CD Publications of interest to Diatomists

All titles available from Savona Books

	Author/Company	Title/Description	Price UK Pounds
M3.	Griffith and Henfrey	Micrographic Dictionary 4th Edition. 1883. Plates only	£8
M4.	Flatters & Garnett	1929 Microslide Catalogue includes images of slides.	£10
M7.	P. T. Cleve	Diatoms from the West-Indian Archipelago 1878. pp20 Text Pages, 5 Tafels.	£10
M8.	J. Brun et J. Tempere	Diatomees fossiles du Japon 1889. 73 Pages, 9 Plates.	£10
M9.	Peragallo et Peragallo	Diatomees marines de France. 1897-1908. 137 Plates and Plate text only (with hyperlink indices)	£15
M10.	F. T. Kutzing	Synopsis diatomearum. 1834. 93 Pages, 7 Plates.	£8
M16.	Hilmar v. Schonfeldt	Die Deutschen Diatomeen des Susswassers und des Brackwassers - 1907. 19 Plates	£8
M17.	Adolf Schmidt	Atlas der Diatomaceenkunde - first 268 plates with hyperlink Index.	£35
M19.	Leuduger-Fortmorel	Diatomees Marines de la Cote Occidentale d-Afrique (Plates and hyperlink Index) 1898. 39 Pages, 8 Plates.	£6
M20.	Luard and Witt	Die Diatomaceen der Polycystinenkreide von Jeremie in Hayti. 1888. 25 Pages,7 Plates.	£5
M35.	Arthur Scott Donkin	The Natural History of the British Diatomaceae	£10
M36.	Jacob Whitman Bailey	Notes on New Species of microscopical Organisms	£5
M37.	Charles Pooley	The Diatomaceae of Weston-super-Mare	£15
M43.	Rev. William Smith	List of the Diatomaceae in the British Museum 1859	£5
M44.	William Gregory	On New forms of Marine Diatomaceae found in the Firth of Clyde and in Loch Fine 1857	£4
M45.	Otto Muller	Kammern und Poren in der Zellwand der Bacillariaceen 1899-1901	£5
M47.	Kain and Schultze	On a Fossil Marine Diatomaceous Deposit from Atlantic City, N.J. 1889	£5
M48.	Dr. József Pantocsek	A FERTÕ TÓ KOVAMOSZAT VIRÁNYA (Bacillariae Lacus Peisonis) 1912	£5
M49.	Dr. Josef Pantocsek	BESCHREIBUNG und ABBILDUNG der FOSSILEN BACILLARIEN des ANDESITTUFFES von SZLIÁCS in UNGARN 1903	£5
M50.	E. G. Grahn M.D.	Diatomaceae found in the neighborhood of Brookville, Indiana, 1885	£4
M69.	Little Imp	A Checklist of British Diatoms	£4
M71.	Little Imp	Diatomaceae on Magic Lantern Slides V.1.0.	£3
M72.	Alfredo Truan y Luard	Diatomeas de Asturias 1844	£5
M73.	Little Imp	A Checklist of Diatoms of the Central U.S.A.	£3
M74.	Little Imp	DiatCode - List of Diatom Species with Int. codes	£3
M76.	Various Authors	Practical Direction for collecting, Preserving, Transporting, Preparing and Mounting Diatoms	£4
M78.	Rev. Eugene O'Meara	Report on the Irish Diatomaceae	£6
M80.	William Smith	A Synopsis of the British Diatomaceae	£10
M81.	J. D. Moller	Diatomaceen Typen-Platte 335	£4

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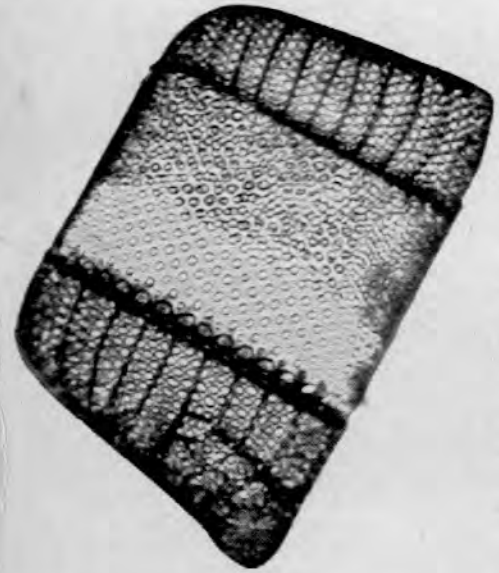
Little Imp Publications



In this Issue:-

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There is no strict editorial policy.

Practical Directions for Collecting, Preserving, Transporting, Preparing and Mounting Diatoms

Various Authors

On Data CD, viewable within a Browser window. A low cost, yet useful reference.

Order via Savona Books (see overleaf)

Front Cover - Isthmia sp.

Flatters & Garnett Diatom Sets

Following the appearance of both the Cole 24 slide set and the Flatters slide list in the last issue a number of correspondents enquired as to the existence of a list detailing the diatom slide sets produced by Flatters & Garnett.

Though the editors have a number of Flatters slides that they can locate relatively easily we are not so organised in the case of literature. We all knew that one of us had a list somewhere, but had to spend some considerable time arguing over who actually had it. Eventually it was located exactly where one of the editors said it would be and another editor had denied having put it there.

DIATOMS **LIST A/d 2**

October 1962

FLATTERS & GARNETT LTD.

309 OXFORD ROAD

MANCHESTER 13

ENGLAND

Established 1901

Telephone:
ARDwick 4545
(2 lines)

Telegrams:
SLIDES
Manchester

All preparations in this list are carefully cleaned material mounted in Hyrax or other suitable mountant of high refractive index. Cover slips are No. 1 circles .16 to .18 mm and slides are 3" x 1" x 0.8 to 1.0 mm.

LOCALITY SLIDES: These are spread preperations from the following localities and include many different species.

SET B. M. 1.		SET B. M. 2.	
Terrebonne, Oregon.	U. S. A.	Le Gard	
Kamischev	U. S. S. R.	Isenski	U. S. S. R.
Warri River	Nigeria	Grotto Girgente	Sicily
Auckland	N. Z.	Lake Pupuke	N. Z.
Ongarota Valley	N. Z.	Popes Creek, Mld.	U. S. A.
Papakaio, Oamaru	N. Z.	Allens Farm, Oamaru.	N. Z.
Bonny River	Nigeria	Lake Forest, Michigan	U. S. A.
Pilling, Lancs.	England	Palos Verde, Cal.	U. S. A.
Reedsmere, Cheshire	England	Lewes, Sussex.	England
Grant, N. York	U. S. A.	South Yarra	Australia
Lompoc, Cal.	U. S. A.	Redondo Beach, Cal.	U. S. A.
Toco	Chile	Yokohama	Japan

One each of above in rack box 1. 16. 0. One each of above in ack box 1. 16. 0.
Single LOCALITY SLIDES available at 3/- each.

Named Diatoms 1, 2 or 3 diatoms of a named species mounted in various aspects wthin a marked circle.

SET B. L. 1.	SET B. L. 2.
Fragilaria harrisonii.	Achnanthes longpipes.
Triceratium pentacrinus.	Actinoptychus undulatus.
Campylodiscus clypeus	Amphitetras antediluviana.
Biddulphia pulchella.	Terpsinoe musica.
Arachnoidiscus ornatus.	Surirella hastata.
Eupodiscus radiatus.	Actinocyclus berkleyi.
Climacosphenia moniligera.	Triceratium majus.
Auliscus cealetus.	Melosira oamaruensis.
Eunotia formica.	Navicula maculata.
Melosira granulata.	Pinnularia cardinalis.
Surirella robusta.	Biddulphia rhombus.
Stephanopyxis grunowii.	Stictodiscus californicus

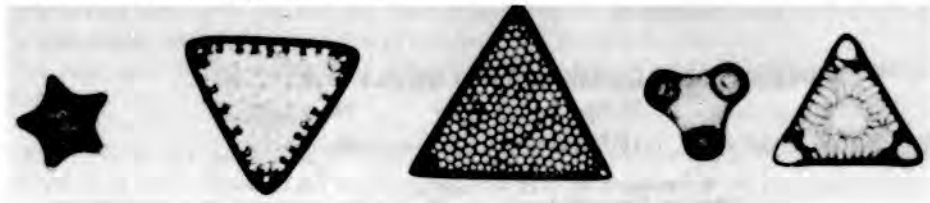
Named Diatoms: Set B. L. 1. & B. L. 2. in rack box £2. 2. 0 per set.
Single Named Diatom Slides available at 3/6 each.

Named Diatoms
TYPICAL MAINE FORMS 3/6 each or 12 in rack box £2. 2. 0.
TYPICAL FRESHWATER FORMS 3/6 each or 12 in rack box £2. 2. 0.
TYPCAL FOSSIL FORMS 3/6 each or 12 in rack box £2. 2. 0.

Type Slides Different diatoms mounted in rows with named list supplied.

12 Forms at	7/- each.
20 Forms at	14/- each.
30 Forms at	21/- each.
40 Forms at	29/- each.
50 Forms at	32/ each.

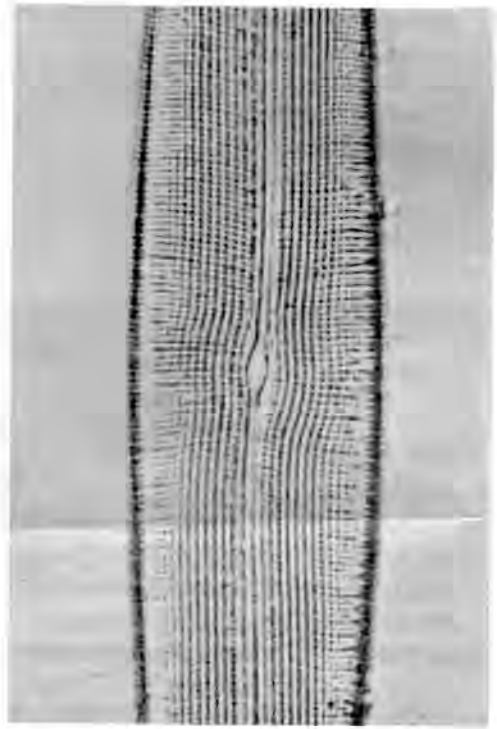
Genus type Slides Five species of one genus mounted in one row, with list supplied. Please state Genus required. 8/- each.



Test Diatoms
2 or 3 known test diatoms carefully mounted to allow critical use of the immersion lens.

SET B. T. 1.
Pleurosigma balticum.
Navicula rhomboides.
Nitzschia sigmoidea.
Triceratium favus.
Stauroneis acuta.
Pleurosigma acuminatum.
Surirella biseriata.
Pleurosigma attenuatum.
Cymatopleura solea.
Synedra ulna.
Hyalodiscus leavis.

SET B. T. 2.
Nitzschia sigma.
Surirella gemmae.
Grammatophora sorpentina.
Amphipleura lindheimeri.
Cymatopleura elliptica. Var. hibernica.
Pleurosigma strigosum.
Navicula amphisboena.
Cymbella aspersa.
Cymatopleura elliptica.
Navicula iridis.
Stauroneis phoenocenteron.



Single Test Diatom Slides available at 4/- each.

Test Plates Different Test Diatoms mounted in rows.
8 Forms @ 12/- each.
12 Forms @ 18/- each.

Circular Slides Diatoms mounted within a circle.
50 Specimens @ 26/- each.
100 Specimens @ 46/- each.

Diatom Star Slide 25 Diatoms mounted in a star pattern.
25 Specimens @ 20/- each.

The Guano Trade

The guano trade was a massive industry in the mid 19th century and continued in that vane well into the 20th Century.
Whilst there has been considerable interest in the diatoms contained in the guano, particularly Pacific and Peruvian products only a little has been written about the companies that plied their trade during these years.
A more complete appreciation of how the guano reached foreign shores adds considerably to the enjoyment and fascination of the unusual diatom fauna found in the shipped products.
It is our intention to consider some of these sources and the diatom species in each at some time in the future as well as to recount a history of 'Guano Mining' in various localties. Some information has already been gathered and the extent of the industry is only gradually becoming apparent. There are a couple of publications well worth a read if you are interested in this subject.

Great Guano Rush: Entrepreneurs & American Overseas Expansion
Author: Jimmy M. Skaggs
Binding: Paperback, 336 pages
Publisher: St. Martins Press, LLC
Published Date: 04/01/1995
List: USD $16.95
ISBN: 0312123396

Reader's Digest
Issue Date: APRIL 1948
Article - Guano

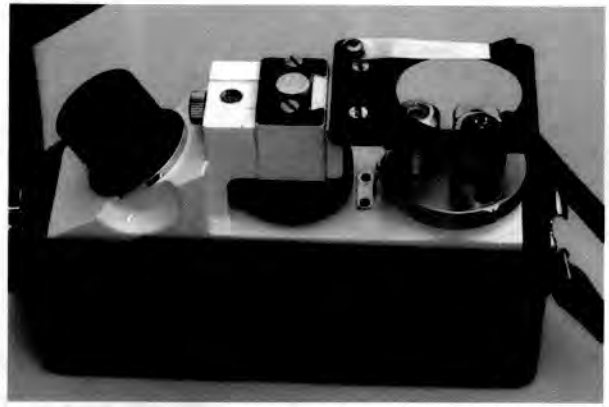
It is an amazing fact that a natural product as lowly as bird droppings has shaped nations. It's influence in the 19th century was so dramatic that the United States used its presence to annexe small islands to large archipeligos and they were not alone. There were frequent conflicts over the rights to guano deposits. The entire country of Peru was effectively built upon the money made from guano exports.
There is a wealth of information regarding government intervention and a considerable amount relating to the acquisition of deposits by particular companies. However, information relating to the company itself is not so common and in some cases all we know is the name of a company.
A lot of the material gathered has been advertising literature and some of this is quite charming. Some such is from Clark's Cove Guano Company in the United States. They produced trade cards depicting a number of characters based around products the guano was used to fertilise.
Whether the fertiliser in question was sea-bird guano or another form of guano (fish or bat) is, in some cases, unclear. Further research will, no doubt, reveal more detail.
The page after the list following is a montage of the Trade Cards of Clark's Cove Guano Company.

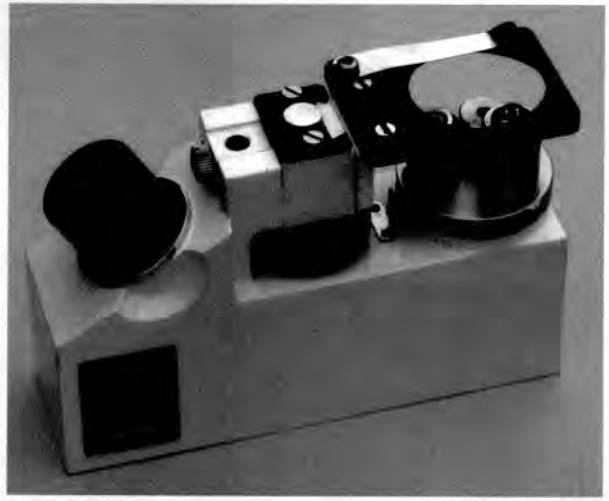
The list on the next page notes some of the companies we have identified. There are probably hundreds of others. Some of the organisations have long since ceased to be. For most we have very little information. If you are able to supply any detail please send to the editors.

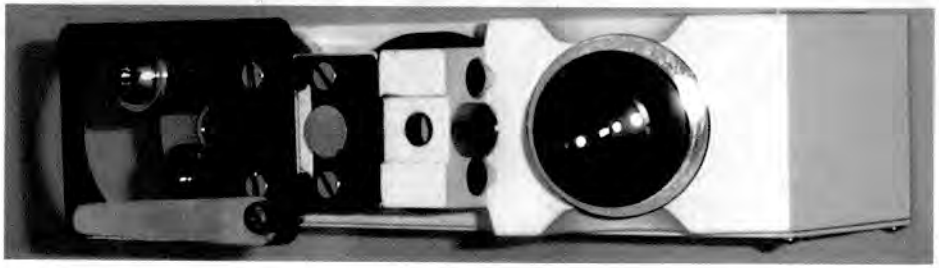
Altissimo Guano Company
American Guano Company
Americus Guano Company
Anglo Continetal Guano Company Ltd
Antilles Guano & Steam Dockyard Company Virgin Islands
Ashepoo Mining and Manufacturing Guano Company
Atlantic Guano Company
Austral Guano Company
Belvedere Fish Guano Company, Limited [1921]
Bisulphated Guano Company
Chesapeake Guano Company (of Baltimore City)
Clarks Cove Guano Company
Coleman Guano Company - a current company
Commercial Guano Company
Damaraland Guano Company Ltd
Dixie Guano Company
Dothan Guano Company
Fish Guano Company
Fish Oil and Guano Company
FS Royster Guano Company
Guanahani Guano Company of Alexandria
Guano Company International Inc
Guano-Werke GmbH
Internationale Guano en Superphosphaat Werken
Kenya Guano Company - (bat guano)
King Guano Company - (bat guano)
Native Guano Company Ltd
Navassa Guano Company
Oil & Guano Company, Sandusky, Ohio
Orient Guano Manufacturing Co.
Pacific Guano Company
Patapsco Guano Company of Baltimore
Pendleton Guano Company
Peruvian Guano Company
Philadelphia Guano Company
Phoenix Guano Company
Pocomoke Guano Company
Reedville Oil & Guano company
Roanoke Guano Company
Savannah Guano Company
Seaboard Fish Oil and Guano Company
Swan Island Guano Company
Twiggs County Guano Company
Union Guano Company
Union Springs Guano Company.
United States Guano Company
Utah Guano Company

Field Microscopes - III

We have just been sent details of the Swift FM-31, which we have included immediately as it appears that this microscope is still available from various vendors in both the UK and America. It is, essentially, a modified McArthur Microscope. It is extremely ruggedly constructed as may be seen from the following photographs.







The following description is from www.melsobel.com.

Ideal for portable use in the field when critical viewing is required, this is a high quality precision made inverted microscope. It will facilitate quick study and specimen identification in the field. It is available with brightfield, or phase objectives with 160mm tube length objectives. It is also capable of doing darkfield and simple polarization with the purchase of additional accessories. All models are equipped with a 10x widefield eyepiece with a 15.5mm field of view.

The illumination system is provided by existing daylight or a battery powered incandescent lamp included with all models.

The microscope comes complete with a handy carrying case.

