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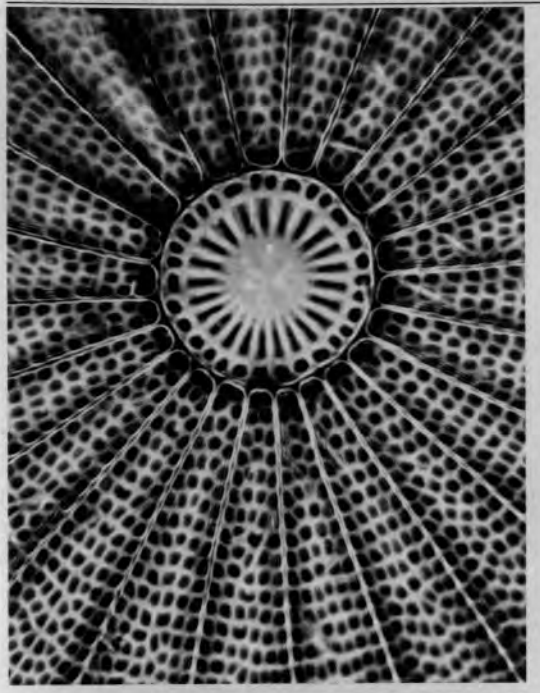

In this Issue:-

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There is no strict editorial policy.

A Synopsis of the British Diatomaceae

by William Smith

This latest CD from Little Imp Publications is a reproduction of both volumes of this classic work. The CD will run in most browsers regardless of hardware platform. Simple hyperlink (point and click) index provides easy navigation to plates and species text.

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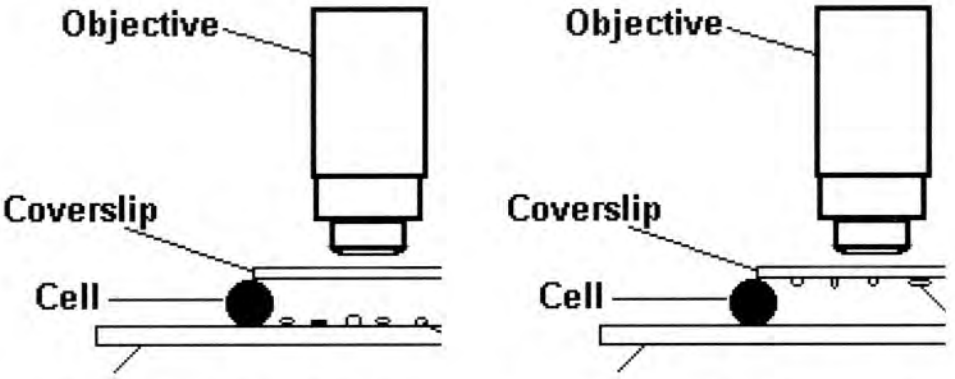
Mounting techniques

Part III- Dry Mounts

Dry mounts of diatoms may take a number of forms. You may wish to mount epiphytic diatoms in-situ, attached to the fronds of seaweed for instance. Other than this why would you want to mount cleaned diatoms dry and would you be able to see them?

To date, in this series, we have advocated the laying of diatoms on the microscope slide itself and covering the resultant strew with mountant and coverglass. This is all very well when we are viewing diatoms using low powers, or long focal length objectives. For most of us the use of a high power objectives involves getting very close to the object you are interested in. Using the techniques previously described (Mounting Techniques Parts I and II) you are probably unlikely to be able to focus through the combined thickness of cover glass and, in some cases, mountant. Therefore it is time now to consider how we might be able to do this and dry mounting techniques provide us with an excuse to do so.



Dry mounts require a cell to be established on the microscope slide to support the coverslip, otherwise anything you might have between slide and coverslip would be crushed by casual handling or even by the weight of the coverslip itself. These cells in microscopical terms are incredibly deep and attempts to focus through the coverslip to the slide below with high power, short focal length objectives are doomed to failure (see Fig. 1.). What we need to do is move the object(s) as near the front element of the objective as possible. We can do this by placing the objects of our desire onto the coverslip itself, so that only the thickness of the coverslip is between the front lens and the object. (See Fig. 2.).

It is preferable, when dealing with diatoms, to always mount your cleaned material on the coverslip, whether dry mounting or mounting in a high refractive index medium (High R.I.). Because this is a little more fiddly most 'mass produced' diatom strew slides are produced with the diatom material on the slide itself (indeed the mounting techniques we have discussed previously have suggested such).

As we have mentioned in previous articles diatom frustules have an affinity for glass and in most cases will 'stick' where they happen to end up. This feature is very useful when mounting diatom slides in a medium of High R.I., and even more so for dry mounts.

Preparing the slide.

Method 1.

There are a number of methods for preparing a 'flexible' cell wall which acts as the support for the coverslip. Much depends on whether you will apply the coverslip warm or cold.

Where the coverslip is to be warm or hot you should have a stock of slides to which a ring has been applied. This ring is made using the ordinary turntable and a fine stiff brush. The material for the ring in the old days was termed 'gold size' if you wished to build a clear cell or 'brown cement' if it were to be visible. 'Gold size' was simply a clear varnish for which you may now substitute Clear Polyurethane Varnish (the quick drying, 'does exactly what it says on the tin' variety is ideal. 'Brown Cement was simply Brown coloured varnish and you may substitute likewise. The outside circumference of the ring should be marginally greater than that of the coverslip and the inner side slightly less than the outer circumference of the coverslip. Allow these to dry and store in a dust-free box.

If you are to apply the coverslip cold then create the ring after you have applied the mounts to the coverslip and allow to become tacky. To determine whether the varnish is tacky you should take a scrap slide or piece of glass and apply a ring to it. You may then test that ring and avoid damage to the real ring (testing the actual ring may cause it to deform and the coverslip may then not seat correctly).

Method 2.

Aluminium rings are available from a number of suppliers and are useful for preparing cells for dry mount diatoms. The thickness of the ring is a matter of personal preference but the thinner ones are easier to finish with a decorative ring. Place the ring on a tile (Any flat faced tile will do. I am still using the tiles we used to decorate the bathroom 10 years ago). Charge a child's paint brush (20p at most stationers and post offices) with some fast drying mountant or varnish and holding the ring with a toothpick apply to the aluminium ring. This done you may take a slide and lower it onto the ring. The ring and slide make contact, turn the slide over and leave to dry. This method works with rings of other materials, like fibre washers.

Preparing the coverslips.

Coverslips should be clean and free from grease. Storing them in alcohol is recommended. If they are taken from alcohol then they should be dried with a lint-free cloth. Many of the older mounters then polished the coverglasses between two flat blocks over which was stretched some 'shammy leather'.

Breathe lightly on a slide and place the cover slip onto the now moist surface of the slide. The film of water will hold the coverslip in place (you may wish to place up to three coverslips on a single 3x1 slide).

Applying the diatoms.

In this article we are only going to refer to the application of strews (selected mounts will appear in later issues). Take the slide bearing your coverslip (see above) and onto it drop a single drop of your diatom suspension (at strew dilution). If you do this from a height of about 2cm the drop will flatten out sufficiently as it hits the glass. Now you may either warm the

slide and slip on a hot-plate or allow to dry naturally. If the suspension you have used has been used before and you know that the dilution is correct to produce a good quality (not too sparse and not too thick) strew then you may proceed. Otherwise examine under the microscope and see that no clumping has occurred and that the frequency of frustules over the surface is neither too light nor too heavy (this does seem to be a matter of personal preference, though you shouldn't have frustules overlapping each other).

The coverslip to cell procedure.

Once the strew has dried (and it should be really dry, don't rush that part of the operation) the coverslip will not longer be 'attached' to the underlying slide as all the moisture holding it there will have been evaporated. With a toothpick move the coverslip to the edge of the slide so that there is sufficient overlapping to be gripped by a pair of coverslip tweezers or forceps. If the tweezers you use are of the angled variety then pick the slip up with the tweezers upside down as your next dextrous operation is to turn the coverslip so that the diatom strew is on the underside.

Method 1.

Now, if the coverslip has been on a hotplate and you have dried rings on slides then simply line up one edge of the coverslip with the outer edge of the ring and make contact with it. The coverslip should 'catch' and you may than release the tweezers, supporting the coverslip with the point of the cocktail stick. Gradually lay the rest of the coverslip and withdraw the cocktail stick. Press the coverslip down gently and it will stick in place. Allow to cool and you may than go on to the ringing and labelling, both of which are a matter of personal preference.

If you have chosen to do the cold coverslip method then the operation is the same but you will have to wait until the ring is thoroughly dry before proceeding to ringing.

Method 2.

If you have created a cell using an aluminium ring or fibre washer then you will need to apply the fast drying mountant or varnish to the ring and place the coverslip onto this. Press down lightly to ensure contact all round and leave to dry.

So why mount diatoms dry? Well, it's easy for one thing. For another it forces us into mounting the diatoms with only the thickness of a coverslip between the subject and the microscope optics. We are not compromising the frustule structures with another agent e.g. mountant. Lastly, High R.I. mountants are expensive and Polyurethane varnish isn't!

The second question is perhaps the most important - Can you see them?

The main reason for using High R.I. mountants is to ensure that a subject which has an R.I. close to glass may actually be seen and does not, in effect, become part of the medium it is immersed in. It is the difference in R.I. between the subject and its surroundings that allow us to see the subject. The difference in the R.I. of silica and air is sufficiently great for us to see frustule detail, and this leads us onto the characteristics of light, refractive index and other matters, all of which we will cover in some depth in future issues.

The Diatom Frustule

(continued)

In the last issue we examined valve shapes in their entirety. In this issue we will look at the valve ends or apices. The same sort of terminology is used when describing the ends of a valve as is used when descibing shapes. These are all more or less derived from Latin descriptions of shape.

Acute - *a point whose internal angle is less than ninety degrees.*

This term would be used when describing such a valve as that of Triceratium sp. and possibly Pleurosigma angulatum v. quadrata which has straight sides and meet at a point with no deviation.

Apiculate - *with a short sharp point on an otherwise blunt end.*

This term is used in most cases where the valve comes to a point at a position beyond that expected by a smoothly curving valve contour. This is best expalined using a diagram.

In this diagram you can see that were the valve outline to continue on its course without deviation then the position indicated by A would be the epredicted valve termination. However, the valve takes an unexpected turn and forms a short, blunt point.

This term, Apiculate, is still used when the point is substantially bigger than the 'short, blunt' definition found in the dictionary. When this is the case the description 'produced' is used in conjunction with the term. e.g. 'produced apiculate', 'apiculate produced', apiculate and produced' etc.

This term 'produced' is oft used in Diatom study and in plain english just means 'sticking out more than one would have expected'.

Capitate - *Bearing a head, knob, or capitulum.*

This term describes a feature that is quite often confused with two other terms - Spatulate and Subcapitate. The key to getting this bit right is to imagine that the valve end needs to have a neck before it broadens into a rounded head. Spatulate ends don't do this and Subcapitate ends have a slight constriction before broadening into the head.

Subcapitate - For ease of comparison we will consider this term immediately. To all intents and purposes it looks capitate but as previously mentioned it has a short thick 'neck'.

Spatulate - *shaped like a spatula.*

Well, a lot depends on what type of spatula you use. It is quite useful to think of this as the shape of a wooden kitchen spoon with a thick handle. There is a head but no discernible neck and thus the head is wider than the trunk.

Cuneate - *wedge shaped.*

This term is used for valve ends that are shaped like a blunted wedge. The apices are rounded, not pointed.

Rounded - In general this term is used to describe pretty well any ending that is not covered by any of the other terms. It refers to a valve whose sides are generally parallel but curve inward at the ends to meet almost at ninety degress to the sides, thus forming a semi-circle.

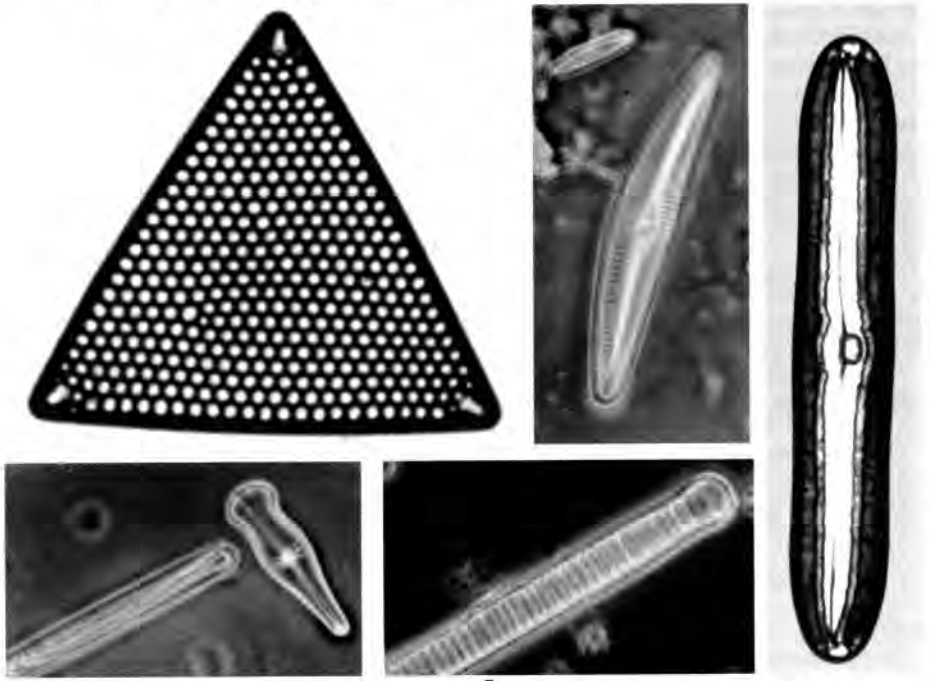
Rostrate - *beaked, shaped like a beak.*

When considering this term you should be thinking of a swans beak, viewed from above. If in doubt then look at the diagram to the left. Note the shoulder created by the narrowing of the valve. The contour then continues parallel until it rounds off.

There are some small complications to contend with. It happens that diatoms grow in all sorts of peculiar shapes. The descriptions above are easy to understand when the diatom valve we are considering is apically symmetrical (symmetrical about its apical axis, the same on each side of a line drawn between the ends). To determine the end type of many diatoms you need to mentally straighten them out. When they are 'bent' to one side or the other they are generally termed 'sigmoidly' arranged.

All the valve end terms we have descibed thus far relate mainly to Pennate diatoms. Centric diatoms when viewed girdle on may also have valve structures that can loosely be called 'ends'. these, apart from spines, usually comprise one or two cones of silex. These cones may be truly conical and concentric i.e. coming to a point at the projected centre of the valve or offset, eccentric, to the projected centre of the valve.

The photographs below show some of the variation you can expect.



