CD Publications of interest to Diatomists

All titles available from Savona Books

	Author/Company	Title/Description	Price UK Pounds
M3.	Griffith and Henfrey	Micrographic Dictionary 4th Edition. 1883. Plates only	£8
M4.	Flatters & Garnett	1929 Microslide Catalogue includes images of slides.	£10
M7.	P. T. Cleve	Diatoms from the West-Indian Archipelago 1878. pp20 Text Pages, 5 Tafels.	£10
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M48.	Dr. József Pantocsek	A FERTÕ TÓ KOVAMOSZAT VIRÁNYA (Bacillariae Lacus Peisonis) 1912	£5
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M69.	Little Imp	A Checklist of British Diatoms	£4
M71.	Little Imp	Diatomaceae on Magic Lantern Slides V.1.0.	£3
M72.	Alfredo Truan y Luard	Diatomeas de Asturias 1844	£5
M73.	Little Imp	A Checklist of Diatoms of the Central U.S.A.	£3
M74.	Little Imp	DiatCode - List of Diatom Species with Int. codes	£3
M76.	Various Authors	Practical Direction for collecting, Preserving, Transporting, Preparing and Mounting Diatoms	£4
M78.	Rev. Eugene O'Meara	Report on the Irish Diatomaceae	£6
M80.	William Smith	A Synopsis of the British Diatomaceae	£10
M81.	J. D. Moller	Diatomaceen Typen-Platte 335	£4

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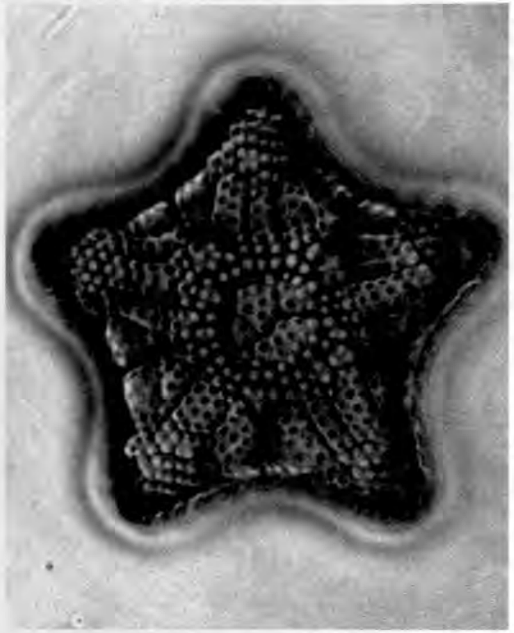
The Amateur Diatomist

Vol. II. No. I. **September 2003**

Little Imp Publications



In this Issue:-

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There is no strict editorial policy.

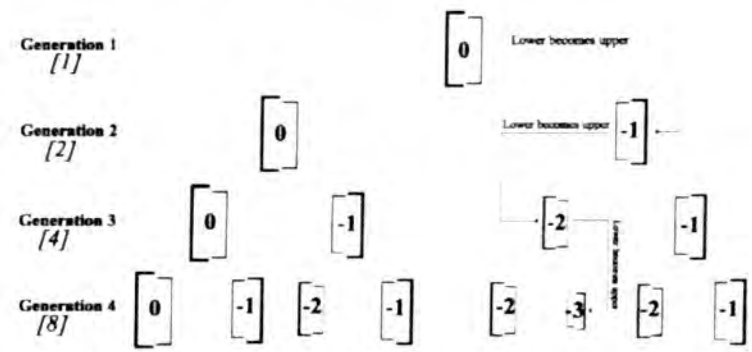
Cover picture: Triceratium - a digital photograph by Steve Edgar.

Further Notes on Reproduction.

- a discussion document.

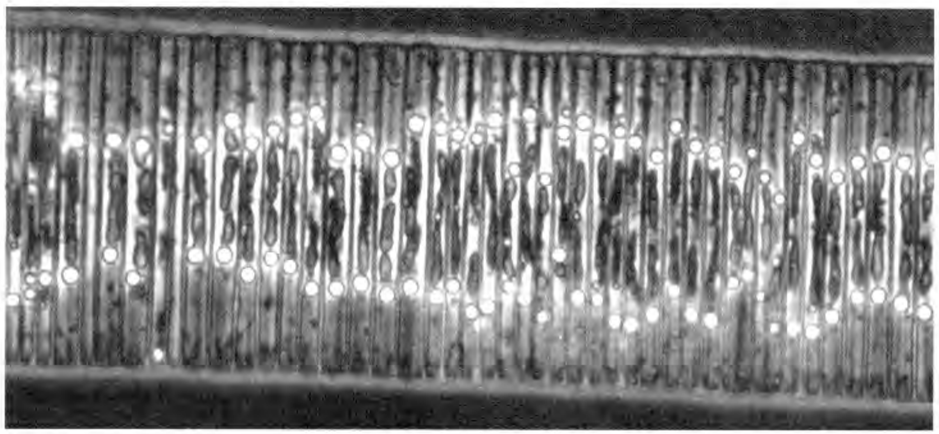
A note sent to us has pointed out that the statement concerning length and width of a daughter frustule being a function of the parent is actually not true as the space between the apices of daughter and parent may differ from the space between the sides that is maintained during the building of a new valve.

The last article concerning Asexual reproduction of diatoms explains the reasoning behind the varying size of the frustules of diatoms of the same species - the two valves when they separate each become a lid and produce a bottom to fit.



There is, however, a small problem when considering diatoms that form chain or thread like colonies.

When you look at these filaments of diatoms the actual thread formed is uniform in width. You can find many thicknesses of filament composed of the same species, so there is variation in size between filaments but not, apparently, in individuals in the same filament.



Fragilaria sp. Photograph by M. Samworth

If the mechanism described previously holds true in these filament forming species then one would expect considerable variation in the thickness of the same filament. This is best appreciated by considering the figures below.

Here the diatom size is represented by a number. The largest being 1 and the smallest being 9. The letter t denotes the position of the top valve and b the bottom valve, remembering that each t,b or b,t combination forms a complete frustule.

b2 1t Single Frustule

t2 3b b2 1t **Division 1**

t2 3b b4 3t t2 3b b2 1t **Division 2**

t2 3b b4 3t t4 5b b4 3t t2 3b b4 3t t2 3b b2 1t **Division 3**

t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t2 3b b4 3t t2 3b b2 1t **Division 4**

t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t2 3b b4 3t t2 3b b2 1t **Division 5**

t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t6 7b b8 7t t6 7b b6 5t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t2 3b b4 3t t2 3b b2 1t
Division 6

t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t6 7b b8 7t t6 7b b6 5t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t6 7b b8 7t t6 7b b6 5t t6 7b b8 7t t8 9b b8 7t t6 7b b8 7t t6 7b b6 5t t4 5b b6 5t t6 7b b6 5t t6 7b b8 7t t6 7b b6 5t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t

t4 5b b6 5t t6 7b b6 5t t6 7b b8 7t t6 7b b6 5t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t4 5b b6 5t t6 7b b6 5t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t4 5b b6 5t t4 5b b4 3t t2 3b b4 3t t4 5b b4 3t t2 3b b4 3t t2 3b b2 1t **Division 7**

The above makes the assumption that all frustules divide at the same time which in all likelihood is unlikely, however, the fundamental principle of variation in size would be apparent.

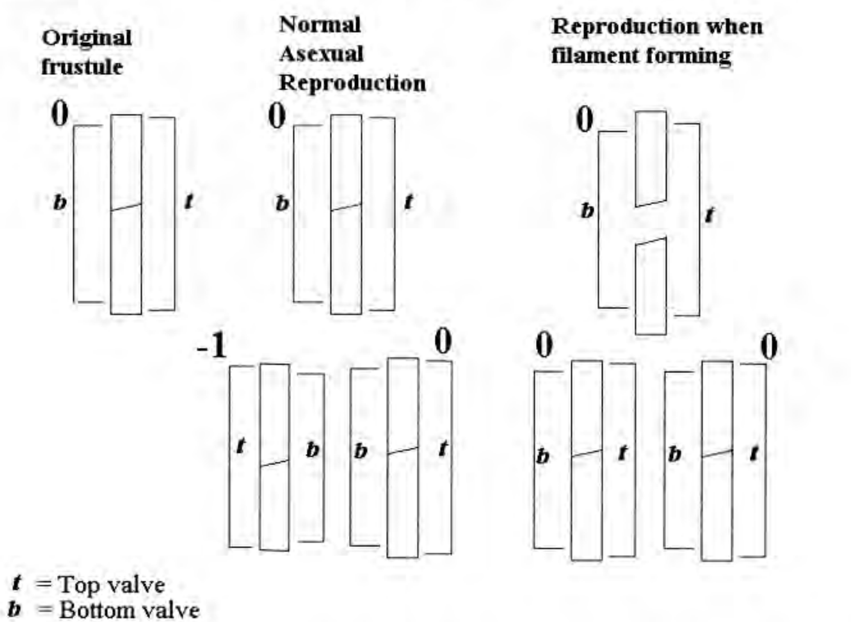
It can be seen from this illustration that if the previously described mechanism were to hold true for frustules living in a filament formation then the filament thickness would vary considerably. Since separate filaments of the same species are not always the same width (thickness) then the following statement must also be true.

"Frustules when existing in a filament colony divide and produce individuals of the same size whereas free living individuals divide and produce individuals, one the same size and one smaller."

This would then explain the different sizes of filament.

This then begs two questions.

1. What causes a frustule to go into colony producing mode?
2. How are individuals of the same size produced to add to the filament length?



Unless individuals of the same size come together by accident and produce filament colonies (which would be an extremely hit and miss affair) then the individuals in colonies must divide to produce two individuals of the same size. This can only be achieved if the lid of the diatom produces a bottom and the bottom of the original produces a top. To do this the individual would need more circumference than exists on the internal circumference of the frustule.

Producing a bottom to fit into the top is no problem as it will be the same size as the existing bottom. Producing a top to fit over the existing bottom would be more difficult.

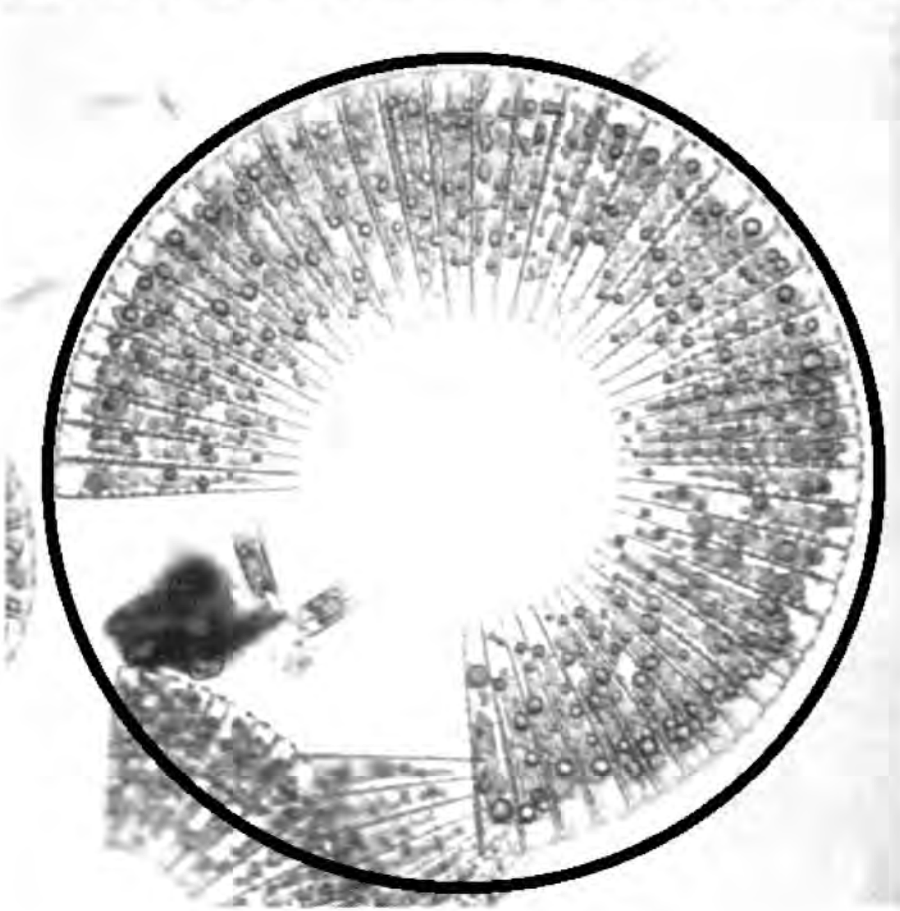
If the frustule has a girdle band that is flexible or expansible then a top could be produced.