SWIFT FM-31 LWD

Swift FM-31 LWD Series

Catalog No.	Objective	Eyepiece	Illuminator	Suggested Use
FM-31 LWD	4X, LWD 10X, LWD 40X	10X WF 15.5mm with case	Illuminator w/bracket & case	Wet mounts
FM-31 LWD P20	4X, LWD P10X, LWD P20X	10X WF 15.5mm with case	Illuminator w/bracket, phase annulus & case	Phase contrast
FM-31 LWD P40	4X, LWD P10X, LWD P40X	10X WF 15.5mm with case	Illuminator w/bracket, phase annulus & case	Phase contrast

Swift FM-31 LWD—Chart of Components Required

Application	Brightfield	Phase	Darkfield	Polarization
Components				
Illuminator Bracket	X	X	X	X
FMA27 Doublet Condenser	X	X	X	X
FMA28 Blue Frosted Filter	X			
FMA29 Phase Annular Diephragm Condenser		X		
FMA30 Clear Green Filter		X		
FMA31 Single Condenser for Darkfield			X	
FMA32 Clear Blue Filter			X	
FMA33 Iris Diaphragm	X			
FMA35 Red Compensator				X
FMA36 Polarizer & Analyzer				X
FMA37 White Frosted Filter	X			
FMA38 10X with Spider Mount			X	

Accessories and Components

Swift Objectives

FMA104 LWD 10X objective
FMA105 LWD 20X objective
FMA106 LWD 40X objective
FMA107 LWD P10X objective
FMA108 LWD P20X objective
FMA109 LWD P40X objective
FMA611 4X objective
FMA612 10X objective
FMA613 40X objective
FMA614 60X objective
FMA744 P40X Phase objective
FMA745 P20X Phase objective
FMA746 P10X Phase objective

Swift Eyepieces

FMA739 20X 14mm Widefield eyepiece
FMA740 15X 13mm Widefield eyepiece
FMA749 10X 15.5mm Widefield eyepiece

Swift Illuminators & Condensers

FMA115 2.2V bulb for FM-31 LWD
FMA747 Complete illuminator, bracket & phase condenser for FM-31 LWD P20 and LWD P40, incl. batteries & case
FMA748 Complete illuminator, bracket & condenser for FM-31 LWD, incl. batteries & case
FMA753 Illuminator bracket only
FMA754 Illuminator with battery only
FMA755 N.A. 0.65 condenser, blue filter & retainer for FM-31 LWD
FMA756 Phase condenser, annular diaphragm, green filter, spacer ring & retainer for FM-31 LWD P20 & LWD P40

Miscellaneous Accessories

FMA111 Metal slide with 16mm diameter hole
FMA122 Mechanical slide
FMA118 Metal attache case
FMA872 Camera adapter
843T Short tripod
792DS Long tripod
FMA27 Doublet condenser
FMA26 Blue frosted filter
FMA29 Phase annular diaphragm condenser
FMA30 Clear green filter
FMA31 Single condenser for Darkfield use
FMA32 Clear blue filter
FMA33 Iris diaphragm
FMA35 1st order red compensator
FMA36 Polarizer and analyzer
FMA37 White frosted filter
FMA38 10X objective with spider mount

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Service. Swift Instruments, Inc. maintains a large, fully staffed Service Department at its Swift Scientific Instrument Division and throughout its worldwide service network. Specially trained, highly skilled technicians — microscope specialists — are always available to make any needed repairs or adjustments.

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Comparison of Oamaru Diatomite

from listings compiled by Lionel N. Bramley

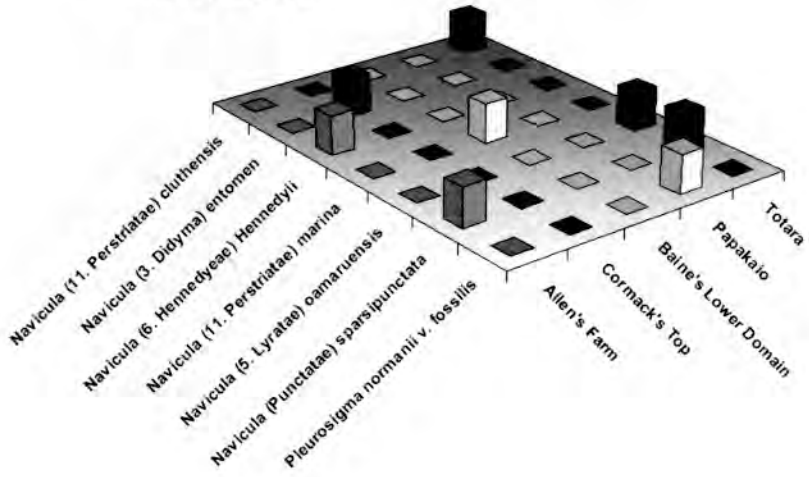
Whilst these lists are not definitive they are interesting comparisons of the various localities associted with the Oamaru deposits. The numbers refer to the Tribe Number (Bold) and the Genus number (normal) given in Van Heurck's 'Treatise on the Diatomaceae'. The figures and names in brackets refer to the groups within the genus.

The coulmns are labelled as follows:-

A = Allen's Farm, B = Cormack's Top, C = Baine's Lower Domain, D = Papakaio, E = Totara

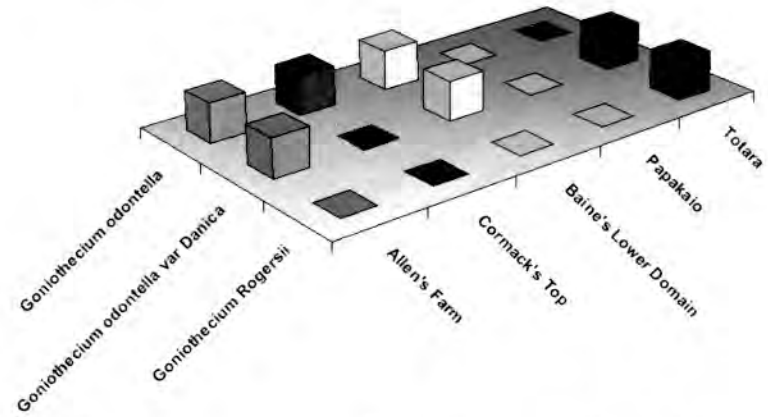
			A	B	C	D	E
1	**Cymbelleae**						
	1	*Amphora sp.*	N	N	N	Y	N
2	**Naviculeae**		**A**	**B**	**C**	**D**	**E**
	7	*Navicula (11. Perstriatae) cluthensis*	N	N	N	N	Y
		Navicula (3. Didyma) entomen	N	Y	N	N	N
		Navicula (6. Hennedyeae) Hennedyii	Y	N	N	N	N
		Navicula (11. Perstriatae) marina	N	N	Y	N	N
		Navicula (5. Lyratae) oamaruensis	N	N	N	N	Y
		Navicula (Punctatae) sparsipunctata	Y	N	N	N	Y
	22	*Pleurosigma normanii v. fossilis*	N	N	N	Y	N

Naviculeae



			A	B	C	D	E
5	**Cocconeideae**		**A**	**B**	**C**	**D**	**E**
	31	*Orthoneis sp.*	N	N	Y	N	N
	33	*Campyloneis totaru*	N	N	N	N	Y
8	**Fragilarieae**		**A**	**B**	**C**	**D**	**E**
	44	*Fragilaria binoides*	N	N	Y	N	N
16	**Surirelleae**		**A**	**B**	**C**	**D**	**E**
	79	*Campylodiscus Echoneis*	Y	N	N	N	N
19	**Chaetocereae**		**A**	**B**	**C**	**D**	**E**
	95	*Goniothecium odontella*	Y	Y	Y	N	N
		Goniothecium odontella var Danica	Y	N	Y	N	Y
		Goniothecium Rogersii	N	N	N	N	Y

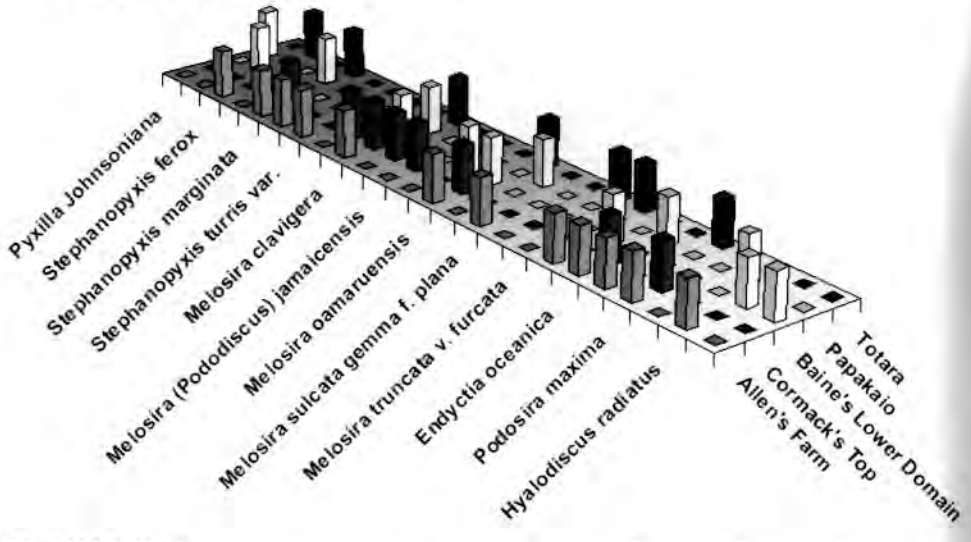
Chaetocereae



			A	B	C	D	E
20	**Melosireae**		**A**	**B**	**C**	**D**	**E**
	96	*Pyxilla Johnsoniana*	N	N	N	Y	N
	101	*Rutilaria radiata*	N	N	Y	N	Y
	103	*Stephanopyxis ferox*	Y	N	N	N	N
		Stephanopyxis Grunowii	N	N	N	Y	Y
		Stephanopyxis marginata	Y	Y	N	N	N
		Stephanopyxis turris	Y	N	N	N	N
		Stephanopyxis turris v.	Y	N	N	N	N
	109	*Melosira arenaria*	N	Y	N	N	N
		Melosira clavigera	Y	Y	Y	Y	Y
		Melosira intersecta	N	Y	N	N	N
		Melosira (Pododiscus) jamaicensis	N	Y	N	N	N
		Melosira laevis	N	N	Y	N	N
		Melosira oamaruensis	Y	Y	Y	N	Y
		Melosira sol	N	N	N	Y	N
		Melosira sulcata					

	gemma f. plana	Y	N	N	N	N
	Melosira truncata	N	N	N	N	Y
	Melosira truncata v. furcata	N	N	N	N	Y
	Melosira Westii	Y	N	Y	N	N
110	*Endyctia oceanica*	Y	Y	N	Y	N
112	*Podosira argus*	Y	N	N	N	Y
	Podosira maxima	Y	Y	N	N	N
114	*Hyalodiscus sp.*	N	N	N	Y	N
	Hyalodiscus radiatus	Y	N	Y	N	N
	Hyalodiscus subtilis	N	N	Y	N	N

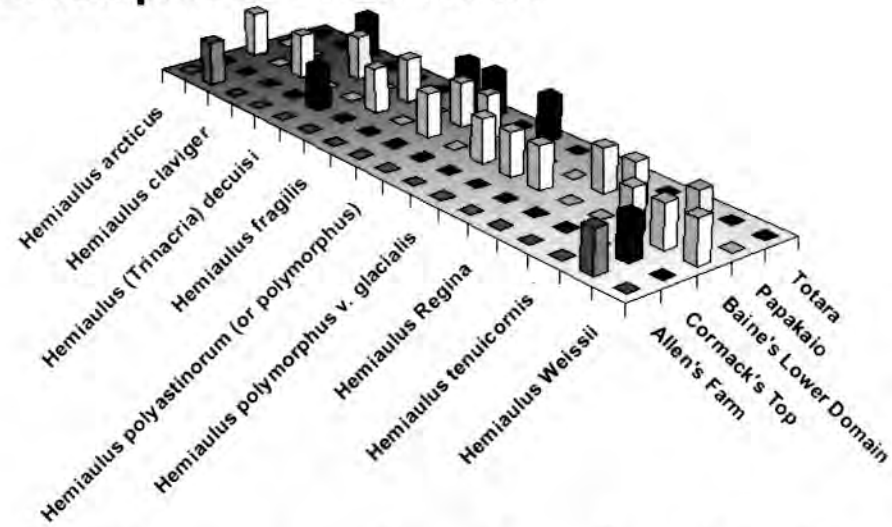
Melosireae



21	**Biddulphieae**	**A**	**B**	**C**	**D**	**E**
119	*Anaulus (Eunotogramma) Weissei*	Y	N	N	Y	Y
	Anaulus (Eunotogramma) Weissei v. producta	Y	N	N	Y	Y
121	*Hemiaulus arcticus*	N	N	Y	N	N
	Hemiaulus (Trinacria) aries	Y	N	N	N	N
	Hemiaulus claviger	N	N	Y	N	Y
	Hemiaulus claviger var.	N	N	N	Y	N
	Hemiaulus (Trinacria) decuisi	N	Y	N	N	N
	Hemiaulus (Trinacria) excavata	N	N	Y	Y	N
	Hemiaulus fragilis	N	N	N	N	Y
	Hemiaulus ornithocephalus	N	N	Y	Y	Y
	Hemiaulus polyastinorum (or polymorphus)	N	N	N	Y	N

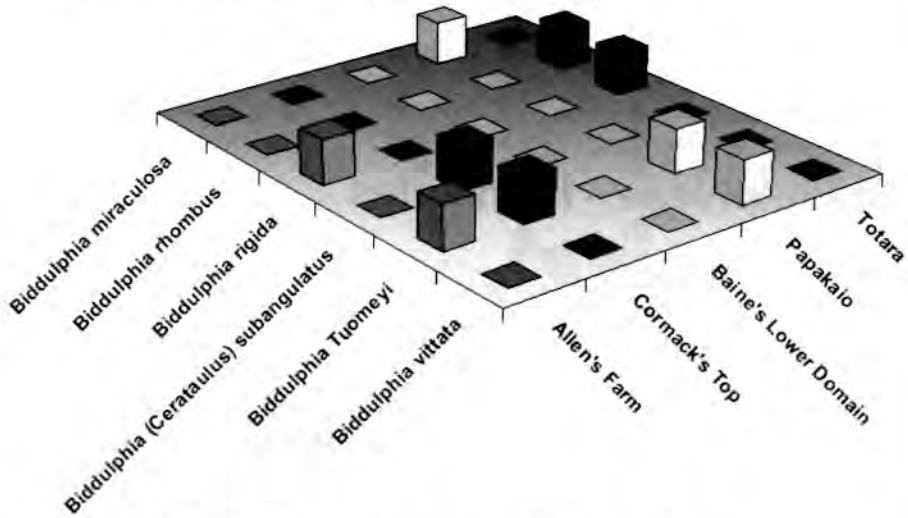
	Hemiaulus polymorphus	N	N	Y	N	Y
	Hemiaulus polymorphus v. glacialis	N	N	Y	N	N
	Hemiaulus polymorphus v. frigida	N	N	Y	N	N
	Hemiaulus Regina	N	N	N	Y	N
	Hemiaulus simulacrum	N	N	N	Y	N
	Hemiaulus tenuicornis	N	N	Y	N	N
	Hemiaulus (Trinacria) ventricosa	Y	Y	Y	Y	N
	Hemiaulus Weissii	N	N	Y	N	N

Biddulphieae - Hemiaulus

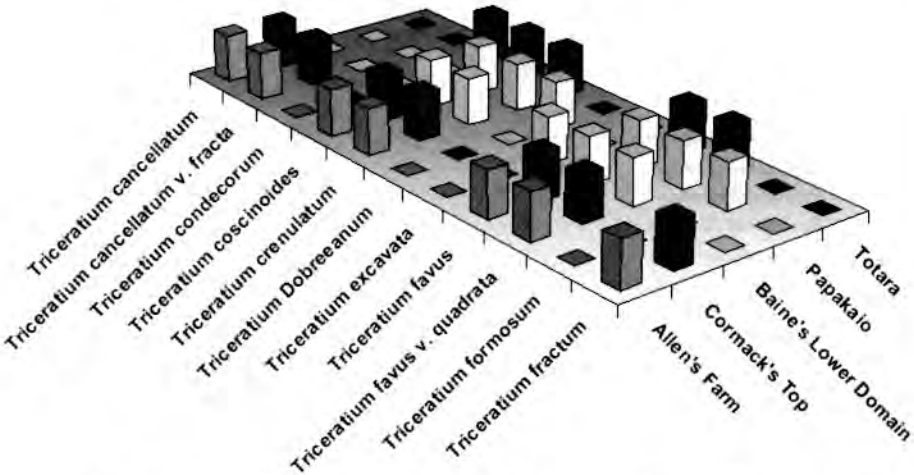


132	*Biddulphia miraculosa*	N	N	N	Y	N
	Biddulphia rhombus	N	N	N	N	Y
	Biddulphia rigida	Y	N	N	N	Y
	Biddulphia (Cerataulus) subangulatus	N	Y	N	N	N
	Biddulphia Tuomeyi	Y	Y	N	Y	N
	Biddulphia vittata	N	N	N	Y	N
132e	*Triceratium cancellatum*	Y	Y	N	N	N
	Triceratium cancellatum v. fracta	Y	Y	N	N	N
	Triceratium condecorum	N	N	N	N	Y
	Triceratium coscinoides	Y	Y	Y	Y	Y
	Triceratium crenulatum	Y	Y	Y	Y	Y
	Triceratium Dobreeanum	N	N	N	Y	N
	Triceratium excavata	N	N	Y	N	N
	Triceratium favus	Y	Y	Y	Y	Y
	Triceratium favus v. quadrata	Y	Y	Y	Y	Y
	Triceratium formosum	N	N	N	Y	N
	Triceratium fractum	Y	Y	N	N	N

Biddulphieae - Biddulphia



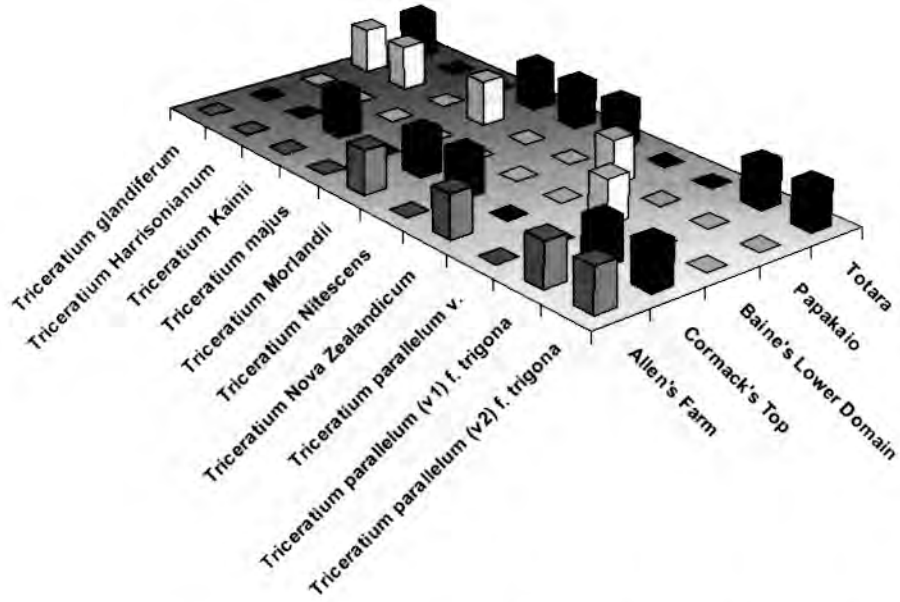
Biddulphieae - Triceratium (I)



