia longissima* var. *reversa* (W. Sm.) V. H. [Syn. *N. reversa* W. Sm.].
S.E. - Ditch near Stoneferry (George Norman).
1023. *Nitzschia Smithii* Ralfs. [Syn. *N. spectabilis* W. Sm. non *N. spectabilis* (Ehrenb.) Ralfs].
S.E. - Rare in a brackish ditch near Stoneferry (George Norman).
1024. *Nitzschia acicularis* (Kutz.) W. Sm. [Syn. *Nitzchiella acicularis* Rabenh.].
S.W. - Hatfield district (M. H. Stiles). Mirfield.
MID W. - Austwick. Adel Bog. Pond at Pool. Hawksworth. Bolton Woods. Boston Spa.
N.W. - Mickle Fell. Dalton.
N.E. - Whitby. Seamer. Scalby Beck. Saltburn. Carlton Bank.
S.E. - Routh. near Sutton. Beverley. Loftsome Bridge, near Wressle. Newsholme. Dairycotes; Cottingham (George Norman).
1025. *Nitzschia gracilis* (Breb.) [Syn. *Nitzchiella gracilis* (Breb.) Rabenh.].
MID W. - Roundhay (William Barwell Turner).
S.E. - Waghen.

GENUS CYLINDROTHECA Rabenh., 1859.

- 1026. *Cylindrotheca gracilis*** (Breb.) Grun. [Syn. *Nitzschia tenia* W. Sm.].
S.E. - Marfleet Clough (pure) (George Norman).

ORDER CRYPTORAPHIDIEAE.

FAMILY MELOSIREAE.

GENUS MELOSIRA Ag., 1824.

- 1027. *Melosira nummuloides*** (Bory) Ag.
S.W. - Goole (E. Hunter).
S.E. - Dairycotes; ditch near Stoneferry (George Norman).
1028. *Melosira varians* Ag.
S.W. - Common. In the millstone grit districts. Abundant Roche Abbey (M. H. Stiles; J. Newton Coombe). Fixby. Heaton. Askern and Hatfield districts; Doncaster(!) town water; Firsby Reservoirs; Rossington (M. H. Stiles). Farnley.
MID W. - Arthington. Leathley. Baildon. Bolton Woods. Otley. Staveley Dam, near Knaresborough. Harrogate; Ripley (George Norman).
N.W. - Jervaulx Abbey. Masham.
N.E. - Frequent. Scalby Beck. Carlton Bank.
S.E. - Beverley. Newsholme. Haltenprice (pure and with sporangia); Spring Ditch; Cottingham; Wawne; Reservoir Waterworks, Hull; Hornsea Peat Deposit (George Norman).
1029. *Melosira distans* Kutz.
1029a. *Melosira distans* var. *nivalis* (W. Sm.) V. H. [Syn. *M. nivalis* W. Sm.].
MID W. - Gilstead.
N.E. - Lockton.
1030. *Melosira Arenulata* Kutz. [Syn. *M. orichalcea* W. Sm.].
S.W. - Very rare, in a boggy puddle, Thorne Moor (George Norman). Plentiful near Marsden.
N.W. - Rokeby.
1031. *Melosira arenaria* Moore.
S.W. - Roche Abbey (M. H. Stiles).
MID W. - Baildon. Gordale. Holden Gill, near Keighley. Kildwick.
N.E. - Near Scarborough. Rievaulx Abbey.

- S.E. - Newbald; Hornsea Peat Deposit; Hull (George Norman).
1032. *Melosira granulata* (Ehrenb.) Ralfs. [Syn. *Orthosira punctata* W. Sm.].
S.W. - Chellow Dean.
S.E. - Hornsea Peat Deposit; in brackish ditch, Stoneferry to Sutton (George Norman).
1033. *Melosira Roesiana* Rabenh. [Syn. *Orthosira spinosa* W. Sm.].
S.W. - On wet rocks near Bingley.
S.E. - Hornsea Peat Deposit (George Norman).
1034. *Melosira Jurgensii* Ag. [Syn. *M. subflexilis* Kutz.].
S.E. - Brackish water ditch running from Stoneferry to Sutton (pure) (George Norman).
GENUS CYCLOTELLA Kutz., 1833.
1035. *Cyclotella comta* (Ehrenb.) Kutz.
S.W. - Doncaster town water (M. H. Stiles).
1036. *Cyclotella operculata* Kutz.
S.W. - Cusworth district; Doncaster town water (M. H. Stiles). Goole (E. Hunter). Near Bradford.
MID W. - Ripley (George Norman). Roundhay (J. Abbott). Staveley Dam, near Knaresborough. Moughton Fell. Arthington.
S.E. - Spring Ditch; Cottingham (George Norman). Loftsome Bridge, near Wressle. Skipwith Common.
1037. *Cyclotella Meneghiniana* Kutz.
MID W. - Baildon.
N.E. - Carlton Bank.
1038. *Cyclotella minutula* Kutz.
S.E. - Hornsea Peat Deposit (George Norman).
1039. *Cyclotella Kutzingiana* Chauvin.
S.W. - Askern, Cusworth, and Hatfield districts (M. H. Stiles), Roche Abbey (J. Newton Coombe; M. H. Stiles). Doncaster. Cullingworth.
N.E. - Near Scarborough, abundant (vi. 1896). Carlton Bank.
S.E. - Spring Ditch; Cottingham; Stoneferry; Market Weighton Canal; Wawne (George Norman).
1040. *Cyclotella Astraea* (Ehrenb) Kutz. [Syn. *C. rotula* Kutz.].
S.E. - Market Weighton Canal; Hornsea Peat Deposit (George Norman).

FAMILY COSCINODISCIDAE

GENUS COSCINODISCUS Ehrenb., 1838.

- 1041. *Coscinodiscus lacustris*** Grun. [Syn. *Cyclotella punctata* W. Sm.].
S.E. - Market Weighton Canal, near the River Foulney, attached to *Myriophyllum* and *Potamogeton* (George Norman; Grunow).
1042. *Coscinodiscus radiatus* Ehrenb.
S.E. - Market Weighton Canal; Reservoir Waterworks, Hull (George Norman). Usually marine.

The Amician Mystery (Or the case of the missing Diatoms)

by Ron Green

This short article is concerned with the 'mystery' that surrounded the Amician test, a Diatom preparation that was the subject of discussion and controversy for over half a century. Various authorities on Diatoms consider the 'mystery' was solved many years ago, but their conclusions may be a little premature.

In the mid eighteenth hundreds the demand by dilettanti microscopists for test objects became an obsession, to meet their requirements Mr. Charles Morgan Topping, a well known professional mounter of microscope slides and an astute business man, began to produce large numbers of test slides on various subjects. In fact it has been recorded at the time of the Great Exhibition of

1851, he had on display five cabinets of microscope slide preparations, with many of the contents devoted to test objects, the list below is a compilation of some we know he produced in the period 1848 to 1855 :-

Infusoria

Fos, N. gracilis.
Amician test.
Grammatophora.
Ceretonis faschiota.
Navicular cuspidata.
- angulata.
- strigosa.
- lineata.
- spencerii.
- baltica.
- hippocampus.
- strigilate.
- formosum.

Hairs

Rabbit.
Squirrel.
Indian Bat.
- Mouse.
- Mole.