The illustration on the previous page represents this action.

To what degree there would be deformation in frustule outline is not clear though there might be some.

This kind of mechanism would allow the cell to divide and produce a frustule of the same size without exposing the cell contents to the outside world.

It may be that the sprung nature of the girdle band allows for the building of a top valve that fits



just as snugly as the original top and is then flexed to allow the two new frustules to part.

It might be beneficial to produce a list of the species that have a split girdle band and mark against them those that form colonies, valve face to valve face. This includes those that form circular colonies, like *Meridion circulare*.

In the photograph (previous page) the circle is displaced by being broken, but you can see that the individuals are the same size.

This mechanism might then provide the answer to Question 2.

Question 1, what makes the individuals form filaments? This might be to do with environmental factors and individuals in a filament possibly passing chemical messages between each other.

Meridion Circulare Photograph by M. Samworth

We would like to hear from someone who can provide definite answers to these questions. We realise that our somewhat simplistic approach to these questions may prove to be troublesome but would appreciate a more authoritative explanation as our explanations are based simply on logical supposition.

Pure Diatom Cultures

A review of the Sciento Diatom Cultures by Mike Samworth

Sometime, a couple of years ago, I received a catalogue from a company called Sciento. The very colourful brochure detailed numerous live cultures of mainly algae and protozoa, principally for educational use. Indeed, I have since used this as a source for such organisms in this context. However, it was not until later that I noticed that they supplied a number of diatoms in culture, eleven different ones in all are listed in the catalogue, or 'catalist' as it is described in the inside front cover.

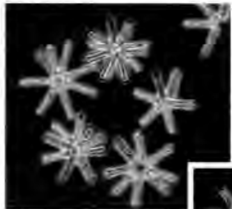
So, this early summer I decided to send for some of these cultures, and this is my description of what they sent. All samples come in small polythene bottles with a 'spout' that can be opened to allow entry of air, or closed for transit. The 'group photo' below shows these containers, which to my mind seem ideal for the purpose.

The samples sent were as follows;

Synedra sp., Fragilaria sp., Pinnularia sp., Stephanodoscus sp., Nitzschia sp., Navicula sp. (two types), Melosira sp., Tabellaria sp., Asterionella sp.

As you can see, there has are no definitive species names on the bottles, though the catalogue does give names for some, eg. Melosira varians, Pinnularia nobilis. I have read on a number of occasions the statement that culturing and sub-culturing algae in laboratories can result in some variation in morphology, and I hope to follow this up with these samples.

It is particularly nice to be able to view and photograph diatoms in a pure culture. Although there is always the chance a 'rogue' cell or two of another species can be seen in the field of view, this does not spoil the fact that there are hundreds of cells of one type, uncluttered by debris or other cells. I especially liked the Asterionella, as shown below, where the variation in colony size and grouping can be observed. In these circumstances, it is somewhat easier to make a preparation of a suitable depth (no debris, grit etc to make it too thick) and cell density to get the photograph you want.



The other great opportunity with these cultures, is to clean the material, and thus end up with a good source of predominantly one species, either for strews or selected/arranged slides. I have done this so far with one of the samples, and due to the purity, used the hydrogen peroxide technique as described in a previous article. This proved most successful, with the added advantage of keeping some of the cellular arrangement, keeping the valves together, and certainly not producing the numerous girdle bands that the hot-acid method usually does.

Another opportunity is to experiment with keeping these cultures alive, and indeed increasing cell numbers. This is a rather longer-term project, but if someone wants to try this, we would certainly look forward to reading about it in the pages of The Amateur Diatomist. The cultures provided take the hard work and uncertainty out of collecting and isolating a genus and indeed a species and is an excellent basis from which you can perform a host of experiments.

Famous Diatomists

Eduard Thum by Mr. J. J. Lobenstein (Dutch Flemish Circle of Diatomists)

Translated by Brian Darnton

Thum was born on the 7th of April 1847 and died on the 26th of September 1926. As a young man he showed a great interest in microscopical animals and plants and enjoyed mounting such organisms for the microscope. It was not surprising then, that with such an overwhelming interest that at the age of 28 he gave up his trade as an instrument maker and devoted himself entirely to the professional making of microscopic preparations. He continued this activity for the rest of his

life. During these years he became a master of the art of slide making and especially the laying of diatoms.

As a qualified instrument maker his knowledge was particularly useful in the manufacture of apparatus for the collection of diatoms and making of slides.

The most important and meaningful factor that won him a place of honour among his peers was his mounting skill.

Initially Thum coped with anything that there was to mount, yet slowly but surely he applied himself to laid preparations. He began to work with radiolaria, but then changed to diatoms which he loved. He described them as tiny little plants that were the most beautiful and most interesting objects of microscopy. He wrote of them that the sheer beauty of their infinitely shaped bodies delighted the eyes, and that their delicately arranged shells stimulated the explorer into ever renewed studies.

His mounting skills were well known by his peers, and most collections of the day included at least some of his slides.

He received diatoms and radiolaria from all over the world, from recent as well as fossil sites. He made strewn slides as well as single and circle collections. His Type slides and Exhibition slides were real works of art, which often included hundreds of diatoms. A contemporary wrote that one had to see the busy man at work in order to understand what it was to work for up to 12 hours behind the microscope with such simple equipment. Thum had great aptitude, but above all he had a great love of the microworld. It was a pleasure for him to instruct an acquaintance in the secrets of microscopy. In 1906 his institute was integrated into the Frank'sch Verlagsnandlug in Stuttgart, but he just carried on manufacturing slides until the end of his life.

Editor's Notes:-

Owner and Founder of Institut fur Mikroskopie, 35 Bruderstrasse, Leipzig to 1894 and then situate at Johannis-Alle.

Source; Photo-micrography, Edmund J. Spitta, The Scientific Press Ltd, 1899.

"We know of no mounter of diatoms in the United Kingdom that can surpass Mr. Firth, of Clifton Park Avenue, Belfast, and few that can equal him, save Mr Gatrell, of Barnes, whose work is of the most excellent quality; [Whilst these pages are passing through the press Mr. Gatrell has sent us some Amphipleura pellucida mounted in realgar and other diatoms in quinidine and piperine which are of the highest order of merit, especially the Amphipleura pellucida, which of late has been so difficult to obtain.] but Thum, of Leipzig, and Moller, of Wedel Holstein, also supply slides of exceptional merit and perfection."

Watermills - Devon, Dorset and Somerset

Following the list of watermills in the Vol.I. No. 2. of The Amateur Diatomist we have been sent the following list of similar sites for Devon, Dorset and Somerset. Site reports welcome should any of you visit the locations.

Dunster Watermill, Somerset.
Built in 1680 and still working. Stone ground corn flour produced. Alongside the river Avill.
Gants Mill, Bruton, Hornsbury, Chard, Somerset.
200 year old working watermill. Now a hotel and restaurant in a landscaped water garden.
Mangerton Watermill, Bridport, Dorset.
17th Century working watermill. Plus museum of rural bygones
Otterton Watermill, Budleigh Salterton, Devon.
The last working mill on the river Otter. Still grinding grain after 1000 years. Water wheel.
Sturminster Newton Mill & Museum, Dorset.
18th Century working mill Driven by a 1904 turbine. On the banks of the river Stour.
Town Watermill, Lyme Regis.
Historic stone corn flour mill. On river Lym. Restoration ongoing.

We know that we now have some Stateside readers as the following list has been sent to us of watermills in Ozark County, Missouri, U.S.A. If anyone does go collecting there perhaps they would like to send some samples or a precis of their results. It would be interesting to do a comparison.

Dawt Mill, Ozark County, Missouri
HC 1, Box 1090, Tecumseh, MO 65760. (417) 284-3540
Hodgson Mill, Ozark County Missouri.
Zanoni Mill, Ozark County, Missouri.
Zanoni Mill Inn, HC 78 Box 1010, Zanoni, MO 65784. (417) 679-4050
Rockbridge Mill, Ozark County, Missouri.
Rainbow Trout Ranch, Rockbridge, MO 65741. (417) 679-3619
Hammond Mill, Ozark County, Missouri

Mounting techniques

Part V - Styrax

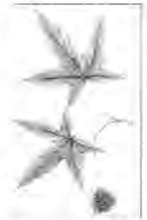
This issues article, rather than being concerned with the method of applying diatoms to a slide, is on a particular mountant and quite specifically on how to make it.

The mountant in question is Styrax.

There is some debate as to which tree actually produces the base resin of Styrax. This base resin is called Storax, and in all likelihood the resin comes from any one of the trees quoted. Older texts tend to quote *Styrax Orientalis* as the source whilst modern Storax appears to be produced by *Liquidambar styraciflua*, the Sweet Gum or American Red Gum. There are other closely

allied species ranging throughout the world and some, if not all, of these may well be a source of suitable resin.

This latter species may be cultivated in the UK, though tapping trees to obtain resin is probably not a viable alternative to buying the resin.



The following descriptions of Storax have been located, either via the World Wide Web (WWW) or from publications and indicate the diversity of the sources of Storax. Quite which is the best for microscopical purposes we are unsure but it might prove an interesting project for someone (offers invited).

The following, most comprehensive, description was found in King's American Dispensatory by Harvey Wickes Felter, M.D., and John Uri Lloyd, Phr. M., Ph. D., 1898

Styrax (U. S. P.)-Storax.

"A balsam prepared from the inner bark of *Liquidambar orientalis*, Miller"-(U.S.P.) (*Liquidambar imberbe*, Aiton).

Nat. Ord.-*Hamamelaceae*.

COMMON NAMES AND SYNONYMS: *Liquid storax, Balsamum storacis, Prepared storax, Styrax praeparatus* (Br.).

Botanical Source.-This tree is a native of Asia Minor, in the extreme southwest of which country it is gregarious, forming forests of trees of from 20 to 60 feet high. The leaves are bright-green, perfectly smooth even at the axils of the veins on the under side, shining above, pale beneath, palmate, with serrated, obscurely trilobed divisions. The aments or catkins are of distinct sexes, monoecious, having a common 4-leaved deciduous involucre; males conical; anthers numerous and subsessile; females globose, composed of small scales which surround the ovary, grow together, and gradually enlarge; calyx urceolate, 1-leafed, 2-flowered; styles 2, subulate; capsules 2, oblong, 1-celled, many-seeded (L.-Jus.).

History and Preparation.-Mr. Daniel Hanbury, in 1857, ascertained that the original storax, derived from *Styrax officinale*, had disappeared from commerce, and that the liquid storax then in the market was collected in the southwestern part of Asia Minor, from **Liquidambar orientalis**, or Oriental sweet-gum tree (see Amer. Jour. Pharm., 1857, p. 249, and 1863, p. 436). The district opposite the islands of Samos and Rhodus is now known to be the only place on the globe where liquid storax is collected on a commercial scale. This is done, according to Mr. H. Massopust (1896), by removing strips of the whole bark lengthwise, by means of a sharp instrument, laying bare the wood. One-fourth of the total bark is removed in one season, which lasts from July to September, during which time the tree is in its sap. The bark is made into bundles and softened by throwing them into kettles with boiling water, and is then pressed out in bags made of goat's hair or in baskets. The balsam is then put into barrels, together with about one-fourth its weight of water. This is intended to keep the balsam soft and prevent loss of its aroma. Before the storax is put on the market, the water is poured off, and the balsam is kneaded with a stick so as to remove "the last drop of water." On storax so treated, the seller allows 16 per cent of tare. It is also made up in tin cans which are put in to boxes (Prof. J. Weller, Zeitschr. des Allg. Oesterr. Apotheker-Vereins, 1896, p. 19). It is shipped to Constantinople, Smyrna, and Bombay, and reaches the western commerce by way of Trieste.

The residual bark from which storax is removed by pressure, is also an object of commerce under the name of Cortex thymiamati. It has a strong odor of storax, and is used at Trieste in the preparation of Storax calamitus, which is a mixture of ground cortex thymiamati (3 parts) with liquid storax (1 part) and some olibanum (J. Moeller, loc. cit.), the purpose being to bring storax into a more easily manageable form. Exposed to the air for some time, it becomes covered with a whitish efflorescence consisting of styracin. Much of the commercial storax calamitus however, is merely "an odoriferous sawdust." (See an interesting article on storax, in Pharm. Era, Vol. VIII, 1892, p. 135.)