Triceratium glandiferum	N	N	N	Y	Y
Triceratium Harrisonianum	N	N	N	Y	N
Triceratium Kainii	N	Y	N	N	N
Triceratium majus	N	N	N	Y	Y
Triceratium Morlandii	Y	Y	N	N	Y

Triceratium Nitescens	N	Y	N	N	Y
Triceratium Nova Zealandicum	Y	N	N	Y	N
Triceratium parallelum v.	N	N	Y	N	N
Triceratium parallelum (v1) f. trigona	Y	Y	N	N	Y
Triceratium parallelum (v2) f. trigona	Y	Y	N	N	Y
Triceratium plenum	N	N	N	Y	Y
Triceratium polycistinorum	Y	N	N	N	N
Triceratium pseudo-nervatum	Y	N	Y	N	Y
Triceratium Pulvinar	Y	Y	Y	Y	N
Triceratium repletum	Y	Y	N	Y	N
Triceratium rugosum	N	N	Y	N	N
Triceratium scitulum	N	N	N	N	Y
Triceratium scitulum v. quadrata	N	N	N	N	Y
Triceratium secedens	N	Y	N	Y	Y
Triceratium secedens v.	N	Y	N	N	N
Triceratium spinosum v. ornata	Y	N	N	Y	N

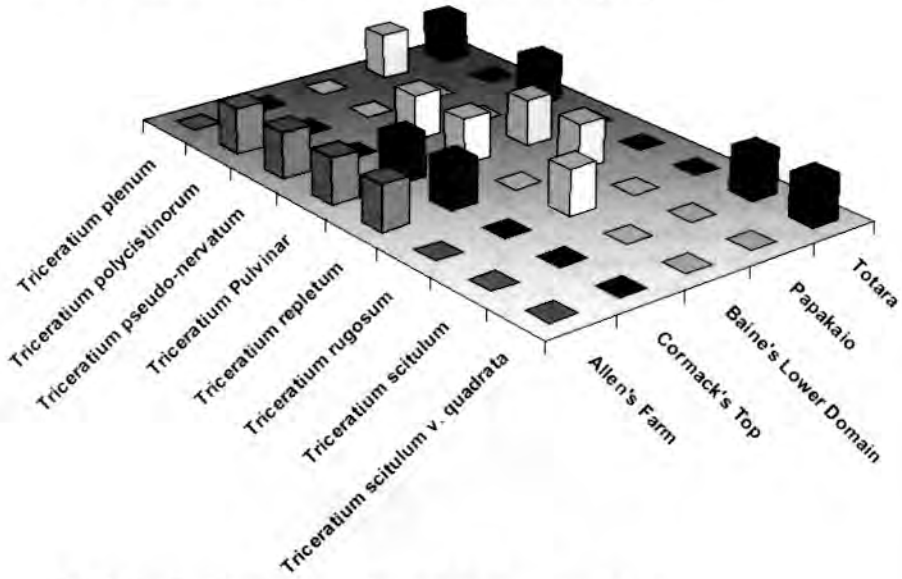
Biddulphieae - Triceratium (II)



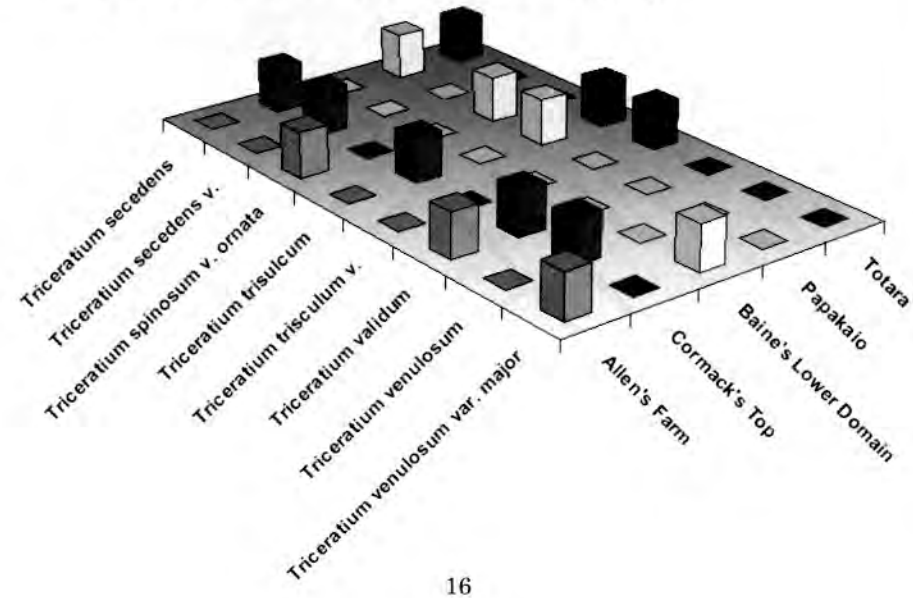
Triceratium trisulcum	N	Y	N	Y	Y
Triceratium trisculum v.	N	N	N	N	Y
Triceratium validum	Y	Y	N	N	N
Triceratium venulosum	N	Y	N	N	N
Triceratium venulosum var. major	Y	N	Y	N	N

134	*Popeia sp*	N	N	Y	N	N
138	*Kittonia elaborata*	Y	N	N	N	N
	Kittonia virgata	N	N	N	Y	N

Biddulphieae - Triceratium (III)

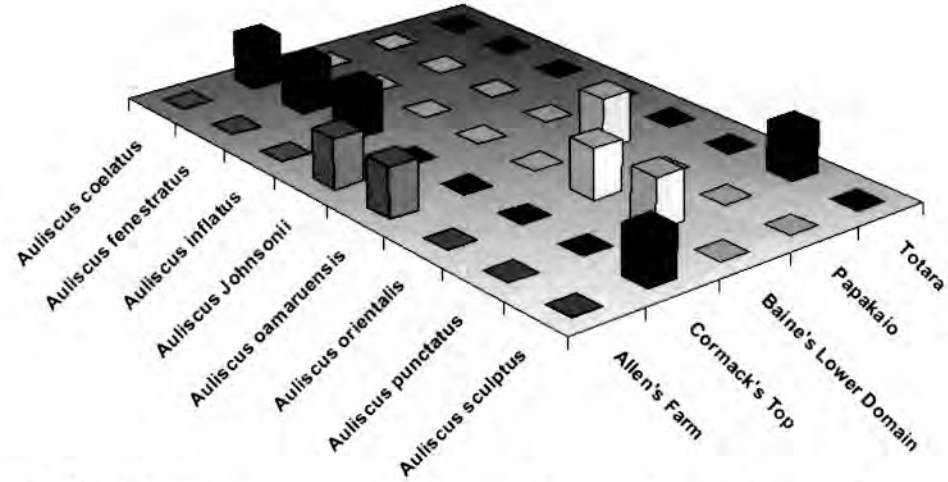


Biddulphieae - Triceratium (IV)



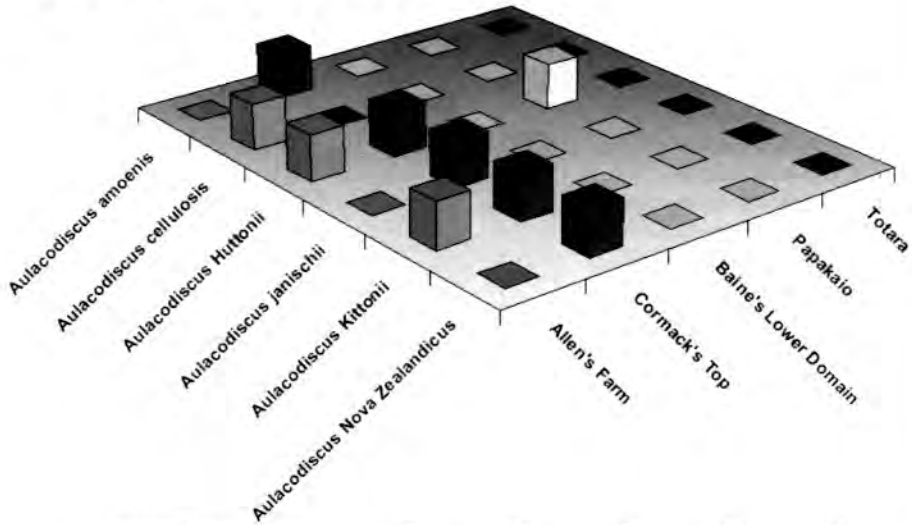
22	**Eupodisceae**	**A**	**B**	**C**	**D**	**E**
141	*Auliscus coelatus*	N	Y	N	N	N
	Auliscus fenestratus	N	Y	N	N	N
	Auliscus inflatus	N	Y	N	N	N
	Auliscus Johnsonii	Y	N	N	N	N
	Auliscus oamaruensis	Y	N	N	Y	N
	Auliscus orientalis	N	N	Y	N	N
	Auliscus punctatus	N	N	Y	N	Y
	Auliscus sculptus	N	Y	N	N	N
149	*Aulacodiscus amoenis*	N	Y	N	N	N
	Aulacodiscus cellulosis	Y	N	N	N	N
	Aulacodiscus Huttonii	Y	Y	N	Y	N
	Aulacodiscus janischii	N	Y	N	N	N
	Aulacodiscus Kittonii	Y	Y	N	N	N
	Aulacodiscus Nova Zealandicus	N	Y	N	N	N
	Aulacodiscus Notatus	N	Y	N	N	N
	Aulacodiscus oamaruensis	Y	Y	N	Y	N
	Aulacodiscus rattrayii	N	Y	N	N	Y
	Aulacodiscus Sollittianus v.	N	Y	N	N	N
	Aulacodiscus Sollittianus v. Nova Zealandica	N	N	N	Y	N
	Aulacodiscus subrimosis	Y	N	N	N	N

Eupodisceae - Auliscus



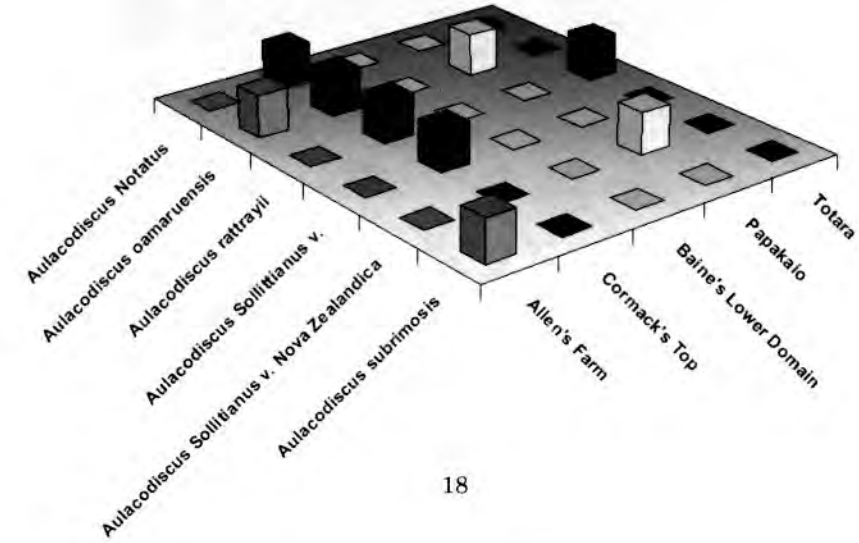
23	**Heliopelteae**	**A**	**B**	**C**	**D**	**E**
157	*Actinoptychus decorans*	N	Y	N	Y	N
	Actinoptychus fuscus	N	N	N	Y	N

Eupodisceae - Aulacodiscus (I)

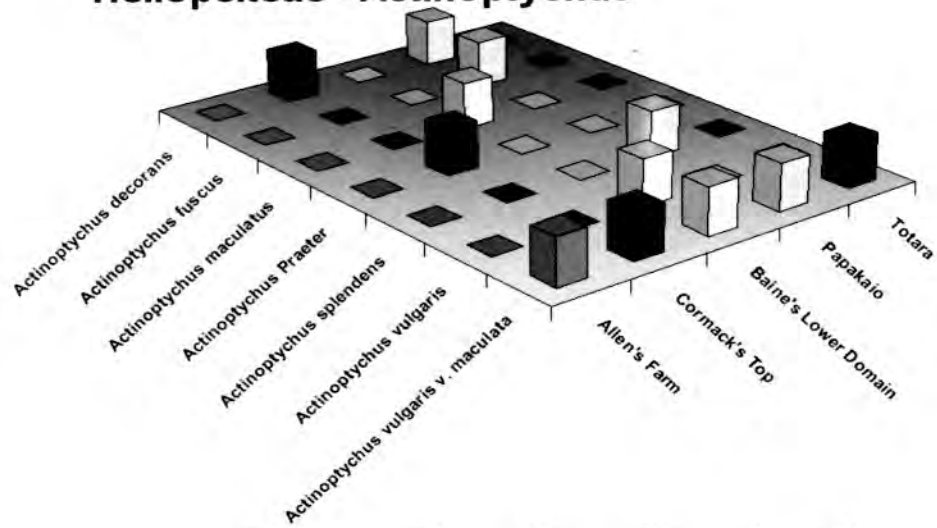


	Actinoptychus maculatus	N	N	Y	N	N
	Actinoptychus Praeter	N	Y	N	N	N
	Actinoptychus splendens	N	N	N	Y	N
	Actinoptychus vulgaris	N	N	Y	N	N
	Actinoptychus vulgaris v. maculata	Y	Y	Y	Y	Y
160	*Anthodiscus floreatus*	N	N	N	Y	N
24	**Asterolampreae**	**A**	**B**	**C**	**D**	**E**
165	*Gyrodiscus Vortex*	N	Y	N	N	N
166	*Asterolampra sp.*	N	N	Y	N	N

Eupodisceae - Aulacodiscus (II)

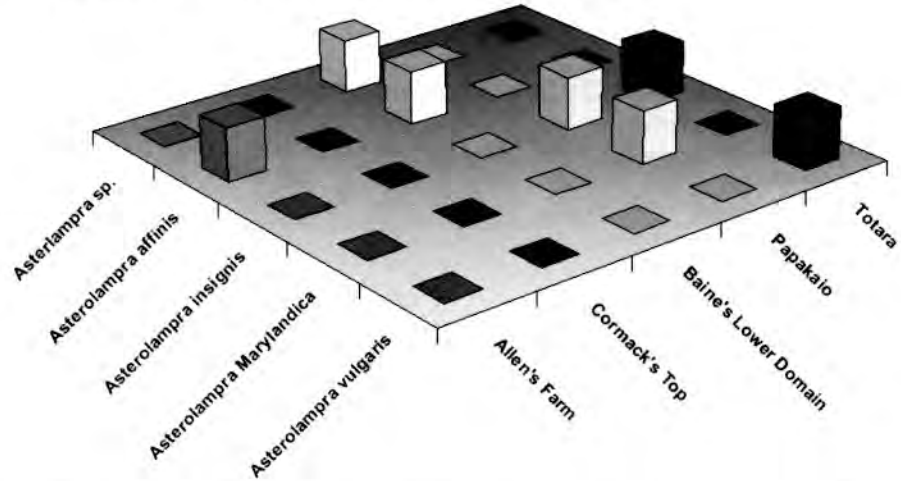


Heliopelteae - Actinoptychus



	Asterolampra affinis	Y	N	Y	N	N
	Asterolampra insignis	N	N	N	Y	Y
	Asterolampra Marylandica	N	N	N	Y	N
	Asterolampra vulgaris	N	N	N	N	Y

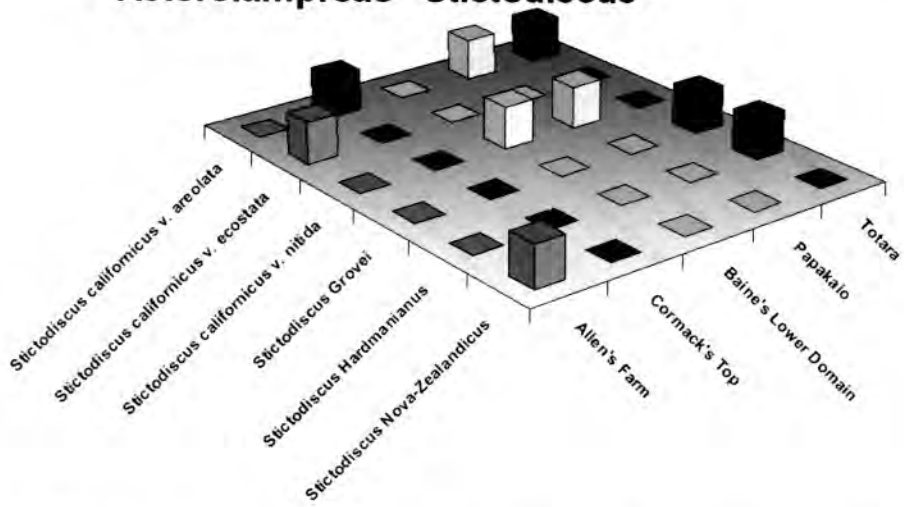
Asterolampreae - Asterolampra



170	*Stictodiscus californicus v. areolata*	N	Y	N	Y	Y
	Stictodiscus californicus v. ecostata	Y	N	N	N	N
	Stictodiscus californicus v. nitida	N	N	Y	Y	N