Scales

Hipparchia janira.
Pontia Brassica.
Azure Blue, P. argiolus.
Azure Blue, P. argus.
Tinea Vestianella.
Amathusia Horsefieldii.
Morpho Menelaus.
Podura Plumbea.
Podura aquatica.
Lepisma saccharina.
Alucita nupta.
Plumed Gnats.
Vanessa Io.

Hairs cont.

Larva of Dermistes.
Tripoli from Kritehelberg.
Muscular fibre.

Please note the compilation nomenclature is as used by Topping, without any correction to conform to current Taxonomy.

The 'mystery' was high lighted in an address by Mr. George C. Karop and read before the Quekett Microscopical Club in 1895, entitled "What was the Amician Test?", he asked the question because of the different opinions given by so many respected authors of Microscopical works. In Karop's search for the truth the diatom considered most likely to be the prime candidate was Navicular rhomboids*. Also like a spiders web, it was quite apparent all the threads to the mystery led directly back to C. M. Topping and his 'Amician test'. As Topping is the only recorded source we have before 1855 of the so called 'Amician Test', the possibility that the test was an invention of Topping's fertile mind cannot be excluded (probably based on his own diatom studies or observations) with a non de plume chosen to attract the dilettanti and thus help to maximise the profits of his business.

I hope to show if any such 'mystery' existed, it was the contents on the test slides themselves which gave rise to the confusion and uncertainty.

One would naturally think anyone who had a slide of Topping's Amician test the answer would be self evident....yes? Maybe, but there is a problem it was a strew slide containing at least one other form of diatom, further Topping did not name the test diatom he simply labelled it 'Amician Test' and last but not least there is evidence which cannot be ignored, which tends to indicate the mystery was not solved.

In 1866 a Mr. E. G. Lobb a well known and very respected microscopist of the time, presented a paper entitled 'Note on illuminating objects with High Powers'. In which he gave detailed instructions on how to resolve quite a number of diatoms using Powell's 170 degree condenser.

In the article he describes how to resolve Navicular cuspidata, Pleurosigma macrum, Pleurosigma fasciola and Navicular rhomboides. Lobb then went on to say (Bold print please Mr. Editor) "the Amician Test requires a different technique to resolve it", and proceeded to described that 'method' (Circular Oblique Lighting).

Those microscopists who have the sixth edition of Mr. J. Hoggs 'The Microscope' 1867 may refer to pages 62-63 which describe Lobb's 'method' in full. Further as Topping at the time (1866) was the only source of the 'Amician' test, the slide preparation used must have been his, for Lobb quoted the name of the test, not the name of the diatom, this fact is very significant. Therefore the evidence of Mr. Lobb's article of 1866 must eliminate Navicular rhomboids as the 'Amician' test, quod erat demonstrandum. Of course there are many loose ends to the story. For instance :-

1. When did Topping begin to produce the Amician test slide?. Was it before 1851 in time for the Great Exhibition?. Or connected later to the many foreign exhibitors attracted to the said exhibition?.

2. Why did Topping not name the diatom?, if it was Navicular rhomboides, Topping after 1850 could have added this to his labels if he had so wished, or was the intention to send his competitors on a wild goose chase, chasing after Navicular rhomboids when the actual test was an 'allied form' often found in conjunction with it?. One must also remember that commercial mounters were very secretive and jealously guarded their 'Trade secrets'. So if confusion was the intent he succeeded.

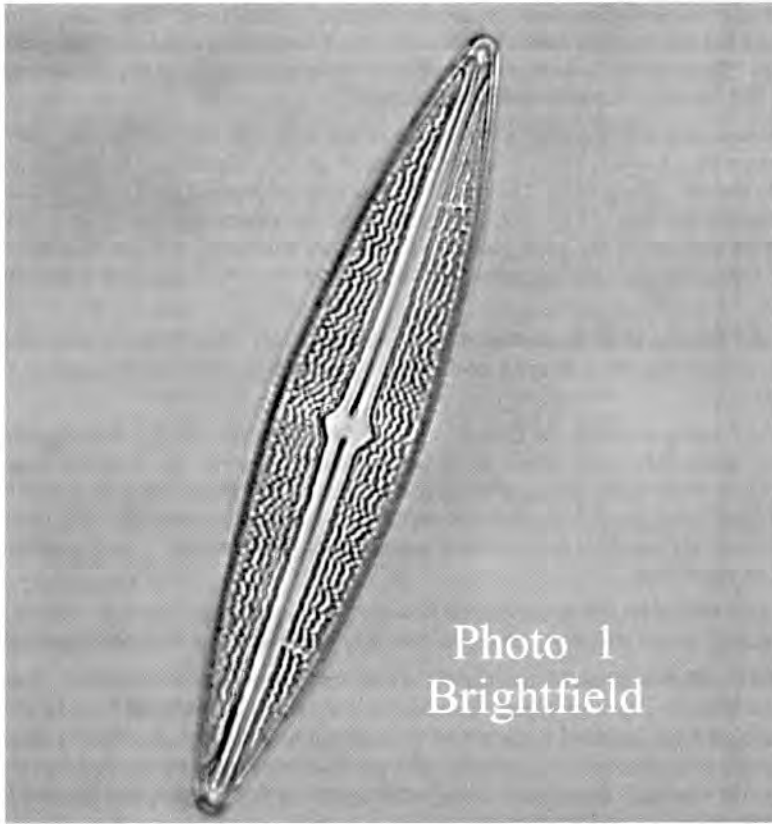
3. If Navicular Rhomboids was not the test how did Topping help his customers find the diatom in question, and further was any such instruction only divulged to the dilettanti aristocracy?.

4. Why did no other commercial moulder of the time supply the Amician test slide?. It is known Mr. Edmund Wheeler began supplying this slide but only after he purchased Topping's business assets which no doubt included a quantity of the Amician source material. Wheeler labelled his slides 'Amician Test Navicular rhomboids' so it would appear he was unaware of the possibility that it was not, was this Topping's last joke from the grave against a competitor he considered an upstart?. alas we will probably never know.

I must now relate my interest which spans almost sixty years with this 'apparent mystery' and personal events of the past which may or may not point to the actual Amician test diatom.

In the year 1946 (we moved house that year), an elderly gentleman who was a microscopist was showing my father and I a number of his Victorian slides, including many by Topping, one of which was an Amician test slide, (I suspect he was only showing them to us in order to borrow my two boxes of Victorian slides, which my father had shown him earlier, but that is another story). The gentleman told us the diatoms on the slide were Navicular rhomboides used for testing objectives. I asked "what were the other diatoms on the slide for, those with the funny zig zag markings?, (see Photograph One. I will refer to them as 'Navicular X' until some kind person identifies them) in answer to my question our host informed me, "he did not know their name but it is quite common in test strews to have others that are not part of the test". I must admit my interest in his answer was not all that great but then at the age of 10 years my interest lay more with observing live Pond life with my Victorian drum microscope.