Description and Tests.-The official storax must conform to the following requirements: "A semiliquid, gray, sticky, opaque mass, depositing, on standing, a heavier, dark-brown stratum; transparent in thin layers, and having an agreeable odor and a balsamic taste. Insoluble in water, but completely soluble (with the exception of accidental impurities) in an equal weight of warm alcohol. If the alcoholic solution, which has an acid reaction, be cooled, filtered, and evaporated, it should leave not less than 70 per cent of the original weight of the balsam, in the form of a brown, semiliquid residue, almost completely soluble in ether and in carbon disulphide, but insoluble in benzin"-(U S. P.). This evidently refers to cold benzin, as some constituents of storax are soluble in boiling benzin (see Chemical Composition). "When heated on a water-bath, storax becomes more fluid, and if it be then agitated with warm benzin, the supernatant liquid, on being decanted and allowed to cool, will be colorless, and will deposit white crystals of cinnamic acid and cinnamic ethers"-(U.S. P.).

Storax is heavier than water. It is sometimes adulterated with mineral matters, resin, turpentine, etc. If large quantities of resins are present, the balsam hardens in cold weather; genuine storax has at all seasons more or less the consistency of honey (J. Moeller, loc. cit.). An important aid in detecting the presence of turpentine and other resins in storax consists in determining the acid number, the saponification and iodine numbers, and other data (see for example, F. Evers, Jahresb. der Pharm., 1896, p. 116; and K. Dieterich, ibid., 1897, p. 11). The British Pharmacopoeia and the German Pharmacopoeia direct that storax be purified by alcohol previous to its being used medicinally.

Chemical Composition.-The chief constituents of storax are certain esters of cinnamic acid, together with free cinnamic acid. These esters are crystallizable styracin (cinnamyl-cinnamate, C6H5CH:CH.COOC9H9, derived from cinnamyl-alcohol C9H9OH, or C6H5CH:CHCH2OH); oily phenyl-propylcinnamate (C6H5CH:CH.COOCH2CH2CH2C6H5), ethyl cinnamate (C6H5CH:CH.COOC2H5), and the cinnamate of the trivalent alcohol storesin (C36H55[OH]3), a substance existing in storax also uncombined and in the form of a sodium compound. It constitutes altogether about one-half of the weight of storax (W. von Miller, Liebig's Annalen, 1877, and Amer. Jour. Pharm., 1878, p. 455; also compare Liquidambar). Other constituents of storax are water (from about 20 to 25 per cent), the hydrocarbon styrol, resin, caoutchouc, ethyl-vanillin, traces of benzoic acid, etc.

W. von Miller, in separating these constituents, proceeded as follows: Storax was wrapped in a linen bag and heated in the vapors of distilling water. The distillate contained volatile styrol (styrolene, cinnamene, phenyl-ethylene, C8H8, or C6H5.CH:CH2). The residual storax passed through the cloth, leaving caoutchouc and resin. The storax was next extracted with 3 times its quantity of diluted caustic soda solution (of about 5 per cent NaOH). This dissolved part of the storesin and all of the free cinnamic acid. The former was precipitated from the solution by carbonic acid gas, then the latter by hydrochloric acid. The residual storax was extracted with cold alcohol, the solvent distilled off, and the residue treated with hot petroleum-ether, which dissolved styracin and the other esters, leaving the remainder of storesin undissolved.

Cinnamic acid (C6H5CH:CH.COOH) is the common constituent of several balsams, e. g.,

balsam of Peru, tolu, storax, etc., and is formed in old oil of cinnamon by oxidation of cinnamic aldehyde (Dumas and Péligot, 1834). It has also been obtained synthetically from benzaldehyde (bitter almond oil) by Perkin. Storax usually yields between 6 and 12 per cent of the acid, but Loewe obtained as much as 23 per cent. It forms shining, odorless crystals of an aromatic, somewhat acrid taste, soluble in hot water, alcohol, and ether. Oxidizers convert it into benzaldehyde and benzoic acid. Its cinnamyl-ester is styracin; its benzyl-ester is cinnameïn (see Balsam of Peru).

Related Species and Preparations.-*Styrax officinale*, Linné, is a small tree growing from 12 to 20 feet or more in height, with the branches alternate and round, having its bark smooth, and the young shoots downy. This plant inhabits the Levant, Palestine, Syria, and is common all over Greece; it is cultivated in several parts of Europe, but at the present, day produces no balsam. It formerly yielded true storax, an article no longer in commerce (see Pharmacographia).

Liquidambar Formosana, Hance.-Formosa and southern China. Yields "a, dry, terebinthinous resin of agreeable fragrance when heated"-(Pharmacographia). The Chinese use it.

Altingia Excelsa, Noronha (Liquidambar Altingiana, Blume).-The rasamala, of Java and Malaysia. Yields a fragrant resin (see Pharmacographia).

Symplocos racemosa, Roxburgh (Nat. Ord.-Stryraceae), Lotur bark.-India. Contains 3 alkaloids, loturine, colloturine, loturidine (Hesse). In dilute acid solutions all show deep violet-blue fluorescence. In India this bark enters into numerous preparations for bowel disorders, and a decoction is used to give "firmness to spongy and bleeding gums." It is also used in menorrhagia, and as a mordant in dyeing red (Dymock, Mat. Med. of Western India).

Other descriptions:

STORAX TREE *STYRAX OFFICINALIS*

This tree grows like the Quince tree in size and shape. The leaves are long and round, white underneath and stiff. The white flowers are followed by berries. The bark contains a gum. There are other similar varieties.

Where to find it: It prefers hotter climates such as in Cyprus and Syria. It will grow elsewhere, but is unlikely to produce any gum.

Flowering time: Spring. The berries appear in early autumn.

Modern uses: A stimulating expectorant, Storax is a balsam obtained by slitting the bark of the tree. It acts in a similar way to other balsams and is mainly used for asthma, bronchitis and catarrh. It is an ingredient of Friar's Balsam. Ointments containing Storax are used for the treatment of scabies and ringworm. It is seldom available except as an ingredient of pharmaceutical preparations

from http://www.alchemy-works.com/incense_storax.html

Storax (Styrax, Stacta, Sweet Oriental gum) The aromatic resin of the Turkish tree, *Liquidambar orientalis*.

from The Macmillan Encyclopedia 2001

A tree or shrub belonging to the genus Styrax (130 species), occurring in tropical regions. They have small white flowers and several species are cultivated as ornamentals, including the Japanese snowbell (*S. japonicum*), which grows to a height of 9 m, and *S. officinalis*, from which the vanilla-scented resin known as storax was formerly obtained. The storax used today in cough mixtures, pastilles, etc., is extracted from trees of the genus Liquidambar. The Sumatran species *S. benzoin* is a source of benzoin. Family: *Styracaceae*.

from http://www.scents-of-earth.com/storax3.html

Storax liquid balsam - *Liquidambar orientalis* - from Turkey. Turkish storax is considered the most prized of all storax balsams.

Storax resin is yielded by the storax tree, which grows up 10 metres (33 ft.) in height. It sheds maple-like leaves in late fall of each year. The resin is harvested using a tool upon the trunk and collecting the resulting resin flow. The resin is dried, cleaned and cooked and extracted with alcohol to produce pure Storax resin.

Storax resin has been used since the days of ancient Mesopotamia, Phoenician traders and Egypt for its wonderful aromatic properties.

from an anonymous source

Common Names and Botany: Levant storax (*L. orientalis* Mill.) is obtained from a small tree native to Turkey. American storax is obtained from *L. styraciflua L.*, a large tree found near the Atlantic coast from New England to as far south as Central America. Also known as the sweet gum tree, red gum, bilsted, star-leaved gum, styrax and the alligator tree.

Scientific Names: *Liquidambar orientalis, L. styraciflua* Family: *Hamamelidaceae*

Commercial Storax resin, we know, has been used without further purification, simply dissolved in Chloroform. We have a quantity of this and have tried it on a number of mounts. Despite its dark brown, almost black, appearance when applied beneath a coverslip it is so thin that even the brown appearance of the mount doesn't affect an image to any significant degree. In this raw form, however, it has a tendency to shrink back and become somewhat brittle. We think that the mountant Dirax is, in fact, this raw resin in Chloroform.

We have a notebook by R. I. Firth that gives the following description for preparing Styrax for microscopical use.

1. Take half a pound of Crude Styrax (Storax).

2. Dissolve in Chloroform.

3. Filter into an old saucepan.

4. Fill saucepan with cold tap water.

5. Bring to the boil and leave at boil for twenty minutes.

6. Pour off as much water as possible whilst still hot.

7. Repeat stages 4. to 6 three more times.

8. Pour remaining styrax onto Pyrex dishes (about a foot square) in as thin a layer as possible.

9. Place dishes outside in a sunny location. Leave to get several hundred hours of sunshine.!

10. The layer of Styrax will attract flies and dust but this does not matter as these will be filtered off after sunchine treatment.

11. The styrax will become 'horny' (we assume this means stiff) and finally brittle.

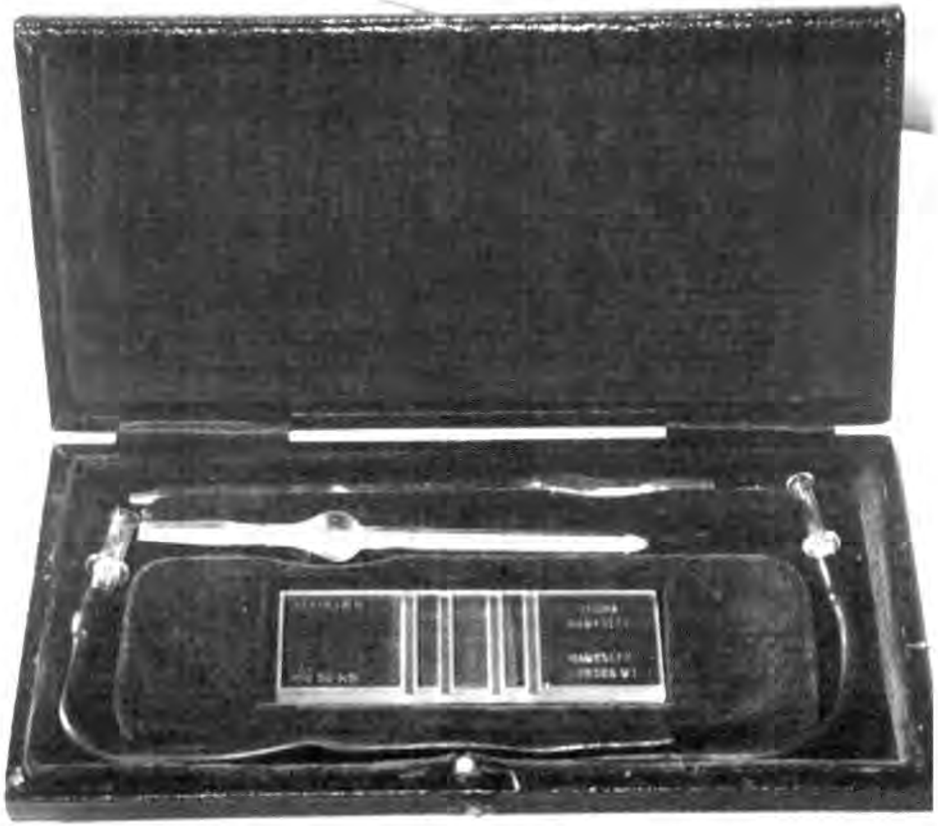
12. When the above occurs scrape styrax into a bottle. Dissolve in Chloroform and filter.

13. The result should be a light golden syrup.

The 'several hundred hours of sunshine' should put most people off, but if it is UV that affects the compound then maybe there is a modern method of exposure that will achieve the same result. Another opportunity for all you budding chemists.