Photographs by M. Samworth

The Diatom Hierarchy

A number of people when they read the draft of the first issue have asked that the partial classification printed in the last issue be extended to be as complete as possible and to include Genera within the Families. To do this we have had to review the latest taxonomy, and it really seems to be so variable that we have decided, to present two models:-

i. the system proposed by Round et al (1990). This taxa definition was originally conceived to cover the Diatom Taxa of the Central U.S.A.

ii. the system proposed by Barber (circa 1974), for British taxa, that uses most of the older genera but seeks to group them without forcing genera name changes.

The coming of the Electron microscopes and their kin heralded new opportunities for the taxonomists to find common features that would bind genera into families and families into orders. Instead, what has happened is the resolution of finer detail allows differentiation to be made at such minute levels that a genus becomes so different from what was once its neighbour that it warrants a new family or order. We don't want to sound Luddite about this, but where will it all end?

Unfortunately using the later taxonomy you will have some Synonymy work to do to locate your named species from older publications. This is our first attempt at laying out this hierarchy so please bear with us.

We hope that readers on both sides of the Atlantic will find these useful.

Any comments are welcome and if a taxonomist has the definitive version for diatom taxa worldwide we will publish that as well.

i. the system proposed by Barber (circa 1974) that uses most of the older genera but seeks to group them without forcing genera name changes.
Division: Bacillariophyta
(Note: Botanists often call the Phylum - Division.)

Order: Centricae
Suborder: Discoideae
Family: Coscinodiscea
SubFamily: Melosirinae
Genus: Melosira
Genus: Paralia
Genus: Groentvedia
Genus: Podosira
Genus: Phacodiscus
Genus: Druridgea
Genus: Hyalodiscus
Genus: Endictya
Genus: Pyxidicula
Genus: Stephanopyxis
SubFamily: Skeletoneminae
Genus: Skeletonema
Genus: Porosira
Genus: Coscinosira
Genus: Thalassiosira
SubFamily: Coscinodiscinae
Genus: Cyclotella
Genus: Coscinodiscus
Genus: Planktoniella
Family: Actinodisceae
SubFamily: Stictodiscinae
SubFamily Actinoptychinae
Genus: Actinoptychus
SubFamily: Asterlomprinae
Genus Asterolamprus
Family: Eupodisceae
SubFamily: Pyrgodiscinae
SubFamily: Aulacodiscinae
Genus: Auliscus
Genus: Roperia
Genus: Actinocyclus
Genus: Eupodiscus
Suborder: Solenoideae
Family: Solenieae
SubFamily: Lauderiinae
Genus: Bacteriosira
Genus: Corethron
Genus: Lauderia
Genus: Schroderella
Genus: Detonula
Genus: Dactyliosolen
Genus: Leptocylindrus
SubFamily: Rhizosoleniinae
Genus: Guinardia
Genus: Rhizosolenia
Suborder: Biddulphideae
Family: Chaetocereae
Genus: Bacteriastrum
Genus: Chaetoceros (-ras)
Family: Biddulphieae
SubFamily: Eucampiinae
Genus: Attheya
Genus: Eucampia
Genus: Streptotheca
SubFamily: Triceratiinae
Genus: Bellerochea
Genus: Ditylum
Genus: Lithodesmium
Genus: Triceratium
Genus: Trigonium
SubFamily: Biddulphiinae
Genus: Biddulphia
Genus: Cerataulus
Genus: Huttonia
SubFamily: Isthmiinae
Genus: Isthmia

SubFamily: Hemiauliinae
Genus: Cerataulina
Genus: Hemiaulus
Family: Anauleae
Genus: Anaulus
Genus: Eunotogramma
Genus: Hydrosera
Family: Euodinieae
Genus: Hemidiscus
Suborder: Rutilarioideae
Order: Pennatae

Section: Araphideae

Suborder: Fragilarioideae
Family: Entopyleae
Family: Tabellarieae
SubFamily: Tabellariinae
Genus: Tetracyclus
Genus: Rhabdonema
Genus: Tabellaria
Genus: Striatella
Genus: Grammatophora
SubFamily: Licmophoriinae
Genus: Licmophora
Family: Fragilarieae
SubFamily: Diatominae
Genus: Meridion
Genus: Diatoma
Genus: Plagiogramma
Genus: Cyclophora
SubFamily: Fragilariinae
Genus: Dimerogramma
Genus: Glyphodesmis
Genus: Cymatosira
Genus: Campylosira
Genus: Sceptroneis
Genus: Podocystis
Genus: Opephora
Genus: Trachysphenia
Genus: Fragilaria
Genus: Fragilariopsis
Genus: Rhaphoneis
Genus: Hannaea (=Ceratoneis)
Genus: Synedra
Genus: Centronella
Genus: Thalassionema
Genus: Thalassiothrix
Genus: Asterionella
Genus: Semiorbis (=Amphicampa)

Section: Rhaphidioideae

Suborder: Eunotioideae
Family: Peronieae
Genus: Peronia
Family: Eunotieae
Genus: Eunotia

Section: Monorhaphideae

Suborder: Achnanthiodeae
Family: Cocconeideae
Genus: Anorthoneis
Genus: Campyloneis
Genus: Cocconeis
Family: Achnantheae
Genus: Achnanthes
Genus: Rhoicosphenia

Section: Birhaphideae

Suborder: Naviculoideae
Family: Naviculeae
Genus: Diatomella
Genus: Mastogloia
Genus: Diploneis
Genus: Amphipleura
Genus: Frustulia
Genus: Brebissonia
Genus: Stenoneis
Genus: Cistula
Genus: Anomoneis
Genus: Stauroneis
Genus: Navicula
Genus: Pinnularia
Genus: Trachyneis
Genus: Neidium
Genus: Scoliopleura
Genus: Scoliotropis
Genus: Oestrupia
Genus: Caloneis
Genus: Pseudoamphiprora
Genus: Gyrosigma
Genus: Rhoicosigma
Genus: Donkinia
Genus: Pleaurosigma
Genus: Toxonidea
Family: Amphiproreae
Genus: Amphiprora
Genus: Tropidoneis
Genus: Auricula
Family: Gomphocymbelleae
Genus: Amphora
Genus: Phaeodactylon
Genus: Okedenia
Genus: Cymbella
Genus: Gomphocymbella
Genus: Gomphonema
Genus: Didymosphenia
Suborder: Epthemioideae
Family: Epthemieae
Genus: Denticula
Genus: Epithemia
Family: Rhopalodieae
Genus: Rhopalodia
Suborder: Nitzschiodeae
Family: Nitzschieae
Genus: Cylindrotheca
Genus: Bacillaria
Genus: Hantzschia
Genus: Nitzschia
Genus: Cymbellonitzschia
Suborder: Surirelloideae
Family: Surirelleae
Genus: Cymatopleura
Genus: Stenopterobia
Genus: Surirella
Suborder: Campylodisceae
Genus: Campylodiscus

ii. the system proposed by Round et al (1990) Diatom Taxa of the Central U.S.A.
Kingdom::Prototista (protos [G.] meaning 'the first' and kristos [G.] meaning 'established'.)
Division: Bacillariophyta

SuperClass: Centrales

Class: Coscinodiscophyceae
Order: Thalassiosirales
Family: Thalassiosiraceae
Genus: Thalassiosira
Family: Skeletonemataceae
Genus: Skeletonema
Family: Stephanodicaceae
Genus: Cyclostephanos
Genus: Cyclotella
Genus: Stephanodiscus
Order: Melosirales
Family: Melosiraceae
Genus: Melosira
Family: Stephanopyxidaceae
Genus: Stephanopyxis
Order: Aulacoseirales
Family: Aulacoseiraceae
Genus: Aulacoseira
Order: Coscinodiscales
Family: Coscinodiscaceae
Genus: Coscinodiscus
Family: Hemidiscaceae
Genus: Actinocyclus

Order: Triceratiales
Family: Triceratiaceae
Genus: Pleurosira
Order: Rhizosoleniales
Family: Rhizosoleniaceae
Genus: Rhizosolenia
Genus: Urosolenia
Order: Chaetocerotales
Family: Chaetoceraceae
Genus: Chaetoceros
Family: Acanthocerataceae
Genus: Acanthoceras

SuperClass: Pennales
Class: Fragilariophyceae
Order: Fragilariales
Family: Fragilariaceae
Genus: Amphicampa
Genus: Asterionella
Genus: Catacombas
Genus: Ctenophora
Genus: Diatoma
Genus: Fragilaria
Genus: Fragilariforma
Genus: Hannaea
Genus: Martyana
Genus: Meridion
Genus: Pseudostaurosira
Genus: Staurosira
Genus: Staurosirella
Genus: Synedra
Genus: Tabularia
Order: Tabellariales
Family: Tabellariaceae
Genus: Tabellaria
Genus: Tetracyclus

Class: Bacillariophyceae
Order: Eunotiales
Family: Eunotiaceae
Genus: Eunotia
Family: Peroniaceae
Genus: Peronia
Order: Mastogloiales
Family: Mastogloiaceae
Genus: Mastogloia
Order: Cymbellales
Family: Rhoicospheniaceae
Genus: Rhoicosphaenia
Family: Anomoeoneidaceae
Genus: Anomoeoneis
Family: Cymbellaceae
Genus: Brebbisonia
Genus: Cymbella
Genus: Encyonema
Genus: Placoneis
Family: Gomphonemataceae
Genus: Gomphoneis
Genus: Gomphonema
Genus: Reimeria
Order: Achnanthales
Family: Achnanthaceae
Genus: Achnanthes
Family: Achnanthidiaceae
Genus: Achnanthidium
Genus: Eucocconeis
Family: Cocconeidaceae
Genus: Cocconeis
Order: Naviculales
Family: Cavinulaceae
Genus: Cavinula
Family: Diadesmidaceae
Genus: Luticola
Family: Amphipleuraceae
Genus: Amphipleura
Genus: Frustulia
Family: Brachysiraceae
Genus: Brachysira
Family: Neidiaceae
Genus: Neidium
Family: Scoliotropidaceae
Genus: Scoliopleura
Family: Sellaphoraceae
Genus: Fallacia
Genus: Sellaphora
Family: Pinnulariaceae
Genus: Pinnularia
(& Caloneis)
Family: Diploneidaceae
Genus: Diploneis
Family: Naviculaceae
Genus: Navicula
Family: Pleurosigmataceae
Genus: Gyrosigma
Genus: Pleurosigma
Family: Plagiotropidaceae
Genus: Plagiotropis
Family: Stauroneidaceae
Genus: Stauroneis
Genus: Craticula
Family: Catenulaceae
Genus: Amphora
Order: Bacillariales
Family: Bacillariaceae
Genus: Bacillaria
Genus: Cylindrotheca
Genus: Denticula
Genus:Hantzschia
Genus: Nitzschia
Genus: Tryblionella
Order: Rhopalodiales
Family: Rhopalodiaceae
Genus: Epithemia
Genus: Rhopalodia
Order: Surirellales
Family: Entomoneidaceae
Genus: Entomoneis
Genus: Pinnularia
Family: Surirellaceae
Genus: Campylodicus
Genus: Cymatopleura
Genus: Stemopterobia
Genus: Surirella

Famous Diatomists (I)

Henri-Ferdinand van Heurck (b. Antwerp 1838-d. 1909).

For much of this article we are indebted to Philippe van Heurck, great grandson of Henri-Ferdinand van Heurck. Particularly for permission to use photographs from his family archive.

Henri van Heurck, aged 8 years After a portrait owned by Philippe van Heurck

Henri van Heurck at the time of his marriage to Jeanne Collignon

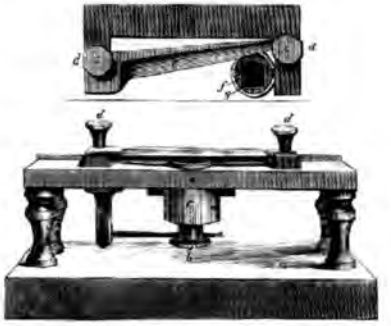
At the age of seventeen (1855) he was taught by Reverend Vincent Gautier[1], Jesuit Schoolmaster and diatomist at Saint-Ignatius Hogeschool and continued there until 1859.In 1863 he married Madamoiselle Jeanne Collignon and moved to a country house South East of Berchem where he founded the Botanical Society of Antwerp.

He mounted sets of slides which were made available to the students of the Botanical Society (who were admitted free) and sold the same sets in Belgium and France. These were sets of Botanical preparations, cut by hand.

In 1865 he wrote his famous treatise on the Microscope. This was reprinted in 1869, the same year the University of Rostock conferred on him an Honorary Doctorate.

A year prior to this van Heurck had made, for himself, a copy of the microtome described by Quekett in " A Practical Treatise on the Microscope", which was actually the instrument made by George Adams in 1770.

In 1873 he let it be known that he had purchased 7-800 preparations from the executors of Graaf Alfred de Limminghe which were rich in diatoms and desmids. Soon afterwards he increased the collection with more than 500 types from the collections of de Brebisson and Eulenstein.



Van Heurck's first mention of a microtome is in 1869, when he referred to an instrument by Rivet and made by the Paris Instrument Maker Vericke[2]

In 1875 he constructed a more original microtome designed quite specifically for sectioning harder objects like timber. In staining his sections he used only a limited set of well tried and tested stains.

Fig. 9.

Left - Nachet Microscope similar to the model in the photograph above right. 'Microscope petit modele droit', 1863. Centre Left - Henri (aged about 33) with his wife. Centre Right - Aged about 37 at the time he was still preparing botanical sections and just about at the time he was appointed Director of the Botanical Gardens at Antwerp. Right - Henri (about 33) with microscope.

In 1877 he was made Director of the Botanical Gardens at Antwerp, having been associated with the gardens for the previous six years.

Van Heurck made some immediate changes and within a year the gardens had been completely replanted (classified after Candolle) with some 1600 plants. Much of the raw material (plants and seeds) were supplied by the Botanical Gardens at Rouen.

Henri and family on board his first vessel 'Nautilus'.

Henri acquired his larger sea-going vessel in the mid 1870s. 'Le Suzon' pictured here is moored close to Antwerp.

'Le Suzon'

On board 'Le Suzon' with his family. Henri is about 43 in this photograph.

'Le Suzon' under way.

When the Gardens were completed and opened to the public van Heurck began a new series of courses in two parts. One on Pure Botany and the other on Applied Botany of plants of Medicinal or Commercial worth. The use of the microscope was encouraged, as was its use in the detection of adulterants.

The 3rd Edition of his treatise on the microscope appeared in 1878, now containing a study of the Diatomaceae. He also announced the commencement of a project 'Synopsis of the Diatoms of Belgium'. For this work, van Heurck chose the classifications proffered by Professor Hamilton L. Smith (an American Diatomist).

The atlas eventually contained 3100 illustrations, a table of generic and specific names and a set of microscopical preparations in a separate case.


Dr Henri Van Heurck
Types du Synopsis des
DIATOMÉES DE BELGIQUE.
—
Amphipleura
pellucida Kütz.
Angleterre.

These slides contained more than 1200 forms and were verified by Dr. Albert Grunow. The objects were mounted in Styrax, a medium invented by van Heurck.