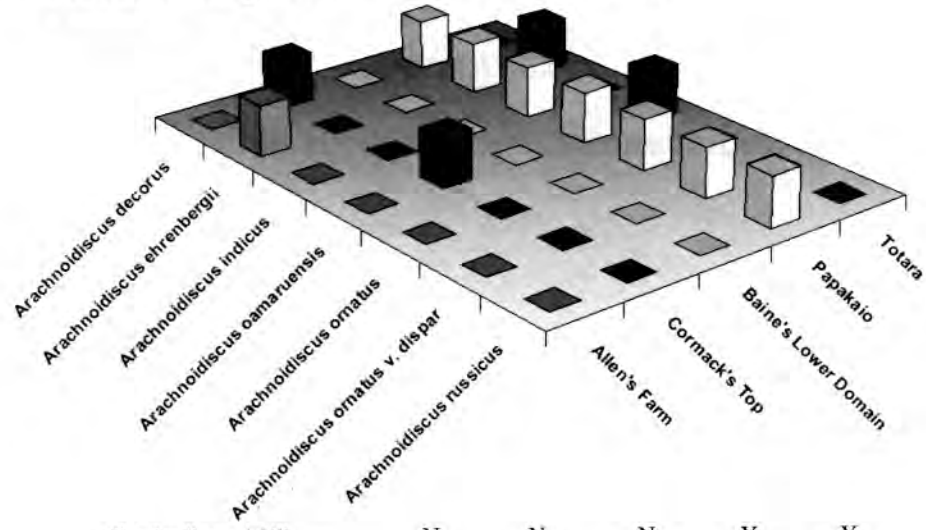
	Stictodiscus Grovei	N	N	N	N	Y
	Stictodiscus Hardmanianus	N	N	N	N	Y
	Stictodiscus Nova-Zealandicus	Y	N	N	N	N

Asterolampreae - Stictodiscus



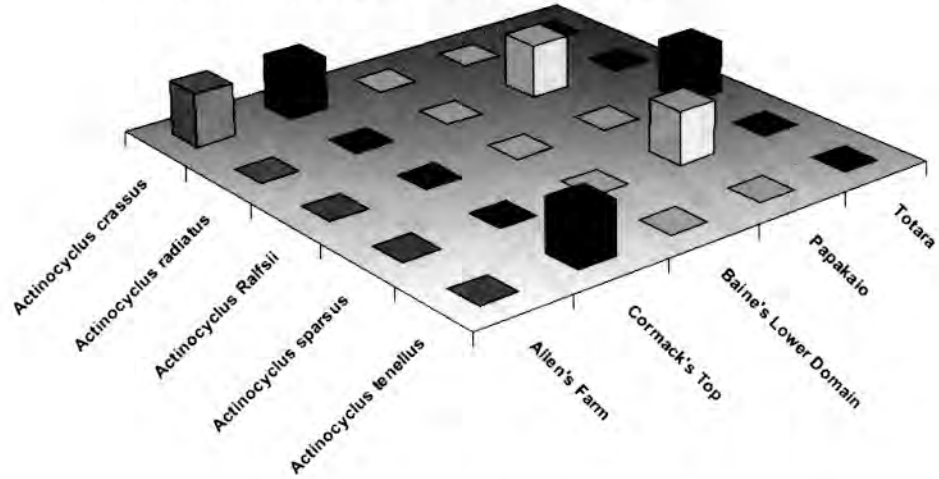
171	*Arachnoidiscus decorus*	N	Y	N	Y	N
	Arachnoidiscus ehrenbergii	Y	N	N	Y	Y
	Arachnoidiscus indicus	N	N	N	Y	N
	Arachnoidiscus oamaruensis	N	Y	N	Y	Y
	Arachnoidiscus ornatus	N	N	N	Y	N
	Arachnoidiscus ornatus v. dispar	N	N	N	Y	N
	Arachnoidiscus russicus	N	N	N	Y	N
177	*Brightwellia hyperbora*	Y	N	N	N	N
	Brightwellia pulchra	N	N	N	N	Y
25	**Coscinodisceae**	**A**	**B**	**C**	**D**	**E**
179	*Craspedodiscus coscinodiscus*	N	N	N	Y	N
183	*Stephanodiscus astraea*	N	N	N	Y	N
186	*Actinocyclus crassus*	Y	Y	N	N	N
	Actinocyclus radiatus	N	N	N	Y	N
	Actinocyclus Ralfsii	N	N	N	N	Y
	Actinocyclus sparsus	N	N	N	Y	N
	Actinocyclus tenellus	N	Y	N	N	N
187	*Coscinodiscus anguste-lineatus*	N	N	Y	N	Y
	Coscinodiscus apiculatu v. ambigua	N	Y	N	N	N
	Coscinodiscus armatus	N	N	N	Y	N
	Coscinodiscus bulliens	N	Y	N	N	Y
	Coscinodiscus crassus	N	N	N	Y	Y
	Coscinodiscus curvatus	N	N	N	N	Y

Asterolampreae - Arachnoidiscus



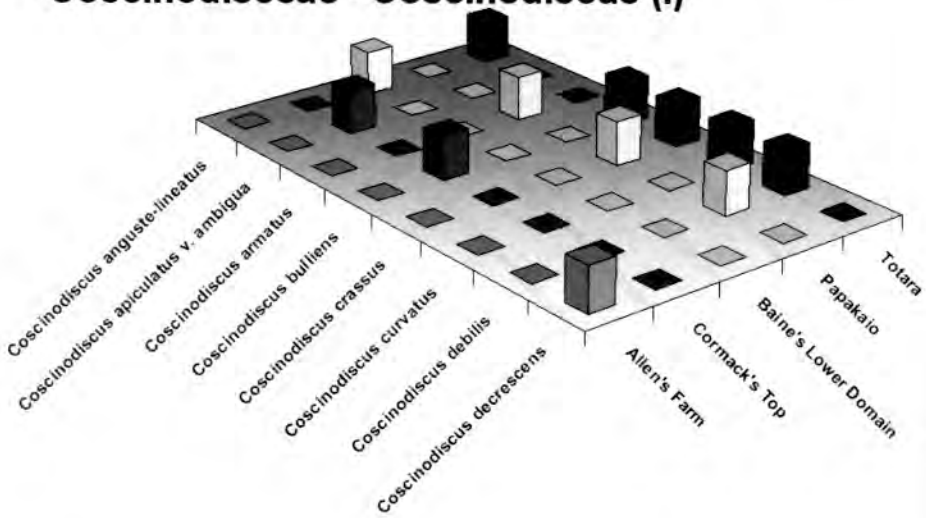
	Coscinodiscus debilis	N	N	N	Y	Y
	Coscinodiscus decrescens	Y	N	N	N	N
	Coscinodiscus denarius	N	N	Y	N	Y
	Coscinodiscus elegans v. spinifera	Y	Y	N	N	N
	Coscinodiscus heteroporus	N	Y	Y	Y	Y
	Coscinodiscus Janischii or biangulatus	N	N	N	Y	N
	Coscinodiscus Kutzingi	Y	Y	Y	N	N

Coscinodisceae - Actinocyclus

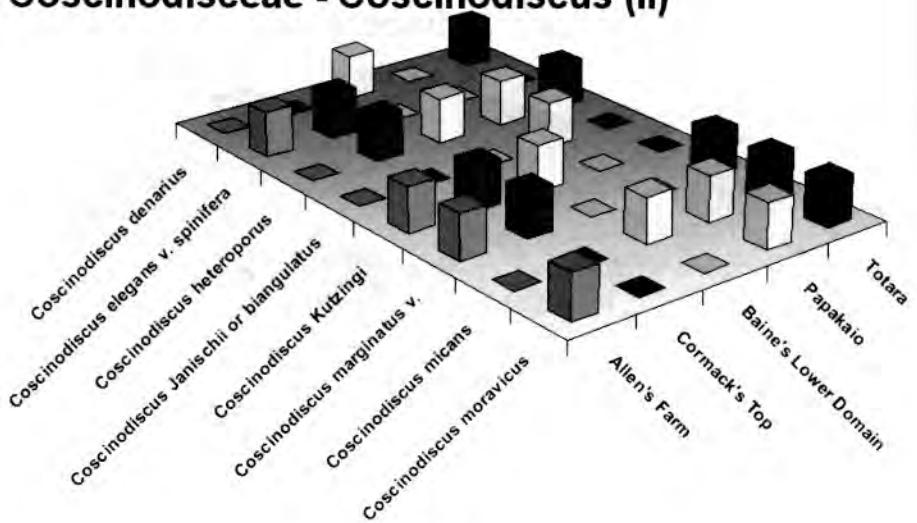


Coscinodiscus marginatus v.	Y	Y	N	N	Y
Coscinodiscus micans	N	N	Y	Y	Y
Coscinodiscus moravicus	Y	N	N	Y	Y
Coscinodiscus nodulifer	N	N	N	Y	Y
Coscinodiscus obscurus	Y	Y	N	Y	N
Coscinodiscus Oculus-Iridis	N	N	N	Y	Y

Coscinodisceae - Coscinodiscus (I)

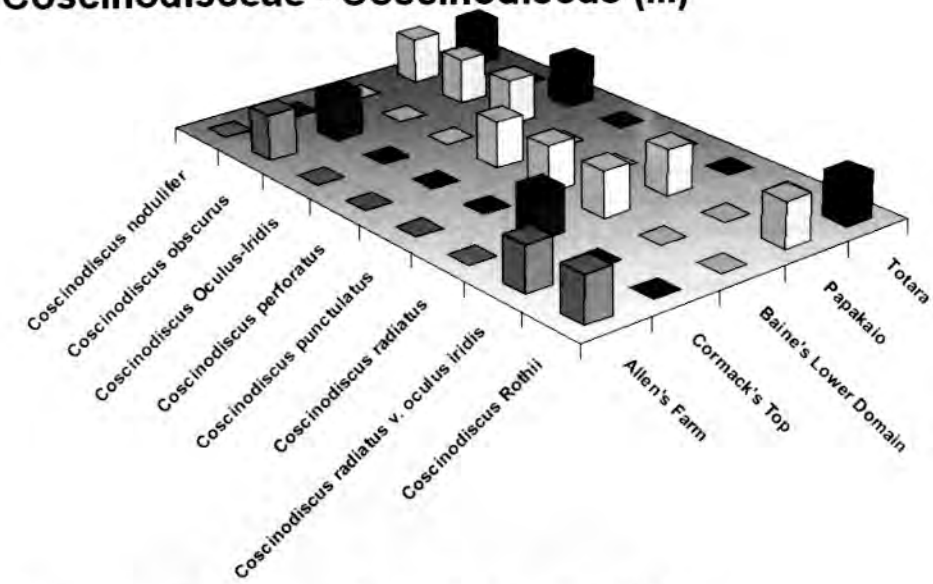


Coscinodisceae - Coscinodiscus (II)

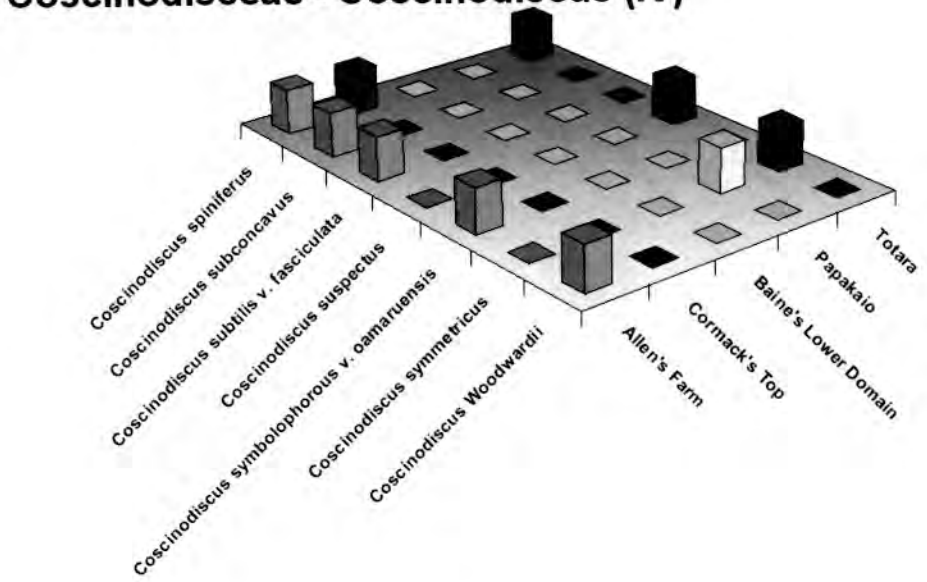


Coscinodiscus perforatus	N	N	Y	N	N
Coscinodiscus punctulatus	N	N	Y	N	N
Coscinodiscus radiatus	N	Y	Y	Y	N

Coscinodisceae - Coscinodiscus (III)

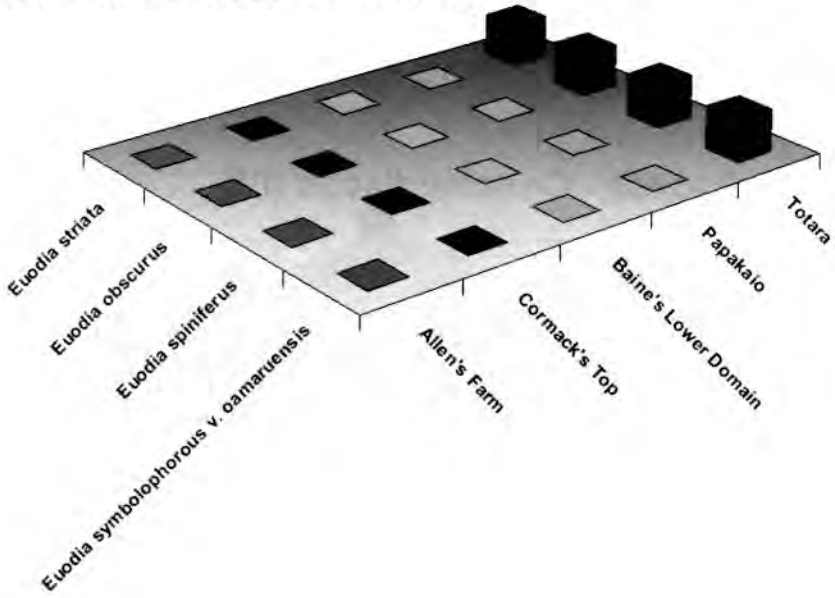


Coscinodisceae - Coscinodiscus (IV)



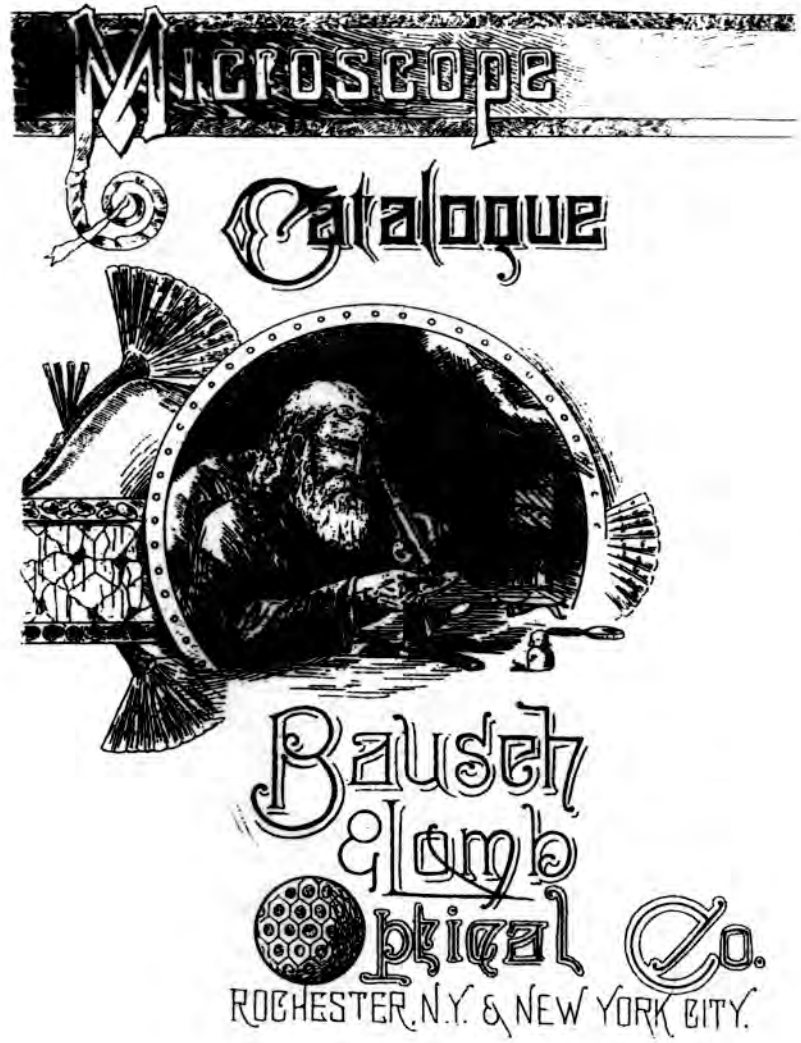
	Coscinodiscus radiatus					
	v. oculus iridis	Y	N	N	N	N
	Coscinodiscus Rothii	Y	N	N	Y	Y
	Coscinodiscus spiniferus	Y	Y	N	N	Y
	Coscinodiscus subconcavus	Y	N	N	N	N
	Coscinodiscus subtilis					
	v. fasciculata	Y	N	N	N	N
	Coscinodiscus suspectus	N	N	N	N	Y
	Coscinodiscus symbolophorous					
	v. oamaruensis	Y	N	N	N	N
	Coscinodiscus symmetricus	N	N	N	Y	Y
	Coscinodiscus Woodwardii	Y	N	N	N	N
187d	*Ethmodiscus obscurus v.*	N	N	Y	N	N
189	*Euodia striata*	N	N	N	N	Y
	Euodia obscurus	N	N	N	N	Y
	Euodia spiniferus	N	N	N	N	Y
	Euodia symbolophorous					
	v. oamaruensis	N	N	N	N	Y

Coscinodisceae - Euodia



Bausch & Lomb Diatoms circa 1900.

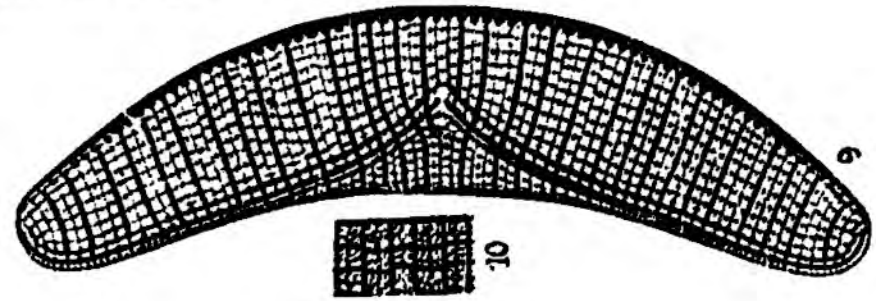
We have been sent the following photocopy of a catalogue cover which depicts Licmophora sp. 'as seen in life'.