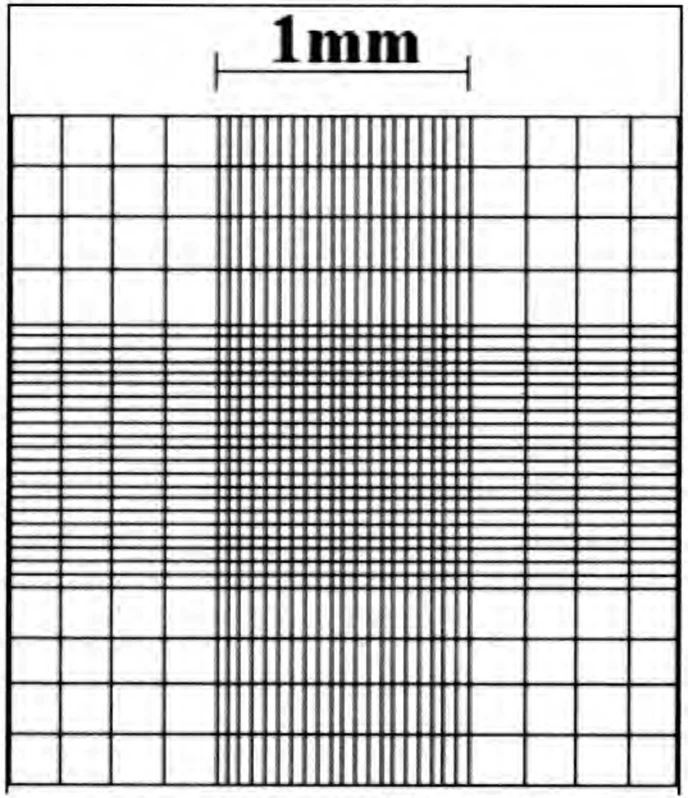
The Haemocytometer

by Mike Samworth



In scientific studies related to diatoms and other algae that are carried out, there are often data sets relating to frustule numbers per volume of water. It is not always mentioned by what method this has been worked out, and even rarer is an explanation of how it is done. The simplest method to use is that of employing a haemocytometer. As the name implies, this device is principally used to make counts of blood cells for medical purposes. However, it can also be put to use to count other objects, notably yeast cells in the brewing industry, and of course can be used for diatoms.

The haemocytometer is basically a thick (about 5mm) slide that contains a very accurately scribed grid of lines. These lines cross at right angles to make a large square, which itself is split into smaller squares, which again are subdivided into yet smaller ones. There are actually a number of different types or 'patterns' but they follow much the same principle. It helps to look at a diagram showing one particular design.



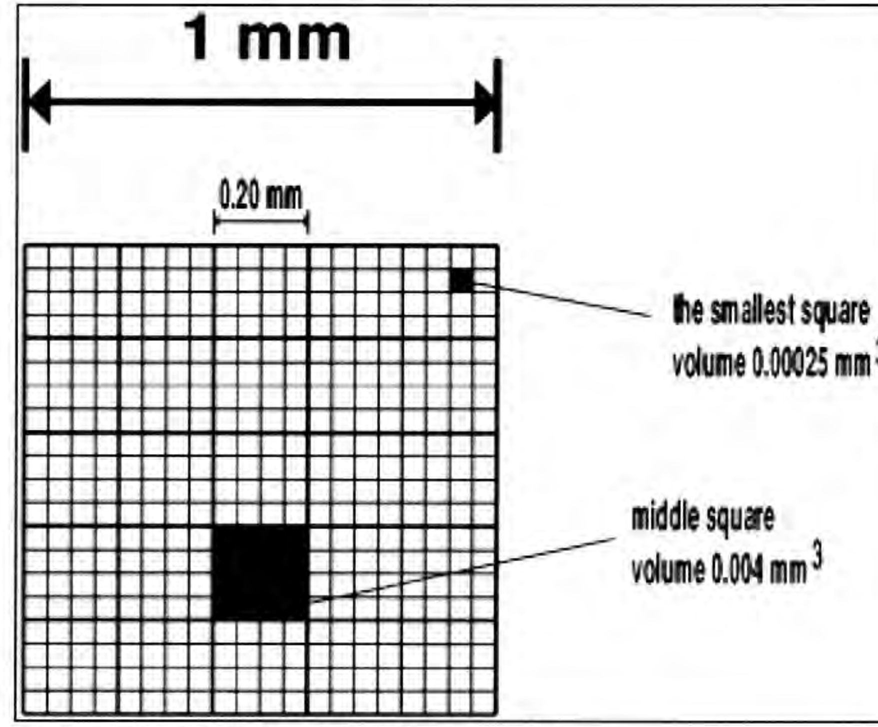
As you will have seen from the above, the dimensions of the grid are known, and the depth of liquid that will be held on the slide. Thus, taking the two together means that the volume of liquid can be calculated for each type of square.

There are three sizes of 'cell' or square;

The largest has dimensions of 1mm x 1mm and so taking into account the depth of 0.1mm means a volume of 1 x 1 x 0.1 = 0.1 mm3

This large central square is sub-divided into 5 x 5 = 25 smaller squares.

Thus, each of these has a volume of 0.2 x 0.2 x 0.1 = 0.004 mm3.

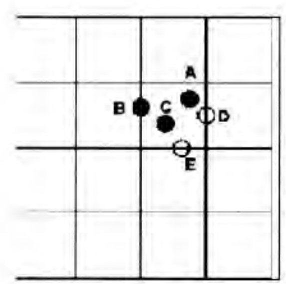


Each of these squares is further subdivided into 4 x 4 = 16 squares.

The volume of each of these is 0.05 x 0.05 x 0.1 = 0.00025 mm3.

The diagram below illustrates the relationship between these three types of square.

In use, a small drop of the suspension of cells to be counted is put onto the central area of the slide, using a pipette or plastic syringe. Then a specialised thickened cover-glass is placed on top. It has to be thick since pressure needs to be applied to bring the two close together, to ensure a uniform depth to the chamber. Return the slide to the microscope stage and focus on the lines.



It depends on the size of the valves to be counted which of the three types of square is used. The square able to contain say half a dozen valves is the most suitable one.

To ensure accuracy, something needs to be done about those valves overlapping lines. This so-called 'edge effect' can be overcome by counting valves overlapping top and left lines, but discounting bottom and right lines for any one square. If enough squares are used, then there should be equal proportions on any one side, so they should cancel out. The diagram below illustrates this.

In the square shown, cells A, B, C are counted and D,E ignored.

A sufficient number of squares should be counted, say 20, and an average calculated. Also, to maintain uniformity, these squares should be selected randomly. Random number tables, or numbers generated on a calculator can be used in combination with a grid system like on an OS map, i.e. using two-way co-ordinates.

The number of valves in the suspension can be calculated using;

DxNSxC where D = dilution of original suspension (if needed), N = total number of valves counted, S = number of squares counted and C = volume of the square type used

An alternative is to use the average for that square type, and its volume, and just calculate the number per mm3.

e.g.

average valves in type C square = 27

volume of square C = 0.00025 mm3

so, valves/mm3 = 1/0.00025 x 27 = 108 000

and remembering that two valves are needed to make a frustule (one diatom): number of diatoms = 108/2 = 54.

When considering the dilution, one should not forget, the original volume from which the resultant cleaned material was acquired, otherwise the result is meaningless. This original volume should not include any of the liquor collected with the diatoms but just the diatom mass itself.

Holiday Diatoms

Some of you will be starting to (or have already begun to) consider next years holiday. If you own a portable microscope (especially one of the Open University McArthur models - being plastic and very light) then you might consider doing a bit of collecting whilst you are away. For ornithologists there are publications available detailing the bird fauna of a particular region. For the Diatomist there are older publications for some regions but these tend to be rare and expensive. We came upon two rather useful lists on the internet, the first of which relates to a popular location for British and German holidaymakers - Turkey.

A gentle word of warning or a tale of woe. Sometime ago a friend was visiting the States and an acquaintance there had some literature and some Diatomaceous earth to send me. What a stroke of luck! The friend was visiting the same town that my acquaintance hailed from. I arranged for them to meet and for the friend to pick up the parcel, thereby saving extortionate postage costs. This my friend duly did and then returned to Boston to catch a flight home. He arrived the night before the flight, booked into an hotel, went for a meal and retired for the night. He had to be up at 2.00am to get to the airport for the flight and found that he just couldn't get to sleep. Looking around for something to do he espied the package and thought he would impress me on his return with his new found knowledge of the diatomaceae. He undid the parcel, took out the literature and began thumbing through it. He reached the middle portion of the pamphlet and on turning the page was alarmed to see two plastic push-seal envelopes containing an off-white substance flop out from between the pages to land on his lap. In a state of panic he picked them up and promptly flushed them down the toilet!

Turkish Seas Diatom Checklist

Achnanthes brevipes Agardh
Achnanthes longipes Agardh
Actinocyclus octonarius Ehrenberg
Actinocyclus ralfsii (W. Smith) Ralfs in Pritchard
Actinoptychus splendens (Shadbolt)
Ralfs in Pritchard
Amphiprora alata (Ehrenberg) Kutz
Amphiprora gigantea Grunow
Amphora ostrearia Brébisson in Kützing
Amphora ovalis Kützing
Asterionella japonica Cleve et Müller
Asterionella notata Grunow in Van Heurck
Asterionellopsis glacialis (Castracane) F. E. Round
Asterolampra grevillei (Wallich) Greville
Asterolampra marylandica Ehrenberg
Asterolampra van-heurckii Brun.
Asteromphalus flabellatus (Brébisson) Greville
Asteromphalus heptactis (Brébisson)
Ralfs in Pritchard
Asteromphalus hookeri Ehrenberg
Asteromphalus hyalinus Karsten
Bacillaria paxillifera (O. F. Müller) Hendey
Bacteriastrum delicatulum Cleve
Bacteriastrum elegans Pavillard
Bacteriastrum elongatum Cleve
Bacteriastrum hyalinum Lauder
Bacteriastrum hyalinum var. princeps
(Castracane) Ikari
Bacteriastrum mediterraneum Pavillard
Ballerochea horologialis Von Stosch
Biddulphia alternans (Bailey) Van Heurck
Biddulphia aurita (Lyngbye) Brébisson et Godey
Biddulphia pelagica Schröder
Biddulphia pulchella Gray
Biddulphia tridens (Ehrenberg) Ehrenberg
Cerataulina pelagica (Cleve) Hendey
Chaetoceros affine Lauder
Chaetoceros affine var. willei (Gran) Hustedt
Chaetoceros anastomosans Grunow in Van Heurck
Chaetoceros atlanticum var. atlanticum
Chaetoceros atlanticum var. neopolitanum
(Schröder) Hustedt
Chaetoceros boreale Bailey
Chaetoceros breve Schütt
Chaetoceros coarctatum Lauder
Chaetoceros compressum Lauder
Chaetoceros constrictum Gran
Chaetoceros costatum Pavillard
Chaetoceros curvisetum Cleve
Chaetoceros dadayi Pavillard
Chaetoceros danicum Cleve
Chaetoceros debile Cleve
Chaetoceros decipiens Cleve
Chaetoceros densum (Cleve) Cleve
Chaetoceros diadema (Ehrenberg) Gran
Chaetoceros didymum var. anglica (Grunow) Gran
Chaetoceros didymum var. protuberans
(Lauder) Gran et Yendo
Chaetoceros diversum Cleve
Chaetoceros eibeni
(Grunow) Meunier in Van Heurck
Chaetoceros gracile Schütt
Chaetoceros holsaticum Schütt
Chaetoceros imbricatum Mangin
Chaetoceros laciniosum Schütt
Chaetoceros lauderi Ralfs in Lauder
Chaetoceros lorenzianum Grunow
Chaetoceros messanense Castracane
Chaetoceros perpusillus Cleve
Chaetoceros peruvianum Brightwell
Chaetoceros pseudocurvisetum Mangin
Chaetoceros rostratum Lauder
Chaetoceros similis Cleve
Chaetoceros simplex Ostenfeld
Chaetoceros sociale Lauder
Chaetoceros teres Cleve
Chaetoceros tetrastichon Cleve
Chaetoceros tortissimum Gran
Chaetoceros vistulae Apstein
Chaetoceros wighami Brightwell
Climacosphenia elongata Bailey
Climacosphenia moniligera Ehrenberg
Cocconeis scutellum Ehrenberg
Coscinodiscus centralis Ehrenberg
Coscinodiscus concinnus W. Smith
Coscinodiscus granii Gough
Coscinodiscus lineatus Ehrenberg
Coscinodiscus marginatus Ehrenberg
Coscinodiscus oculus-iridis (Ehrenberg)
Coscinodiscus perforatus var. pavillardi
(Forti) Hustedt
Coscinodiscus radiatus Ehrenberg
Coscinodiscus wailesii Gran and Angst
Cyclotella meneghiniana Kützing
Cylindrotheca closterium
(Ehrenberg) Reimann et Lewin
Cymbella turgidula Grunow