A few years later in 1952 I saw my second Topping Amician test Slide owned by an Arts master (he was a collector of Victorian microscope slides and knew of my interest in microscopy), on the slide were the same strange 'Navicular X' diatoms. We attempted to resolve them, but as neither of us had an objective with sufficient aperture we failed. My microscope at

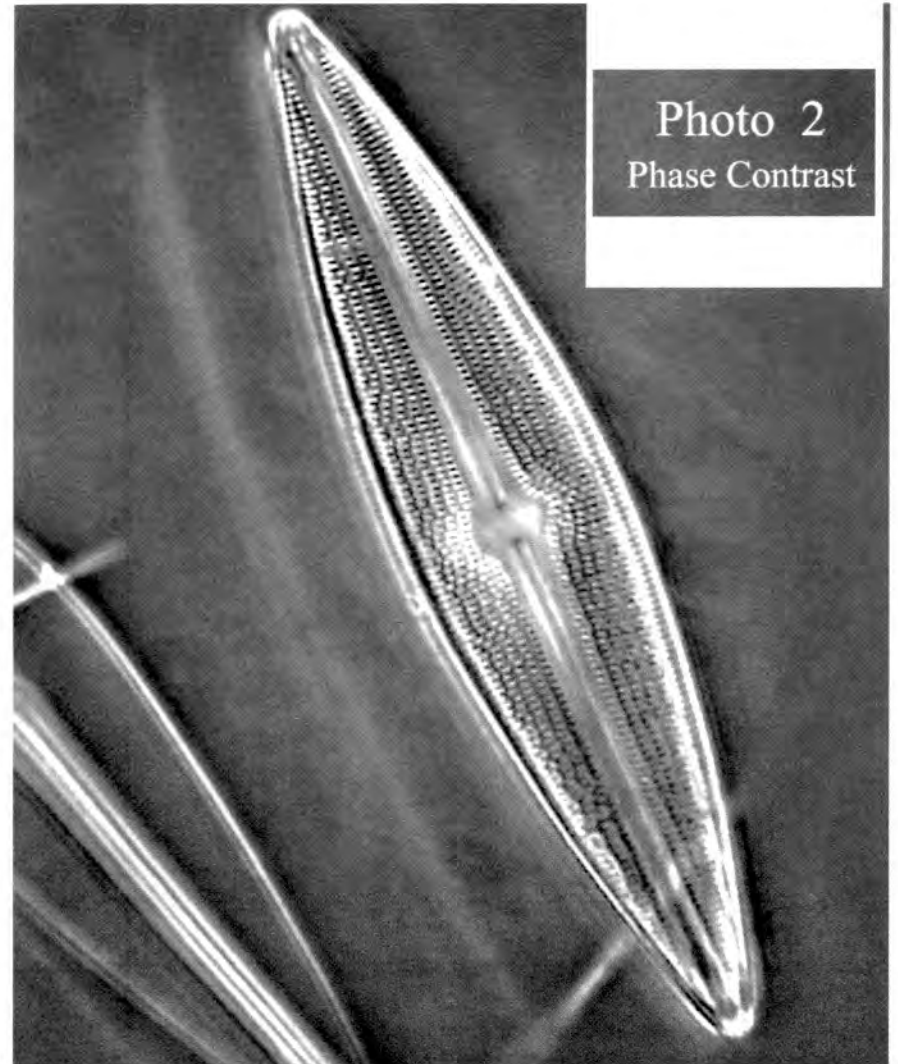


the time was made by Swift & Sons circa 1880, and the highest power objective I had was only one quarter of an inch with a low n.a.

Many years later in the early 1990's I saw my third and fourth Amician test Slides, a friend asked for my help in pricing items belonging to a number of deceased members estates for the next sales and wants (to be quite fair he always liked more than one opinion on price, also it gave him the opportunity to sell me a few items without becoming involved with their packing and posting). Among the effects was a small box of Victorian slides which contained two slides of the Amician test, one by Topping the other by Wheeler. I asked if I could borrow the box for a day or two before making any decision to buy them, this I did on his usual proviso "If you break or damage them in any way it will cost you".

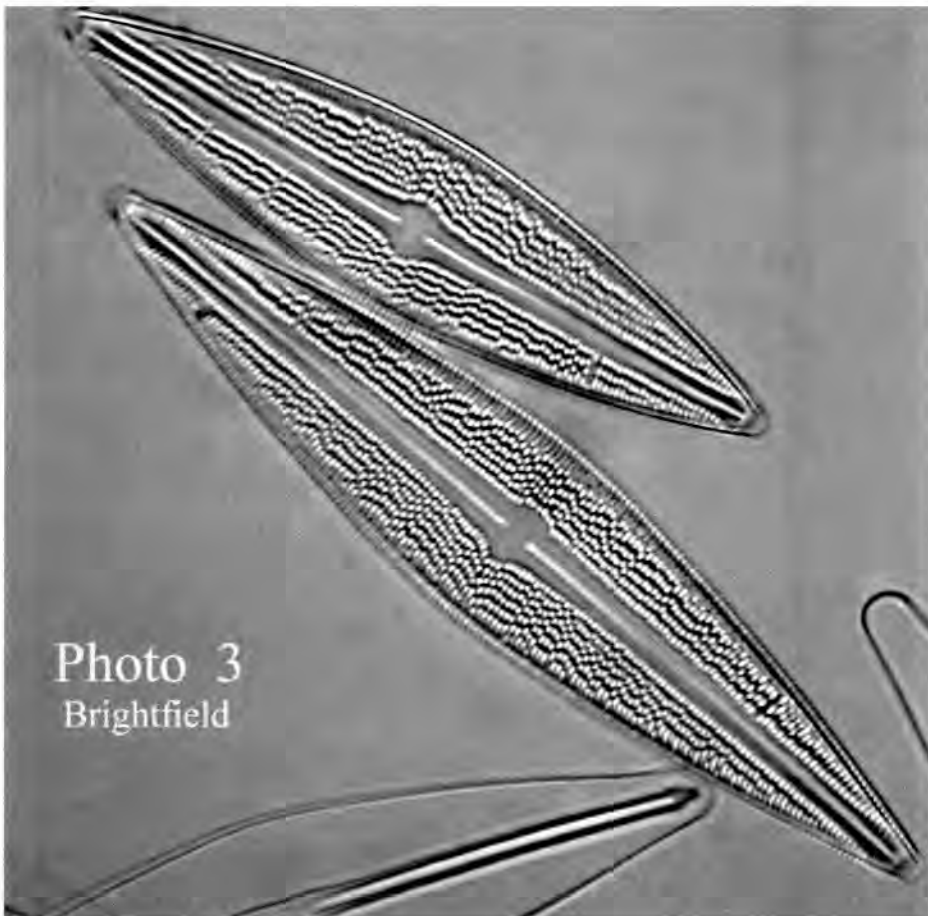
This time it was out with my 'trusty' Vickers M15c, once set up the strange 'Navicular X' diatoms which I had previously noted in earlier years could clearly be seen with a power of only 200x on both slides. For the plain glass Wheeler slide a 100x oil immersion objective was in order. But because the Topping slide was paper covered I thought discretion was the better part of valour, therefore my observations were limited to a 3 mm dry Apo objective.

The diatoms on the Wheeler slide were the first to be resolved, but the black punctae delineation



left much to be desired, it was a most confusing image which changed drastically with the slightest change of focus. I therefore tried Phase Contrast with an oil immersion objective, it was soon apparent what a strange 'beast' the diatom was. Instead of the punctae appearing as black dots they took the form of slits but fewer in number making it far coarser than navicular rhomboides as shown in Photograph Two.

The 3 mm objective I used on the Topping slide gave similar results to the Wheeler brightfield findings, but the image was somewhat degraded, the correction collar was working up against the stop with the front element touching the cover slip (I later discovered someone had assembled



the objective incorrectly). With my curiosity satisfied the slides were returned, for alas in all honesty the suggested price was far above what I could justify to my wife, sob, sob.