Unmounted Microscopic Objects

Unfortunately this set has no suppliers identification though many sets of this ilk were supplied by people such as R.G.Mason of Clapham.

Deposit Deskine Logie
Deposit Black Moss, Aberdeen (Navicula Hitchcochii)
Epithemia Hyndmanii
Deposit Amherst, Victoria
Deposit Malta
Deposit Toome Bridge, Ireland



Adolf Schmidt - Atlas der Diatomaceenkunde
Locations cited:- Skye U.K.
Plate/Figure & Notes:- Plate 249/Figure 9-10
Species Name:- Epithemia hyndmanii William Smith

Famous Diatomists

Frederic G. Kitton (1827-1895)
Born - Cambridge 24th April 1827. Died - London 22nd July 1895.
Diatomist and Microscopist.
A biography of Frederic Kitton was published in Le Diatomiste. p. 201 entitled 'Notice biographique sur M. Frederic Kitton' by Dr. Henri van Heurck. It contains a full list of all his publications.
Published set of Norfolk diatoms, 1881. NORFOLK DIATOMS. Series I-IV, numbers 1-100. 1885. Specimens are strewn mounts on microscope slides. A set as above exists in the Farlow Herbarium - Harvard University.
References - G. A. Walker-Arnott correspondence (Depatment of Botany, Natural History Museum ; Catalogue of Scientific Papers compiled and Published by the Royal Society VII, 83; X, 407; XII, 387; XVI 299.; Memoir by his son (portrait and bibliography included), 1895; 'Diatomiste', II, 201 (portrait and bibliography included); Journal of Botany 1895, 312.; Journal of the Quekett Microscopical Club 1895, 152. Transactions of the Norfolk and Norwich Naturalists Society VI, 201; Kittonia - Grove and Sturt.
Hon. F.R.M.S. (Science Gossip January 1882)
Article Science Gossip January/February 1882 - Early History of the Diatomaceae.
Science Gossip February 1882 Article reviewing a review - Fineness of Striation as a specific Character of Diatoms.
Science Gossip April 1882 Article - On the Origin of Hair-bell, Foxglove &c. also in the same issue 'Cutting Sections of Coal'.

Science Gossip July 1882 Microscopy Section - another 'Cutting Sections of Coal' article.
Science Gossip August 1882 Microscopy Section - a note explaining the meaning of the sign x in relation to magnification. Also another note on Cutting Coal Sections
Science Gossip Sept. 1882 - Another Article in the on-going saga of 'Cutting sections of coal.'.
Science Gossip September 1882 Botany section - Ladies Traces.
Science Gossip October 1882 - A rather terse missive concerning the figure x when used as a magnification term and also a note on the term 'talc' as used in sliders.
Many articles in Science Gossip with the intials F.K.
Science Gossip November 1882 - Article 'Preparation of Diatoms.'
Part II of An Essay on the Classification of the Diatomaceae by M. Paul Petit (Translated by F. Kitton, Hon. F.R.M.S.) was read before the Royal Microscopical Society June 6th 1877 and is published in the August 1877 Part CIV of the Monthly Microscopical Journal [Transactions of the Royal Microscopical Society]
F. Kitton wrote a chapter on the Polariscope for Half-hours with the Microscope by E. Lankester, M.D., F.R.S. (1877)
Co-Author with J. Deby - A bibliography of the microscope and micrographic studies, part III - The diatomaceae (For private distribution) - 1882
Co-Author - DIATOMS : Directions for collecting, preserving, transporting, preparing and Mounting Specimens of the Diatomaceae. By Prof. Arthur Mead Edwards, M.D.; Prof. Christopher Johnston, M.D. ; Prof. Hamilton L. Smith. LL.D. ; and Frederic Kitton, Esq. - Published by the Industrial Publication Company, New York. 1878 (Note at this time that Arthur Mead Edwards, Prof. Hamilton L. Smith and Frederick Kitton were all honorary members of the QMC.
There were so many articles and piecces of correspondence in the pages of Science Gossip that the rest of this volume could be taken up by enumerating these.
In 1883 was a Corresponding Member de la Societe Belge de Microscopie.
The 1881 Census has the following details:
Dwelling: Bedford Cross St, Heigham, Norfolk, England
Fredk. KITTON, Married. Aged 53. Male. Born:-Cambridge, Norfolk, England. Head of Household. Preparer Of Microsopic Objects (Sci Purs)
Mary KITTON, Married. Aged 48. Female. Born:-Alrewas, Stafford, England. Wife of above. Preparer Of Microsopic Objects (Sci Purs)
Arthur KITTON, Unmarried. Aged 23. Male. Born:-Norwich, Norfolk, England. Son of Above. Tobacconist
Walter S. KITTON, Unmarried. Aged 19. Male. Born:-Norwich, Norfolk, England. Son of above. Surveyor Unemployed (Merchants Clerk)
Edith KITTON, Unmarried. Aged 17. Female. Born:-Norwich, Norfolk, England. Daughter of the above. Governess
George E. KITTON, Unmarried. Aged 13. Male. Born:-Norwich, Norfolk, England. Son of the above. Scholar
Frank KITTON, Unmarried. Aged 11. Male. Born:-Norwich, Norfolk, England. Son of the above. Scholar
Florance KITTON, Unmarried. Aged 9. Female. Born:-Norwich, Norfolk, England. Daughter of the above. Scholar

In the 1877, 1878, 1879, 1880, 1881 QMC Honorary Members list - Frederick Kitton, Hon. F.R.M.S., &c., 10 Haymarket, Norwich. - elected September 22nd 1876.

Old Papers - Revisited

In this series of articles we will reproduce some hard to find papers from years gone by.
In this issue we reproduce an article from Science Gossip by the diatomist Frederick Kitton, the subject of the Famous Diatomist article.

Strange Habitats of Certain Species of Diatomaceae

by F. Kitton

Originally published in Hardwicke's Science Gossip October 1873 (No.106) p.222.

The ubiquity of the lower forms of life, both vegetable and animal, constantly attracts the attention of the natural-history student. The only preventive to the production and growth of organized forms appears to be the absence of moisture. In the boiling springs of Iceland, and in the snow of the Arctic region, may be found microscopic evidences of life. Nay, even in the arid brine-pans of Cheshire these simple forms "live, move, and have their being."
The Diatomaceae, like other low forms of life, are almost invariably present wherever moisture occurs, as among the roots of mosses growing in humid situations, or among confervoid growths so frequently seen on stones or walls exposed to spray from a fountain or the drip of a gutter. Among the roots of mosses many species of Diatoms seem to luxuriate, and one of the most remarkable is *Liparogyra dentroteres*, Ehr.; *Orthosira mirabilis*, Gregory ("Trans. Mic. Soc.," vol. iv. p.37). Frustules with spiral band, vitreous, sometimes slightly bent; valve discoid, with three or more obscure central puncta; margin set with short spines. (Washings from moss growing on alders, Heigham, Norfolk, F.K.; in moss from roof of cottage, Penzance, Ralfs; trunks of trees, Venezuela, Ehrenberg. Fig. 133: a, arcuate frustule; b, straight filament; c, valve.)

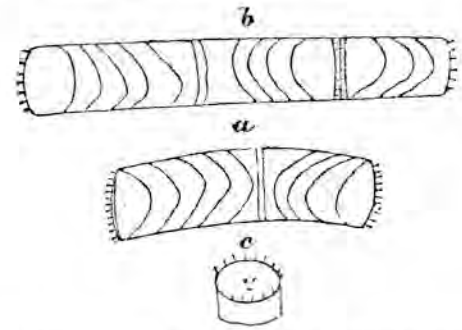


Fig. 133. *Liparogyra dentroteres*: *a*, arcuate frustule; *b*, straight filament; *c*, valve.

Ehrenberg describes two other species of the genus; viz., L. circularis, which seems to differ only from the preceding in the greater number of lines in the spiral (both forms were found in the Venezuela gathering), and L. scalaris, figured in the *Mikrogeologie*, and which I have reproduced, fig. 134 (South America).
In moss taken from very wet localities I have occasionally found that very remarkable filamentous diatom *Orthosira Dickeii*. It does not occur in anything like the abundance in which it occurred in its original habitat, nor have I seen the sporangial(?) state of it in gatherings from other sources.

Fig. 134. *Liparogyra scalaris.*

Orthosira Dickieii. - Frustules straight, cavities subspherical, valve discoid. Sporangial (?) frustule fusiform, with undulate margin (Cave near Aberdeen, Dr. Dickie; moss washings, Norfolk, F. Kitton. Fig. 135: a, sporangial frustule; b, ordinary frustules).

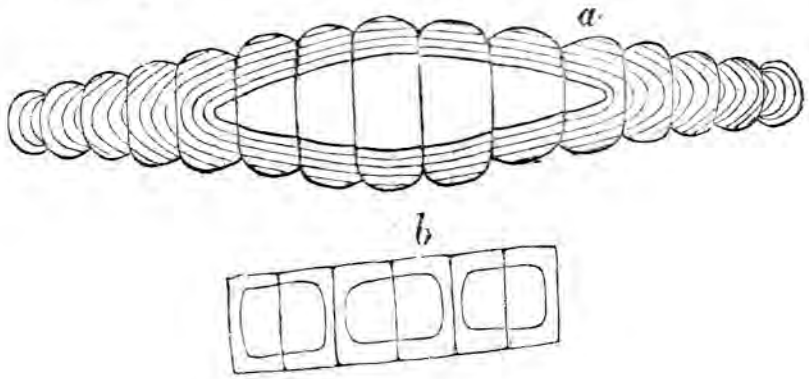


Fig. 135. *Orthosira Dickieii.*

Much obscurity exists as to the nature of the so-called sporangial frustule. Mr. Thwaites, in his description of this form ("Annals of Natural History," vol. i. pl. 12, 2nd series), seems to have no doubt of its sporangial nature. He thus describes its formation:- "At its commencement the endochrome, at the same time it withdraws from the end of the frustule, produces at its centre an additional ring of cell-membrane, and this process continues at certain intervals". The author of the 'Synopsis of British Diatomaceae, however, does not admit that it is a sporangial condition of the frustule, but considers it rather an abnormal development, analagous to what sometimes takes place in other genera. In no other members of this genus has there been found any analagous process in the formation of sporangia. Another difficulty arises from the mode in which self-division takes place in the sporangium, subsequent to its formation. It will be seen that after the formation of a number of concentric rings of silex, the sporangia assume an elongated fusiform shape, and upon the cessation of this ring development, an ordinary frustule makes its appearance, occupying the central portion of the fusiform body, but leaving the attenuated extremities unemployed.

Nitzschia vivax. - Frustule linear, valve linear, lanceolate, arcuate, apices produced, striae distinct, 20 to 25 in .oo1". (Moss, Alder Carr, Heigham, Norfolk, - fig. 136)

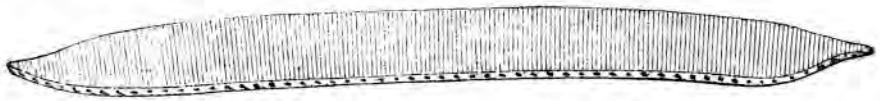
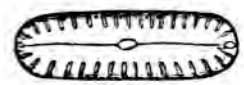


Fig. 136. *Nitzschia vivax.*

I had formerly doubts as to the identity of the moss form with the species usually found in brackish water, but a careful comparison has satisfied me that they are alike. On neither forms are the striae so close as stated by Smith (30 in .001").

Another form almost invariably found in moss washing is *Pinnularia borealis*: although not peculiar to them, a few isolated valves may usually be found in the sub-peat deposits and recent



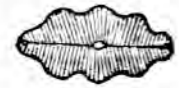


Fig. 137. *Pinnularia borealis.* **Fig. 138. *Navicula undosa*, Ehr.**

freshwater gatherings. *Pinnularia borealis*, Ehr., valve linear, ends rounded, costae distinct, about 13 in .100", not reaching meridian line, length of valve from 0.0013 to 0.0025"; fig. 137, in moss washings from various localities.

Dr. Schumann, in his "Die Diatomaceen der Hohen Tatra," figures this form with a minute puncta on the entire surface of the valve. I have not, however, been able to detect any traces of them in my specimens.

Navicula endosa, Ehr. - Valve minute, oblong lanceolate, margins undulate (3 on each side), ends suddenly produced, striae delicate, slightly radiant. (oss washings, Norfolk, F. Kitton; in a deposit on a damp pavement, Edinburgh Castle, communicated by Dr. Arnott.) This elegant little species seems to have escaped the notice of Smith, Gregory, Greville, and other English diatomists.

Norwich **F. Kitton**

Diatomite as a Filter Aid

Following the article in the last issue on Industrial uses of diatomite and the mention of Dicalite, a reader forwarded the web addresses of three companies who market diatomite as a filter aid, one of these being Dicalite itself.

http://www.dicalite-europe.com/diatom.htm

contains a lot of technical information concerning the product and its method for removal of any organic matter. They use the heat method to effectively clean the diatomite.

http://www.cff.de/us/prod/diacel.htm

is another filter agent offering particle sizes from 75 microns thru 2500 microns.

http://www.worldmineral.com/CeliteIndex.asp

lists 5 diatomite products for a range of industrial uses:-

Celite
Kenite
Diactiv
Primisil
Diafil

and list their uses as encompassing

Filter aids for Beer, Chemicals, Edible Oils, Food, Fruit Juices, Liquid Wastes, Pharmaceuticals, Sweeteners, Water and Wine;

and

Functional additives for Agricultural Chemicals, Cosmetics, Food, Paint, Paper, Plastic Film, Polishes and Rubber.

A pounds worth of pleasure.

by Steve Gill

At a meeting recently my attention was drawn to a small innocuous and uninteresting pinewood box resembling an old pencil case. Four labels had been stuck to its lid as in the accompanying photograph.

Obviously the title Diatoms was interesting but from the weight of the item it appeared to be empty. Inside however were 8 of the 10 tubes noted on the label, each containing what appeared to be 'fresh samples'. The box and its contents were marked with a yellow Post-It note bearing the legend - £1. I considered this for a brief moment before I rashly extracted a pound coin from my pocket and paid the vendor.

I had never heard of the locations noted on the labels though I had heard of J. Spencer whose cleaned samples were in tubes 4 and 5.

James Spencer of Halifax, West Yorkshire

Science Gossip May 1879 Exchange Column -

'Wanted, Smith and Becks "Popular Microscope" in exchange for first-class transparent sections of coal, plant or cash. - James Spencer, Salisbury Place, Halifax.'

Member of the Yorkshire Naturalists' Union Halifax Borough 1891 and 1894 (elected prior to 1883) living at 8 Salisbury Place, Akroydon, Halifax.

James Spencer, Halifax was voted to the Yorkshire Boulder Committee and the Yorkshire Fossil Flora Committee - research committees of the Yorkshire Naturalists Union in 1891.

Science Gossip September/November 1882 Article - *'Recreations in Fossil Botany. Astromyelon and its Affinities by James Spencer.'*

Science Gossip March 1883 Arcticle - *'Recreations in Fossil Botany (Lyginodendron oldhamium).'.*

This was no VIII in a series printed in Science Gossip.

Science Gossip May 1883 Article - *'Recreations in Fossil Botany, Reproductive Organs of Fossil Plants'.* No. IX of series.

Science Gossip July 1883 Article - *Recreations in Fossil Botany (Sporocarpons and Zygospores)* Part X.

The 1881 Census Entry as follows:-

Dwelling: 8 Salisbury Place, Northowram, York, England

James SPENCER M 47 M Halifax, York, England Rel: Head Occ: Clerk In Worsted Factory

Mary SPENCER M 40 F Halifax, York, England Rel: Wife

James H. SPENCER U 9 M Halifax, York, England Rel: Son Occ: Scholar

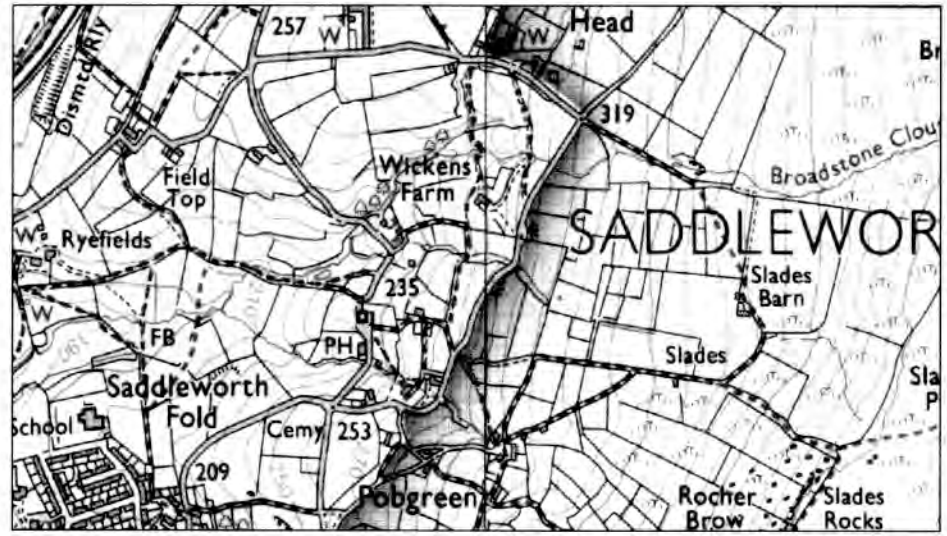
Louisa SPENCER U 5 F Halifax, York, England Rel: Daur Occ: Scholar

The box wasn't of Spencer vintage and the labels were of the self-adhesive variety so these samples were not contemporary with the collector whose box this once was.

Perhaps the place names might indicate whose collection material this was. Firstly, what is a Clough?

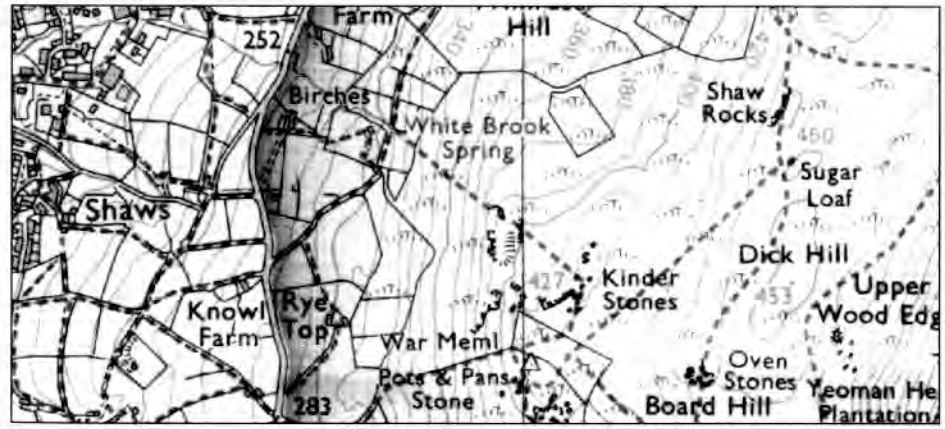
According to the dictionary - a ravine or valley. I scoured a place name gazeteer and discovered that, of those mentioned, most appeared to be located in the neighbourhood of Saddleworth in West Yorkshire. Saddleworth is situate to the west of the principal Pennine watershed. It is historically a township in the Agbrigg Wapentake of the West Riding of Yorkshire. Until 1869 Saddleworth was a Chapelry within the parish of Rochdale but is now a parish in its own right. Although it is still a part of the County of Yorkshire, Saddleworth is now included in the Metropolitan Borough of Oldham.