Dactyliosolen antarticus Castracane
Dactyliosolen blavyanus (H. Peragallo) Hasle
Dactyliosolen fragilissimus (Bergon) Hasle
Dactyliosolen mediterraneus H. Peragallo
Desmarella moniliformis Kent
Diploneis bombus Ehrenberg
Ditylum brightwelli
(T. West) Grunow in Van Heurck
Fragilaria crotonesis Kitton
Fragilariopsis atlantica Paasche
Fragilariopsis cylindrus
(Grunow) Krieger in Helmcke & Krieger
Eucampia cornuta (Cleve) Grunow
Eucampia zoodiacus Ehrenberg
Grammatophora marina (Lyngbye) Kützing
Guinardia cylindrus (Cleve) Hasle
Guinardia flaccida (Castracane) H. Peragallo
Gyrosigma balticum (Ehrenberg) Rabenhorst
Gyrosigma fasciola (Ehrenberg) Griffith et Henfrey
Gyrosigma spenceri (Quekett) Griffith et Henfrey
Gyrosigma tenuissimum
(W. Smith) Griffith et Henfrey
Helicotheca thamesis (Schrubsole) Ricard
Hemiaulus hauckii Grunow in Van Heurck
Hemiaulus membranaceus Cleve
Hemiaulus sinensis Greville
Lauderia annulata Cleve
Leptocylindrus danicus Cleve
Leptocylindrus minimus Gran
Licmophora abbreviata Agardh
Licmophora ehrenbergii (Kutzing) Grunow
Licmophora flabellata Agardh
Licmophora gracilis (Ehrenberg) Grunow
Licmophora paradoxa (Lyngbye) Agardh
Lithodesmium undulatum Ehrenberg
Mastogloia angulata Lewis
Mastogloia fimbriata (Brightwell) Cleve
Mastogloia smithii Thwaites ex W. Smith
Mastogloia splendida (Gregory) Cleve
Melosira borreri Greville
Melosira moniliformis (Müller) Agardh
Melosira nummuloides C.A. Agardh
Navicula crabro Ehrenberg
Navicula lanceolata (Agardh) Kützing
Navicula pennata A. Smith
Navicula zostereti Grunow
Nitzschia longissima
(Brébisson in Kützing) Ralfs in Pritchard
Nitzschia lorenziana Grunow in Cleve et Grunow
Nitzschia panduformis Gregory
Nitzschia sicula (Castracane) Hustedt
Nitzschia sigma (Kützing) W. Smith
Odontella mobiliensis (Bailey) Grunow
Paralia sulcata (Ehrenberg) Cleve
Phaeodactylum tricornutum Bohlin
Plagiogramma van-heuckii Grunow
Pleurosigma angulatum (Quekett) W. Smith
Pleurosigma delicatulum W. Smith
Pleurosigma elongatum W. Smith
Pleurosigma formosum W. Smith
Pleurosigma macrum W. Smith
Pleurosigma normani Ralfs in Pritchard
Podocystis perrinensis
Pseudonitzschia delicatissima
(P. T. Cleve) Heiden in Heiden et Kolbe
Pseudonitzschia fraudulenta (Cleve) Hasle
Pseudonitzschia pseudodelicatissima (Hasle) Hasle
Pseudonitzschia pungens
(Grunow ex P. T. Cleve) Hasle
Pseudonitzschia seriata
(Cleve) H. Peragallo in H. & M. Peragallo
Rhabdonema adriaticum Kützing
Rhizosolenia acuminata (H. Peragallo) Gran
Rhizosolenia alata f. alata
Rhizosolenia alata f. gracillima (Cleve) Gran
Rhizosolenia alata f. indica (H. Peragallo) Gran
Rhizosolenia bergonii H. Peragallo
Rhizosolenia calcar-avis Schultze
Rhizosolenia castracanei H. Peragallo
Rhizosolenia delicatula Cleve
Rhizosolenia fragilissima Bergon
Rhizosolenia hebetata var. semispina (Hensen) Gran
Rhizosolenia imbricata var. shrubsolei
(Cleve) Schröder
Rhizosolenia robusta Norman in Pritchard
Rhizosolenia setigera Brightwell
Rhizosolenia stolterfothii H. Peragallo
Rhizosolenia styliformis Brightwell
Rhizosolenia temperei H. Peragallo
Schroederella delicatula (H. Peragallo) Pavillard
Skeletonema costatum (Greville) Cleve
Skeletonema menzelii
Guillard, Carpenter et Reimann
Stephanophyxis palmeriana
Stephanophyxis turris (Greville) Ralfs in Pritchard
Streptotheca thamesis Shrubsole
Striatella delicatula Kützing
Striatella interrupta (Ehrenberg) Heiberg

Striatella unipunctata (Lyngbye) Agardh
Surirella fastuosa Ehrenberg
Synedra fulgens (Greville) W. Smith
Synedra hennedyana Gregory
Synedra ulna (Nitzsch) Ehrenberg
Synedra undulata (Bailey) Gregory
Thalassionema nitzschioides
(Grunow) Mereschkowsky
Thalassiosira allenii Takano
Thalassiosira angulata (Gregory) Hasle
Thalassiosira anguste-lineata
(A. Schmidt) G. Fryxell et Hasle
Thalassiosira decipiens
(Grunow in Van Heurck) Jörgensen
Thalassiosira eccentrica (Ehrenberg) Cleve
Thalassiosira gravida Cleve
Thalassiosira hyalina (Grunow) Gran
Thalassiosira nordenskioeldii Cleve
Thalassiosira rotula Meunier
Thalassiosira subtilis (Ostenfeld) Gran
Thalassiosira tenera Proschkina-Lavrenko
Thalassiosira weissflogii
(Grunow) G. Fryxell et Hasle
Thalassiothrix frauenfeldii Grunow
Thalassiothrix longissima Cleve and Grunow
Thalassiothrix mediterranea Pavillard
Triceratium dubium Brightwell
Triceratium favus Ehrenberg
Tropidoneis maxima Gregory

The second lists species to be found on the Western coast of Sweden.

Specie	**Salinity Preference B=Brackish M=Marine F=Freshwater**	**Habitat**
Achnanthes brevipes Agardh	B (M)	epiphytic, epilithic
Achnanthes delicatula (Kützing) Grunow	B (F)	episammic, epilithic
Achnanthes lanceolata (Grunow) Lange-Bertalot	F (B)	episammic, epilithic
Achnanthes lemmermannii Hustedt	B	episammic
Actinocyclus octonarius Ehrenberg	B (F)	pelagic
Actinoptychus senarius (Ehrenberg) Ehrenberg	M (B)	tychopelagic
Amphora copulata (Kützing) Schoeman & Archibald	F (B)	
Amphora decussata Grunow	M (B)	
Amphora helenensis Giffen	M (B)	epipelic
Amphora ovalis (Kützing) Kützing	B (F)	epilithic, epipelic
Amphora veneta Kützing	B (F)	epipelic
Ardissonia crystallina (Agardh) Grunow	M (B)	epiphytic
Asterionellopsis glacialis (Castracane) Round	M	pelagic
Asterionellopsis kariana (Grunow) Round	M	pelagic
Attheya septentrionalis (Østrup) Crawford	B	episammic
Aulacoseira islandica (Müller) Simonsen	F (B)	pelagic
Aulacoseira subarctica (Müller) Haworth	F (B)	pelagic
Bacillaria paxillifer (Müller) Hendey	B (F)	epilithic, epipelic
Bacterosira bathyomphala (Cleve) Syvertsen & Hasle	M	
Brockmanniella brockmannii (Hustedt) Hasle, von Stosch. & Syvertsen	M	pelagic
Caloneis amphisbaena (Bory) Cleve	B	epipelic
Caloneis liber (Smith) Cleve	M	epipelic
Campylodiscus fastuosus Ehrenberg	M	epipelic
Cerataulina pelagica (Cleve) Hendey	M (B)	pelagic
Chaetoceros affinis Lauder	B (M)	pelagic
Chaetoceros costatus Pavillard	M	pelagic
Chaetoceros debilis Cleve	M	pelagic
Chaetoceros diadema (Ehrenberg) Gran	B (M)	pelagic
Chaetoceros didymus (Ehrenberg) Ehrenberg	M	pelagic
Chaetoceros lorenzianus Grunow	M	pelagic
Chaetoceros mitra (Bailey) Cleve	M	pelagic
Chaetoceros radicans Schütt	M	pelagic
Chaetoceros seiracanthus Gran	M	pelagic
Chaetoceros simplex Ostenfeld	B	pelagic
Chaetoceros socialis Lauder	M	pelagic
Cocconeis costata Gregory	M (B)	epiphytic
Cocconeis disculus (Schumann) Cleve	F (B)	episammic
Cocconeis distans Gregory	M	epiphytic
Cocconeis peltoides Hustedt	B (M)	episammic
Cocconeis placentula Ehrenberg	B (F)	epiphytic, episammic, epilithic
Cocconeis pseudomarginata Gregory	M (B)	epilithic
Cocconeis scutellum Ehrenberg	B	epiphytic
Cocconeis speciosa Gregory	B(M)	epiphytic
Cocconeis stauroneiformis (Smith) Okuno	B (M)	epiphytic
Coscinodiscus asteromphalus Ehrenberg	B	pelagic
Coscinodiscus concinnus Smith	M	pelagic
Coscinodiscus granii Gough	B	pelagic
Coscinodiscus radiatus Ehrenberg	B (M)	pelagic
Coscinodiscus wailesii Gran & Angst	M (B)	pelagic
Cyclostephanos dubius (Fricke) Round	F (B)	pelagic
Cyclotella spp. (Kützing) de Brébisson		
Cyclotella atomus Hustedt	F (B)	pelagic
Cyclotella choctawhatcheeana Prasad	B	pelagic
Cyclotella meneghiniana Kützing	B (F)	pelagic
Cyclotella radiosa (Grunow) Lemmermann	F (B)	pelagic
Cyclotella rossii Håkansson	B	pelagic
Cyclotella schumannii (Grunow) Håkansson	F (B)	pelagic
Cyclotella stelligera Cleve & Grunow	F (B)	pelagic
Cyclotella striata (Kützing) Grunow	B (M)	pelagic
Cylindrotheca closterium (Ehrenberg) Reimann & Lewin	B	pelagic, epipelic
Cymatosira belgica Grunow	M	episammic
Cymbella cistula (Ehrenberg) Kirchner	F	epiphytic
Delphineis surirella (Ehrenberg) Andrews	M (B)	episammic
Detonula confervacea (Cleve) Gran	M	pelagic
Dimeregramma minor (Gregory) Ralfs	M (B)	epipelic
Diploneis aestiva (Donkin) Cleve	M	epipelic
Diploneis aestuari Hustedt	F	epipelic
Diploneis bombus (Ehrenberg) Ehrenberg ex. Cleve	M	epipelic
Diploneis chersonensis (Grunow) Cleve	M	epipelic
Diploneis decipiens Cleve	M (B)	epipelic
Diploneis didyma (Ehrenberg) Ehrenberg	B	epipelic
Diploneis entomon (Ehrenberg) Cleve	M	epipelic
Diploneis interrupta (Kützing) Cleve	B	epipelic
Diploneis litoralis (Donkin) Cleve	M (B)	epipelic
Diploneis oculata (Brébisson) Cleve	B (F)	epipelic
Diploneis smithii (Brébisson) Cleve	B (F)	epipelic
Diploneis stroemii Hustedt	B	epipelic
Diploneis subcincta (Schmidt) Cleve	M	epipelic
Ditylum brightwellii (West) Grunow	M (B)	pelagic
Encyonema caespitosum Kützing	B (F)	epilithic
Encyonema silesiacum (Bleisch in Rabenhorst) Mann	F (B)	epiphytic, epilithic
Eunotia minor (Kützing) Grunow	F	epipelic
Fallacia cryptolyra (Brockmann) Stickle & Mann	B (M)	epipelic
Fallacia forcipata (Greville) Stickle & Mann	B (M)	epipelic
Fallacia litoricola (Hustedt) Mann	M (B)	epipelic
Fallacia pygmaea (Kützing) Stickle & Mann	B (F)	epipelic
Fallacia pseudolitoricola (Håkansson) Håkansson	B	epipelic
Fragilaria capucina Desmazières	F (B)	pelagic