Bringing this story more up to date, in 2004 I purchased an Edmund Wheeler Amician test slide, can you imagine my feelings of disappointment when I discovered the source material was not the same. The 'Navicular X' diatoms were missing it contained only a pure strew of Navicular rhomboides, from past experience the slide was an obvious 'forgery' although not a modern one but one committed by Wheeler himself. In all probability this was done, because he had used all of Topping's source material, forcing him to substitute his own Navicular rhomboides stock, he would not have considered this wrong as his Amician label did indicate that diatom.

This year (2005) I set myself the task of finding if any 'Navicular X' diatoms were 'lurking' among my diatom collections. One may think this would be very hard to do from memory, but not really, the diatom is so distinctive it is a case of once seen never forgotten. Photographs One, Two and Three, record my success. This now leads me to ask the question "Is this Topping's

'Amician' test diatom, also is it one and the same as Mr. Lobb described how to resolve in 1866? ". Or is this just supposition based on an extraordinary series of coincidences?. Unfortunately to date the number of Amician slides I have examined are too few (five in total) to allow any positive conclusions to be drawn. Although I must admit out of nostalgia for days long gone I am inclined to believe it is the test diatom for it has a most interesting and unusual form. But what do you the readers think?.

Any reader of this journal who may wish to find the diatom 'Navicular X' among their collections, are advised to first search any Navicular rhomboides (Frustulia saxonica) strew slides they may have with Photograph One at their side, which should help to make identification easy. I would respectfully suggest a preliminary search at a magnification of 200/300x, followed by confirmation at 400/600x before changing to oil immersion, if you have Phase Contrast it may be used to advantage. Also if anyone can identify 'Navicular X' please inform this journal.....Happy searching.

In the event any Amateur or Professional mounter of diatoms, at some time in the future finds this diatom when out and about gathering material and considers making a mount of this diatom. I can assure them it will make an excellent test slide for the higher powers, and if you would be so kind I would like to place an order for one.

About the Photographs.

The photographs were taken by a Samsung 2.1 mega pixel digital camera attached to a Vickers M15c microscope. Photo One is brightfield at a magnification of 400x, taken with a Microplan 40x objective, 0.65 n.a. Photo Two was taken using Phase contrast at 900x, objective 90x, 1.25 n.a. with focus adjusted to show black punctae resolution, and Photo Three brightfield at 1000x, with a Vickers Plan apo 100x objective, 1.30 n.a, focused to show white punctae resolution. All images are cropped to cut out non relevant material.

Please note I am neither a Diatomist or an Historian therefore I must apologise for the use of any loose terminology. All errors are of course mine.

References

- Mr. G.C. Karop. "What was the Amician Test ?". Q.M.C. Journal. March 15th 1895, pp 79-82.
- Mr. E.G. Lobb. 'Note on illuminating objects with High Powers'. Trans, Mic, Soc," London, 1866, pp 39-41.
- Mr. E.M. Nelson. 'Navicular Rhomboids and Allied Forms'. Q.M.C. Journal. June 28th 1910, pp 93-98.
- Mr. J. Hoggs. 'Mr Lobb's methods'. The Microscope Sixth Edition, 1867, pp 62-63.
- Mr. B. Nuttall. Q.M.C. Journal. 2002, pp 409-426.
- Mr. J. Hoggs. 'The Microscope' 2nd Edition, 1855.
- Mr. J. Quekett. 'Practical Treatise on the use of the Microscope', 1st Edition 1848.

Addendum 1.

When I found a number of the 'Navicular X' diatoms on a Navicular rhomboides strew slide (est. count ratio 10 per 100), by an unnamed mounter and from an unknown location, I decided to try and find the source of the material. After examining over one hundred named location diatom strews from around the world, two slides were found both by the same mounter, each containing only one 'Navicular X' diatom at a ratio greater than 1 per 500 , this appeared to be

a classic case of cross contamination from an unknown source. I therefore examined other slides from this mounter and on a slide from the Isle of Lewis, Scotland (an island with numerous lochs), the diatom 'Navicular X' was found, with the slide having an estimated count ratio exceeding 10 per 100 diatoms, making the above island one probable source for Toppings 'Amician test'.

Addendum 2

Whilst a friend who is in the P.M.S. was proof reading the manuscript he informed me his 1st edition of "Hogg's 'The Microscope' 1854, does not have the Amician test in the included Toppings list", yet we know my 2nd edition of 1855 has. This fact is of great interest, unless it be one of omission it could possibly mean allowing for a publishing lead time of normally one year, that 1853 is the most likely date Topping began to produce the Amician Test slide, a date which would undermine any excuse for not correctly naming the test diatom, but I stand to be corrected.

Ron Green Rotherham, England. 16th December 2005

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* *Frustulia saxonica*.

*My apologies to authors of Pulp Fiction.

Editors Notes:-

The Jacob Whitman Bailey Collection at Harvard University contains a number of samples which relate to this article.

1. Fossil infusoria; test used by Amici; J. W. Bailey Coll. 1435
2. *Navicula amicii* Fossil infusoria; American; locality ?; J. W. Bailey Coll. 1439
3. *Navicula amicii* Florence, Italy; J. W. Bailey Coll. 1422
4. *Navicula amicii* *Navicula amicii*; resolved March 27 fairly over whole surface, several times; J. W. Bailey Coll. 1441
5. Amici's test; J. W. Bailey Coll. 1442
6. *Navicula amicii* *Navicula amicii*; very difficult; J. W. Bailey Coll. 1451

The interesting point concerning these samples is that *Navicula amicii* doesn't exist as a named species and is not a pseudonym of any diatom as far as Van Landingham is concerned. Thus it appears not to exist and yet it is included in Bailey's Collection.

If anyone is able to examine these samples then we would at the very least determine what species Bailey considered was used in the Amician test.

Further reading:-

Amician test what was it? (Karop). [SERIES 2, VOLUME VI, 1894-1897 Page 079] (Quekett CD ref:Disc 2 VOL12/079.htm)

Karop, G.C. 1895. What was the Amician test? (see also Nelson, E.M.). [SERIES 2, VOLUME VI, 1894-1897 Page 079] (Quekett CD ref:Disc 2 VOL12/079.htm)

Amician test the, note on (Nelson). [SERIES 2, VOLUME XI, 1910-1912 Page 217] (Quekett CD ref:Disc 2 VOL17/217.htm)

Nelson, E.M. 1911b. Note on the Amician test. [SERIES 2, VOLUME XI, 1910-1912 Page 217] (Quekett CD ref:Disc 2 VOL17/217.htm)

Navicula rhomboides allied forms, and the Amician test (Nelson). [SERIES 2, VOLUME XI, 1910-1912 Page 093] (Quekett CD ref:Disc 2 VOL17/093.htm)

Amician test the, *Navicula rhomboides* and allied forms (Nelson). [SERIES 2, VOLUME XI, 1910-1912 Page 093] (Quekett CD ref:Disc 2 VOL17/093.htm)

Navicula rhomboides identified as the Amician test (Nelson). [SERIES 2, VOLUME XV, 1923-1927 Page 109] (Quekett CD ref:Disc 3 VOL21/109.htm)

Amician test *Navicula rhomboides* identified as the (Nelson). [SERIES 2, VOLUME XV, 1923-1927 Page 109] (Quekett CD ref:Disc 3 VOL21/109.htm)

Nelson, E.M. Reported item: the Amician test identified by Reade. [SERIES 2, VOLUME XV, 1923-1927 Page 109] (Quekett CD ref:Disc 3 VOL21/109.htm)

Diatoms, observation techniques, use as test objects Amician test {frustule} - see separate entry *Arachnoidiscus* as a test object (Smith, T.). [SERIES 2, VOLUME III, 1886-1889 Page 247] (Quekett CD ref:Disc 1 VOL9/247.htm)

Another Mill

The Mill is in Lower Slaughter signposted off the A429 (Fosse Way) some 4 miles south of Stow-on-the-Wold. The stream that feeds the mill pool and runs on through the village is a tributary of the River Windrush. This is easily accessible as it is both narrow and shallow.