Now Saddleworth isn't that far from Halifax , a link there perhaps.

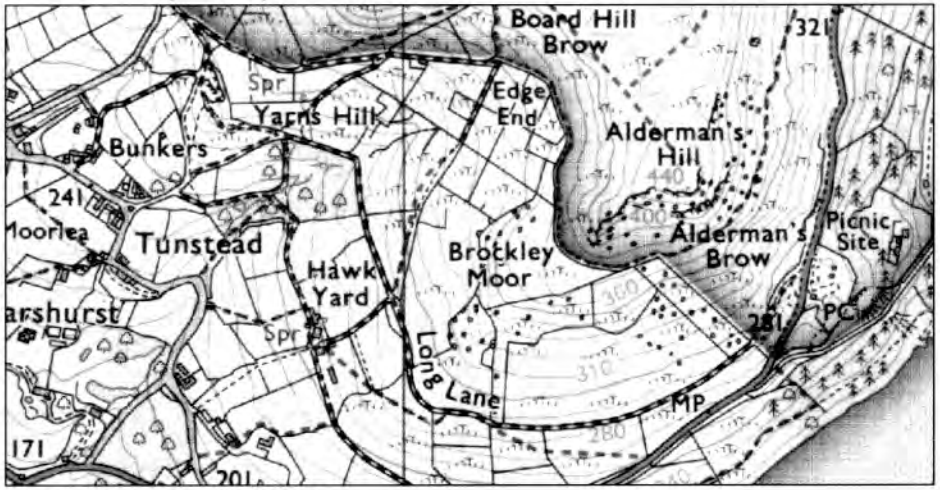


Capper Clough - Nr. Saddleworth Fold, West Yorkshire. National Grid Ref. 005 064

6" Ordnance Survey Map of Saddleworth published in 1849-51 (Yorkshire West Riding Sheets 258, 259, 270, 271 and 279).



Dick Clough below Pots and Pans. National Grid Ref. 013 0154
6" Ordnance Survey Map of Saddleworth published in 1849-51 (Yorkshire West Riding Sheets 258, 259, 270, 271 and 279).
Holden Clough - Possibly near Clitheroe.
Green House - No mention of this as yet.
Ashworth Valley
A fabulous 2 mile walk to Norden beside the pretty Cheesden Brook along its tree-lined valley. Located at Hooley Bridge, on the Bury-Rochdale Road (the B6222), and ends at the Rochdale-Edenfield Road (the A680).



Binn Green Map ref: SE 017044
"A remote car park off the A 635 road, above Dovestone Reservoir. Although this is a very pleasant spot, views out are restricted by trees. The S-shaped car park has a tarmac road and compacted limestone parking bays. There are toilets suitable for all users, with level access from a reserved parking space. There are no picnic tables or other facilities on site and there are no level walks from here. "
6" Ordnance Survey Map of Saddleworth published in 1849-51 (Yorkshire West Riding Sheets 258, 259, 270, 271 and 279).

Now to the tubes. These are of glass with plastic stoppers. Again modern materials so a recent collector is indicated for the place named material. Tubes 1 and 6 had dried out but the material was still evident. These were resuspended in distilled water.

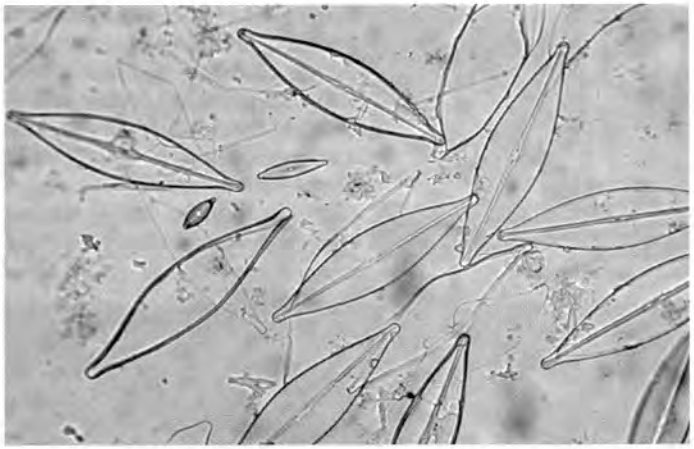
All the tubes, as the labels foretold, contained diatoms; so my one pound purchase was looking good value.
There was no odour that I could detect and apart from the remnants of silt the material was cleaned. Even the dark samples had

been cleaned, but not sieved.
I made up a number of slides using ZRAX mountant (available from Klaus Kemp). The samples were in various states of being cleaned. There appeared to be quite a lot of detritus still in some of the samples and yet others were almost completely cleaned. My first attempts were not so good as the

samples were actually quite concentrated.
Tube 6 appeared to have very little in terms of diatomaceous material so was not mounted.
Tube 9 was missing if there ever had been one, as the label has no sample name against it.
Tube 7 was missing completely.

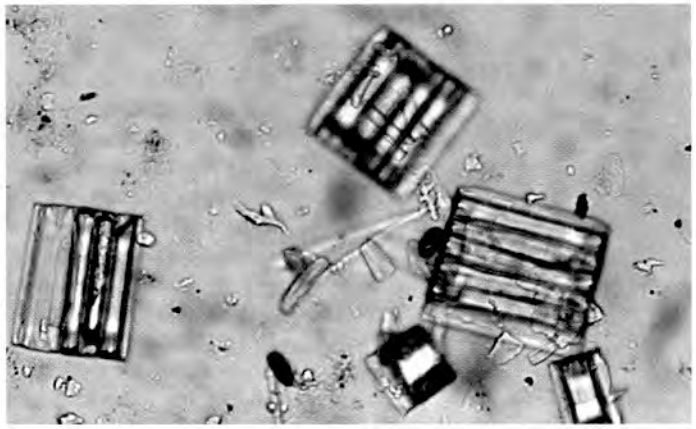
Tube 1.

Dick Clough.
This is an almost pure sample of Diatoma hiemale.



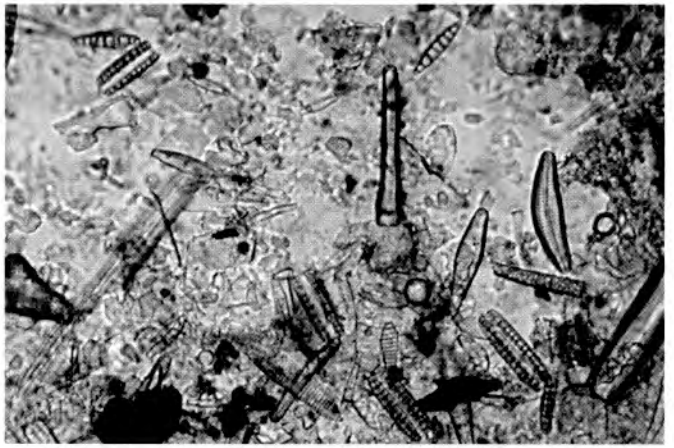
Tube 2
Another almost pure sample.

Tube 3

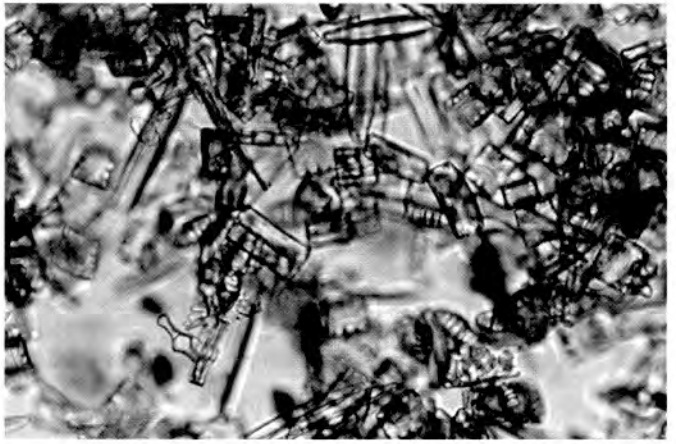


Tube 4

Tube 5



Tube 8



Tube 10

Those lustrous black rings...

I have always been an admirer of the wonderful, highly convex black rings that adorn many of the earlier mounts. I have experimented with all manner of ringing cements, paints and enamels, but have never really achieved anything that comes close. There has been talk of 'hot-knifing' and secret formulae. Not long ago I came across an entry in C.N. Walter's microscopy diary which might point the way.

"I use Brown Cement, sold by Flatters &Garnett. This is Shellac. To make it Black, it could be added, as can be seen from the formulae below.
Use a No. 1 sable hair brush. Small blob on tip, raise brush vertical so that the Cement just goes a little way down the sides. Use brush at an acute angle
Turntable, brush, hand, forearm, and shoulder all in same axis.
Two applications at intervals of 24 hours.
Trim the outer edge and the inner edge of the cement with point of a penknife. Turntable running fast.

Formulae:-

Per S. H. Meakin: Ordinary Shellac
Dissolve in Goodrich's Methylated Spirit (Sold in Shops).
Then add plenty of Boots Black Spirit Dye.
Let stand for a week or so, shaking twice daily.
Then filter through muslin.
May have to squeeze the Shellac through.

Per E. D. Evens: Shellac 10 gm
Castor Oil 1 cc
100% M. S. 12 cc
Lamp Black 1 gm (Carbon Black)

MURRAYITE: Flatters & Garnett do not recommend this for Diatom mounts as they say it is not impervious to Immersion Oil."

An Extract from "Prehistoric Man in Ayrshire"

by John Smith of Dalry (1895) - covering the Parishes of North Carrick
When the waters of Loch Doon were lowered at one time by cutting away a bit of the rocky barrier at its north end, several canoes were got in the loch near the castle. In one of them, as the writer of the New Statistical Account of the parish tells, there were got an oaken war-club and a battle-axe. Two of the canoes have been preserved in a pond at the head of Glen Ness. They have all been made out of single oak trees, one of them being 23 feet long, and 30 inches in depth, by 33 inches in breadth. A rich diatom deposit occurs under peat in the bottom of the loch.

Stepping Stones

If you are going to fall in collecting diatoms then access to the very middle of a river where the water flows fastest is essential and what easier ways of gaining access than via stepping stones placed there by an ancient peoples with amazing foresight, that they should build a diatom access route into the very heart of a swollen torrent.
The downstream submerged face of such stones is nearly always a rich collecting point.

Uses of Diatomaceous Earth

Extract from the Statement of Peter J Smith √ Former Senior Scientific Officer, VI Centre, Barton Hall, Preston
"The work undertaken at the time focused on the role of meat and bone meal in the spread of BSE. Attention was paid to tallow but in my view, correctly concluded that due to the high temperatures, scrubbing and refining processes involved, it was unlikely to be a factor contributing to the BSE problem. The marketing and distribution arrangements for tallow were also different to that of meal and if tallow had been a factor the cases of BSE reported would not have been concentrated to certain geographical areas. However, there remains a potential problem with tallow which was not considered at the time. Tallow run off from cookers or presses is often cleaned by passing through a rolling drum of diatomaceous earth. This earth collects coarse particulate residues from the rendered fat, some of which will have been removed at relatively low temperatures. These particles and fat could be expected to be high in lipid content and tissue from brain or chord materials and potentially BSE agent. The diatomaceous earth with extracted particles and residues would usually be dumped to waste or be recycled, but in some cases may have been collected and added to final feeds. In an unregulated industry where profit margins are tight, every opportunity would be taken to secure extra income. It is unlikely that records exist which show the extent of this practice. This loophole is unlikely to have been closed early in the control measures adopted [for] BSE and the practice may have continued into the 1990's, but again it is difficult to verify."

The Creationist Argument.

Bernard Northrop researched the diatomaceous earth beds near Lompoc in Santa Barbara County, California. Evolutionary geologists have maintained that these beds formed gradually over vast periods of time, but Northrup's studies provided striking evidence of the rapid and catastrophic deposition of these beds.

In the Sicquoc area, countless billions of the delicately sculptured siliceous cell walls of diatoms (microscopic organisms) have been deposited in such a way that fish were entombed with bones and even body organs intact. Some fossil fish were trapped so that they lie parallel to the bedding plane of the diatom matrix, but many other fish fossils extend across the bedding plane. ;the latter fossils (standing partly on end) must have been buried quickly, or else the part not buried at first would have been devoured by scavengers, or would have decayed long before it could have been buried by a diatom "rain." Fossils of various fish, sea birds, and whales also indicate that the diatom material was deposited rapidly and catastrophically rather than by gradual and uniform activity.

Northrup postulated that the original diatom supply was first formed in cool waters after the Flood and was redeposited at the Lompoc site during a post-Flood catastrophe.

From a Notebook by C. N. Walter

GUIDE RINGS ON COVER GLASS.

On a plain slide, put tiny spot of saliva in centre, and place a cleaned CG on it and gently press it down. This will keep the CG in position. Put on ringing table and centre the CG to the 3/8" ring on the ringing table.

Use a ROTRING VARIANT PEN 0.2 sold at Drawing Office suppliers. Use the holder arm on the turntable. It will give excellent rings, any diameter, and contains Pelikan Black Indian Ink (use Filtered Ink).

Another way is to use a mapping pen. Put small drop of the Indian Ink in a watch glass or paint tray, and dip tip of pen in it. Use it as above with the table holder. It is not so satisfactory as the Rotring.

It is wiser to do a good number, say 100 at a time while one has got the knack of it easily; the first two or three may not be perfect. When they are dry store in a tube.

Carmine paint is a good alternative. Use a 00 Sable Hair Brush, after removing all but 3-4 hairs in centre.

PRESERVING MATERIAL.

Keep in tubes, one for each locality and appropriately labelled. Preservative is

Distilled Water 95%
Phenol (Crystals), 5%

Filter mixture before using. Every year or two the preservative should be decanted and replaced with fresh.

CLEANING SLIDES.

Grease Free. Take fresh box of slides; put them one at a time into a bowl of warm Rinso, or Persil, and let stand for an hour.

Take out one at a time, lay on a piece Kleenex and fold over. When the Kleenex is dry the batch can go back into the slide box, still in the Kleenex, and marked "Degreased".

Chemical Free. 4 oz. bottle containing Acid Alcohol (see below). Take degreased slides and put into the bottle where stored until wanted. When taken out for use let them dry without rubbing.

ACID ALCOHOL

Per Gray.	Per E. Marson.
Acetic acid 1%	Hydrochloric Acid .5 ml
70% M. S. 99%	75% M. S. 100ml.

RULING SEARCH & STORE SLIDES.

Rule a piece of paper size of a slide 3" x 1"

1/8" squares. There will be 48 numbered squares. Put this paper slip in slide rack and the cleaned slide on it. Using another slide to provide an edge, and pressing it down firmly rule all lines with diamond pen.

Then, on the same side insert the letters and numbers as in above diagram. Do this on dark ground.

The other side of the slide will be smooth and the one for use, and letters and numbers will appear right way round. With Gurr's Glass Ink, at one end, put "SEARCH" or "STORE". The reading of these words will ensure slide is right way up when diatoms are put on it.

Clean with Rinso and store in Acid Alcohol.

SUPPORTS FOR COVER GLASS.

I have a quantity of these but hardly ever use them. The difficulty is to position them so that the CG can be centred with its guide ring in relation to the diatom, and the supports inside the edges of the cover glass. Only way to use the supports is to have the guide ring on the slide with the diatom fixed in the centre of it. Can then put supports on well inside the CG edges. They should be placed in position on the adhesive before it is heated dry.

They are useful for a very deep diatom when CG could not rest level. S. H. Meakin never used them for the reasons I have given above and depended on sufficient depth of mountant.

Authors who have named Diatoms.

Arnott, George Arthur Walker	1799-1868
Azpeitia Moros, Florentino	
Bailey, Jacob Whitman	1811-1857
Barker, John William	1887-1948
Brigger, Albert L	
Brun, Jacques	1826-1908
Cheneviere, E	
Cleve, Per Theodor	1840-1905
Cottam, Arthur	-1911
Ehrenberg, Christian Gottfried	1795-1876
Forti, Achille Italo	1878-1937
Fuge, Dingley P	
Grant, William M	
Greville, Robert Kaye	1794-1866
Grove, Edmund	
Grunow, Albert	1826-1914
Hanna, G. Dallas	1887-
Harvey, William Henry	1811-1866
Hustedt, Friedrich Carl	1886-
Janisch, Carl	1825-1900
Johnson, Christopher	
Kitton, Frederic	1827-1895
Lefebure, P	

Long, John A	
Mann, Albert	1853-1935
Meakin, Samuel Henry	1876-1955
Moller, Johann Diedrich	1844-1907
Norman, George	1823-1882
Pantoscek, Jozsef	1846-1916
Peragallo, Hippolyte	1851-
Ralfs, John	1807-1890
Rattray, John	1858-1900
Schmidt, Adolf Wilhelm Ferdinand	1812-1899
Smith, James	
Aturt, Gerald	1860-1947
Tempere, Johannes Albert	1847-1926
Van Heurck, Henri Ferdinand	1838-1909
Walker. W. C.	
Wise, Frederick Clunie	1884-1962
Witt, Otto Nikolaus	1853-1915

(*Editors Note: There are many more than those contained in the above list which was compiled in the 1960s*)

SIEVES.

For use in cleaning diatoms.
I purchased mine from
Endecotts (Filters) Ltd.
Lombard Road,
S. W. 19.
and have the following set made of brass:-
They are 2" diameter and nickel mesh.