Fragilaria crontonensis Kitton	F (B)	pelagic
Fragilaria striatula Lyngbye	B (M)	epiphytic
Fragilariopsis atlantica Paasche	M	pelagic
Gomphonema acuminata Ehrenberg	F (B)	epiphytic
Grammatophora marina (Lyngbye) Kützing	B (M)	epiphytic
Grammatophora oceanica Ehrenberg	M	epiphytic
Guinardia delicatula (Cleve) Hasle	M	pelagic
Gyrosigma acuminatum (Kützing) Rabenhorst	B (F)	epipelic
Gyrosigma fasciola (Ehrenberg) Griffith & Henfrey	B	epipelic
Gyrosigma tenuissimum (Smith) Griffith & Henfrey	B (M)	epipelic
Gyrosigma wansbeckii (Donkin) Cleve	B	epipelic
Hyalodiscus scoticus (Kützing) Grunow	M (B)	epiphytic
Leptocylindrus danicus Cleve	M (B)	pelagic
Leptocylindrus minimus Gran	M (B)	pelagic
Lithodesmium undulatum Ehrenberg	M	pelagic
Lyrella atlantica (Schmidt) Mann	M	epipelic
Lyrella hennedyi (Smith) Stickle & Mann	M	epipelic
Lyrella spectabilis (Gregory) Mann	M	epipelic
Mastogloia baltica Grunow	B (F)	epilithic, epipelic
Mastogloia smithii Thwaites	B (F)	epilithic, epipelic
Melosira arctica Dickie	B	pelagic
Melosira moniliformis (Müller) Agardh	B	epiphytic
Melosira nummuloides Agardh	B	pelagic
Navicula cincta (Ehrenberg) Ralfs	B (F)	epipelic
Navicula digito-radiata (Gregory) Ralfs	B	epipelic
Navicula lanceolata (C.A. Agardh) Ehrenberg	B	epipelic
Navicula peregrina (Ehrenberg) Kützing	B	epipelic
Navicula ramosissima (Agardh) Cleve	B (M)	epilithic, epipelic
Navicula recens (Lange-Bertalot) Lange-Bertalot	B (F)	epipelic
Navicula scutelloides Smith	F (B)	epipelic
Nitzschia distans Gregory	M (B)	epipelic
Nitzschia sigma (Kützing) Smith	B	epipelic
Nitzschia thermaloides Hustedt	B (F)	episammic
Odontella aurita (Lyngbye) Agardh	M (B)	epiphytic
Odontella mobilensis (Bailey) Grunow	M (B)	pelagic
Opephora olsenii MØller	B	epiphytic
Paralia sulcata (Ehrenberg) Cleve	B	tychopelagic
Parlibellus hamulifer (Grunow) Cox	M (B)	epilithic, epipelic
Petroneis granulata (Bailey) Mann	M	epipelic
Petroneis humerosa (Brébisson) Stickle & Mann	B	epipelic
Petroneis latissima (Gregory) Stickle & Mann	B (M)	episammic
Pinnularia quadratarea (Schmidt) Cleve	B (M)	epipelic
Plagiogramma staurophorum (Gregory) Heiberg	M (B)	epipelic
Plagiogrammopsis vanheurkii (Grunow) Hasle, von Stosch, & Syvertsen	M	pelagic
Pleurosigma angulatum (Quekett) Smith	M (B)	epipelic
Pleurosigma formosum Smith	M (B)	epipelic
Pleurosigma salinarum (Grunow) Grunow	B (M)	epipelic
Porosira glacialis (Grunow) Jørgensen	M	pelagic

Proboscia alata (Brightwell) Sundström	M	pelagic
Pseudonitzschia multiseries (Hasle) Hasle	M	pelagic
Raphoneis amphiceros (Ehrenberg) Ehrenberg	M	episammic
Rhabdonema arcuatum (Lyngbye) Kützing	B (M)	epiphytic
Rhabdonema minutum Kützing	B (M)	epiphytic
Rhizosolenia hebetata Bailey	B (M)	pelagic
Rhizosolenia pungens Cleve	M (B)	pelagic
Rhizosolenia setigera Brightwell	M (B)	pelagic
Rhoicosphenia curvata (Kützing) Grunow	B	epiphytic
Rhopalodia acuminata Krammer	B (M)	epilithic, epipelic
Skeletonema costatum (Greville) Cleve	B	pelagic
Stauroneis spicula Hickie	F (B)	epilithic
Stellarima stellaris (Roper) Hasle & Sims	M	pelagic
Stephanodiscus rotula (Kützing) Henedy/ neoastraea Håkansson & Hickel	F (B)	pelagic
Stephanopyxis turris (Arnott in Greville) Ralfs	M	pelagic
Surirella crumena Brébisson ex Kützing	B (F)	epilithic, epipelic
Surirella fastuosa Ehrenberg	M	epilithic, epipelic
Surirella ovalis Brébisson	F (B)	epilithic, epipelic
Tabellaria fenestrata (Lyngbye) Kützing/ flocculosa (Roth) Kützing	F	pelagic
Tabularia fasciculata (Agardh) Williams & Round	B (M)	epiphytic
Tabularia ktenoeides Kuylenstierna	M (B)	epiphytic
Thalassionema nitzschioides Grunow	B (M)	pelagic
Thalassiosira angulata (Gregory) Hasle	B (M)	pelagic
Thalassiosira anguste-lineata (Schmidt) Fryxell & Hasle	M (B)	pelagic
Thalassiosira baltica (Grunow) Ostenfeld	B (F)	pelagic
Thalassiosira eccentrica (Ehrenberg) Cleve	M (B)	pelagic
Thalassiosira gravida Cleve	M (B)	pelagic
Thalassiosira hyalina (Grunow) Gran	B (M)	pelagic
Thalassiosira lineata Jousé	M	pelagic
Thalassiosira minima Gaarder	M (B)	pelagic
Thalassiosira nordenskioeldii Cleve	M (B)	pelagic
Thalassiosira oestrupii (Ostenfeld) Hasle	B (M)	pelagic
Thalassiosira pacifica Gran & Angst	M (B)	pelagic
Thalassiosira punctigera (Castracane) Hasle	M (B)	pelagic
Thalassiosira rotula Meunier	M (B)	pelagic
Thalassiosira subtilis (Ostenfeld) Gran	M (B)	pelagic
Thalassiosira tenera Proschkina-Lavrenko	M (B)	pelagic
Toxarium undulatum Bailey	M	epiphytic
Trachyneis aspera (Ehrenberg) Cleve	M	epipelic
Triceratium alternans Bailey	M	epiphytic
Tryblionella acuminata Smith	B	epipelic
Tryblionella coarctata (Grunow) Mann	B (M)	epipelic
Tryblionella navicularis (Brébisson) Ralfs	B	epipelic
Tryblionella punctata Smith	B	epipelic

This list provides us with a useful opportunity to explain the habitat terms you may come across and which are featured in the list above.

pelagic - living in the surface waters

tychopelagic - A tychopelagic diatom spends most of its life cycle episammically, growing on a bottom substrate, until some water disturbance moves it into the water column.

epiphytic - growing on another plant

episammic - growing on a substrate of sand or mud

epilithic - living on rocks, stones or hard substrate

epipelic - growing within bottom sediments

Useful Notes

In this section we will be publishing those ephemera that we all compile when pursuing one line of interest or another. These snippets get filed away in the drawer designated 'things that will come in useful', never to see the light of day again. The very fact that it was necessary to compile them meant that either they had not been done before or were generally unavailable. Many others must have these hoards of 'Useful Information'. Rather than leave them gathering dust and book mites why not have them printed here for others to use.

Following the conversion table in the last issue it was pointed out that some quite old publications used proper fractions when specifying frustule dimensions e.g. Flora Europaea Algarum Aquae Dulcis et Submarinae, Sectio I by Rabenhorst 1864, uses fractions of a millimetre. Van Heurck, on the other hand, uses 'centiemes de millimetres' (hundredths of a millimetre or multiples of 10 microns).

Fractions of an inch	Microns
1/5 (0.200000)	5080
1/6 (0.166667)	4233.3418
1/7 (0.142857)	3628.5678
1/8 (0.125000)	3175
1/9 (0.111111)	2822.2194
1/10 (0.100000)	2540
1/11 (0.090909)	2309.0886
1/12 (0.083333)	2116.6582
1/13 (0.076923)	1953.8442
1/14 (0.071429)	1814.2966
1/15 (0.066667)	1693.3418
1/16 (0.062500)	1587.5
1/17 (0.058824)	1494.1296
1/18 (0.055556)	1411.1224
1/19 (0.052632)	1336.8528
1/20 (0.050000)	1270
1/21 (0.047619)	1209.5226
1/22 (0.045455)	1154.557
1/23 (0.043478)	1104.3412
1/24 (0.041667)	1058.3418
1/25 (0.040000)	1016
1/26 (0.038462)	976.9348
1/27 (0.037037)	940.7398
1/28 (0.035714)	907.1356
1/29 (0.034483)	875.8682
1/30 (0.033333)	846.6582
1/31 (0.032258)	819.3532
1/32 (0.031250)	793.75
1/33 (0.030303)	769.6962
1/34 (0.029412)	747.0648
1/35 (0.028571)	725.7034
1/36 (0.027778)	705.5612
1/37 (0.027027)	686.4858
1/38 (0.026316)	668.4264
1/39 (0.025641)	651.2814
1/40 (0.025000)	635
1/41 (0.024390)	619.506

1/42 (0.023810)	604.774
1/43 (0.023256)	590.7024
1/44 (0.022727)	577.2658
1/45 (0.022222)	564.4388
1/46 (0.021739)	552.1706
1/47 (0.021277)	540.4358
1/48 (0.020833)	529.1582
1/49 (0.020408)	518.3632
1/50 (0.020000)	508
1/51 (0.019608)	498.0432
1/52 (0.019231)	488.4674
1/53 (0.018868)	479.2472
1/54 (0.018519)	470.3826
1/55 (0.018182)	461.8228
1/56 (0.017857)	453.5678
1/57 (0.017544)	445.6176
1/58 (0.017241)	437.9214
1/59 (0.016949)	430.5046
1/60 (0.016667)	423.3418
1/61 (0.016393)	416.3822
1/62 (0.016129)	409.6766
1/63 (0.015873)	403.1742
1/64 (0.015625)	396.875
1/65 (0.015385)	390.779
1/66 (0.015152)	384.8608
1/67 (0.014925)	379.095
1/68 (0.014706)	373.5324
1/69 (0.014493)	368.1222
1/70 (0.014286)	362.8644
1/71 (0.014085)	357.759
1/72 (0.013889)	352.7806
1/73 (0.013699)	347.9546
1/74 (0.013514)	343.2556
1/75 (0.013333)	338.6582
1/76 (0.013158)	334.2132
1/77 (0.012987)	329.8698
1/78 (0.012821)	325.6534
1/79 (0.012658)	321.5132
1/80 (0.012500)	317.5
1/81 (0.012346)	313.5884
1/82 (0.012195)	309.753
1/83 (0.012048)	306.0192
1/84 (0.011905)	302.387
1/85 (0.011765)	298.831
1/86 (0.011628)	295.3512
1/87 (0.011494)	291.9476
1/88 (0.011364)	288.6456
1/89 (0.011236)	285.3944
1/90 (0.011111)	282.2194
1/91 (0.010989)	279.1206
1/92 (0.010870)	276.098
1/93 (0.010753)	273.1262
1/94 (0.010638)	270.2052
1/95 (0.010526)	267.3604
1/96 (0.010417)	264.5918
1/97 (0.010309)	261.8486
1/98 (0.010204)	259.1816
1/99 (0.010101)	256.5654
1/100 (0.010000)	254
1/101 (0.009901)	251.4854
1/102 (0.009804)	249.0216
1/103 (0.009709)	246.6086
1/104 (0.009615)	244.221
1/105 (0.009524)	241.9096
1/106 (0.009434)	239.6236
1/107 (0.009346)	237.3884
1/108 (0.009259)	235.1786
1/109 (0.009174)	233.0196
1/110 (0.009091)	230.9114
1/111 (0.009009)	228.8286
1/112 (0.008929)	226.7966
1/113 (0.008850)	224.79
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1/115 (0.008696)	220.8784
1/116 (0.008621)	218.9734
1/117 (0.008547)	217.0938
1/118 (0.008475)	215.265
1/119 (0.008403)	213.4362
1/120 (0.008333)	211.6582
1/121 (0.008264)	209.9056
1/122 (0.008197)	208.2038
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1/124 (0.008065)	204.851
1/125 (0.008000)	203.2
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1/127 (0.007874)	199.9996
1/128 (0.007813)	198.4502
1/129 (0.007752)	196.9008
1/130 (0.007692)	195.3768
1/131 (0.007634)	193.9036
1/132 (0.007576)	192.4304
1/133 (0.007519)	190.9826
1/134 (0.007463)	189.5602
1/135 (0.007407)	188.1378
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1/139 (0.007194)	182.7276

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1/273 (0.003663)	93.0402
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1/319 (0.003135)	79.629
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1/322 (0.003106)	78.8924
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1/331 (0.003021)	76.7334
1/332 (0.003012)	76.5048
1/333 (0.003003)	76.2762
1/334 (0.002994)	76.0476
1/335 (0.002985)	75.819
1/336 (0.002976)	75.5904
1/337 (0.002967)	75.3618
1/338 (0.002959)	75.1586
1/339 (0.002950)	74.93