The length running through the village is spanned by small stone bridges where you might find diatom accumulations.

Warden's Walk runs along the frontage, round the Mill and to the rear where there is restricted access to the Mill pond area.



Favourite Locations

Mallorca and my favourite collecting sites

by Klaus D. Kemp

Over the many years that I have visited Cala San Vicente on the North side of the Island of Mallorca with my wife Sheila, I have had an arrangement where I take myself off for one day per week to do my collecting.

Cala San Vicente offers those who enjoy a quite and scenic holiday the opportunity to go for pleasant walks and having two sheltered coves ideal swimming conditions, if you are looking for nightlife this is not the place for you. The surrounding countryside is unspoilt, with small Restaurants and Bars. Buses run on a fairly regular basis to all parts of Mallorca so you need not be stuck in just one place. We have always found the Hostel "Oriola" to be a pleasant place to spend our holidays with the ownership of the Hostel being shared by family members, who provide good and clean accommodation complete with home cooking at very reasonable prices. The proprietor Senor Juan Noguera is reputed to be an expert on the Orchids and Birds of Mallorca, he has on many occasions invited me to join him on Orchid hunts (of which I know nothing) however it affords me the luxury of having a local guide prepared to take me into the hills where mountain streams appear never to dry up, even in the middle of the dry season. I was fortunate enough on one occasion to even collect *Amphipleura pellucida* growing on or with

Batrachospermum (Frog spawn algae). This proved interesting as the late John Carter often advocated that striae and puncta increase in numbers according to the elevation where they are growing. On this occasion it proved not to be the case as the striae and punctae were much coarser than those from my local collecting site at Brean in Somerset where the site is at sea level and possibly even affected by salt spray. This year I was lucky enough again to be invited to join him on an expedition into the hills. While he hunted for the elusive Orchids I wandered off and found a culvert which presumably was constructed to irrigate the Olive trees. In this culvert I found growing on the sides some *Fontinalis* and on checking it with my field microscope found some rather large *Amphora ovalis*, a very welcome sample as I have not had this species in great numbers before.

Of all the sites that I have collected in by far the most interesting and favourite has to be the Salinas at Albuferata, this can be reached by bus from Cala San Vicente and change Buses in Poerto Pollensa which then takes you through the historic town of Alcudia. Be sure to ask the bus driver to drop you off at S'illot as otherwise you have quite a long walk along the Albuferata, which in itself is quite lovely to walk through, in particular if you have an interest in Birds, the most spectacular being the Bee eaters. The Salinas consist of a number of large manmade concrete holding tanks of varying degrees of salinity. On checking each of these you will find different species predominate according to the salt levels. My main reason for visiting these each year is to see if the *Mastogloia braunii* and *Mastogloia aqualegia* remain throughout the various seasons. The answer is they do indeed remain but where they are dominant, at the early part of the year, they decline in numbers as presumably the temperatures get extremely high in July, August and September. However, I have never come away empty handed and have a good record from this location over many years.

The photo shows the floating masses of almost pure Diatoms mixed at times with Blue green algae.

This year there was a little rough weather in the coves, lifeguards had strung a rope across the cove to prevent swimmers being dragged out with the undertow. Having reached the rope I noticed a fine brown growth on it and promptly ran my hand along it to dislodge the growth. This



was placed in a plastic bag and checked back at the Hotel. It turned out to be a most interesting colonial form of *Navicula*, which to date I have not managed to name. But what I found of interest were the long dichotomous branching fans which you would never see once the material had been treated with Acids, this has made a lovely fluid mount.

On the road to Alcudia, but within walking distance from the main bus terminal in Poerto Pollensa, on the right hand side there is a small river which runs into the sea. If you walk along this river you again get varying degrees of salinity and where it becomes brackish you get some fine growths of Diatoms. I have collected *Achnanthes brevipes* in great numbers from here, which also had growing with it some lovely *Pleurosigma strigosum*.

The purpose of the article is to encourage you to always have some plastic bags with you and not miss opportunities when they present themselves.

Those of you who also like Foraminifera should make their way to beaches South of Alcudia where the beaches seem to be made up of Foraminifera, with hardly any evidence of sand, this gives the beach a lovely white colour and soft texture.

Pulling and Mounting Glass Needles for use in the Kemp Micromanipulator

By Stephen S. Nagy, M.D.

Glass needles have stood the test of time for use in diatom micromanipulators. They are relatively simple to make, are flexible and will bend under a frustule when lowered onto the surface of a microscope slide. They do not stay bent, the way that metal needles do, and often they will spring back into their original shape after being flexed while picking up or depositing diatoms.

Alas, every good needle is doomed to break at some point, often due to inattentiveness of the diatomist. For example, a common error is to fail to raise the needle when bringing a thicker slide into the field of view, and suddenly there is no needle tip visible through the microscope!

Needles are crafted from plain soda lime glass capillary tubes; the type that is used to make microhematocrit readings can often be found cheaply at Ebay, or possibly discarded from your local hospital laboratory. Tubes that have been pretreated with heparin should be avoided. Thicker-walled capillary tubes, such as those used to measure melting points of crystals in chemistry labs, may also be used, but may be more difficult to use because of their thickness. For use on the micromanipulator, the needle is mounted inside the lumen of an 18 gauge Luer-lock hypodermic needle that has been cut down to about 6 mm length and blunted, and the glass needle is mounted inside the hypodermic needle hub using either sucrose melted into the lumen of the needle with saliva, or a twist of Parafilm T laboratory paraffin film around the needle (Prof. Dailey's technique). The cut-down needle hub is friction-mounted on the micromanipulator, which is constructed with a male Luer-lock fitting on the end of the arm.

Making a glass needle requires two melts and two pulls. The first melt closes the lumen of the capillary to make a solid glass cylinder, and the first pull reduces the diameter of the resulting glass rod to make it thin enough to fit inside of the lumen of the Luer-lock hub's needle base. The second melt tapers the diameter of the rod rapidly to a straight point.

While a pipette puller would doubtless simplify this process, making the needles by hand is traditional. It is also frustrating, since even after practice a considerable amount of luck seems necessary to get a useable needle, and the number of failed needles outnumbers successful ones, even from the hands of experienced needle-makers.

A hotter flame, such as one produced by an alcohol lamp with about 5 mm. of wick exposed or a small butane torch, is used for the first melt and pull. The capillary tube is held above the flame

and about 25 mm of capillary heated to melting by moving the capillary through the flame. This melted section is then pulled to approximately 50 mm to 75 mm length, as determined by the thickness of the final intended needle.

A cooler flame, or nichrome wire heated to a dull red with a direct current transformer, is used for the second pull. The wick of the alcohol lamp should be lowered until only about 1 mm or less emerges from the metal tube that contains it on the lamp, leaving a very small flame that is just large enough not to self-extinguish.