1878, in the third edition of 'Le Microscope' he wrote for the first time on the study of diatoms. At the same time he began to make notes for his 'Synopsis des Diatomes de Belgique'

1879 he had to defer the study of above due to eye disease, but during this 'rest' he made a fine collection of beetles!

A family portrait. Taken in the garden at his Antwerp home.

From 1879-1880 Vice-President of Belgian Society of Microscopists, and from 1881 was President of the same. (The Society ceased in 1907)

When compiling his atlas van Heurck had studied the collections and papers of many of the diatomists of his time and had been supported in his own collection of material by Delogne and Gautier.He had, over a period, acquired many of Mollers test plates. Shortly before Mollers death (1907) van Heurck bought Mollers complete collection of these slides including the 'Universum Diatomacearum Moellerianum'. This is a slide (completed in 1890) which contains, arranged by row, 4026 diatoms.

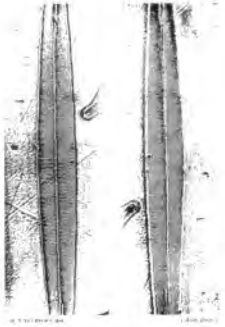
Van Heurck received the very first apochromatic objective, 3mm oil immersion, made by Zeiss, from the hands of Dr. Roderick Zeiss.

A family dinner at his home in Antwerp.

This , one of their first 1.63NA objectives, he used to good effect (though a similar objective supplied to English microscopists had failed to elicit a favourable response). Using this objective van Heurck succeeded in resolving (and photographing) the dots on Amphipleura pellucida. The photograph appears as the frontispiece to his volume on Photo-Micrography.

In 1887 he was asked by the Botanic and Micrographic Society of Belgium to write a simple guide to Diatoms. He left this work to another member of the society, Mr H Ph Adam, who wrote the book 'Coup d'oeil discret sur le monde invisible' in 1873 and drew up the third edition.

In 1888 Henri was an exhibitor at the Grand Concours International des Sciences et de l'Industrie in Brussels. His exhibitors card, reproduced here bears the signature Dr. H. van Heurck.



VAN HEURCK 71

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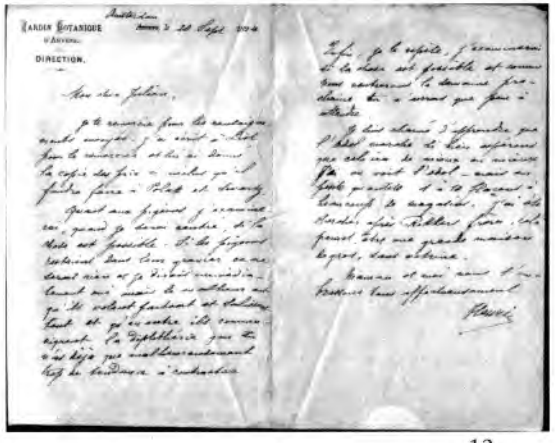

In 1894 van Heurck made a sojourn to Amsterdam to collect diatoms from the North Sea. Whilst there he wrote to his son who was at that time looking after the family business.

Henri in his laboratory in Antwerp. The instrument in front is an X-ray discharge tube. This apparatus was the first to be operated in Belgium, just one month after Wilhelm Conrad Roentgen's[1] discovery in December 1895.

LA TECHNIQUE ET LES APPLICATIONS DIVERSES DES

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GUIDE PRATIQUE DU RADIOGRAPHE

PAR LE

Dr HENRI VAN HEURCK

AVEC 10 PLANCHES ET NOMBREUSES FIGURES DANS LE TEXTE.

ANVERS
ÉDITÉ AUX FRAIS DE L'AUTEUR.
1897.

OUVRAGES PRINCIPAUX DE L'AUTEUR :

Above Left: A pamphlet published in 1897 describing the use of the X-ray discharge apparatus. Above Right: Henri van Heurck, aged approximately 50.

Left and Centre:Aged about 55. Note the Nachet microscope on the table. This is still in the family's possession. Right: The microscope depicted here is from the 1863 Nachet Catalogue Descriptif des Instruments de Micrographie, described as 'Microscope grand modele perfectionne' and is identical to the one in the photograph.

Author of -

- 'A Treatise on the Diatomaceae' 1886
- 'The Microscope: its construction and management including technique, photo-micrography and the past and future of the microscope' 1893 (translated into English by Wynne-Baxter[4])
- 'Le microscope, sa construction, son maniement, et son application aux etudes d'anatomie vegetale' 1865 (2nd Edition 1869)
- 'Photo-micrography' 1894 *(A CD version of this publication is available from Savona Books)*
- 'Synopsis des diatomee de Belgique' 1880-1885. The Farlow Herbarium - Harvard University has a collection of slides issued with the book - by Heurck & Albert Grunow (1826-1914)
- TYPES DU SYNOPSIS DES DIATOMEES DE BELGIQUE .... Series I-XXII, numbers 1-550, 1882-1885. Specimens are strewn mounts on microscope slides.
- The Northern Microscopist of June 1882 contains an article 'The Electric Light applied to Microscopical Research' by Dr. Henri van Heurck being a translation of a paper read before the Microscopical Society of Belgium.

[1]Rev. Vincent Gautier
b. 27th December 1827. 1853-1859 lay science teacher. Studied for priesthood at Louvain. Science teacher Saint-Ignatius Hogeschool 1869-1881. Lived in Bruxelles and Tournai and d. Arlon 4th February 1903.

[2]C. Vericke - 2 Rue de la Parcheninerie, Paris (1873-1885). Described himself as 'a student of E. Hartnack.'

[3]Wilhelm Conrad Roentgen - b. March 27th 1845, d. February 10th 1923

[4]Wynne Edwin Baxter
b. Lewes, Sussex, 1844 d. London 1st October 1920. - buried Lewes. In the 1881 Census Wynne E. Baxter is described as a Solicitor, living at 208 High Street, Lewes All Saints, Sussex, with his wife Kate Bliss Baxter and his children. He is perhaps most generally well known as being the Coroner at the inquest into the Whitechapel Murders (Jack-the-Ripper).

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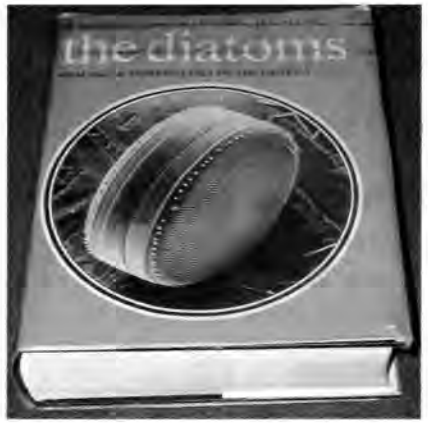
Book Review

The Diatoms : Biology and Morphology of the Genera.
F.E. Round., R.M. Crawford., D.G. Mann.
Cambridge University Press, 1990. ISBN 0-521-36318-7 Price £170.00

This book is said to be the first modern text to present a wide-ranging introduction to the Diatoms, together with a full description of the commonest genera. It is written to be an essential reference, and at 747 pages, and around two and a half inches thick, it is certainly not a book to take with you.



The book is the result of one of the authors having free access to a scanning electron microscope (SEM) at an English University in the late seventies, and bears witness to both the usefulness of this device and the heavy use to which this machine was quite obviously put.

The first 130 pages are taken up with a gentle introduction to the diatoms, including a short historical survey of the group and its study. There follows sections on cell structure, division, life-cycle, wall morphogenesis, distribution and ecology. The major part of the book however is the generic atlas, an attempt to provide a critical overview of the genera. This is said to be the first since 1928. A system of classification is provided, including 17 new genera (at the time), though the considerable problems of classification are not discussed in great detail. No doubt otherwise the book would have been even bigger!

It is refreshing to see a short section on collecting and studying the diatoms. Though short, this does include numerous references to fuller works. It is perhaps a pity that for the amateur these may prove difficult to obtain. An important point mentioned on the subject of cleaning, is that of removing excess organic material such as leaves, macro-algae etc. which would be converted to carbon particles rather than completely oxidised. Also, the oft-mentioned statement that there is no universally best method, and that almost every diatomist has some preferred method.

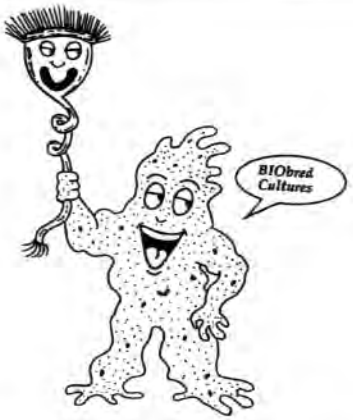
The section on cell structure and symmetry is very much helped by excellent SEMs and very well drawn diagrams shown in various planes. These are mostly of generous size, and help build up a 3-D picture of each diatom shape. A section on the living protoplast is welcome, as is a comprehensive coverage of the cell cycle. There are some excellent light micrographs of cell division, in particular of Navicula oblonga, showing stages of cleavage of the protoplast. Auxospore development is covered most comprehensively, and it is good to see not just a token comment on the ecology of these organisms.

As a precursor to the generic atlas, is a section on systematics, covering general concepts and their application in this taxonomy. That brings us to page 131, and the rest of the book is taken up with the generic atlas. This is the main reason for the books being, and it is here that the SEMs come to the fore, with several being used for each genus, in addition to a light micrograph. Whilst this combination is an excellent one, it is in some cases a little

disappointing that a line drawing has not been included, as this would have added to it greatly. Also, there are occasions where the light micrograph is not as illuminating as it could be. The main problem for the vast majority of us is that having only recourse to the light microscope means that we will have great difficulty seeing aspects that are evident in the SEMs.

Overall, the book is very much recommended, and I wish that I had been able to spend longer with this copy. Especially since the price of the book puts it out of reach of most amateurs. However, if you can get to see a copy, in a reference library for instance, then do not hesitate to do so.

Mike Samworth, North Yorkshire, UK.



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Authority and Provenance Names

Authority and provenance names have always been used when referring to a particular species of diatom. The main reason for this is to allow the diatomist to refer back to the author being cited to facilitate identification..

Over the years various species have been re-classified, re-named and re-described by subsequent diatomists, the result being hat without references it would be impossible to verify a particular species, variation or form.

It is the norm when specifying a species to include references to the author of the work used to determine the species.

Where a form has been re-described etc., it is usual to include the original author in brackets and to follow this with the reference to the author you are using to identify the species, though the original author in brackets may come after the current author. It is unusual to include more than two levels of reference despite the fact that the species or whatever may have been classified many times.

When you are labelling slides of selected species, for instance, you should also cite the authority on the label. If the species in the publication you are using as reference is not new then you should copy the provenance/authority element from their description.

Some authors also include the authority of the genus though this is less common.

The following examples will help you understand the possible structures.

Actinoptychus Ehrenbergii Ralfs.
Genus *Epithet* *Species Authority*

Navicula sejuncta Ad. Schm. (Nordesee, p. 87, pl. I, f. 18*)
Genus *Epithet* *Species Authority* *Publication in which described*

Stephanopyyxis Grunowii Gr. et. St. Mar. Foss.
Genus *Epithet* *Authority* *Marine* *Fossil*

Goniothecium (Ehr.) odontella Grun. (Ehr.) Mar. Foss
Genus Authority *Genus* *Epithet* *Species Authority* *Original Species Authority* *Marine* *Fossil*

We have a list of Authority and Provenance abbreviations with details of the actual name and some works by them. We would be happy to print this list in a future issue if there is sufficient interest shown. Please let us know if you would find it useful.

Cleaning Diatoms

by Mike Samworth
Part 3.

Hot Acid Methods

As the name suggests, this involves the use of hot acids, and hence there is a certain degree of risk that must be taken into account. This should be considered prior to starting, since it applies to the acquisition, storage, use and subsequent disposal of material. I shall try to give some idea of things to be careful with as I describe the process, but ultimately, the responsibility is yours. See also safety comment at foot. The method I use has been one generally handed down from experienced users and perhaps modified slightly by myself and co-workers, both by design and necessity.

1. Filter or centrifuge raw material to remove large pieces. Try to end up with a volume no more than say 20 ml, as this will reduce the volumes of chemicals needed and thus lessen the risk.
2. Put the sample into a conical flask, or a boiling tube. This should be Pyrex as it will be heated, and make sure it is good strong glass. Add roughly twice the volume of concentrated hydrochloric acid. It may start to effervesce, a sure sign that it is needed. This is to remove calcium salts that may be in the sample, especially if sampling in limestone areas. Such salts would precipitate out later, ruining your sample.

3. Heat the sample until it starts to boil, and simmer like this for a few minutes, or until a dark greenish colour results.
4. Allow to cool, and carefully add water, gradually. Centrifuge, and repeat with fresh distilled/de-ionised water for say four washings to remove all trace of the hydrochloric acid before the next stage (or allow to settle for 20 mins, decant and repeat with distilled/de-ionised water).
5. Add about twice the volume of concentrated sulphuric acid CAREFULLY, as this may induce spitting. Heat until it starts to boil. It will most likely go very dark. After a few minutes, add a pinch of potassium chlorate (a powerful oxidising agent). Do this in stages until the sample begins to clear, you will have to experiment here as samples do vary so much. TAKE CARE as there is usually a vigorous reaction at this stage.
6. When the sample is fairly clear (it may be rather yellow-white looking) allow to cool, after which very carefully add distilled water gradually, TAKE CARE, as there may be vigorous spitting, and much heat generated at this stage. When you have added a good quantity of water, wash out the acid as previously (stage 4).

You should now have a cleaned sample. Mount a drop in water to examine. If happy, then add a drop or two of 20% phenol solution as a preservative against fungal growth, and label up your tube before you forget. If the sample is not fully cleaned, then you can always repeat the sulphuric acid stage.

SAFETY NOTE: Much of the above needs very good ventilation, ideally a fume cupboard, though doing it outside is often possible. Please be very careful with strong acids. It is easy to become complacent, and indeed, most regular cleaners will have some experience of how this can happen. Use drip-trays for you acids bottles, have everything you need set up, and take things steady. Always wear eye protection, and being near running water helps. We hope to have an article written by a qualified chemist on the subject of safety. Disposal should also be considered; where are you going to wash your supernatant? Acidified waste can be neutralised with limestone chips and a large volume of water.

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Diatom Genera List - E, F, G, and H

The list contains the naming authority and the date when the genus was first described.