Meshes to inch.	Diam.	Mesh.		
50		500	u	=.50 mm
100		250	u	=.25 mm
150		160	u	=.16 mm
200		125	u	=.12 mm
300		80	u	=.08 mm
400		60	u	=0.6 mm

To use them.
Before sitting, material should be given one or two rinsings, by letting settle and then decanting the clear liquid.
Use evaporating dish with water in it.
Hold sieve in left hand with mesh just immersed in the water.
Small quantity of turbid fluid poured into sieve. Very small quantity.
Move sieve slightly up and down and gently tap right hand side with forefinger.
Fine material will go through mesh, leaving larger diatoms and particles of earth in sieve. Mud etc, will also get broken up and pass through.
With wash bottle pour a little into the sieve and repeat above procedure. Do this once or twice.
The turbid liquid which has passed through should be retained and examined.
Residue in mesh:-
Invert over an evaporating bowl.

Pour water from wash bottle on to underside of mesh, also use pipette on the inside to clear.
Pour into flask for preservation.
Rinse material in basin with wash bottle.
Should now have a collection of nearly free diatoms, i.e. clear of debris.
Do this through meshes of various sizes.
(*Editors Note: See advertisement below for currently available filters at low cost*)

Things That Go Bump in the Night

The origin of this little phrase is from a Scottish (some say Cornish) prayer.

"From ghoulies and ghosties and long-leggety beasties,
And things that go bump in the night, Good Lord, deliver us!"

This prayer is quite apt for diatomists who leave samples in tight capped bottles without fixing the sample in any way.

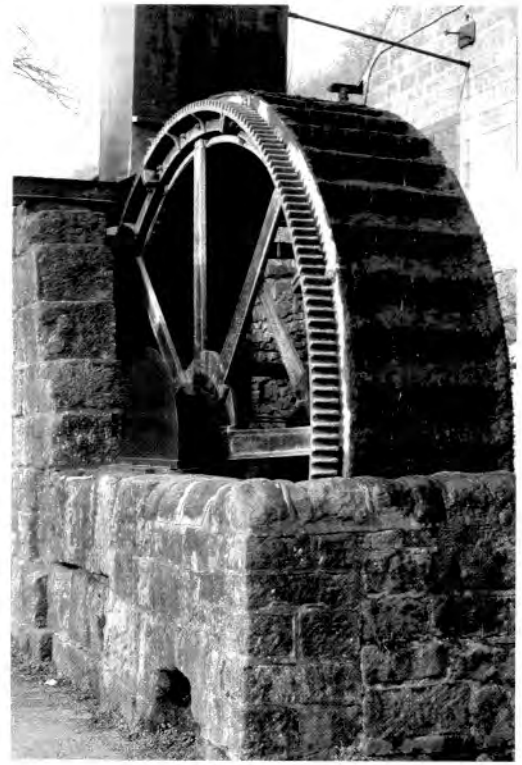
Cromford Mill

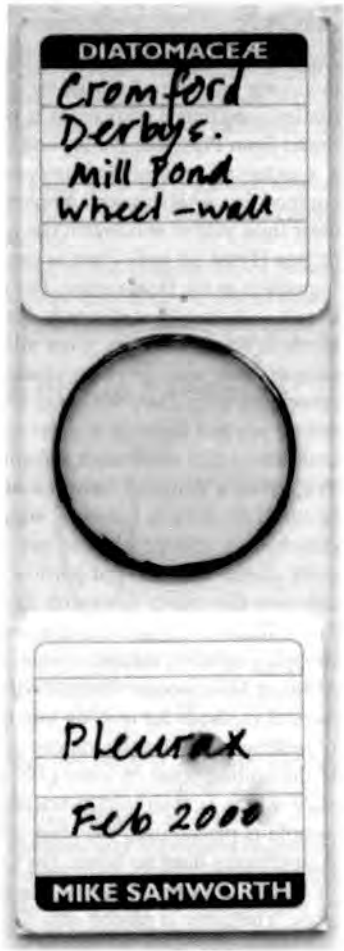
by Mike Samworth

When I lived in Staffordshire, my preferred route to Sheffield to see my Mother was via Matlock. The A38 is quite a good road, and the A61 through Chesterfield too, but, I confess, the reason was to fit in a visit to a couple of bookshops. By far the best of these is the remarkable 'Scarthin Books' in Cromford just outside Matlock Bath. Many will be familiar with the area as the home to the famous Arkwright Mills, but it is well worth a visit to this wonderful bookshop. It comprises three floors crammed full with new and secondhand stock, on all subjects, and in particular they have good Natural History and Science sections and will order any in-print book for you. There is also a very good café upstairs serving home-made soups and vegetarian dishes. Anyhow, enough advertising!

Opposite the bookshop is a large pond (Cromford Pond) and a waterwheel, which in recent years has been working. This is the source of the samples I have taken there over the last five years or so. Around the wheel is a wall, which as the photographs hopefully show, is in the splash zone of the wheel. As such, an algal flora is supported, and this is what I sample, usually with my trusty white plastic spoon. Strews made from such samples contain mainly Cymbella-type frustules, the odd Gomphonema etc. The fascination with this sort of thing is not what you find as such, but looking to see if there is anything to sample each time, and if it contains any diatoms at all.

For anyone wishing to visit, Cromford is at the junction of the A6 with the A5012, or SK 29 56.





Note:

I am prepared to exchange slides from the above location for well made slides from other locations.

Send details to:-

Mike Samworth
6 Moorfield Bungalows,
Scotton,
North Yorks.
DL9 3ND.

ZRAX

Zrax is a new synthetic resin designed for use as a high refractive index microscope slide mounting medium for diatom samples. Developed by Chemistry Professor W. P. Dailey (dailey@sas.upenn.edu) using a proprietary process, Zrax is currently available in the United States from Professor Dailey and in Europe from Mr. Klaus Kemp (www.diatoms.co.uk). Zrax , a condensation product between naphthalene and formaldehyde, is similar in chemical composition to Hyrax and Naphrax, neither of which are still produced. Zrax in the form of a clear light yellow solid resin has a refractive index of at least 1.7. Unlike Naphrax, and to some degree Hyrax as well, Zrax is permanently stable and does not present any "droplets" or other impurities in the final mount. The neutral resin has a softening temperature of about 100 degrees C and is thermally stable to at least 250 degrees C. It is soluble in toluene and xylene but not alcohol. Water, however, is not tolerated in the mount, and should be removed carefully from the sample, slide and cover by heating before mounting. There are no studies on the safety risks associated with Zrax but users are expected to follow appropriate chemical safety procedures during use and cleanup in order to minimize personal exposure and environmental impact. It is understood that purchasers and end users use Zrax at their own risk.

Preparing a Working Solution of Zrax

In the U.S., Zrax is currently supplied as a solid resin in clear one ounce bottles and must be dissolved in toluene prior to use. Toluene is available as a paint thinner in most hardware and paint stores. The unfilled portion of the bottle is filled with toluene and mixed several times a day over the course of several days until a homogeneous solution results. For use, a portion of this solution is transferred to a separate container and additional toluene is added until a freely dropping solution results.

Making Microscope Mounts with Zrax

Several methods for making microscope mounts with Zrax may be used. All require some form of heating to remove the toluene solvent. The most convenient form of heat is a hot plate set close to the boiling point of water (100 degrees C). Several drops of diluted Zrax are placed onto the slide which is then gently warmed until most of the solvent has evaporated. The cover with sample is placed onto the resin and heating is continued overnight. Prolonged heating at these temperatures does no harm. For samples that are mounted directly onto the slide, several drops of diluted Zrax are dropped onto the sample and the solvent is removed by warming on the hot plate. The cover is placed onto the resin and heating is continued overnight. Excess mountant is easily removed from the cooled slide by a single-edged razor blade. Ringing the slide cover is not necessary.

The Editors Notes on ZRAX

ZRAX (pronounced zeerax) is an American made High Refractive Index mountant, formulated and produced by Bill Dailey, from whom we understand it is available to Stateside diatomists. In the UK it is supplied on Bill's behalf by Klaus Kemp (advert inside front cover).

We at Amateur Diatomist were pleased to be sent a small sample for evaluation, the results of which are set out below.

We did not directly measure the R.I. but did compare it against other mountants of known R.I. and would estimate it to be slightly in excess of 1.7, which is quite impressive. The mountant itself is of a light honey hue with a consistency of thin honey.

It is thin enough to be dropped onto the slide easily and spreads out under the weight of the coverslip quite readily. Our first attempts with the mountant, using it as we do others of a similar

ilk, were frustrating as the valve and frustules were consistently marred by the retention of pockets of air, this despite vigorous driving off of the solvent. Thinning the mountant a little didn't seem to improve matters. However, flooding the dried strew with solvent before dropping the mountant worked a treat and the mountant penetrated the valve voids admirably. Once we had mastered this process the mounts were excellent providing good contrast, excellent for photography.

We did, however, note another feature which is less desirable. If you drive off too much solvent the mount becomes brittle and the cover glass has a tendency to spring. We wonder whether some form of plasticiser additive might be required to correct this feature.

We have been informed that further experimentation and refining of the process has improved these qualities and if this is so then we would heartily recommend the amateur give this mountant a go, particularly considering the scarcity of Naphrax in the U.K. at present.

The "sprung" tendency of some girdle bands (a reader's notes).

A girdle band (of the hairclip variety) as one is normally induced to view them.

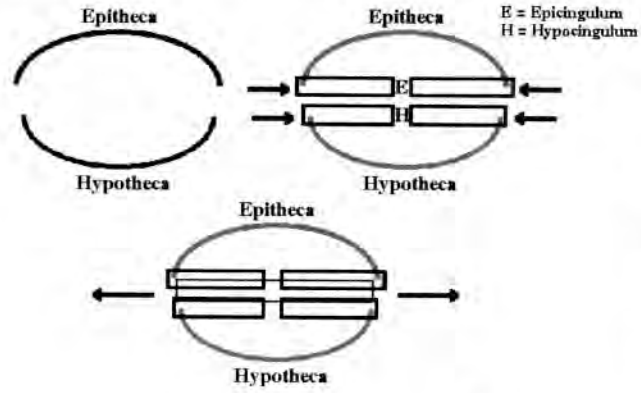
Girdle band with internal tension crossing over

Girdle band with external tension opening out

When cleaning an almost pure sample girdle bands were displaced that acted in two quite distinct ways when freed from their valve locations.

Are these two forms indicative of the way the two valves of the frustule are kept together?

e.g. The two girdle bands with internal tension lock onto the epitheca and hypotheca becoming the epicingulum and the hypocingulum and the external tensioned girdle band locks onto the internal faces of these two bands to hold the two valves together.In plan view this might look as the illustration below. The general concensus seems to be that these girdle bands allow for the expansion of the cell by the addition of further girdle bands. In other words there may be two girdle bands or more depending how much growing the cell has done.



If this is the case then extra girdle bands can only be produced at the same size as the original girdle band otherwise the pillbox formula of the frustule would be lost.

How do you fit two girdle

bands, each exactly the same (dimension wise) as the other, together. Answer:- Clip them together with another smaller girdle band from the inside.

In this diagram the light grey areas are the valves, the dark grey are the girdle bands that are sprung to close onto the frustule, the black area is the overlapping pillbox effect and the white line marks the centre position of the splaying girdle bands which hold the two girdle bands of each valve together.

There would be a ratio between externally sprung and internally sprung girdle bands:- 1:1(+1). If you could isolate a frustule with or without extra gidle bands and then clean it in situ to separate the component parts you might stand a chance of seeing whether this is the case.

Diatoms examined....

by Mike Samworth

The following extract is from an 'A' level Biology examination paper, not all that long ago. It is adapted from an article in the Independent Newspaper, and I thought it would be of interest to readers.

Dumb waiters that square the ocean's food circle

Almost all the inhabitants of the ocean, from the haddock to the carnivorous great white shark, depend ultimately upon sea-dwelling algae - the floating vegetation of the oceans. But how do the algae obtain the nutrients they need while getting the sunlight necessary for photosynthesis? It is a tricky problem, because the nutrients, derived from dead organic matter, tend to be deep in the sea out of the reach of sunlight. According to the science journal Nature, the algae form tiny submersible 'mats'.

These mats seem to play an astonishing role in the transport of nutrients. Researchers found that tangled Rhizosolenia mats only a few square centimetres in size appear able to travel vertically for hundreds of metres to carry nutrients to the surface waters. Divers collected samples of algal mats close to the surface of the Pacific Ocean. They then left the mats standing in jars of seawater for several minutes. To their surprise, the investigators found that some of the mats rose to the top of the jar while others fell to the bottom. Even more surprisingly, the mats travelling upwards turned out to be transporting much larger amounts of nitrate than those travelling downwards.

Further investigation showed that the tiny mats can penetrate right down to the rich pools of nitrate at the bottom of the ocean and transport nitrate back to the surface. They appear to rise with their load, bask in the sunlight while using up the nutrients, then fall back to the deep water to replenish their stocks.

Readers may be interested further in this phenomenon. There is a chapter on Vertical Migration in the book 'Life at small scale' by David B Dusenbery, Scientific American Library, 1996, which should be still available. Those of a more practical nature may wish to try their own experiments. Klaus Kemp once told me of some Gyrosigma specimens that went up and down according to the times of the tides, whilst in his dish. Happy experimenting.

Footnote: if anybody out there cannot resist finding out what the questions were that went after the extract, and wish to pit their wits against them, then we may be able to furnish them with such on application.

Spacers Protect Fragile Frustules

by Stephen S. Nagy, M.D.
snagymd@pol.net

While most diatoms are more-or-less two-dimensional, some do have height and stand at an altitude above the slide that they are mounted upon. As a consequence, if an inadequate depth of mountant is used in constructing the slide, the diatoms will meet an untimely end, being visible as small fragments between the slide and coverslip.

To hold the coverslip at some distance from the slide surface, diatomists have used a number of "spacers" which are typically mounted in a set of three around the diatom arrangement, as if on spokes of a wheel separated by an angle of 120 degrees. The spacers can be small dots of foil, but punches of this caliber are not available commercially... so the challenge is to construct one and learn how to use it.

Fortunately, the local US hardware store has a rack of tiny brass tube and rod stock, and the smallest rod just happens to slide into the lumen (bore space) of the smallest tube. These are made by the K&S Metal Center, 6917 West 59th Street, Chicago, Illinois 60638, phone (773) 586-8503, and each piece costs about US $1.20. The tube is listed as #8125 1/16" Round Brass Tube and the rod as #8159 .020 Brass Rod.

It is not difficult to cut off a piece of each using a fine-toothed metal saw, being careful not to deform the ends, leaving the rod about 3 mm longer than the tube. The tube is placed into an electrical drill in the position of the drill bit, turned on, and the ends of the tube are cut at an angle, first with an emery board, and then with 400 grit emery paper, keeping the drill stationary and holding with the abrasives at a 45-degree angle. The end of the rod is squared-off using the fine emery paper. This results in a tube with angled ends that can cut a circle in the diameter of the lumen of the tube, and a flat-faced rod that fits precisely inside of the tube, just slightly longer than the tube length.

The tube can easily be twirled while pressed against a piece of aluminum foil to create small foil "dots" than can be uses as foil spacers of a predictable diameter to use in mounting diatoms. These measure at about 1 microns in thickness.

The punch works best if pushed against a rubber backing, such as a special green pad made for craft work. However, it will not always produce perfectly round foil spacers and each should be quickly checked for roundness before use: some have a jagged edge or tears.

For exact placement of the spacers on the microscope slide, it helps to have concentric circles drawn on the back of the slide. Before starting, I make a circle in blue with a ballpoint pen (biro) slightly larger than the diameter of the coverslip, and other circles in red at about half the diameter, and another in the exact center of the slide that is perhaps 0.5 mm in diameter. One can position the distance of the spacers accurately using these guide lines viewed from the top of the slide. Spacers placed very near the edge of the coverslip can be problematic as they have the tendency to float off to the side when the mountant is still quite liquid. Placing the spacers so that the inner edge just touches the mid-diameter red circle works well and keeps the cover elevated even if there is a bit of drift.

After placing the punched spacers on the slide surface, drag them through a dense area of adhesive, then position them using a needle mounted in a handle. These are spaced by eye at 120 degrees apart so that they define an equilateral triangle. A graphic template placed under the slide will allow positioning at 120 degrees separation with ease.

Once the spacers are in the correct position, each spacer can be flattened in place with the handle

of a scalpel or with the broad rear end of a pair of forceps, exerting pressure across the top of each spacer, starting the pressing at the edge of the spacer closer to the center of the mount and shifting the pressure radially away from the center, which both expresses extra adhesive from under the spacer and flattens the foil. This means that the spacers are not wrinkled or distorted and each elevates the cover slip at the same altitude above the surface of the slide.

After heating the slide to dryness, adding a guide ring, and soaking the diatoms in toluene to express any trapped air bubbles, a small drop of mountant is placed with a dropper on the diatoms, and then the slide without a coverslip is put on the hotplate to harden for a period of time, sometimes fifteen to twenty minutes. Then add additional mountant and finally the coverslip for an overnight heating. The initial heating without coverslip allows any bubbles to come out of the diatoms without the chance of forming under the coverslip and helps to anchor the diatoms in place with the mountant before moving the coverslip over them, which movement always risks dislodging diatoms.

After overnight heating, the blue ring allows one to center the arrangement nicely using the needle. Remove any excess mountant from around the cover, then reheat the slide and look at the hot slide against a white piece of paper to get the alignment correct. The space between the coverslip and the diatoms created by the spacers greatly reduces the chances of dislodging a diatom from the slide during this process, and thus far I have had good success in recentering the coverslip without creating any "floaters."

The ballpoint ink rings dissolve readily in creme glass cleaner, and when cleaned, the slide has no evidence to show how the coverslip was positioned at the center of the slide.

The visual appearance of an exactly-centered arrangement and spacers is brilliant.

Microscope Slide Ringing

by Stephen S. Nagy, M.D.
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The finish of a microscope slide often proclaims the quality of the preparation long before it is placed onto a microscope stage. While shoddy slides are unappealing to every observer, the goal of a well-made microscope slide maker should be to elicit a "Gasp!" of appreciation when the slide is first seen, accompanied by the impulse to go directly to the microscope to see what treasure is presented on the slide.

While the quality of the slide's label is important, nothing completes a well-made slide as much as precision ringing around a circular cover slip. If this ring is relatively narrow and artfully done, or, better, if this primary ring is decorated with concentric rings of a contrasting color, the slide announces that great care was expended in its creation, and that it can be a jewel to own and to appreciate. The ring serves to decorate the slide, as well as to provide protection against popping the cover off mountant that may be brittle, whether Styrax, Pleurax, Zrax, Naphrax, or Hyrax.

Unfortunately, directions of how to ring a microslide do not seem to exist, with only cursory mention made of this finish in standard texts and articles about microscope slide preparation, as if this process were a simple one. The typical one-sentence comment might read thus: "Ring the slide to finish the preparation."

Because slide ringing is not simple, I have attempted to put down some thoughts about how to approach this task to achieve a superior outcome. It is my hope that this article will be helpful to anyone wanting to learn this art.