The second heating is done with continuous tension on the ends of the capillary tube with the solid needle in the middle, as this is lowered slowly down onto the low flame or nichrome heat source. At some point the glass cylinder melts, and the continuous pull creates the rapid taper to a point - if one is lucky.

The point of each needle needs to be examined under the microscope at about 100 diameters' magnification to determine the outcome.

Problems with creating the needle are mostly in the second melt and pull step. If the heat source is not hot enough, the pull will end with an audible "pop!" and an examination of the end of the intended needle under the microscope will show that the needle shaft ends with a clean transverse break, not a point.

On the other hand, if the second heat source is too great, then the taper will not be short, but may be so long and thin that the result is unuseable.

Another problem is that at times the point of the needle will not be straight, but curved. In some circumstances, this may not make the needle unuseable, but in others, it must be discarded.

Capillary tubes that have been pulled unsuccessfully may be remelted and pulled again; after some four to five pulls, the glass will become brittle and unuseable.

When the diatomist has a useable needle, and a modified hypodermic needle to mount it in, it is simple to put the cut-off end of the hypodermic needle into some saliva on one's lip, then dip it into a small pinch of ordinary table sugar. The blunt end of the glass needle is inserted into the lumen of the hypodermic through the sugar crystals, and then some additional saliva on the tip of a finger is used to melt the sugar crystals on the outside of the needle, which will be sucked into the hypodermic needle lumen around the glass needle by capillary action, all of which will eventually crystallize and lock the glass needle in place. Even though it is still not solidified, this needle may be used immediately. The glass needle will be easily removable for a period of days and will then harden.

Alternatively, the needle may be placed into the lumen of a dry needle, and a 3 mm. width strip of Parafilm will anchor the needle if it is wrapped around the needle and hypodermic needle in a spiral fashion.

When the glass needle finally breaks, the hypodermic hub may be dropped into a small glass of water until the sucrose is dissolved and the glass needle blown out from the Luer-lock hub. Please be careful in discarding the broken glass needle remaining inside the hypodermic: it is still quite sharp enough to make a very painful human splinter that will be hard to locate if it penetrates the skin!

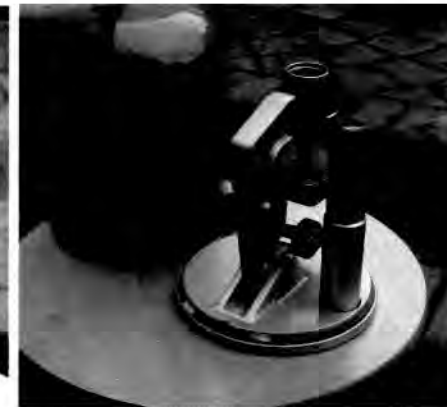
Needles are best stored on a microscope slide that has a piece of double-stick tape attached across the width of the slide at one end. Needles may be lined up parallel to each other on this adhesive strip and removed for use. Keeping the slide in a plastic slide mailer assures that they will remain clean until used.

In the matter of needles used to pick up diatoms, the only certainties are that a glass needle works best, and that every glass needle that is used will eventually break, requiring the diatomist to find another.

Field Microscopes (V) Meopta (Type AZ) Student Microscope

This microscope is surprisingly good and perhaps more suited to field work than others that have been featured.

At first sight it looks to be skin to a toy microscope. Do not be fooled, it has quality optics and is well worth keeping an eye out for. They occasionally turn up at meetings and I have seen them being sold on eBay.



apochromat and also the perfection brought about in the computation and workmanship of an apochromat. The 'black and white dot' effects are visible with this diatom by focussing the different planes. The dots at the back of the focus should be intensely black, and the whole diatom should look particularly brisk and bright, with an entire absence of all traces of fluffiness when using a well made objective of high aperture. So too the white dots ought to appear like pearls laid upon the surface of the valve, no appearance of fog being visible. To obtain perfect definition with a semi-apochromat it may be necessary to use green light to remove the secondary spectrum."

So far so good! We know what we ought to see with a Zeiss 3mm objective, N.A. 1.40 and a magnification of 1200 diameters.

It would, however, be interesting to know what numerical aperture Amici must have had to resolve this diatom.

The importance of numerical aperture as an indicator of the possible performance of a lens is that it is related to the resolving power of the objective. Several mathematical expressions have been used. This being so, I think we might well opt for the simplest.

$$R = \frac{\lambda}{2 * N.A.}$$

R=separation (in μm) of particles or lines

λ =wavelength of light

N.A. = numerical aperture

Referring to the Numerical Aperture Table in Carpenter and Dallinger (7th or 8th Edition) we find:-

"Limit of resolution of the form *Navicula rhomboides* known as *Frustulia saxonica* and *N. crassinervis*, 78000 to 87000 lines to the inch. In *N. crassinervis* transverse striae 80,500 to the inch have been seen with Pwell and Lealand's dry 1/12 N.A. 1.0.

Carpenter and Dallinger give an N.A. of 0.84.

At first sight it looks pretty grim for those of us lacking either the Zeiss 3mm, N.A. 1.40 or the P. & L. 1/12 N.A. 1.0.

Look again at the table. This indicates an N.A. of 0.84. Perhaps the situation is not too bad. The figures we are given are 78000, 80500 and 87000 lines to the inch. Let's take 87000 lines to the inch as being the most demanding.

87000 lines per inch =

$$\frac{87000}{25.4} \text{ lines per mm}$$

$$= 3425.2 \text{ lines/mm}$$

Remember

$$1 \text{ mm} = 1000 \mu\text{m}$$

$$\text{Spacing} = \frac{1000}{3425.2}$$

$$= 0.29 \mu\text{m}$$

Now, we can use our formula

$$R = \frac{\lambda}{2 * N.A.}$$

If we use the following values:

$$\lambda = 540 \text{ nm} = 0.54 \mu\text{m} \text{ (green light)}$$

$$R = 0.29$$

then

$$\left\{ 0.29 = \frac{0.54}{2 * N.A.} \right\} = \left\{ 2 * 0.29 = \frac{0.54}{N.A.} \right\}$$

$$= \left\{ 0.58 = \frac{0.54}{N.A.} \right\}$$

$$= \left\{ 0.58 * N.A. = 0.54 \right\}$$

$$N.A. = \frac{0.54}{0.58} = 0.93$$

I will not inflict any more arithmetic on you. Martin Luther once said "Medicine makes people ill, Mathematics makes them sad and Theology makes them sinners."

For the more coarsely marked diatoms an N.A. of 0.83 will suffice, for the finest specimens an N.A. of 0.93 would be needed.

It is recorded that in 1844 Amici constructed an objective of 1/7 inch focal length (3.6mm) which when he brought it to this country astonished microscopists by its angle of aperture of 112 degrees.

To convert this to N.A. we first divide by two:

$$\frac{112^\circ}{2} = 56^\circ$$

then take the sine:

$$\text{sine } 56^\circ = 0.83$$

Thus, he could have resolved specimens of *Navicula rhomboides*. The demonstration of this objective had a very important effect. It directly led Andrew Ross to improve his lenses. Other makers followed.

So much for the arithmetic. I have now consulted Spitta's 'Photomicrography'. He now admits that "This specimen is a difficult one. No oblique light is necessary and the 'iris' must not be too much closed. Owing to the specimen rarely being flat, focussing is extremely difficult and it is not often a photograph can be taken with the dots equally sharp over the whole picture."