Genus	Described by	Date
Echinaria	F. T. Kützing	1844
Echinella	H. C. Lyngbye	1819
Echinodiscus	A. Mann	1925
Echinopyxis	J. Pantocsek	1913
Ectodictyon	G. C. Khursevich & G.L. Cherniaeva	1989
Ellerbeckia	R. M. Crawford	1988
Emersonia	J. W. Bailey	1842
Encyonema	F. T. Kützing	1833
Encyonopsis	K. Krammer	1997
Endictya	C. G. Ehrenberg	1845
Endosigma	A. de Brébisson in Orbigny x	
Endostauron	A. Grunow	1880
Entogonia	R. K. Greville	1863
Entomogaster	C. G. Ehrenberg	1871
Entomoneis	C. G. Ehrenberg	1845
Entopyla	C. G. Ehrenberg	1848
Ephemera	T. B. B. Paddock	1988
Epipellis	R. W. Holmes	1985
Epithelion	J. Pantocsek	1905
Epithema	A. de Brébisson	1838
Epithemia	F. T. Kützing	1844
Ethmodiscus	A. F. Castracane	1886
Eucampia	C. G. Ehrenberg	1839
Euceratoneis	A. Grunow in L. Rabenhorst	1865
Eucocconeis	P. T. Cleve ex F. Meister	1912/1895
Eumeridion	F. T. Kützing	1844
Eunotia	C. G. Ehrenberg	1837
Eunotiopsis	A. Grunow in P.T. Cleve & J.D. Möller	1879
Eunotogramma	J. F. Weisse	1854
Euodia	J. W. Bailey ex J. Ralfs in A. Pritchard	1861
Euphyllodium	G. Shadbolt	1854
Eupleuria	G. A. W. Arnott	1858
Eupodiscus	C. G. Ehrenberg	1844
Eupodiscus	J. W. Bailey	1851
Excentron	J. Ralfs in A. Pritchard	1861
Exilaria	R. K. Greville	1827
Extubocellulus	G. R. Hasle, H.A. von Stosch & E.E. Syvertsen	1983
Falcatella	L. Rabenhorst	1853
Falcula	M. Voigt	1960
Fallacia	A. J. Stickle & D.G. Mann in F.E. Round, R.M. Crawford & D. G. Mann	1990
Fenestrella	R. K. Greville	1863
Fibula	Wm. Smith	1859
Flexibiddulphia	R. Simonsen	1987
Florella	J. N. Navarro	1982
Fontigonium	P. A. Sims & N.I. Hendey	1996
Fossula	G. R. Hasle, E.E. Syvertsen & C.H. von Quillfeldt	1996
Fragilaria	H. C. Lyngbye	1819
Fragilariella	N. I. Hendey	1958

Fragilariforma	D. M. Williams & F.E. Round	1988
Fragilariopsis	Friedrich Hustedt in Adolf Schmidt	1913
Frickea	H. Heiden in Adolf Schmidt et al.	1906
Frustulia	C. A. Agardh	1824
Frustulia	L. Rabenhorst	1853
Fryxelliella	A. K. S. K. Prasad, K.A. Riddle & R.J. Livingston	1997
Fusotheca	C. Mereschkowsky	1878
Gaillonella	J. B. M. Bory de Saint-Vincent	1825
Geminella	P. J. F. Turpin	1828
Gephyria	G. A. W. Arnott	1858
Girodella	Gaillon ex P. J. F. Turpin	1828
Gladiopsis	R. Gersonde & D.M. Harwood	1990
Gladius	A. Forti & P. Schulz	1932
Gleseria	E. G. Lupikina & L.M. Dolmatova, L.M.	1984
Gloeonema	C. G. Ehrenberg	1856
Gloeotila	F. T. Kützing	1833
Gloiodictyon	C. A. Agardh	1830
Gloionema	C. A. Agardh	1812
Glorioptychus	G. D. Hanna	1927
Glyphodesmis	R. K. Greville	1862
Glyphodiscus	R. K. Greville	1862
Gomphocaloneis	F. Meister	1932
Gomphocymbella	O. F. Müller	1905
Gomphogramma	A. Braun in L. Rabenhorst	1853
Gomphoneis	P. T. Cleve	1894
Gomphonella	L. Rabenhorst	1853
Gomphonema	C. A. Agardh	1824
Gomphonema	C. G. Ehrenberg	1832
Gomphonenopsis	L. Medlin in L. Medlin & F.E. Round	1986
Gomphonitzschia	A. Grunow	1868
Gomphopleura	H. Reichelt in O. Herrmann & H. Reichelt	1892
Gomphoseptatum	L. Medlin in L. Medlin & F.E. Round	1986
Gomphosphaeria	F. T. Kützing	1836
Gomphosphenia	H. Lange-Bertalot	1995
Gomphotheca	N. I. Hendey & P.A. Sims	1982
Gonioceros	H. Peragallo in H. Peragallo & M. Peragallo	1907
Goniothecium	C. G. Ehrenberg	1843
Gonium	O. F. Müller	1786
Gossleriella	F. Schütt	1892
Grallatoria	F. T. Kützing	1844
Grammatonema	F. T. Kützing	1845
Grammatophora	C. G. Ehrenberg	1840
Grammonema	C. A. Agardh	1832
Grayia	E. Grove & J. Brun in Adolf Schmidt et al.	1892
Griffithsia	C. A. Agardh	1817
Groentvedia	N. I. Hendey	1964
Grovea	Adolf Schmidt	1890
Grunoviella	Henri-Ferdinand van Heurck	1896
Grunowia	L. Rabenhorst	1864
Grymaia	J. W. Bailey ex L.W. Bailey	1861
Guinardia	H. Peragallo	1892
Gutwinskiella	G. B. De Toni	1894
Gyrodiscus	O. N. Witt	1886

Gyroptychus	Adolf Schmidt.	1890
Gyrosigma	A. H. Hassall	1845
Halionyx	C. G. Ehrenberg	1844
Halurina	C. Zimmermann	1918
Hamatusia	S. R. Stidolph	1993
Handmannia	M. Peragallo in R. Handmann	1913
Hannaea	R. Patrick in R. Patrick & C.W. Reimer	1966
Hantzschia	A. Grunow	1877
Hantzschiopsidea	J. Gruss	1928
Haslea	R. Simonsen	1974
Haynaldella	J. Pantocsek	1892
Haynaldia	J. Pantocsek	1889
Haynaldiella	J. Pantocsek ex Henri-Ferdinand van Heurck	1896
Heibergia	R. K. Greville	1865
Helicotheca	M. Ricard	1987
Heliodiscus	Henri-Ferdinand van Heurck Fide G. Karsten in A. Engler & K. Prantl	1928
Heliopelta	C. G. Ehrenberg	1844
Helisella	A. Jurilj	1949
Helminthopsidella	P. C. Silva	1970
Helminthopsis	Henri-Ferdinand van Heurck	1896
Hemiaulus	C. G. Ehrenberg	1844
Hemiaulus	P. A. C. Heiberg	1863
Hemidiscus	G. C. Wallich	1860
Hemiptychus	C. G. Ehrenberg	1848
Hemizoster	C. G. Ehrenberg	1844
Hendeya	J. A. Long, D.P. Fuge & J. Smith	1946
Henseniella	F. Schütt ex G.B. De Toni	1894
Henshawia	A. Mann	1925
Hercotheca	C. G. Ehrenberg	1844
Heribaudia	M. Peragallo in Frére J. Héribaud	1893
Heromphala	P. Lefébure	1947
Heroneis	P. Lefébure	1947
Hesslandia	A. Cleve-Euler in A. Cleve-Euler & I. Hessland	1947
Heterocampa	C. G. Ehrenberg	1870
Heterodictyon	R. K. Greville	1863
Heteromphala	C. G. Ehrenberg	1858
Heteroneis	P. T. Cleve	1893
Heterostephania	C. G. Ehrenberg	1854
Himantidium	C. G. Ehrenberg	1840
Himantosoma	V. B. A. Trevisan di San Leon	1848
Homalodiscus	A. S. Orsted	1844
Homoeocladia	C. A. Agardh	1827
Hormophora	A. Jurilj	1957
Horodiscus	G. D. Hanna	1927
Humbugodiscus	J. Deby	1890
Hustedtia	F. Meister	1932
Hustedtiella	R. Simonsen	1960
Huttonia	E. Grove & G. Sturt	1887
Huttoniella	G. Karsten	1928
Hyalodictya	C. G. Ehrenberg	1871
Hyalodiscus	C. G. Ehrenberg	1845
Hyalopyxis	I. V. Makarova	x

Hyalosira	F. T. Kützing	1844
Hyalosynedra	D. M. Williams & F.E. Round	1986
Hyalotrochus	D. M. Harwood & R. Gersonde	1990
Hydrolinum	H. F. Link	1820
Hydrosera	G. C. Wallich	1858
Hydrosilicon	J. Brun	1891
Hydrosirella	Friedrich Hustedt	1952
Hylobiblium	Wolle	1894
Hyperion	A. M. Gombos, Jr.	1983
Hystrix	J. B. M. Bory de Saint-Vincent	1822

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Questions and Answers.

Q. I have noticed in a number of strews from fossil material that the frustules all appear to be at the maximum size range given for their species - how can this be?

A. This phenomenon is not unknown in fossil samples and also in gatherings from blooms. The explanation proffered certainly seems to fit the condition.

i. Fossil material is accumulated over a considerable period and it is impossible to determine one seasons growth from another but if one were to imagine an environment that in one season gets flushed with just sufficient nutrients and raw materials to produce a limited number of generations - each getting smaller - before the nutrients ran out, the total reduction in size from the original individuals would be quite small. If in that season all the diatoms were generated from resting spores then they would all start out full-sized. When the nutrients were exhausted the diatoms would discard their frustules and return to the resting spore stage and next season they would awaken and again produce full sized individuals. If this scenario were repeated year after year for eons then all frustules would appear to be at the maximum end of their size range. (see article Diatom Reproduction for further explanation)

ii. Should you gather diatoms from what appears to be a sudden bloom you may also encounter this feature. The above explanation holds true here also. All the individuals are either the result of newly activated resting spores or are very close generations to them and as such all appear to be individuals at the maximum of their size range.

Diatom Reproduction

When you first look at an almost pure strew of diatoms (all or nearly all of one species) you may well be struck by the variation in size of individuals.

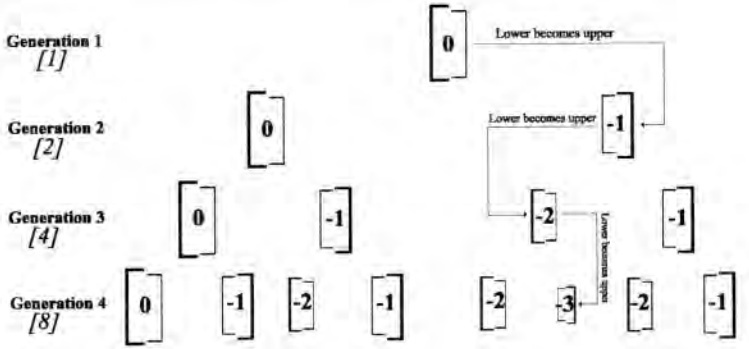
How is it they are so variable? Do the small ones grow up to be big ones?

We will endeavour to answer these questions below.

You will remember from the articles on the Diatom Frustule in earlier issues that the frustule itself is a lid and box arrangement, each part being called a valve. The lid, being the larger of the two valves, fits snugly over the lower box, the smaller of the valves. This arrangement allows for division of the frustule to create two new individuals. This process is termed Asexual Reproduction.

Asexual Reproduction.

The nucleus in the cell divides, as does the protoplasm, to surround the two nuclei and become separate masses (this is termed Mitosis). The two masses are still contained within a single frustule (box and lid). Once the cellular separation has completed the two cells begin to build their missing valves. The cell within the large valve (the lid) makes a smaller valve (the box) and the cell within the smaller valve (the box) isn't aware that it is in the smaller valve and also builds a box i.e. a smaller valve. Thus the smaller valve of the initial organism is now the larger valve (the lid) of another. All this happens within the two valves of the original frustule and this is why you can often seen valves within valves. Perhaps the best species to see this in is *Isthmia nervosa*. The image above depicts this stage.



You can see by consulting Diagram 1 (above) that successive divisions will result in smaller and smaller frustules on the one hand and frustules of the same size as the parent on the other.

Diagram 1 exaggerates the decrease in size on each successive division in order to illustrate the process. The actual decrease in size is;- the silica wall thickness plus a very small percentage of the same and actually answers one of our questions - Do small diatoms grow up to be big ones? - No, but they might grow up to become smaller! This binary division quickly generates a large population and with some diatoms which divide in this manner in as little as six hours, if you work your way through Table 1, you will appreciate the vast numbers that may be formed from a single individual in ideal circumstances.

Table 1

Time	Number	Time	Number
Start	1	72 hours (3 days)	4,096
6 hours	2	78 hours	8,192
12 hours	4	84 hours	16,384
18 hours	8	90 hours	32,768
24 hours (1 day)	16	96 hours (4 days)	65,536
30 hours	32	102 hours	131,072
36 hours	64	108 hours	262,144
42 hours	128	114 hours	524,288
48 hours (2 days)	256	120 hours (5 days)	1,048,576 -One Million after five days
54 hours	512	144 hours (6 days)	16,777,216
60 hours	1,024	168 hours (1 week)	268,435,
66 hours	2,048	336 hours (2 weeks)	72,057,594,037,925,376 Seventy two thousand billion after 2 weeks

Obviously these figures only serve to indicate the exponential growth in numbers and don't take account of mortality and nutrient supply. It does, however, explain how huge blooms of diatoms at sea can suddenly appear, where millions of individuals are dividing. If we took just 1000 individuals and assumed them to be dividing at the above rate then in the two weeks we have considered there would be 72 trillion frustules.

Each frustule, when dividing will produce another individual of the same size and one smaller individual of the next size down. It is worth noting when looking at Table 2, the rarity of full-sized frustules, and the relative frequency of the medium-sized frustules. Of course, other things affect the make-up of a population and a whole science, Population Dynamics, has been built on these variabilities.

In any given situation the nutrients available, and particularly the silica to build the frustules, can become depleted and in this event then millions of diatoms die. Diagram
In the sea their remains sink to the ocean floor and become incorporated into the diatomaceous ooze that coats the depths of our oceans. (It is this mass of frustules that over time, with the laying down of layer upon layer and the movement of the earth's crust, eventually becomes the diatomaceous earth deposits).

In practice the reduction in size of the individual will only proceed whilst the size of the frustules allows for the inclusion of all the necessary cell components and sufficient volume to function correctly. There appears to be no set rule for this size as a relationship to the full sized individual and it is difficult to ascertain from published frustule dimensions, which generally only give Length and Width.