1/340 (0.002941)	74.7014
1/341 (0.002933)	74.4982
1/342 (0.002924)	74.2696
1/343 (0.002915)	74.041
1/344 (0.002907)	73.8378
1/345 (0.002899)	73.6346
1/346 (0.002890)	73.406
1/347 (0.002882)	73.2028
1/348 (0.002874)	72.9996
1/349 (0.002865)	72.771
1/350 (0.002857)	72.5678
1/351 (0.002849)	72.3646
1/352 (0.002841)	72.1614
1/353 (0.002833)	71.9582
1/354 (0.002825)	71.755
1/355 (0.002817)	71.5518
1/356 (0.002809)	71.3486
1/357 (0.002801)	71.1454
1/358 (0.002793)	70.9422
1/359 (0.002786)	70.7644
1/360 (0.002778)	70.5612
1/361 (0.002770)	70.358
1/362 (0.002762)	70.1548
1/363 (0.002755)	69.977
1/364 (0.002747)	69.7738
1/365 (0.002740)	69.596
1/366 (0.002732)	69.3928
1/367 (0.002725)	69.215
1/368 (0.002717)	69.0118
1/369 (0.002710)	68.834
1/370 (0.002703)	68.6562
1/371 (0.002695)	68.453
1/372 (0.002688)	68.2752
1/373 (0.002681)	68.0974
1/374 (0.002674)	67.9196
1/375 (0.002667)	67.7418
1/376 (0.002660)	67.564
1/377 (0.002653)	67.3862
1/378 (0.002646)	67.2084
1/379 (0.002639)	67.0306
1/380 (0.002632)	66.8528
1/381 (0.002625)	66.675
1/382 (0.002618)	66.4972
1/383 (0.002611)	66.3194
1/384 (0.002604)	66.1416
1/385 (0.002597)	65.9638
1/386 (0.002591)	65.8114
1/387 (0.002584)	65.6336
1/388 (0.002577)	65.4558
1/389 (0.002571)	65.3034
1/390 (0.002564)	65.1256
1/391 (0.002558)	64.9732
1/392 (0.002551)	64.7954
1/393 (0.002545)	64.643
1/394 (0.002538)	64.4652
1/395 (0.002532)	64.3128
1/396 (0.002525)	64.135
1/397 (0.002519)	63.9826
1/398 (0.002513)	63.8302
1/399 (0.002506)	63.6524
1/400 (0.002500)	63.5
1/401 (0.002494)	63.3476
1/402 (0.002488)	63.1952
1/403 (0.002481)	63.0174
1/404 (0.002475)	62.865
1/405 (0.002469)	62.7126
1/406 (0.002463)	62.5602
1/407 (0.002457)	62.4078
1/408 (0.002451)	62.2554
1/409 (0.002445)	62.103
1/410 (0.002439)	61.9506
1/411 (0.002433)	61.7982
1/412 (0.002427)	61.6458
1/413 (0.002421)	61.4934
1/414 (0.002415)	61.341
1/415 (0.002410)	61.214
1/416 (0.002404)	61.0616
1/417 (0.002398)	60.9092
1/418 (0.002392)	60.7568
1/419 (0.002387)	60.6298
1/420 (0.002381)	60.4774
1/421 (0.002375)	60.325
1/422 (0.002370)	60.198
1/423 (0.002364)	60.0456
1/424 (0.002358)	59.8932
1/425 (0.002353)	59.7662
1/426 (0.002347)	59.6138
1/427 (0.002342)	59.4868
1/428 (0.002336)	59.3344
1/429 (0.002331)	59.2074
1/430 (0.002326)	59.0804
1/431 (0.002320)	58.928
1/432 (0.002315)	58.801
1/433 (0.002309)	58.6486
1/434 (0.002304)	58.5216
1/435 (0.002299)	58.3946
1/436 (0.002294)	58.2676
1/437 (0.002288)	58.1152

1/438 (0.002283)	57.9882
1/439 (0.002278)	57.8612
1/440 (0.002273)	57.7342
1/441 (0.002268)	57.6072
1/442 (0.002262)	57.4548
1/443 (0.002257)	57.3278
1/444 (0.002252)	57.2008
1/445 (0.002247)	57.0738
1/446 (0.002242)	56.9468
1/447 (0.002237)	56.8198
1/448 (0.002232)	56.6928
1/449 (0.002227)	56.5658
1/450 (0.002222)	56.4388
1/451 (0.002217)	56.3118
1/452 (0.002212)	56.1848
1/453 (0.002208)	56.0832
1/454 (0.002203)	55.9562
1/455 (0.002198)	55.8292
1/456 (0.002193)	55.7022
1/457 (0.002188)	55.5752
1/458 (0.002183)	55.4482
1/459 (0.002179)	55.3466
1/460 (0.002174)	55.2196
1/461 (0.002169)	55.0926
1/462 (0.002165)	54.991
1/463 (0.002160)	54.864
1/464 (0.002155)	54.737
1/465 (0.002151)	54.6354
1/466 (0.002146)	54.5084
1/467 (0.002141)	54.3814
1/468 (0.002137)	54.2798
1/469 (0.002132)	54.1528
1/470 (0.002128)	54.0512
1/471 (0.002123)	53.9242
1/472 (0.002119)	53.8226
1/473 (0.002114)	53.6956
1/474 (0.002110)	53.594
1/475 (0.002105)	53.467
1/476 (0.002101)	53.3654
1/477 (0.002096)	53.2384
1/478 (0.002092)	53.1368
1/479 (0.002088)	53.0352
1/480 (0.002083)	52.9082
1/481 (0.002079)	52.8066
1/482 (0.002075)	52.705
1/483 (0.002070)	52.578
1/484 (0.002066)	52.4764
1/485 (0.002062)	52.3748
1/486 (0.002058)	52.2732
1/487 (0.002053)	52.1462
1/488 (0.002049)	52.0446
1/489 (0.002045)	51.943
1/490 (0.002041)	51.8414
1/491 (0.002037)	51.7398
1/492 (0.002033)	51.6382
1/493 (0.002028)	51.5112
1/494 (0.002024)	51.4096
1/495 (0.002020)	51.308
1/496 (0.002016)	51.2064
1/497 (0.002012)	51.1048
1/498 (0.002008)	51.0032
1/499 (0.002004)	50.9016
1/500 (0.002000)	50.8

Diatom Genera List - P

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

Genus	Described by	Date
Pachyneis	R. Simonsen	1974
Palaeotrigonium	A. G. Vologdin	1962
Palmella	H. C. Lyngbye	1819
Palmeria	R. K. Greville	1865
Palmerina	G. R. Hasle	1995
Paltonophora	F. T. Kützing	1833
Pantocsekia	A. Grunow ex J. Pantocsek	1886
Papiliocellulus	G. R. Hasle, H.A. von Stosch & E.E. Syvertsen	1983
Pappia	M. Hajós in M. Hajós & Z. Rehakova	1974
Paradesmus	A. C. J. Corda	1835
Paralia	P. A. C. Heiberg	1863
Parelion	Adolf Schmidt	1889
Parlibellus	E. J. Cox	1988
Pauliella	F. E. Round & P.W. Basson	1997
Pelagodictyon	K. B. Clarke	1994
Pentapodiscus	C. G. Ehrenberg	1843
Peponia	R. K. Greville	1863
Peragallia	F. Schütt	1895
Peragalloella	Henri-Ferdinand van Heurck	1909
Periptera	C. G. Ehrenberg	1844
Perissonoe	G. W. Andrews & V.A. Stoelzel	1984
Peristephania	C. G. Ehrenberg	1854
Perithyra	C. G. Ehrenberg ex Henri-Ferdinand van Heurck	1896
Perizonium	F. Cohn & C. Janisch ex L. Rabenhorst	1864
Peronia	A. de Brébisson & G.A.W. Arnott ex F. Kitton	1868
Peroniopsis	Friedrich Hustedt	1952
Perrya	F. Kitton	1874
Petitia	M. Peragallo in Jean-Clodius Tempère & H. Peragallo	1909
Petrodictyon	D. G. Mann in F.E. Round, R.M. Crawford & D.G. Mann	1990
Petroneis	A. J. Stickle & D.G. Mann in F.E. Round, R.M. Crawford & D. G. Mann	1990
Phacodiscus	A. Meunier	1910
Phaeodactylum	K. von Bohlin	1897
Pharyngoglossa	A. C. J. Corda	1835
Phialediscus	L. Vailionis	1930
Phlyctaenia	F. T. Kützing	1849
Pinnularia	C. G. Ehrenberg	1843
Pinnulariosigma	T. V. Desikachary, V.N. Raja Rao & V.T. Sridharan in T. V. Desikachary	1989
Pinnunavis	H. Okuno	1975
Placoneis	C. Mereschkowsky	1903
Plagiodiscus	A. Grunow & T. Eulenstein in A. Grunow	1867
Plagiodiscus	A. Jurilj	1949
Plagiogramma	R. K. Greville	1859
Plagiogrammopsis	G. R. Hasle, H.A. von Stosch & E.E. Syvertsem	1983
Plagiolemma	T. B. B. Paddock	1988
Plagiotropis	E. Pfitzer	1871
Planktoniella	F. Schütt	1893
Planothidium	F. E. Round & L. Bukhtiyarova	1996
Pleurocyclos	S. J. Casper & W. Scheffler	1986
Pleurodesmium	F. T. Kützing	1846
Pleurodiscina	P. C. Silva	1970
Pleurodiscus	J. W. Barker & S.H. Meakin	1944
Pleuroneis	P. T. Cleve	1895
Pleurosigma	W. Smith	1852
Pleurosiphonia	C. G. Ehrenberg	1871
Pleurosira	(G. Meneghini) V.B.A. Trevisan di San Leon	1848
Pleurostauron	L. Rabenhorst	1859
Plicatodiscus	Z. I. Glezer	
Pliocaenicus	F. E. Round & H. Håkansson	1992
Ploiaria	J. Pantocsek	1889
Plumosigma	T. Nemoto	1956
Podiscus	J. W. Bailey	1844
Podocystis	J. W. Bailey	1854
Pododiscus	F. T. Kützing	1844
Podosira	C. G. Ehrenberg	1840
Podosphenia	C. G. Ehrenberg	1837
Pogoneis	F. E. Round & P.W. Basson	1997
Polyceratium	A. F. Castracane	1886
Polygonalium	A. G. Vologdin	1962
Polymyscos	C. Janisch	1888
Polymyxus	J. W. Bailey ex L.W. Bailey	1861
Pomphodiscus	J. W. Barker & S.H. Meakin	1947
Ponticella	C. G. Ehrenberg	1872
Pontodiscus	D. N. Temniskova-Topalova in Temnoskova-Topalova et al.	1981
Poretzkia	A. P. Jousé	1949
Porguenia	M. J. Sullivan	1997
Porocyclia	C. G. Ehrenberg	1848
Porodiscus	R. K. Greville	1863
Porosira	E. Jørgensen	1905
Porostauros	F. Habirshaw	1877
Porosularia	B. V. Skvortzov	1976
Porpeia	J. W. Bailey ex J. Ralfs in A. Pritchard	1861
Potamodiscus	J. Gerloff	1968
Praecymatosira	N. I. Strelnikova	1979
Praeepithemia	A. P. Jousé	1952
Praethalassiosiropsis	R. Gersonde & D.M. Harwood	1990
Pritchardia	L. Rabenhorst	1864
Proboscia B.	G. Sundström	1986
Proboscidea	T. B. B. Paddock & P.A. Sims	1980
Proboscineis	F. Butzin	1980