He used a Zeiss Apo 1/8 N.A. 1.40 with a Powell and Lealand dry Apo N.A. 1.0 condenser and an 'F' line screen.

The 7th Edition of 'The Microscope' by Hogg (1869) gives complex instructions for resolving this diatom using oblique illumination and a 1/8th, 1/12th, or a 1/16th objective with an angle of aperture in excess of 140 degrees (N.A. greater than 0.94).

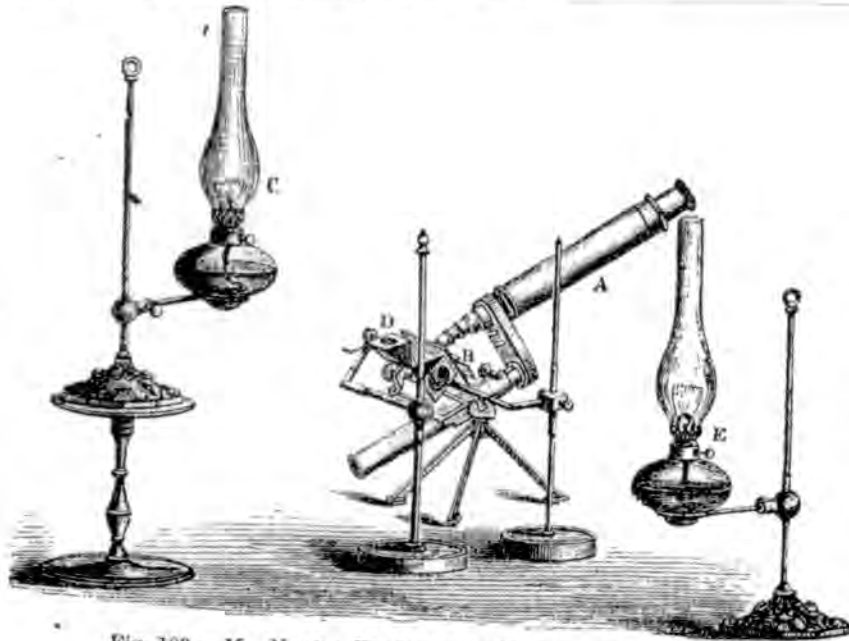


Fig. 103.—Mr. Newton Tomkins' Double Prism Illumination.

The conclusion to be drawn from this is that he did not find this an easy diatom to resolve.

Now, I will lay my cards on the table and tell you of my personal experience. One evening, together with a few friends I decided to have a look at this diatom. The slides we examined were '*Frustulia rhomboides*' by N.B.S. We tried a number of oil immersion objectives but with none of them did we obtain really convincing resolution. The problem seemed to be one of contrast rather than of resolution. We could see the markings were there, but very faintly.

The following evening I returned to the fray. I tried a variety of oil immersion and high power dry objectives. Really, I should have made a much more systematic attack. With the oil immersion objectives I had a good diffraction spectrum visible with a phase telescope. It was, however, difficult to see the structure as desired.

In desperation I turned to other methods. Before anyone asks, yes I tried dark ground illumination - using a modern porroidal dark ground illuminator. This did not help. Using an N.A. 1.30 objective at full aperture with the darkground illuminator I had an extreme form of annular illumination. The markings on the diatom were now quite clearly visible. I told myself that a green filter helped but I may be kidding myself.

My final effort involved oblique illumination. Yes - oblique illumination. I tried a variety of stops. The most successful being that illustrated. But - the image still lacked contrast.



Like Frank Sinatra I am making a come-back. This is nothing more or less than one-upmanship. I also tried the Hungarian 'Metrimplex' condenser. When this exotic device was first introduced forty or fifty years ago great claims were made for its ability to give 'three dimensional images'. It can, on a good day, give very pleasing high relief images. Really, as with some other techniques it is really a rather complex way of obtaining oblique illumination. After all this, you will quite reasonably ask "What did you see?". The honest answer must be - not very much.

Yes - the diatom was resolved, but the contrast was disappointing.

So - what now? I will no doubt return to this when time allows. Meanwhile, if you would like to try your hand - be my guest. If you feel that you have done significantly better than I have do let me know.

Meanwhile I am left with a deepened respect for Giovanni Battista Amici and the good Doctor Spitta.

Recording your observations (I)

Recording the information is important and having that information to hand when the slide is on the stage should be made as convenient as possible. If your microscope bench also houses your computer then you might keep the information on a database of some description and this is fine as long as you always have that database with you. What happens when you take your slide box out somewhere, to a friends or to an exhibition or to consult a colleague. The database is then useless unless you have a print of it and you have remembered to take it. I do use a database but I also persist with a method of recording that was used before the advent of cheap computer technology and before I really understood what a database was.

You could write the information on the label of the microscope slide itself and indeed many research and educational establishments do this when mass producing slides. These slides are seldom kept for posterity so their aesthetics are not that important. For the amateur, however, who takes a pride in the finished slide, with ringing and personalised labels perhaps, defacing the slide in such a way is sacrilege. This is also true of older slides, from hallowed diatomists of the past, that you might have in your collection. My preferred method is to write the information on a 3x1 slip of card that sits in the cabinet beneath the slide itself if it is of the drawer type, or in an adjacent slot if of the slide box variety. You can slip three or four cards beneath the slide or in an adjacent slot and thereby accumulate quite a bit of information pertaining to the mount. These cards (printed overleaf) can be supplied ready printed by the printers of this publication.