Table 2 - Part 1

Division	Number (from a single individual)	Size 0	Size -1	Size -2	Size -3	Size -4	Size -5	Size -6
0	1	**1** [100%]						
1	2	**1** [50%]	**1** [50%]					
2	4	**1** [25%]	**2** [50%]	**1** [25%]				
3	8	**1** [12.5%]	**3** [37.5%]	**3** [37.5%]	**1** [12.5%]			
4	16	**1** [6.25%]	**4** [25%]	**6** [37.5%]	**4** [25%]	**1** [6.25%]		
5	32	**1** [3.125%]	**5** [15.625%]	**10** [31.25%]	**10** [31.25%]	**5** [15.625%]	**1** [3.125%]	
6	64	**1** [1.5625%]	**6** [9.375%]	**15** [23.4375%]	**20** [31.25%]	**15** [23.4375%]	**6** [9.375%]	**1** [1.5625%]
7	128	**1** [0.78125%]	**7** [5.46875%]	**21** [16.40625%]	**35** [27.34375%]	**35** [27.34375%]	**21** [16.40625%]	**7** [5.46875%]
8	256	**1** [0.39063%]	**8** [3.125%]	**28** [10.9375%]	**56** [21.875%]	**70** [27.34375%]	**56** [21.875%]	**28** [10.9375%]
9	512	**1** [0.19531%]	**9** [1.75781%]	**36** [7.03125%]	**84** [16.40625%]	**126** [24.60938%]	**126** [24.60938%]	**84** [16.40625%]
10	1,024	**1** [0.09766%]	**10** [0.97656%]	**45** [4.39453%]	**120** [11.71875%]	**210** [20.50781%]	**252** [24.60938%]	**210** [20.50781%]
11	2,048	**1** [0.04883%]	**11** [0.53711%]	**55** [2.68555%]	**165** [8.05664%]	**330** [16.11328%]	**462** [22.55859%]	**462** [22.55859%]
12	4,096	**1** [0.02441%]	**12** [0.29297%]	**66** [1.61133%]	**220** [5.37109%]	**495** [12.08496%]	**792** [19.33594%]	**924** [22.55859%]
13	8,192	**1** [0.01221%]	**13** [0.15869%]	**78** [0.95215%]	**286** [3.49121%]	**715** [8.72803%]	**1287** [15.71045%]	**1716** [20.94727%]
14	16,384	**1** [0.0061%]	**14** [0.08545%]	**91** [0.55542%]	**364** [2.22168%]	**1001** [6.10962%]	**2002** [12.21924%]	**3003** [18.32886%]
15	32,768	**1** [0.00305%]	**15** [0.04578%]	**105** [0.32043%]	**455** [1.38855%]	**1365** [4.16565%]	**3003** [9.16443%]	**5005** [15.27405%]
16	65,536	**1** [0.00153%]	**16** [0.02441%]	**120** [0.18311%]	**560** [0.85449%]	**1820** [2.7771%]	**4368** [6.66504%]	**8008** [12.21924%]
17	131,072	**1** [0.00076%]	**17** [0.01297%]	**136** [0.10376%]	**680** [0.5188%]	**2380** [1.8158%]	**6188** [4.72107%]	**12376** [9.44214%]
18	262,144	**1** [0.00038%]	**18** [0.00687%]	**153** [0.05836%]	**816** [0.31128%]	**3060** [1.1673%]	**8568** [3.26843%]	**18564** [7.0816%]
19	524,288	**1** [0.00019%]	**19** [0.00362%]	**171** [0.03262%]	**969** [0.18482%]	**3876** [0.73929%]	**11628** [2.21786%]	**27132** [5.17502%]
20	1,048,576	**1** [0.0001%]	**20** [0.00191%]	**190** [0.01812%]	**1140** [0.10872%]	**4845** [0.46206%]	**15504** [1.47858%]	**38760** [3.69644%]

Table 2 - Part 3

Div.	Number (from a single individual)	Size -13	Size -14	Size -15	Size -16	Size -17	Size -18	Size -19	Size -20
0	1								
1	2								
2	4								
3	8								
4	16								
5	32								
6	64								
7	128								
8	256								
9	512								
10	1,024								
11	2,048								
12	4,096								
13	8,192	**1**[0.01221%]							
14	16,384	**14**[0.08545%]	**1**[0.0061%]						
15	32,768	**105**[0.32043%]	**15**[0.04578%]	**1**[0.00305%]					
16	65,536	**560**[0.85449%]	**120**[0.18311%]	**16**[0.02441%]	**1**[0.00153%]				
17	131,072	**2380**[1.8158%]	**680**[0.5188%]	**136**[0.10376%]	**17**[0.01297%]	**1**[0.00076%]			
18	262,144	**8568**[3.26843%]	**3060**[1.1673%]	**816**[0.31128%]	**153**[0.05836%]	**18**[0.00687%]	**1**[0.00038%]		
19	524,288	**27132**[5.17502%]	**11628**[2.21786%]	**3876**[0.73929%]	**969**[0.18482%]	**171**[0.03262%]	**19**[0.00362%]	**1**[0.00019%]	
20	1,048,576	**77520**[7.39288%]	**38760**[3.69644%]	**15504**[1.47858%]	**4845**[0.46206%]	**1140**[0.10872%]	**190**[0.01812%]	**20**[0.00191%]	**1**[0.0001%]

Table 2 - Part 2

Divison	Number (from a single individual)	Size -7	Size -8	Size -9	Size -10	Size -11	Size -12
0	1						
1	2						
2	4						
3	8						
4	16						
5	32						
6	64						
7	128	**1**[0.78125%]					
8	256	**8**[3.125%]	**1**[0.39063%]				
9	512	**36**[7.03125%]	**9**[1.75781%]	**1**[0.19531%]			
10	1,024	**120**[11.71875%]	**45**[4.39453%]	**10**[0.97656%]	**1**[0.09766%]		
11	2,048	**330**[16.11328%]	**165**[8.05664%]	**55**[2.68555%]	**11**[0.53711%]	**1**[0.04883%]	
12	4,096	**792**[19.33594%]	**495**[12.08496%]	**220**[5.37109%]	**66**[1.61133%]	**12**[0.29297%]	**1**[0.02441%]
13	8,192	**1716**[20.94727%]	**1287**[15.71045%]	**715**[8.72803%]	**286**[3.49121%]	**78**[0.95215%]	**13**[0.15869%]
14	16,384	**3432**[20.94727%]	**3003**[18.32886%]	**2002**[12.21924%]	**1001**[6.10962%]	**364**[2.22168%]	**91**[0.55542%]
15	32,768	**6435**[19.63806%]	**6435**[19.63806%]	**5005**[15.27405%]	**3003**[9.16443%]	**1365**[4.16565%]	**455**[1.38855%]
16	65,536	**11440**[17.45605%]	**12870**[19.63806%]	**11440**[17.45605%]	**8008**[12.21924%]	**4368**[6.66504%]	**1820**[2.7771%]
17	131,072	**19448**[14.83765%]	**24310**[18.54706%]	**24310**[18.54706%]	**19448**[14.83765%]	**12376**[9.44214%]	**6188**[4.72107%]
18	262,144	**31824**[12.13989%]	**43758**[16.69235%]	**48620**[18.54706%]	**43758**[16.69235%]	**31824**[12.13989%]	**18564**[7.0816%]
19	524,288	**50388**[9.61075%]	**75582**[14.41612%]	**92378**[17.61971%]	**92378**[17.61971%]	**75582**[14.41612%]	**50388**[9.61075%]
20	1,048,576	**77520**[7.39288%]	**125970**[12.01344%]	**167960**[16.01791%]	**184756**[17.61971%]	**167960**[16.01791%]	**125970**[12.01344%]

e.g.
Two examples from Identification of Freshwater Diatoms from Live Material by Eileen J. Cox.

Surirella capronii	**Gyrosigma accuminatum**
Length 120-350(m, Width 60-125(m.	Length 60-180(m, Width 11-18(m.

Simply taking these measurements and assuming that the longest length goes with the largest width and the smallest length with the smallest width does not let you arrive at a relationship, as the size of an individual resulting from a division must be a function of the original length and width.

This is best illustrated using ratios.

Surirella capronii
Largest: Length=350 Width=125 Ratio=2.8:1 **Smallest:** Length=120 Width=60 Ratio=2:1

Gyrosigma accuminatum
Largest: Length=180 Width=18 Ratio=10:1 **Smallest:** Length=60 Width=11 Ratio=5.5:1

An individual dividing and producing a lower valve to fit into the existing valve must make it in relationship to the original. Therefore, if the original valve has a length/width ratio of 2.8:1 then the new valve will also have that ratio.

It has been mooted that about at about 65% of the original volume the organism can no longer sustain another division.

As is indicated by the two examples not all frustules of a given species are the same.

All this is due to variability in the species. This variability, might for instance, be as a result of the nutrient availability when the full-sized individual was formed, or perhaps to the availability of silica in its environment at that time also, or to variations in its DNA. But if the division is by Mitosis then each cell will have an exact copy of the original DNA and no variation is possible and anyway how do we get back to a full-sized individual?

It is at this point that Sexual Reproduction comes in to play.

Sexual Reproduction.

At the point where another division cannot be performed the Diatom cell enters a different cycle.

At the point where it would normally divide, and if conditions are conducive, the Diatom will, instead of dividing the nucleus into two by means of Mitosis will create three or four 'haploid' cells by means of Meiosis. In general, although this does vary from genus to genus, only one of these haploid cells actually survives and as the frustule falls away it is released as a free swimming gamete. It locates, presumably by some chemical means, another such gamete, fuses with it and produces an auxospore. The auxospore swells and produces a protective film about itself and sets about creating a new frustule. This frustule is a full-size construction and this is where some of the full-sized diatoms actually come from. It is this mechanism, where two halves of DNA from different individuals pair, that allows for the production of variations in form. This in part answers our first question - Why is it they are so variable?

Editor's Note:- There are a number of variations to the process described above.

There are some other aspects that we need to consider when talking about apparent variation within a species, these will be addressed in later articles.

Useful Notes

Conversion Table for Fractions of a 12th part of an Inch
(1/x''' as per Rabenhorst) to:- **a. Fractions of an Inch, b. Decimal Fractions of an Inch, c. Microns**

D. Ehrenbergii *Ktz.* (Bac. T. 17. F. XVII. 1—3. Rabenh. Süssw. Diat. p. 35. T. II. F. 7. Alg. N. 601. Desmaz. ed. nov. N. 102. Bad. N. 4. Wart. N. 128. Pritch. Inf. T. IV. F. 15. Bacillaria elongata Ehrb. Inf. p. 198. N. 272. T. XV. F. V. Gloeonema Heufleri Menegh. Linnaea. Dist. elongatum var. β. Sm. p. 40. F. 311. β. Rabenh. Alg. sub No. 1063.). D. lineare polos versus paulum dilatatum, valvis linearibus sub polis constrictis, apicibus capitatis, rotundatis; costis 12—24 in 0,001".
Long. 1/96—1/20''' = 0,0009—0,0045".

Fractions of a 12th part of an Inch
Decimal Fractions of an Inch

The example above is from Flora Europea Algarum aquae dulcis et submarinae by Ludovico Rabenhorst published in 1864. It uses the inch as the basis for its measurements. The symbol for an inch being two single quotes ("). This is the next lowest 12th division of a foot, denoted by a single quote ('). You will see, therefore that the next lowest division of the inch will be three quotes (''') denoting a 12th part of an inch.

Fractions of 1/12th of an Inch to Fractions of an inch, Decimal fractions of an inch and Microns

Frac. of 1/12 inch	Frac. of an inch	Dec. fraction of an inch	Microns
1/1	1/12	0.08333333	2116.6710
1/2	1/24	0.04166667	1058.3355
1/3	1/36	0.02777778	705.55709
1/4	1/48	0.02083333	529.16785
1/5	1/60	0.01666667	423.33430
1/6	1/72	0.01388889	352.77861
1/7	1/84	0.01190476	302.38168
1/8	1/96	0.01041667	264.58398
1/9	1/108	0.00925926	235.1857
1/10	1/120	0.00833333	211.66721
1/11	1/132	0.00757576	192.42475
1/12	1/144	0.00694444	176.38936
1/13	1/156	0.00641026	162.82096
1/14	1/168	0.00595238	151.19090
1/15	1/180	0.00555556	141.11152
1/16	1/192	0.00520833	132.29205
1/17	1/204	0.00490196	124.51017
1/18	1/216	0.00462963	117.59295
1/19	1/228	0.00438596	111.40385
1/20	1/240	0.00416667	105.83367
1/21	1/252	0.00396825	100.7939
1/22	1/264	0.00378788	96.212440
1/23	1/276	0.00362319	92.029296
1/24	1/288	0.00347222	88.194747
1/25	1/300	0.00333333	84.666963
1/26	1/312	0.00320513	81.410546
1/27	1/324	0.00308642	78.395345
1/28	1/336	0.00297619	75.595516
1/29	1/348	0.00287356	72.988778
1/30	1/360	0.00277778	70.555823
1/31	1/372	0.00268817	68.2798
1/32	1/384	0.00260417	66.146092
1/33	1/396	0.00252525	64.14166
1/34	1/408	0.00245098	62.255153
1/35	1/420	0.00238095	60.476438
1/36	1/432	0.00231481	58.796540
1/37	1/444	0.00225225	57.207448
1/38	1/456	0.00219298	55.701992
1/39	1/468	0.00213675	54.273739
1/40	1/480	0.00208333	52.916899
1/41	1/492	0.00203252	51.626246
1/42	1/504	0.00198413	50.397053
1/43	1/516	0.00193798	49.225031
1/44	1/528	0.00189394	48.106283
1/45	1/540	0.00185185	47.037258
1/46	1/552	0.00181159	46.014711
1/47	1/564	0.00177305	45.035678
1/48	1/576	0.00173611	44.09743
1/49	1/588	0.00170068	43.197492
1/50	1/600	0.00166667	42.333545
1/51	1/612	0.00163399	41.503477
1/52	1/624	0.00160256	40.705336
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1/444	1/5328	0.00018769	4.7674038
1/445	1/5340	0.00018727	4.7566908
1/446	1/5352	0.00018685	4.7460258
1/447	1/5364	0.00018643	4.7354086
1/448	1/5376	0.00018601	4.7248388
1/449	1/5388	0.00018560	4.7143160
1/450	1/5400	0.00018519	4.7038401
1/451	1/5412	0.00018477	4.6934105
1/452	1/5424	0.00018437	4.6830272
1/453	1/5436	0.00018396	4.6726896
1/454	1/5448	0.00018355	4.6623977
1/455	1/5460	0.00018315	4.6521509
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1/457	1/5484	0.00018235	4.6317919
1/458	1/5496	0.00018195	4.621679
1/459	1/5508	0.00018155	4.6116104
1/460	1/5520	0.00018116	4.6015854
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1/463	1/5556	0.00017999	4.5717704
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1/465	1/5580	0.00017921	4.5521074
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1/468	1/5616	0.00017806	4.5229280
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1/470	1/5640	0.00017730	4.5036821
1/471	1/5652	0.00017693	4.49412
1/428	1/5136	0.00019470	4.9456197
1/429	1/5148	0.00019425	4.9340918
1/430	1/5160	0.00019380	4.9226174
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1/474	1/5688	0.00017581	4.4656774
1/475	1/5700	0.00017544	4.4562762
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1/496	1/5952	0.00016801	4.2676086
1/497	1/5964	0.00016767	4.2590221
1/498	1/5976	0.00016734	4.2504701
1/499	1/5988	0.00016700	4.2419524
1/500	1/6000	0.00016667	4.2334688

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The origins of SI Units.