Historically, many commercial firms selling microscope slides such as Watson, Ward's, Turtox, or Flatters & Garnett have ringed their slides with shellac dissolved in alcohol pigmented with lampblack, and a little glycerin added to make the finish glossy. This mix had the advantage of being impervious to toluene or other cyclic organic solvents, and hence immersion oil could be cleaned with xylene, toluene, or benzene without concern for dissolving the ring. However, the mixture had a tendency to remain partially fluid, and never really dried completely; in a warm or humid climate, the rings could become sticky.

The modern practice is to use glossy enamel paints for the slide rings. These dry hard, provide a "clamp" around the edge of the coverslip that acts to prevent the coverslip from shattering off, and can be made in different colors with fine rings overlaying a larger base ring on the slide.

As is the case with many detailed tasks, the individual wishing to make fine rings needs to understand that they are likely to make 50 to 100 hopelessly imperfect slides as they develop their technique, and, with patience, have confidence in the old saying "Practice makes perfect." It requires both an understanding of the materials and the development of certain manual skills, along with the correct equipment, in order to make fine rings successfully.

Necessary Equipment

§ A single-edge razor blade

§ An X-acto craft knife or surgeon's scapel fitted with a #11 blade, tapering in an extended triangle to a fine point

§ Paste glass polish designed to clean smooth top ranges, a white cream containing diatoms and an alcohol solvent. (I use Weiman Cook Top Cleaning Cream distributed by The Herbert Stanley Co., Gurnee, Il 60031, <http://www.weiman.com>)

§ Xylene

§ Cotton buds on sticks (Cotton swabs, or "Q-tips" in the USA or equivalent)

§ A dropper bottle for the Xylene

§ A cavity microscope slides

§ Bottles of enamel paint - I prefer to use the Model Master line of paints made by the Testor Company, Rockford, Illinois in their glossy finishes. These are available in the USA at craft or hobby stores in 14.7 milliliter bottles. They have a wide variety of colors. An enamel available in the UK under the brand name "Hammerite" is recommended by Klaus D. Kemp.

§ Brushes:

1. a fine-point "Liner" brush, such as a 10/0 or 20/0 sable brush
2. an "Angled shader" brush, flat, of approximately 1.5 mm width tapering to a fine point.
3. A flat "Shader" brush about 10 mm in width.

(I have appreciated the Princeton Art & Brush Company's 20/0 monogram #3050M and their 0 Angular Shader #3050AS, which have a fatter handle than most and which are made with great care. These are made in Japan and are in American Craft stores.)

§ A stereo microscope capable of 15x - 25x magnification with bright illumination that may be from one point source. A single halogen lamp is sufficient to produce the top light needed for a clear view of the slide.

§ A slide ringing table that will fit under the stereo microscope and allow the preparer to view the slide on the table under the microscope while applying the ring. This should turn very smoothly and for at least fifteen seconds before coming to a stop; many ringing tables are neither smooth nor long-turning because of shoddy construction or inadequate mass in the table.

Preparing for Ringing

Let's suppose that one starts with a preparation just completed, with the cover slip in place but excess mountant running out from under the edge of the cover. One has taken steps to harden the mountant to brittleness by leaving it on a warm heater overnight or longer to drive out the majority of the solvent that liquified the mountant; the mountant that extends onto the surface of the slide beyond the edge of the coverslip is brittle and chips. The mountant under the cover is sufficiently hardened that pressure on the edge of the coverslip will not cause the cover to move. (Which might cause the untimely end of the mount!)

One uses the single-edged razor blade to chip off the mountant, gently scraping the horizontal surface of the slide, and exerting pressure on the mountant, which flakes off under pressure. This pressure should be exerted with the blade moving tangent to the edge of the coverslip, not perpendicular to it, which can cause chipping of the edge, or, in a worst case, the whole cover to pop off the mount. The final small adherent pieces of mountant may chip off the edge of the cover in little crescents, leaving a relatively clean (if jagged) edge to the mountant under the cover, without any chips or nicks in the edge of the cover.

The slide is then taken to the sink, where a drop or two of paste glass cleaner is placed on the slide, and then rubbed gently on the slide and cover surface with fingertips. A toothbrush may be helpful to clean the slide closest to the cover. Gentle pressure should remove any oily residue and bits of chipped mountant remaining on the slide surface. When done, the slide is rinsed in cold water (hot can soften the mountant, with disastrous results!) the water should "sheet" off the slide and coverslip (appear as a smooth film without droplets forming). If water droplets form on the surface of the slide during rinsing, the process should be repeated because this is an indication that the glass is not clean. The toothbrush will help dislodge the cleaner nearest to the edge of the cover under the running water. The slide is dried with a soft, lint-free cloth.

The slide is placed on the ringing table under the stereo microscope, centered, and the edge of the cover examined as the slide rotates. There may be small adherent bits of mountant remaining that protrude beyond the edge of the cover, which may be chipped, "lathed," or whisked off the slide using the X-acto knife or scalpel with the #11 scalpel blade. This will leave small bits of mountant on the slide, which may easily be whisked off the surface using the wide shader brush dry.

Finally, the slide is adjusted on the ringing table so that under 15x, the right upper quadrant of the cover is visible in the field of view. I spin my ringing table counter-clockwise with my left hand, and apply the enamel with my right hand, the brush entering the field of view of the stereomicroscope at about 3 p.m., with the brush angled up and to the left, so that the brush comes right down on the edge of the cover at a tangent to the curve, and the enamel flows off of the brush directly in the path that I want at the edge of the coverslip. I have a single fiberoptic light source that shines on the top surface of the slide at the 12 o'clock position as I look at the slide through the stereomicroscope.

Applying the Ring

There are two approaches to applying the ring, one which uses a fine-pointed brush for the entire process, which results in a very narrow, fine ring, and one which uses the angled brush, which produces a wider base ring that can be decorated with fine top rings in a later application. Regardless of the brush chosen, the diatomist will have to apply two coats of enamel to achieve the gently curved top line across the width of the enamel from coverlip to slide surface that finishes the slide professionally. While a single application of shellac will dry without distortion, it is not possible to make a smooth ring with one coat of enamel, since it dries and contracts

markedly with the evaporation of solvent. A second coat of the base enamel is needed to create the ring with the desired pleasing convex contour.

The viscosity of the enamel is critical in achieving a good result. Enamel that is too fluid will eagerly spread as it is applied, creating a line diameter much wider than intended, or will come off the brush in relatively "huge" droplets that end any attempt at creating a circle around the coverslip. Enamel that is insufficiently liquid will have difficulty coming off the brush, and will daub onto the slide in small spots separated by skips, leaving a jagged line. One wants enamel with a viscosity that is just sufficiently liquid to come cleanly off the brush, and really only practice can instruct the diatomist in assessing this correctly.

Shake up the bottle for about 60 seconds to resuspend any particulates, then unscrew the cap and invert it on the counter next to the ringing table. Dip the brush into the enamel puddle on the exposed surface. Streak a scrap piece of paper to see how the enamel comes off the brush, and if it appears too viscous, put a drop of xylene into the puddle in the cap, stirring it into the enamel puddle there using the brush. (At the same time I also add several drops to the bottle, appreciating that solvent is lost every time the bottle is opened.) Then recheck the viscosity on the scrap paper, and, if the streak on the scrap paper looks about right, dip the tip of the brush into the wet enamel in the cap, then apply the enamel to the slide.

The first step is to fill the L-shaped gap created by the cover in contact with the surface of the slide. The point of the brush fits into this ninety-degree angled "L" while the slide rotates, and lays down a ring that fills the deepest part of the "L." One then gently moves the brush laterally from the base of the coverslip to widen the ring. With the angled brush one wants to fit the very tip of the brush into the "L" the same is true with the fine liner. Depending upon the desire of the diatomist, this enamel ring may be kept deliberately narrow (less than 1 mm) or may be widened to 1.5 to 2 mm in width if one intends to decorate the base ring later. The first coats of enamel applied can define the width of the ring, but it is probably better to err on the side of a narrower ring, since unforseen events can occur later which will force one to widen the ring (see Common Problems below).

When the desired width is achieved, and the corner of the L-gap is filled, the diatomist applies additional enamel with a brush, a little at a time, until a ring is built up which has a convex surface across its diameter, from the cover to the periphery. With the angled shader, the brush is turned so that the edge that has the ends of the fibers is facing down towards the wet enamel ring, and as the slide rotates on the turntable, the enamel on the slide actually pulls the paint off of the ends of the brush hairs.

It is generally most productive to apply only a little enamel at a time, watching the brush for any evidence of a ball of enamel forming a short distance from the tip of the brush. (This is especially a problem when using the fine-point liner brush.) If this happens, this ball is best whisked off the brush against the inner lip of the enamel bottle before touching the slide again, because these small globules can ruin the ringing if they come off the brush as a droplet onto the enamel on the slide. The desirable appearance is that the brush should show a fullness from the new enamel carried by it after it is dipped, and this should largely flow off the brush, adding to the depth of the enamel on the slide with each application. When the enamel ring appears as a convex bulge, creating a semi-circular reflection of the light source, this phase of the application of the ring is complete.

The ring should extend slightly onto the very edge of the horizontal surface of the cover to hold it more tightly to the slide and to help prevent any inadevertent ejection of the cover off the slide or Newton rings (if there is a partial separation).

If there are many slides to be ringed, the slide can be removed from the ringing table and set in

a dust-free place to dry, to be returned to the ringing table at a later time. (I use bank checkbook box covers to shield drying slides from dust, although any box top will do. The checkbook box tops are wider than 3" and provide a dustless environment for up to seven slides at a time and minimize the risk of fibers appearing in the ring when it is examined later.)
If one is working for quality, and with a limited number of slides to be ringed at any one time, the slide is best left in place on the ringing table to dry overnight. On checking the slide some twelve hours later, the enamel will have contracted, and the lovely top line of the circle will now be distorted, with a flat line of enamel on the edge of the cover, dropping down to a level elevated from the surface of the slide but still lower than the coverslip, tapering off to the slide surface as one moves across the diagonal of the coverslip.
If the edge of the enamel on the surface of the cover is uneven when the slide is rotated, it will sometimes be useful to scrape this off with either the single-edge razor or with the X-acto knife, leaving the enamel on the slide up to and touching the vertical edge of the cover. This is not hard to do, and if the enamel has dried sufficiently, it comes off easily without any distortion of the enamel on the slide.
If the inner edge of the ring on the top of the cover is smooth and looks good, simply apply another coat of the enamel in the base color to the center of the ring, being mindful not to extend the second coat to the inner or outer edges of the ring. When dried, it will not be possible to discern which paint is from the first or second application.
For re-application of the base coat of enamel, it seems to work best if the initial re-application occurs with a slightly-wetter-than-normal viscosity enamel, to create the moist surface that will "grab and hold" the reapplication. One then builds up the depth of the ring using successive touches with the brush until the desired convex contour is achieved.
Following the second application of the base color, one can have confidence that this contour will remain on drying, and the slide can then be put aside to dry for several days, assuming that one a ring of a single color on the slide.

Applying decorative rings to the base ring

When the base ring has dried and is of a pleasing surface contour, additional rings for decoration may be added in a contrasting color. This is most simply done if the slide remains on the turntable, but a completed slide may be re-centered and the decorative rings applied with just a small amount of additional effort expended in the recentering.
The decorative rings are applied with enamel that is thinner-than-normal in viscosity with the finest line brush that is available. It must flow off of the brush readily and in a very fine line. A 10/0 or 20/0 sable line brush will do the job. The enamel that will form the decorative rings is dipped from the stock bottle and several daubs are placed on a plain microscope slide, or into a well slide's depression. Then a small drop of xylene is added, and the solvent mixed well in with the line brush. The viscosity is checked as usual on a scrap piece of paper.
One might think that a magnification setting on the stereomicroscope that will fill the field of view with the ring would be most helpful, but this is not true. The same setting of 15x seems to work best for me, since one needs to bring the brush into the field of view and then apply it precisely to the ring, which cannot easily be done if the field of view is limited too sharply. With the magnification provided by the stereomicroscope, the decorative top rings are surprisingly easy to apply (assuming that no familial tremor exists in the diatomist!). Having the steady hands of a surgeon is an asset.
The decorative ring must be made with enamel applied sparingly, with multiple layers built up in successive light touches to form the final decorative ring in a contrasting color. It can readily be

destroyed by the same hazards discussed earlier, most specifically a brush that is too heavily-laden with thin enamel.
It is simplest to lay down the decorative ring directly in the center of the base ring. Note that a ring that is too narrow relative to the width of the base ring will not have a pleasing appearance when examined with the naked eye; if it is a single ring it should have a width of about one-quarter to one-third of the width of the base ring.
If one is making multiple decorative rings, one can make the decorative second ring relatively wide, centered and covering about 50% of the width of the base ring. This allows space for another ring to be centered directly on top of it with the base color, which produces a final appearance of two decorative rings of a contrasting color, neatly spaced between three concentric rings of the base color. With some practice, and with the magnification provided by the stereomicroscope, it becomes relatively simple to apply these rings, with the pleasing result that one has five concentric rings in contrasting colors. This technique is much simpler than attempting to add two separate decorative rings that are spaced correctly and which are of the correct width in an attempt to achieve the same final appearance.

Brush Cleaning

Clean brushes are necessary, since over time the enamel will build up at the base of the fibers, spreading the point of the brush into an explosion of fibers. Of course, with organic solvents ventilation is necessary, but a trick that will minimize the amount of solvent used and released to the air is to get three small capped culture tubes, fill with xylene, and after wiping most of the enamel off of the brush with a tissue, successively swishing the brush in each tube, taking off a little more each time. My practice is to use a few drops of xylene in a cavity slide, swishing the brush through this as a final solvent cleaning, with the advantage that this will allow one to work the enamel loose from the fibers near the brush ferrule, thus preventing a build-up here. After this final rinse, I'll wash the fibers with soap and water, then gently shape them by pulling the brush through oposing finger tips, leaving it to dry in the desired shape.

Common Problems

There are a few predictable problems that are worth discussion.
§ Persistent specular highlights in the wet ring: A bright spot whizzes by as one applies the enamel, which does not disappear with subsequent revolutions of the table. This is caused either by an air bubble, or, more likely, by a fiber that has drifted into the enamel. Stop the table from turning, inspect the highlight under higher magnification, and either rupture the air bubble with the tip of the brush, or very carefully use a needle or fine-tip forceps to lift the fiber out of the enamel, then continue to apply more enamel. One must lift straight UP to avoid marring the smooth line of the ring.
§ Brush with a bad hair day: At times a brush willl show a number of fibers sticking off to the side as one attempts to apply enamel. One can pinch the fibers of the brush between two fingers with a tissue over the fibers, which will express the enamel from between the fibers, and allow the brush to come to a point again. Care in cleaning the brush, and shaping it before drying, will help to preserve the configuration of the fibers and to avoid this problem.
§ A glob of paint leaps from the brush onto the ring, destroying the smooth line of the ring: This need not be a disaster. Sometimes the ring can simply be widened and smoothed with subsequent applications of enamel so that the whole thing need not be lost. One must do the enamel application while in a peaceful, unhurried state of mind; it is always better to apply less enamel at each application, rather than more, to prevent this sort of catastrophe. In a worst case, the

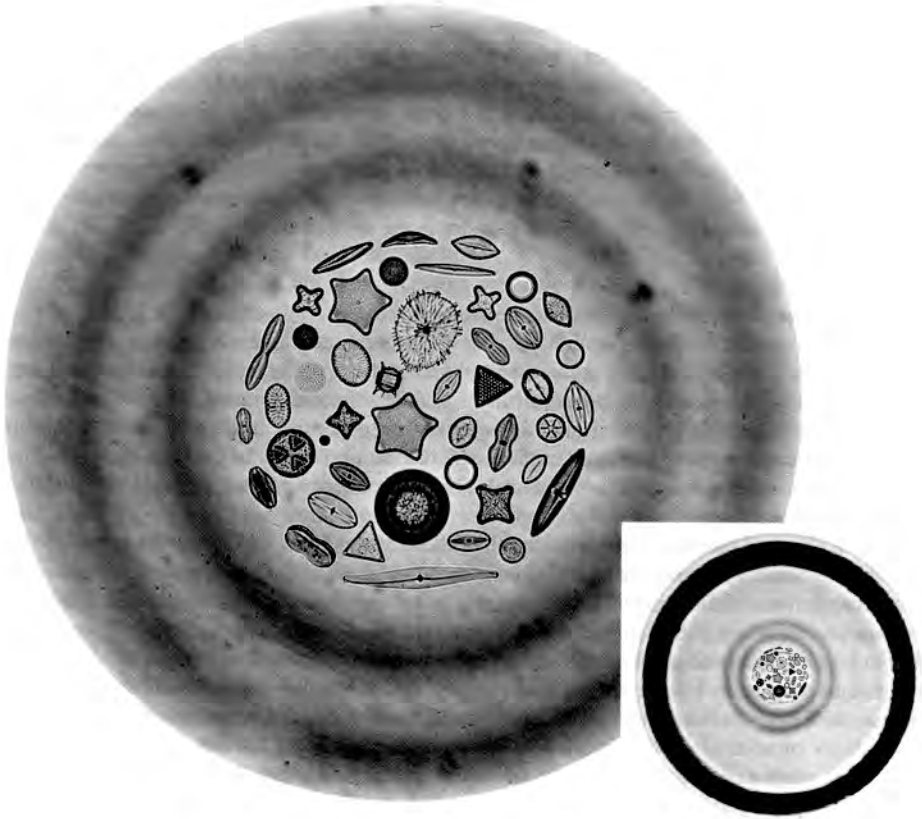
enamel is allowed to dry, then removed from the slide and coverslip with the straightedge razor blade, and then one has a clean, new slide to ring again!

Summary and Appreciation

It is my hope that these comments will assist both the novice and experienced diatomist or microscope slide-maker to create superlative rings on their slides.

I am indebted to my long-distance mentor, Klaus Kemp, for his assistance in helping me to learn the fundamentals of slide finishing and slide ringing and for his frequent and always constructive criticisms of my diatom efforts across time. This includes his ongoing assistance in attempting to eradicate any gross Americanisms of expression in my writing, and speech, which efforts have been (quite surprisingly!) partially successful, despite a very steep learning curve here. I am also appreciative of the understanding of my dear wife Pati for allowing me time alone to work on this hobby.

Written questions, if any, may be directed to me by email at snagymd@pol.net <mailto:snagymd@pol.net>; if you do not hear back from me in a few days' time, please resend since it is sometimes difficult to determine whether email from an unknown source is spam.



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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.