Slide Detail:-	Notes:-

X	Y	Comment

Cleaning Diatoms for Fluid Mounting

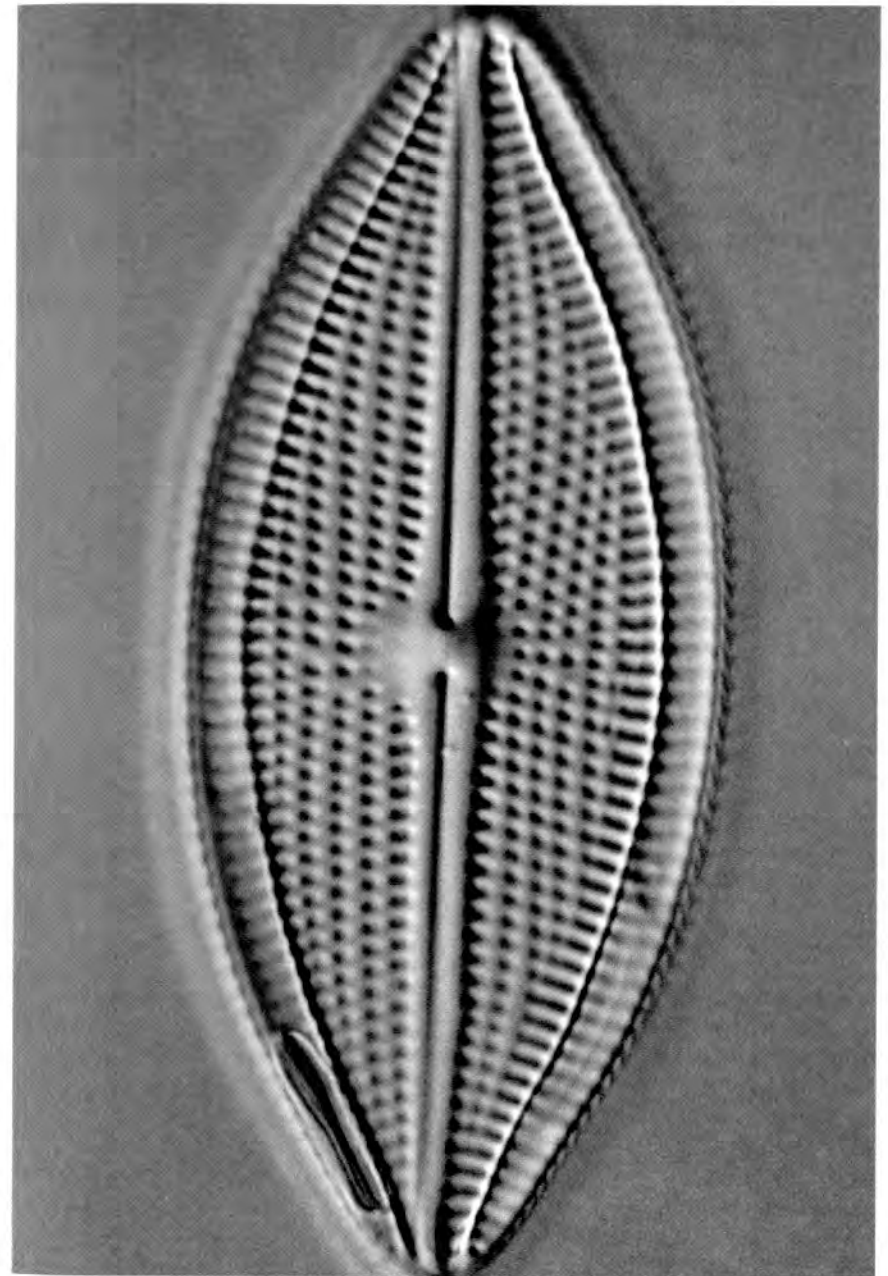
by Ernie Ives

I don't know how a 'real' diatomist would have tackled cleaning marine diatoms for fluid mounting but the ones I got yesterday were in with a lot of flocculate material and after some experiments I came up with the method below. If you have a better method, please let me know. I've been fairly successful in cleaning the diatoms but I guess there was at least 50% loss - not that it mattered as there is still more than enough for a few slides. I first stirred the material into a tapered glass and when much of the stuff had settled, pipetted it into a small Petri dish. I then used a technique which I am calling slow speed centrifuging. The petri dish is moved in about 6 mm circles at about 1 rotation per second. I guess like the panning for gold technique. When the 'correct' speed/size of circle is found the diatoms will gather in the centre of the dish. If it is rotated slightly faster any heavier material goes to the centre. By combining the two methods and pipetting off the rubbish and the diatoms and repeating the procedure several times and putting the diatoms into filtered seawater each time, a fairly clean sample was obtained. I'm preserving them in 5% formalin. Still some bits of rubbish in there but probably acceptable for a fluid mount of this type. I used a similar technique once before to separate ostracods from the debris they thrive in.

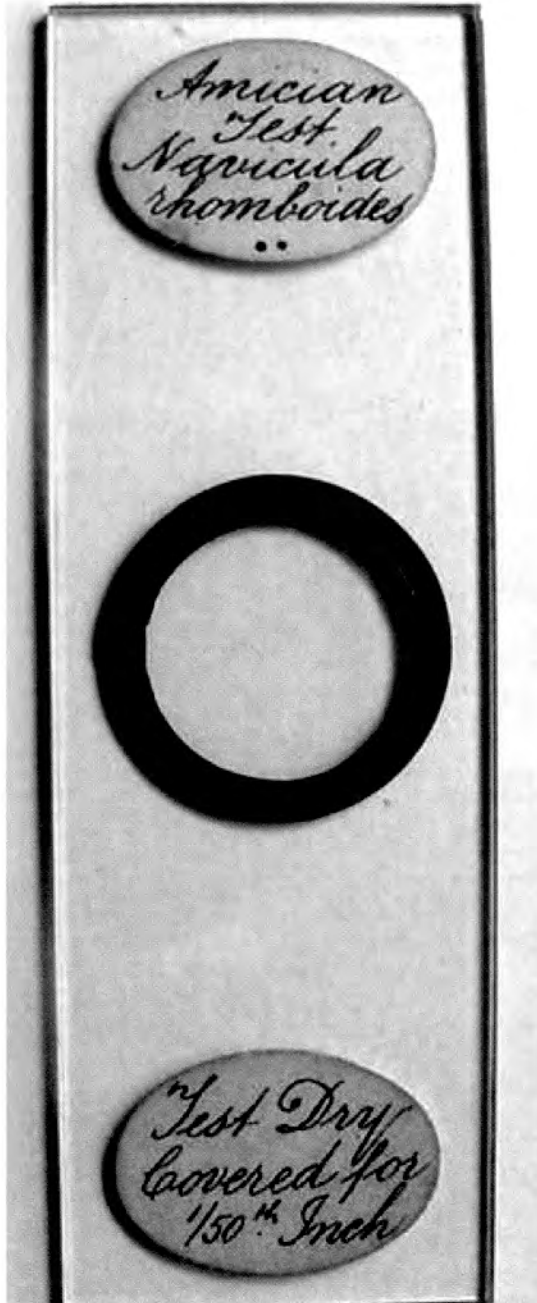


Navicula pseudo-mastogloia

by Stephen Nagy

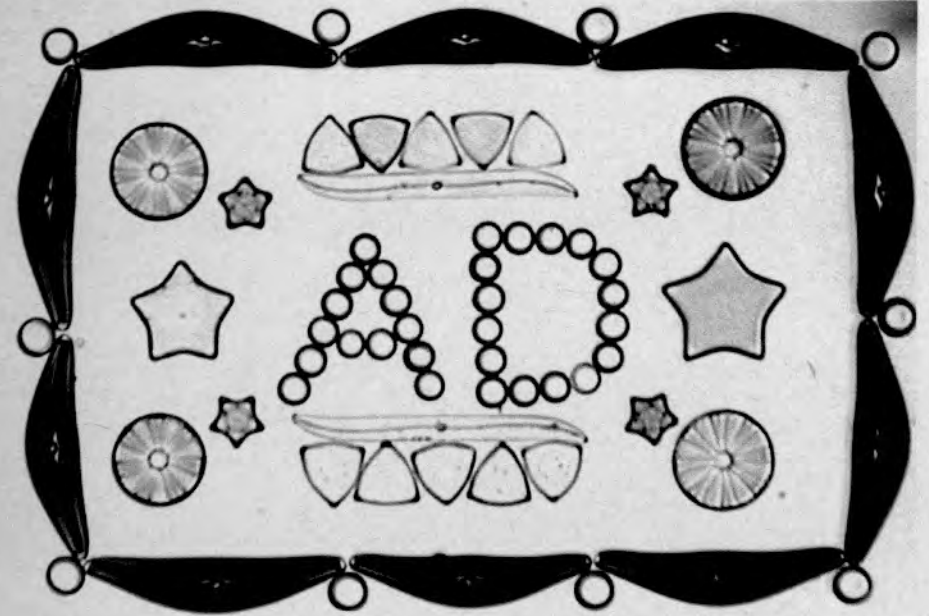


An Amician Test Slide



The next issue of

The Amateur Diatomist



Notes for contributors.

Since this is not intended as a scientific publication and the editing and compilation tasks are performed by volunteers, we have no real rules concerning copy.

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"No one of us know all there is to know, and yet we do not know what we do not know." - Anon.