On May 8, 1790, following a motion by Talleyrand, the National Assembly determined on the creation of a decimal system of measurement units that would remain stable, unvarying and simple. The first unit chosen was based on a pendulum beating a second. On March 30, 1791, following a proposal by the AcadÊmie des Sciences (Borda, Lagrange, Laplace, Monge and Condorcet), the National Assembly finally agreed that a Metre would be a 1/10,000,000 of the distance between the North Pole and the Equator. On April 7, 1795 the Convention decreed that the new "Republican Measures" were to be, henceforth, legal measures in France.

The units of measurement included:-
Metre (length), Litre (volume), Gram (mass), Bar (pressure)
Prefixes in Greek were used for factors of 10:-
deca- (x 10) 101, hecto- (x 100) 102, kilo- (x 1,000) 103
myria- (x 10,000) 104
and prefixes in Latin were used for fractions:-
deci- (1/10) 10-1 [d], centi- (1/100)10-2 [c], milli- (1/1,000)10-3 [m]
micro 10-6 [u], nano 10-9 [n], pico 10-12 [p], femto 10-15 [f], atto 10-18 [a]

The metric system has survived, practically unchanged, as the basis of today's Systeme International d'Unités (SI).

Old Papers - Revisited

This paper was first published in the Journal of the Quekett Microscopical Club Vol. 7. Pt. 9. pgs. 179-181 April 1859. Thomas Brightwell was born in Ipswich on the 18th March 1787 and died at Norwich on the 17th November 1868. He was buried at Thorpe, Norwich. Elected a Fellow of the Linnean Society in 1821.

On some of the RARER or UNDESCRIBED SPECIES of DIATOMACEAE.

Part I.

by T. Brightwell, F.L.S.

It is my purpose in this and some following papers descriptions of some of the many undescribed or unfigured species of Diaotmaceae, chiefly marine, which still are found in our cabinets; illustrated by Mr. Tuffen West's excellent figures they will, I trust, be acceptable and useful to algologists.

1. *Eunotia eruca.* - Valve slightly arcuate, from three to five or six flexures or undulations above and below; extremities slightly produced, striated. Varies in length from .0018, with three flexures to .004 with five flexures. Striae 20 in .001. *Amphicampa eruca* (Ehr., 'Mikr.' Pl. xxxi, F. vii).Fresh-water lagoon, near Melbourne, New South Wales; Mackie. (Pl. IX, fig. 1, and fig. 1a.

2. *Cocconeis coronata,* n. sp. - Valve oval, slightly constricted at the extremities, stout marginal band, with from two to thirty-two transverse canaliculi; disc striated, moniliform; striae 15 in .001. Valves .002 long by .0014 broad. Shell cleanings. West Indies. (Pl. IX, fig. 2.)

3. *Cocconeis fimbratus,* n. sp. - Oval, margin fringed with a band indented internally, disc striated, with lines of dotted striae. Corsican Algae. (Pl. IX, fig. 3.)

4. *Campylodiscus striatus,* Ehrenb. - Disc in the middle part smooth, with a double series of parallel canaliculi on each side, eleven in the smaller to twenty in the larger specimens. Kutzing, Species 'Alg.' p.33, No. 11. Vera Cruz. (Pl. IX, fig. 4.)

5. *Surirella limosa,* Bailey. - V. broadly ovate, accuminate, faintly punctato-striate. Canaliculi seventy-five to eighty, short and indistinct, not reaching more than 1/6th across the valve, leaving large blank centre. Length .01 by .045 in breadth. Striae very indistinct, 22 in .001. Professor Bailey, MS.? This species was, Mr. Tuffen West thinks, sent to Professor Smith, with this name.
New Zealand, Mackie. Mud, Hudson River, New York, N.A., Professor Bailey. Mr. T. West has seen a specimen from Thames mud. (Pl. IX, fig. 5.)

6. *Stauroneis fulmen,* n. sp. - F. V. oblong; V. lanceolate acute. Margin with a marked double inflexion on each side. Stauros very slightly, if at all, dilated towards the margin of the valve. Striae fine and sharp, 22 in .001. Length from .008 to .015.
Fresh water, Melbourne, N.S.W., Mackie. (Plate IX, fig. 6a, V.; 6b, F.V.)

7. *Pleurosigma longina,* P. Smith. - V. lanceolate, flexure moderate, extremeties greatly elongated; acute; colour faint straw; striae transverse, 36 in .001; length from .02 to .025.
Arctic Regions, Dr. Sutherland.)Pl. IX, Fig. 7.)

8. *Odontidium speciosum,* n. sp. - Valve subcruciform or rhomboidal, angles rounded, naked, costae short, distinct, sixteen on each side. (Pl. IX, fig 8, a, side view; b, front view.) Shell cleanings.

9. *Odontidium punctatum,* n. sp. - Valve subrhomboidal, angles pointed, cellular, obscurely punctato-striate, without costae. (Pl. IX, fig. 9.) Shell cleanings.

10. *Odontidium Baldjickii,* n. sp. - Valve ovately rhomboidal. Costae about twenty on each side the median line, distinct, reaching nearly to, but leaving a linear open space down the centre. (Pl. IX, fig. 10).
From a clay or earthy deposit found on bones imported from Baldjick, near Varna, Mr. Norman.
The species last described are allied to O. Harrisonii of Professor Smith, and we refer to his observations ('S.B.D.,' vol. i, p.18), as to their true position in a systematic arrangement.

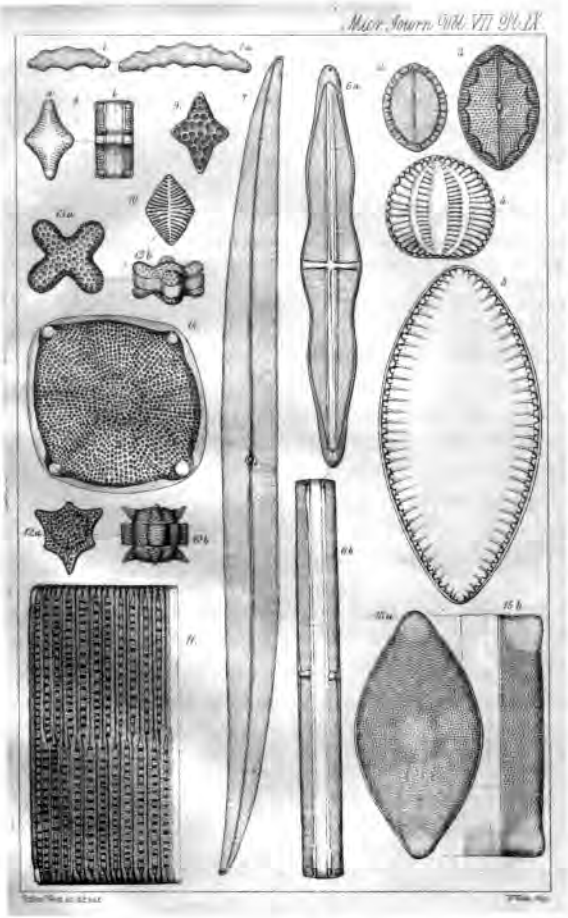
11. Rhabdonema mirificum, Professor Smith. - "Septa with three to twelve irregular perforations."
See Dr. Walker Arnott's observations, 'Mic. Journal,' vol. vi, p.92. (Pl. IX, fig. 11.)

12. Triceratium (?) dubium, n. sp. - Valve clypeate, punctate, with six rounded projections, the lower one elongate.
Mauritius. (Pl. IX, fig. 12, a, side view; b, front view.)
We place this species (which is not of unfrequent occurrence) provisionally among the Triceratia. It probably forms the type of a new genus.

13. Amphitetras crux, n. sp. - Valve cruciform, with the extremeties widely rounded, cellular punctate. (pl. IX, fig. 13, a, front view; b, side view.)

14. Amphitetras antediluviana (?) (Pl. IX, fig. 14.) - Mr. T. West believes this to be a valve of a sporangial frustule, of this species. Its unusually large size, imperfect shape and thinness, the cellular appearance of its punctation, and its occurrence among a larger number of valves of the regular form lead to this conclusion.

15. Biddulphia Balaena. - V. ovate, elongated at the extremities; F.V. quadrate. Frustule punctato-striate.
Zygoceros Balaena, Ehr. - See Roper on Biddulphia, 'Trans. Micr. Soc.' vol. vii, p.20.
Arctic Regions, Cornwall Island, N. Lat. 75o, Dr. Sutherland.



Description of Plate IX.
Illustrating Mr. Brightwell's paper on various Diatomaceae.

Fig. 1. Eunotia Eruca. (Ehr.)

Fig. 2. Cocconeis Coronata. (n. sp.)

Fig. 3. Cocconeis fimbriata. (n. sp.)

Fig. 4. Campylodicus Striatus (Ehr.)

Fig. 5. Surirella lunosa. (Bail.)

Fig. 6. Stauroneis Fulmen. (n. sp.)

Fig. 7. Pleurosigma longina. (W.Sm.)

Fig. 8. Odontidium Speciosum. (n. sp.)

Fig. 9. Odontidium punctatum. (n. sp.)

Fig. 10. Odontidium Baldjicum. (n. sp.)

Fig. 11. Rhabdonema mirificum. (W.Sm.)

Fig. 12. Triceratium ? dubium (n. sp.)

Fig. 13. Amphitetras Crux (n. sp.)

Fig. 14. Amphitetras Antediluviana (?) probably a valve from a sporangial frustule.

Fig. 15. Biddulphia Balaena. (Ehr.)

Diatoms by Dark-ground Illumination

- with some historical musings. - Part I.
by Barry Ellam

Those of you of a certain age may recall the teaching of optics for "O" Level. There were little practical exercises with 'spectacle' lenses and pins. These were always done on benches exquisitely designed so that one could not comfortably look through the lenses whilst standing, sitting or kneeling. We learned to turn these little experiments into scale diagrams. These in turn allowed us to deduce whether the image would be real, or virtual, where it would be located, whether it would be erect or inverted and the degree of magnification or reduction.

Later, in those days of logarithm tables we learned to do the same thing by calculation.

During the "A" Level course we discovered that lenses were not perfect, that they were prone to a terrifying range of defects - chromatic aberration, spherical aberration, comma and the rest. Looking at this catalogue of horrors it seemed amazing that images were formed at all. Of course, you will have noticed, the thing we didn't grasp (at least I didn't) was how images are formed. We knew where, which way up and how big - but not how.

Now the progressive refinement of lens design and construction is history. The introduction of achromatic objectives, the use of fluorite and then the apochromatic objective. In the twentieth century the use of anti-reflective coatings and computerised design systems has led to further improvements.

In the nineteenth century there were a number of microscope makers in Britain and mainland Europe. They produced, in the main, decent workmanlike instruments. There was quite intense competition. Amongst these manufacturers was a firm by the name - Carl Zeiss.

Before writing more of Zeiss, it may be in order to write a few words on the subject of diffraction.

When light passes a straight edge or shines through a small hole or slit it is bent slightly away from its original direction. Rays of different wavelengths (different colours) are bent by different amounts.

Sir Isaac Newton had looked for possible evidence of wave like properties in light but had missed this phenomenon - diffraction.

This phenomenon was explained in terms of the wave theory by that great universalist Sir Thomas Young (1773-1829). The inscription on Young's memorial tablet in Westminster Abbey begins:-

> *"A man alike eminent in almost every department of human learning.*
> *Patient of unintermitted labour,....."*

Independently, in France, an obscure provincial engineer, Augusin Fresnel, of the Corps des Ponts et ChauseÈs, employed in supervising the design and construction of roads and bridges pursued the same ideas.

In March 1819, The Paris Academy of Sciences sat to judge the best scientific treatment of the phenomenon of diffraction. Two explanations were submitted. One was absurd. Fresnel's explanation however, was of such power, scope and mathematical sophistication that its author burst into the forefront of research into the nature of light.

Fresnel, who had begun his studies of diffraction in 1815 whilst in prison for fighting as a member of the small army which tried to block Napoleon's return after his escape from Elba.

Only a few years later he was awarded the Académie prize for his explanation.

Of more immediate interest are diffraction gratings. These consist of sets of parallel equidistant slits or grooves. I am sure that, as diatomists, you will appreciate the relevance of such structure.

The development of gratings is usually attributed to Joseph von Fraunhofer (1787-1826). He was born at Straubing in Germany. At the age of ten Joseph started work with his father. When his father died in 1798 he was apprenticed to a Munich mirror maker and glass cutter. In 1806 he entered the optical workshop of the Munich Philosophical Instrument Company and there developed a sound knowledge of the theory and practice of optics.

He also worked under Pierre Guinard, a master glass maker, acquiring a practical knowledge of glass making. By 1811 he was a director of the company.
He discovered the dark lines in the solar spectrum (universally known as the Fraunhofer lines) in 1814.

In 1821 he developed the diffraction grating. At first he worked with fine silver wire on a frame, the wire being wound on the threads of two fine screws set parallel. Later he used gratings ruled on glass with a diamond point and also reflection gratings.

Fraunhofer insisted on high quality craftsmanship, this led to scientific discoveries and developments on both the atomic and cosmic scale. His 91/2 inch refracting telescope was of such quality that it earned him freedom from taxes in Munich.

He never published his researches, or his methods for calculating and testing lenses, viewing these as trade secrets.

The production of gratings was put on to a sound footing by Henry Augustus Rowland (1848-1901), professor of Physics at John Hopkins University, Baltimore. Rowland had a talent for the practical design of experimental apparatus. He developed ruling engines to such an extent that his work has hardly been surpassed.

Between 1886 and 1895 he made use of a grating to re-map the solar spectrum, cataloguing the wavelengths of 14000 of the Fraunhofer lines with high accuracy.

Of course such original gratings were very expensive. Celluloid replica gratings were first made by a Mr. T. Thorp of Manchester and were known as "Thorp gratings".

Some of you may remember reading of the "Cell Theory" developed independently by Theordor Schwann (1810-1882) and Mathias Schlieden (1804-1881). It has been said that this contained little that was new, and what there was, was wrong. Schwann of course, was the discoverer of the Schwann cell. It is, however, with Mathias Schlieden that we are concerned. He was possibly, on of the strangest personalities of all time. He was an ex-barrister who had enjoyed but little success as an advocate. Being flippant he could be described as a *miserable pleader!*

He then failed as a suicide, shooting himself in the forehead but without achieving the intended result. Having failed as a lawyer and a suicide he turned to Biology, being awarded doctorates in medicine and philosophy.

His importance to us, is that it was largely Schlieden who induced the young Carl Zeiss to devote himself to optics.

Zeiss was the son of a German craftsman. a toy maker, cabinet maker and 'Carver of

Portraits in Ivory' at the Grand Duke's Court in Jena.

After leaving school in 1834 he spent twelve years as an apprentice studying and working in various scientific workshops until he felt confident to set up his own. Before this, however, he had to pass a rigorous examination. In due course, the Office of the Grand Duke's Superintendent of Works awarded him a licence to manufacture and sell mechanical and optical instruments and to establish a mechanical workshop.

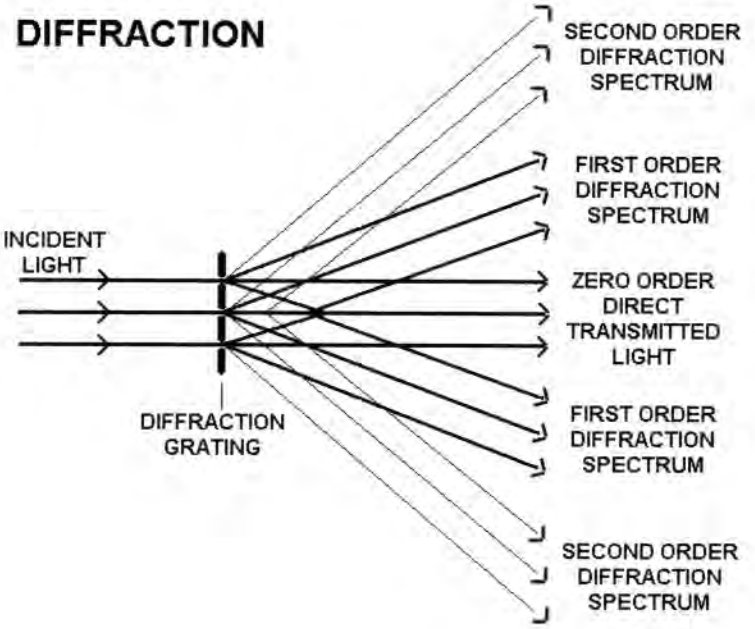
It was at this time that Mathias Schlieden guided him into the manufacture of microscopes and in 1857 wrote a testimonial to Zeiss's success.

By 1866 the firm was twenty years old and produced its thousandth microscope. The staff had increased from three to twenty. All worked an $11\frac{3}{4}$ hour day with a quarter of an hour break in the morning and an hour for lunch.

Zeiss felt that the only way of getting ahead of the competition was to replace the old hit and miss, rule of thumb methods with a scientific understanding of the instrument.

He enlisted the aid of the mathematician Barfuss. I have so far failed to find any mention of Barfuss in the histories of mathematics to which I have access. I can only assume that he was a solid, capable mathematician quite untroubled by original thoughts. After the death of Barfuss Zeiss was able to arouse the interest of Ernst Abbe, a lecturer in Physics.

Much has been written of Abbe's contribution to microscope optics. Perhaps his greatest contribution was his Theory of Microscopical Vision. I have no intention of trying to explain this theory in full, simply reminding the reader of one or two important ideas. These are most easily explained imagining a diffraction grating as the microscope object.



When light strikes a diffraction grating some of the light passes straight through - the direct beam. Some, however, is diffracted into a series of spectra, first order, second order etc. There is a phase difference between the direct and diffracted rays. Thus, when they re-combine in the image plane, there is interference which produces the image.

The finer the diffracting structure, the greater will be the angle between the direct ray and the first diffracted ray. This is the reason why resolution depends on numerical aperture rather than magnification.

If, as in dark-ground illumination we block the direct rays, the image is formed by interference of diffracted rays. This image of course will have reversed contrast.

If you feel inclined to experiment with diffraction gratings these are available from - Edmund Optics Ltd, 1 Tudor House, Lysander Close, Clifton Moor, York, YO30 4XB - as Holographic Diffraction Grating film (current catalogue p296).
This is available with either 25,400 or 12,700 lines per inch.

25400 lines per inch = 1000 lines per mm

12700 lines per inch = 500 lines per mm.

At 1000 lines per mm the spacing is 1(m.

At 500 lines per mm the spacing is 2(m.

The resolving power (R) of an objective is given by the formula $R = \lambda/2N.A.$

λ = wavelength of light. For green light take 540nm.

N.A. = Numerical aperture of the objective.

(a) 1000 lines per mm, spacing 1 µm

540nm = 0.54µm

$1 = 0.54/2$ N.A. i.e. N.A. $= 0.54/2 = 0.27$

(b) 500 lines per mm, spacing µm.

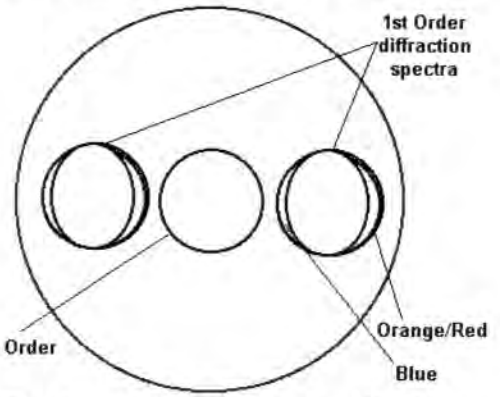
$2 = 0.54/2$ N.A.

$2NA = 0.54/2$ ie. N.A. $= 0.54/4 = 0.135$

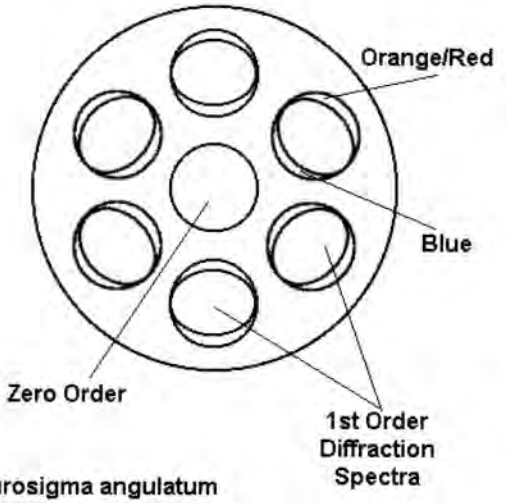
Two interesting observations may be made using these film gratings. Before starting, however, it makes sense to put a small 'marker' spot on the surface of the grating. This way, you have something upon which to focus. Why make life difficult?

If you have them available, try using objectives of N.A. 0.1, 0.17, 0.25 etc. You will not achieve clear resolution until the N.A. exceeds the calculated values. At the same time, it is instructive to remove the eyepiece and examine the rear focal plane of the objective. A phase telescope, if available, is useful here.

DIFFRACTION SPECTRA AS OBSERVED IN REAR FOCAL PLANE OF OBJECTIVE



Diffraction grating. x10 objective NA 0.25



Pleurosigma angulatum x40 Objective NA. 0.65

When resolution has been achieved you will observe a bright central spot (direct rays - zero order) and two small circular spectra, one on either side. These are the first order diffraction spectra. It is instructive to carry on to use even higher N.A. objectives whilst, with each change of objective, examining the rear focal plane of the objective. This is a topic to which I will return.

Diatoms have long been favourite objects with microscopists. In 1841 R. Harrison and J. D. Sollitt of Hull directed the attention of microscopists to the use of diatoms as test objects. I know nothing about these two gentlemen and any information would be welcome.

With very brief consideration you will see that diatoms may be regarded as minute, naturally occurring diffraction gratings.

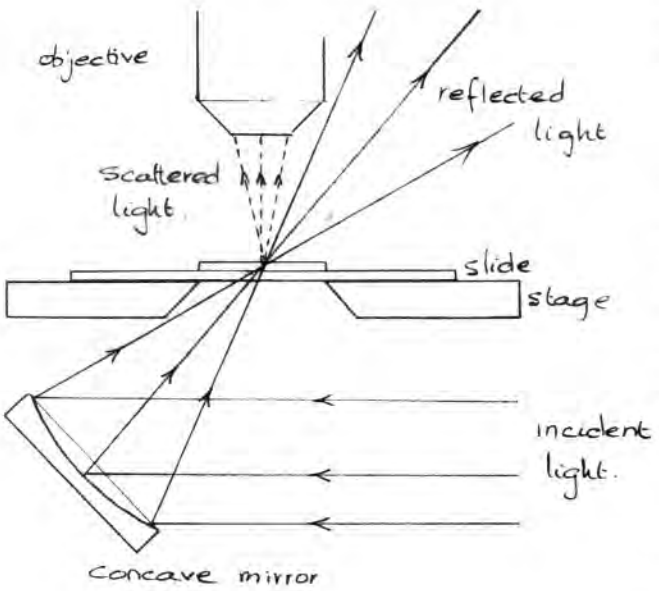
Now, to dark-ground illumination. To quote the late Professor C. E. M. Joad - "It all depends what you mean by....".

We may use dark-ground illumination for various reasons. For exhibition work and pictorial photomicrography it can be quite spectacular. We may use it simply to obtain a different view of a specimen, or in a last ditch

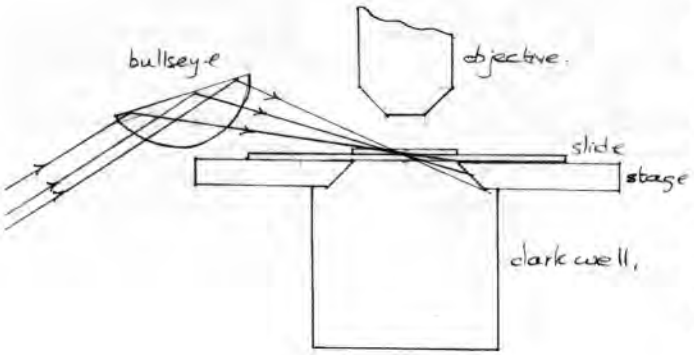
desperate attempt to resolve a finely marked form. Or simply, we may use it because we like it.

Low Powers - No substage required.

The first of such methods is attributed to the Rev. J. D. Reade, though it is much older than this. Leeuwenhoek is thought to have used a similar method of dark-ground illumination.



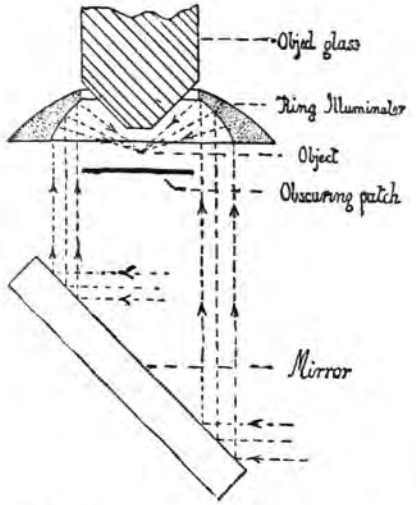
It is often convenient to use the concave mirror of the microscope. On some older stands the tailpiece carrying the mirror could be swung aside. With more modern stands the mirror may be removed and set in a suitable block of wood, drilled for the purpose. Lacking a mirror, an external light, even a decent torch may be used effectively. This method is, of course, open to the criticism that the light is from one side only. For low-power, and exhibition use this is of no consequence. A microscope with a thin stage is desirable.



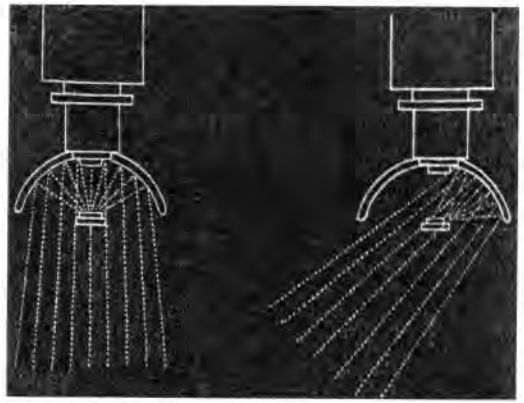
A similar effect may be achieved with light directed from above the specimen. Any reasonably intense light source will serve. Those of you of an inventive turn of mind may be moved to make a purpose built illuminator using a L.E.D. (Light Emitting Diode).

I particularly like the old-fashioned Bull's-eye, or stand condenser. This is set with its curved side downwards, slightly above the plane of the stage. Light is directed up through the curved surface, totally reflected from the flat surface and focussed on the specimen. No black background is required. I always use a dark well to avoid unwanted out-of-focus effects. My dark wells are black film 'cans', cut down if necessary, and secured beneath the stage with 'Blu-Tac'.

Should you be lucky enough to acquire one, a silver side-reflector achieves similar results very elegantly. Again, a dark-well is advisable.



Beck 1930s



Carpenter 1856

The last such device I will mention is the Lieberkuhn. Even Quekett refers to it as 'the venerable Lieberkuhn'. With low to medium powers it can work beautifully. Strictly speaking a Lieberkuhn was made for use with one particular objective. However, with the careful application of masking tape it is not infrequently possible to coax a Lieberkuhn to work on another objective of similar focal length.

No condenser is used, but, originally dark wells were provided in a holder which fitted in the substage. In form, these were small metal cylinders, blackened at one end and with a metal mounting rod.

Light passed around this device to be reflected from the Lieberkuhn on to the specimen. The image was, of course, seen brilliantly illuminated against the dark well.

Slides were also specially prepared for use with the Lieerkuhn. In those a relatively small black disc could be placed on the slide as a background to the specimen.

Should you have the good fortune to stumble across a Lieberkuhn at a sensible price it should not be too hard to pair it with a suitable objective. All that is needed is a small disc of

black paper stuck on the back of the slide.

The Spot Lens.

Up to the time of the Second World War spot lenses were quite widely available. The construction is simple. It consists of a plano-convex 'bull's-eye' lens with a circular black stop on the flat surface. Commonly it is used with the flat surface uppermost.

Today the easiest thing is to obtain an un-mounted bull's-eye and to cut a stop from a piece of black card. I find a stop of 20mm diameter useful with low-power objectives. For cutting circular stops etc. a plastic circle template is useful. Of course, the un-mounted bull's-eye will not fit any form of substage. It may be secured above or below the substage ring by small pellets of 'Blu-tac'. If the focal length of the bull's-eye is too long, try using it with the concave mirror. It is also possible, with a little ingenuity, to adapt this device for use with a stereo microscope.

Again- excellent for exhibition use!

It gives excellent dark-ground for arranged group slides of diatoms and for the largest forms such as Arachnoidiscus.

Rheinberg illumination is also possible with the spot lens. Rheinberg discs may be made using Cellulose Acetate as used with overhead projectors. Use permanent markers (spirit based) not the water based pens. Mark out the discs using a black pen and then colour in. Some experimentation may be needed to obtain satisfactory results. Some years ago I demonstrated 'oblique Rheinberg'. In this case the coloured areas are asymmetrical. Very interesting results may be obtained in this way. Of course, with suitable stops cut from black card oblique illumination may also be obtained.

One other very simple method of obtaining dark-ground illumination with low-powers deserves a mention. Here the concave mirror should be at such a distance below the stage that light can be brought to focus on the slide. Now a black paper stop is placed at the centre of the mirror. Some experimentation is needed to find the correct size of the stop and the exact position of the mirror.

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Species Lists

The following lists were all compiled by Lionel Bramley and refer to samples collected in the UK and cleaned by him. The numbers refer to the Tribe Number **(Bold)** and Genus Number *(Italic)* given in Van Heurck's 'A Treatise on the Diatomaceae'. The figures and names within brackets refer to the groups within the genus.

What these lists illustrate particularly well is the tendency for the Amateur Diatomist to adopt the naming system they are most comfortable with, a convention to which they are able to relate their own observations. Van Heurck's work was published considerably before Mr. Bramley began collecting and identifying species, but was possibly one of the first works he referenced for identification purposes. Although the authorities are missing from these lists, because of the references made to Van Heurck's Tribes, Genus and Groups it is simply a matter of reference to this work to ascertain which species, by what authority, is actually being noted.

Lionel Bramley is, unfortunately, no longer with us but he has left us a legacy of a series of booklets containing meticulous notes. It is from these booklets that the following lists are extracted.

Twineham Green, London N.12. - Stream

2. Naviculeae
7. Navicula (Crassinerves) cuspidata
7. Navicula (Pinnularia) viridis
22. Gyrosigma scalproides
7. Synedreae
40. Synedra ulna var. Danica
16. Surirelleae
77. Cymatopleura apiculata
77. Cymatopleura elliptica
78. Surirella ovalis
78. Surirella robusta
17. Nitzschieae
81. Nitzschia dubia
81. Nitzschia triblionella

Walthamstow Reservoirs. Green river weed

1. Cymbelleae
1. Amphora ovalis
2. Cymbella lanceolata
6. Stauroneis acuta
16. Surirelleae
78. Surirella biseriata
79. Campylodicus (sub)angularis

Walkerswick, Suffolk - Brown Weed

1. Cymbelleae
1. Amphora Pusio
2. Naviculeae
7. Navicula *(2. Radiosae)* oblonga
7. Navicula *(2. Radiosae)* digito-radiata var Cyprinus
7. Navicula *(3. Didymae)* Crabro
7. Navicula *(3. Didymae)* didyma
7. Navicula *(3. Didymae)* interrupta
7. Navicula *(4. Ellipticae)* Smithii
7. Navicula *(10. Abbreviatae)* elegans
7. Navicula *(11. Perstriatae)* marina
7. Navicula *(16. Formosae)* laburnica
7. Navicula *(16. Formosae)* amphisbaena
7. Navicula (Schizonema *2. Staureneideae*) crucigerum
7. Navicula (Schizonema *3. Perstriatae*) Grevillei
7. Navicula (Libellus) rhombica
7. Navicula ?
22. Pleurosigma affine
22. Pleurosigma angulatum
22. Pleurosigma elongatum
22. Pleurosigma strigosum
22. Gyrosigma Balticum
22. Gyrosigma distortum
22. Gyrosigma fasciola var. sulcata
22. Gyrosigma scalproides
22. Gyrosigma litterale
24. Amphiprora alata
25. Trophidoneis (Amphoropsis) recta
4. Achnantheae
30. Achnanthes brevipes
30. Achnanthes groenlandia
7. Synedreae
40. Synedra ?
16. Surirelleae
78. Surirella Gemma
78. Surirella fastuosa
78. Surirella ovalis
78. Surirella ovalis var. ovata
78. Surirella striatella
17. Nitzschieae
81. Nitzschia acuminata
81. Nitzschia circumsuta
81. Nitzschia linearis

81. Nitzschia navicularis
81. Nitzschia punctata
81. Nitzschia Sigma
81. Nitzschia Tryblionella
81. Nitzschia Tryblionella var. Levidensis
81. Nitzschia Tryblionella var. littoralis
20. Melosireae
109. Melosira ?
114. Hyalodiscus stelliger
21. Biddulphieae
132. Biddulphia Baileyi
132. Biddulphia Rhombus
132e Triceratium alternans
23. Heliopelteae
157. Actinoptychus glabratus
157. Actinoptychus splendens
25. Coscinodisceae
187. Coscinodiscus excentricus
187. Coscinodiscus marginatus
187. Coscinodiscus oculus-iridis
187. Coscinodiscus punctulatus
187. Coscinodiscus subconcavus

Fishbourne Creek, nr. Fishbourne Mill, Sussex. (Top surface of Mud - Brackish)

2. Naviculeae
6. Stauroneis Phoenicentron
6. Stauroneis Gregorii
7. Navicula *(1. Pinnulariae)* major
7. Navicula *(1. Pinnulariae)* nobilis
7. Navicula *(1. Pinnulariae)* viridis var. commutator
7. Navicula *(2. Radiosae)* digito-radiata
7. Navicula *(2. Radiosae)* distans
7. Navicula *(2. Radiosae)* oblonga (three vars.)
7. Navicula *(2. Radiosae)* peregrina
7. Navicula *(2. Radiosae)* peregrina var.
7. Navicula *(2. Radiosae)* spuria
7. Navicula *(2. Radiosae)* viridula
7. Navicula *(3. Didymae)* Bombus
7. Navicula *(3. Didymae)* didyma
7. Navicula *(3. Didymae)* splendida
7. Navicula *(4. Ellipticae)* elliptica
7. Navicula *(5. Lyratae)* Lyra
7. Navicula *(5. Lyratae)* Lyra var. recta
7. Navicula *(5. Lyratae)* Lyroides
7. Navicula *(5. Lyratae)* Lyra var. elliptica
7. Navicula *(7. Asperae (Trachoneis))* aspera
7. Navicula *(7. Asperae)* aspera var. intermedia
7. Navicula *(10. Abbreviatae)* elegans
7. Navicula *(11. Perstrialae)* marina
7. Navicula *(15. Seriantae)* serians
7. Navicula *(16. Formosae)* formosa
7. Navicula *(19. Linearae)* liber
7. Navicula *(19. Linearae)* tripunctata var. schizonemoides
19. Scoliopleura latestriata
19. Scoliopleura tumidi
22. Pleurosigma angulatum
22. Pleurosigma angulatum var. strigosum
22. Pleurosigma angulatum var. quadratum
22. Pleurosigma affine
22. Pleurosigma elongatum
22. Pleurosigma formosum
22. Pleurosigma latum
22. Gyrosigma attenuatum
22. Gyrosigma attenuatum var. scalprum
22. Gyrosigma accuminatum
22. Gyrosigma balticum
22. Gyrosigma balticum var. Wansbeckii
22. Gyrosigma littorale
22. Gyrosigma strigilis
24. Amphiprora surilloides
25. Tropidoneis (Orthotropis) lepidoptera
25. Tropidoneis (Plagiotropis) elegans
4. Achnantheae
30. Achnanthes brevipes
30. Achnathes brevipes f. lata
7. Synedreae
40. Synedra baculus
40. Synedra brockmanni
40. Synedra crystallina var. consfucua
40. Synedra fulgens
40. Synedra ulna
8. Fragilareae
44. Fragilaria capucina
16. Surirelleae
78. Surirella comis
78. Surirella elliptica
78. Surirella fastuosa
78. Surirella Gemma
78. Surirella intercedens?
78. Surirella ovalis
78. Surirella ovalis var. ovata
78. Surirella robusta
78. Surirella Smithii
78. Surirella Solea
78. Surirella striatula
79. Campylodiscus bicostatus
79. Campylodiscus Echeneis
79. Campylodiscus Hibernicus
17. Nitzschieae
81. Nitzschia bilobata
81. Nitzschia circumsuta
81. Nitzschia linearis
81. Nitzschia scalaris

81. Nitzschia Sigma
81. Nitzschia sigmoides
20. Melosireae
109. Melosira arenaria
109. Melosira moniliformis?
109. Melosira nummuloides
109. Melosira undulata
114. Hyalodiscus stelliger
21. Biddulphieae
132. Biddulphia aurita
132. Biddulphia Regina
132. Biddulphia Rhombus
132e Triceratium alternans
132f Biddulphia (Amphitetras) antideluviana
132f Biddulphia (Amphitetras) antideluviana var. pentagonia
22. Eupodisceae
141. Auliscus coelatus
141. Auliscus sculptus
151. Roperia tessalata
23. Heliopelteae
157. Actinoptychus undulatus
25. Coscinodisceae
187. Coscinodiscus cribrosus var. ?
187. Coscinodiscus excentricus
187. Coscinodiscus radiatus

Paul's Pier Wharf, River Thames, London. (Wall scrapings - gel from outfall and green weed)

1. Cymbelleae
2. Cymbella Ehrenbergii
2. Naviculeae
4. Mastogloia ?
6. Stauroneis Phoenicentron
7. Navicula *(2. Radiosae)* oblonga
7. Navicula *(13. Crassinerves)* cuspidata
19. Scoliopleura latestriata
22. Pleurosigma angulatum var. Aestuaria
22. Gyrosigma attenuatum
5. Cocconeideae
34. Cocconeis pseudo-marginata
34. Cocconeis speciosa
6. Epithemieae
36. Eunotia praerupta
7. Synedreae
40. Synedra ulna
40. Synedra ulna var. amphirynchus
40. Synedra ulna var. lanceola
16. Surirelleae
77. Cymatopleura elliptica
77. Cymatopleura Solea
78. Surirella biseriata
78. Surirella elegans
78. Surirella Gemma
78. Surirella robusta v. splendida
78. Surirella turgida
17. Nitzschieae
81. Nitzschia clarissima
81. Nitzschia majuscula
81. Nitzschia Sigma
81. Nitzschia sigmoidea
81. Nitzschia ?
20. Melosireae
109. Melosira sol
111. Cyclotella Kutzingiana
21. Biddulphieae
118. Hydrosera whampoense
132. Biddulphia Rhombus
132. Biddulphia Rhombus var. trigona
132d Biddulphia (Cerataulus) laevis f. minor
132d Biddulphia (Cerataulus) Smithii
132e Triceratium alternans
132e Triceratium Favus
23. Heliopelteae
157. Actinoptychus adriaticus
157. Actinoptychus areolatus
157. Actinoptychus splendens
157. Actinoptychus undulatus
25. Coscinodisceae
187. Coscinodiscus excentricus
187. Coscinodiscus denarius
187. Coscinodiscus cribrosus (var. 2)
187. Coscinodiscus radiatus
187. Coscinodiscus subtilis var. Normanii

Diatomite Deposits in Indonesia :

We have been sent the following list of deposits. None of the sites are familiar to us. If anyone has further details or samples we would welcome any information.

North Sumatera : Toba Samosir, North Tapanuli
West Java : Bogor, Kuningan, Cianjur, Tasikmalaya
Central Java : Brebes, Temanggung, Surakarta, Wonosobo, Boyolali
Yogyakarta : Kulonprogo
East Java : Jombang, Sidoarjo, Mojokerto

Collecting bottles - A tale of oh!

Over recent years, following a couple of minor, but potentially serious, accidents with glass collecting bottles we have adopted the use of small plastic, rigid polythene bottles.

Many of us tend to carry collecting bottles with us, just in case we pass a likely looking spot where diatoms might flourish. Those less fashion conscious among us tend to carry these bottles in jacket pockets and trouser pockets. Unfortunately we have a propensity for falling over and falling in. It is this feature of our activities that leaves us open to damage. Falling over with glass objects in pockets is not recommended. We all have enough major arteries in places where pockets are situated (I wonder why pockets were placed in these locations) that shattered glass fragments could seriously damage your health. Couple that with the tendency for these glass phials to leak, plastic stoppered or corked, and the resultant uncomfortable and embarrassing wet patch spreading earthward (although this is less of a problem if you have just fallen in) and you have two very good reasons for swapping to rigid polythene unbreakable bottles. Even if you are not damaged in an accident there is the loss of your sample to be considered.

We have taken to using 22ml Screw Cap Polythene bottles. These are translucent enough to see the contents, they are rigid and the screw cap forms an excellent water-tight seal. They may be available from other suppliers but ours are purchased from D.J. & D. Henshaw at £11.00/100, which works out cheaper than the glass equivalent. So, as a Yorkshireman, there's the over-riding reason to use them.

Sales, Wants and Exchanges

Exchanges should be described accurately and fully. They should be FAIR.

Burton Pond - Exchange - I would be glad to receive any odd unwanted samples containing unusual diatoms, and also marine plankton. For my part I can offer some cleaned material from Burton Pond in West Sussex that has a variety of freshwater forms. Contact - J. A. Miles, 43 Singleton Crescent, Ferring, West Sussex BNN12 5DG. Tel:- 01903 245319. Please contact before sending material.

U.S. A. Material Exchange - I am seeking to swap fossil material from any location worldwide, but would prefer Hungarian, Danish or Russian samples. Raw material preferred of 5 to 10 grams weight. In exchange I can trade excellent quality raw fossil material from the following locations: Klammath Falls, Oregon, U.S.A. (fossil freshwater, very diverse species represented), Terrebone, Oregon, U.S.A. (fossil freshwater about 97% whole frustules), Brady Hotsprings, Nevada, U.S.A. (fossil freshwater, primarily small Melosira with lots of carbonates present) and Dunkirk, Maryland (fossil marine, cleans easily, very diverse). Please reply in the first instance to Stephen Nagy, M.D. via email: snagymd@pol.net.

Diatomaceous Earth - From Oamaru. Small samples exchanged for similar from other locations. D. S. Gill. Tel: 024 76 327989 with details before sending.

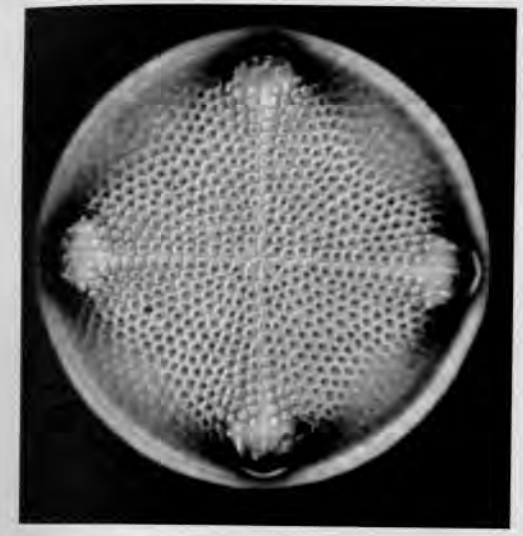
Peragallo et Peragallo etc. - Little Imp CDs exchanged for well mounted diatoms. See publications list for offerings. Contact the publishers to discuss exchange.

Old diatom mountants wanted. - Particularly Hyrax amd Styrax. Any condition. Contact Steve Gill. Tel. 024 76 327989. Diatom strew slides in exchange.

Wanted - Part 1 of 'An Index to the Genera and Species of the Diatomaceae by F.W.Mills'. A photocopy of the aforementioned part required to complete a set. Please contact Dr. Kenneth Green (01482 846943) with details if you can furnish such.

The next issue of

The Amateur Diatomist



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If you wish to name anyone then get their permission first as seeing your name in print, and perhaps associated with something you would rather was forgotten, can come as something of a shock.

We hope that by adopting this relaxed approach to the submission of copy you will all break out the notepads and begin writing. What you have to say concerning Diatoms, mounting and Microscopy is of interest to us all.

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