Progonoia	H. -J. Schrader	1969
Prorocentrum	C. G. Ehrenberg	1833
Prorostaurus	C. G. Ehrenberg	1843
Proshkinia	N. I. Karayeva	1978
Proteucylindrus	C. -W. Li & Y.-M. Chiang	1979
Protonema	Meneghinini	1845
Protoraphis	R. Simonsen	1970
Psammodictyon	D. G. Mann in F.E. Round, R.M. Crawford & D.G. Mann	1990
Psammodiscus	F. E. Round & D.G. Mann	1980
Psammosynedra	F. E. Round	1993
Psammothidium	L. Bukhtiyarova & F.E. Round	1996
Pseudauliscus	Adolf Schmidt	1875
Pseudauliscus	G. Leuduger-Fortmorel	1879
Pseudo-eunotia	A. Grunow in Henri-Ferdinand van Heurck	1881
Pseudo-nitzschia	H. Peragallo in H. Peragallo & M. Peragallo	1900
Pseudo-pleurosigma	P. T. Cleve & A. Grunow	1880
Pseudoamphiprora	(P. T. Cleve) P.T. Cleve	1894
Pseudoaulacodiscus	V. N. Vekschina	1961
Pseudoaulacosira	E. G. Lupikina & G.K. Khursevich	1991
Pseudocerataulus	J. Pantocsek	1889
Pseudodictyoneis	P. T. Cleve ex J. Pantocsek	1892
Pseudodimerogramma	H. -J. Schrader in H.-J. Schrader & J. Fenner	1976
Pseudoencyonema	K. Krammer	1997
Pseudogomphonema	L. K. Medlin in L.K. Medlin & F.E. Round	1986
Pseudoguinardia	H. A. von Stosch	1985
Pseudohimantidium	Friedrich Hustedt & G. Krasske in G. Krasske	1941
Pseudoleyanella	H. Takano	1985
Pseudomastogloia	J. Pantocsek	1905
Pseudoperonia	E. Manguin	1964
Pseudopodosira	A. P. Jousé in A.I. Proschkina-Lavrenko	1949
Pseudopyxilla	A. Forti	1909
Pseudorutilaria	(Grove & Sturt ex DeToni & Levi) Grove & Sturt ex De Toni	1894
Pseudosolenia	B. G. Sundström	1986
Pseudostaurosira	D. M. Williams & F.E. Round	1988
Pseudostephanodiscus	J. Sieminska	1988
Pseudostictodiscus	A. Grunow ex Adolf Schmidt et al.	1882
Pseudosynedra	G. Leuduger-Fortmorel ex C.S. Boyer	1827
Pseudosynedra	J. Pantocsek ex G. Moesz	1904
Pseudotriceratium	A. Grunow	1884
Psygmatella	F. T. Kützing	1834
Pteroncola	R. W. Holmes & D.A. Croll	1984
Pterotheca	A. Grunow ex Forti	1909
Ptychodiscus	E. O'Meara	1867
Punctastriata	D. M. Williams & F.E. Round	1988
Pyrgodiscus	F. Kitton ex P.T. Cleve	1885
Pyrgupyxis	N. I. Hendey	1969
Pyxidicula	C. G. Ehrenberg	1834
Pyxidicula	N. I. Strelnikova & V.A. Nikolaev	1986
Pyxilla	R. K. Greville	1865

The Diatom Frustule (continued)

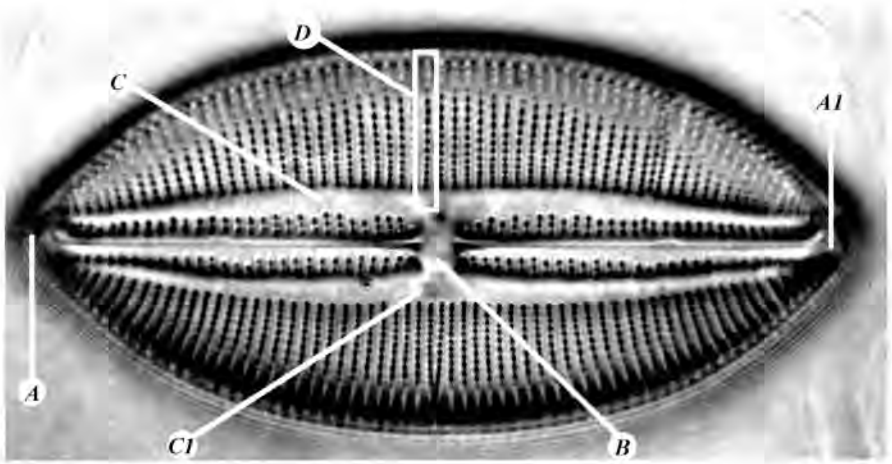
This issue deals with structures and features to be seen on the valve itself.

Illustrated with some fine light micrographs from Steve Edgar.

It is difficult to decide at which end of the size spectrum to start. Gross features contain fine features and indeed a collection of fine features make up the gross features. Traditionally the fine features have been described first, which is alright if the fine features are big enough to see. In many cases they are not, so we will begin with the larger featuresand thne incorporate the smaller features where appropriate.

The first larger feature to be considered is the raphe. This feature occurws on most but not all pennate diatoms. The raphe, though it implies a single feature is often composed of a number of parts, probably two halves. It is mostly aligned apex to apex and is split in the middle. Ignoring this central break the whole raphe is in fact an area where no silica is present, a ravine in fact, and on either side of this ravine there may be thicknend areas of silica (or hyaline areas as they are known), the name given to this thickened area in which the raphe sits is the apical ridge. It is this raphe that is used in the movement of the diatom (Centric diatoms do not have a raphe and therefore do not move of their own volition).

The photograph below shows the slit and the hyaline areas immediately adjacent (the apical ridge) along the imaginary line A to A1.



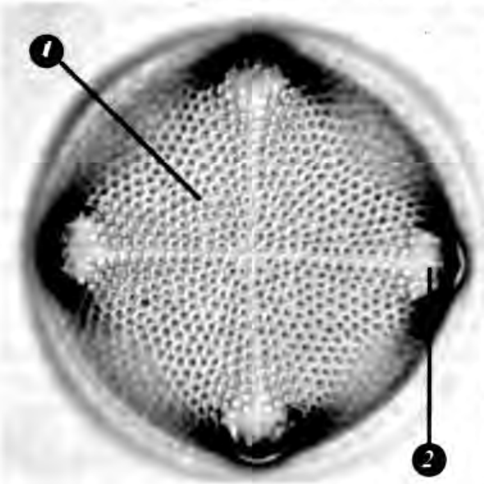
You can also see that the raphe is disrupted at the central area (called the central nodule) at B. This central area is present in many diatoms and may vary in size, shape and orientation, and again can be an important feature in detemining species

The raphe terminals (ends) also feature in descriptions (points A, A1, and B). The terminals of the furrow itself and its associated ridge may have particular characteristics used in determining species. They may be bulbous, bent or curved and these will be discussed in another article. Remember that there may be four raphe terminals, 2 in the centre and 1 at each of the poles.

Examples of hyaline area (silica thickenings) can be seen at the central nodule B and also at C and C1.

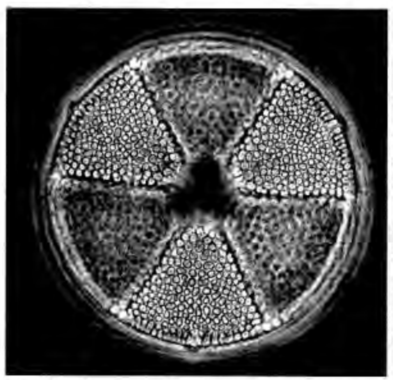
We will return to this image later in this article.

If we now look at a centric diatom we can see some slightly different features.



At 1 we can see what appears to be a large hole. These holes or perforations are called Areolae. Now here we have to be quite careful as the term areolae is generally used for large holes and in some cases for depressions in the frustule which itself contains small holes. These areaolae may be hexagonal, polygonal, circular, or elliptical. Generally these areolae form patterns or linear features though this is only the case where the areolae are of a similar size. In the previous photograph you will see that the areolae ARE of a regular size and the pattern produced is that of radiating lines. Where areolae size differs you will usually be unable to detect any regular patterns, as can be seen in the next photograph.

Whilst we are considering this valve you may note at 2 a raised area. These raised areas may be termed 'elevations' or if more pronounced 'processes'. It they stand on stalks they are termed 'pediform' (as in 'pedicle - a little stalk').



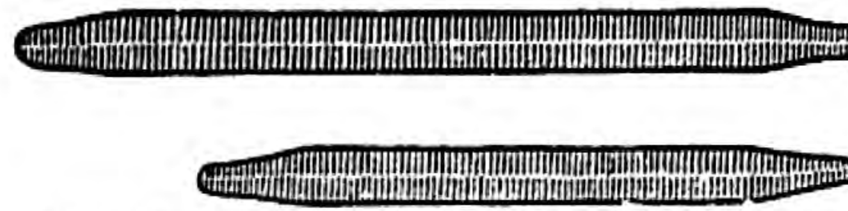
In the photograph to the left you will note that there are three areas of the frustule in-focus and three out of focus. This is because the face of the frustule 'undulates'. Undulations, twists and torsions are yet other gross features which can help to determine genus and in some cases species. An example of twisting can be seen in the small photograph below.

Above we mentioned that the areolae may form lines and linear features and when we are talking about centric diatoms these are the terms we use. However, these lines, when present on pennate forms are called striae. Striae are lines of areolae, usually formed from the central apical axis to the margin of the valve. Areolae, as we have mentioned, are large holes and not all diatoms, in fact the majority, have small holes and these, though they are effectively the same type of structure, are called punctae. It has become more common these days to use the one term - punctae, to describe both areolae and punctae. If you return to the first photograph you will see at D a row of punctae forming a single striae.

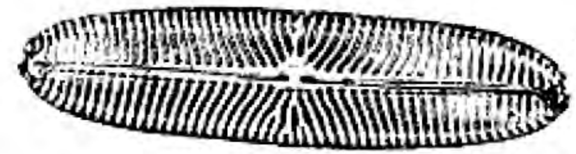
There is a term for even finer holes, porelli, though you are unlikely to see these with a light

microscope.

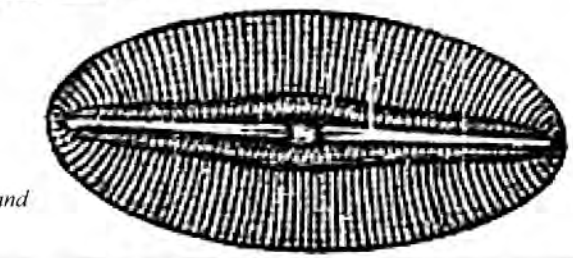
Patterns of striae are also evident and to appreciate these you have to look at the whole frustule, or at least a large part of it. When determining patterns it is the norm to start at the apical centre and work towards an apex, noting how the striae lie in relation to one another. The three drawings and the photograph below illustrate this. There are many patterns and by far the easiest way to cope with them is to sketch the striae formations and look for a similar pattern in your favourite diatom reference book. We will produce a more detailed discussion of these patterns in a later issue.



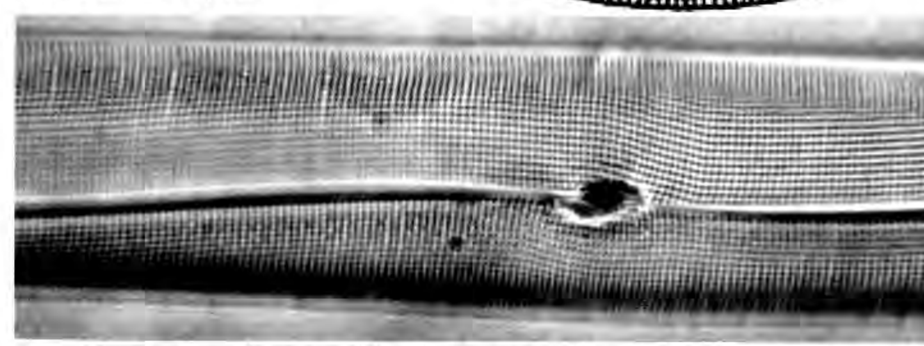
Fragilaria virescens - Striae parallel from center to apex (note there is no central nodule).



Navicula digito-radiata - Striae curved towards the central area.



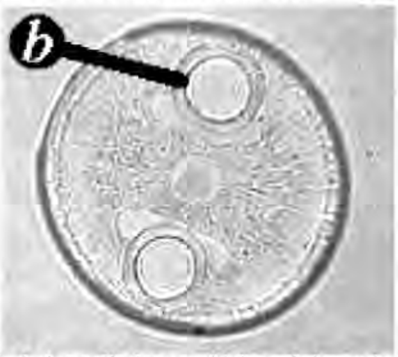
Navicula aestiva - Striae radiate and become curved at apices.



Gyrosigma sp. - Striae parallel raphe to margin and punctae appear to form striae longitudinally parallel to sigmoidal raphe.

There is another feature found on frustules that should not be confused with striae. These are thickened ribs of silica and may themselves contain areolae or punctae. They are termed alveolae. The genus Surirella is useful in illustrating these, as may be seen at 'a' in the photograph on the left.

This term alveolae is generally reserved for pennate diatoms, but centric diatoms also have thickened silica features, usually attached to the margin and tending towards the centre. These are termed costae. The photograph below of a Triceratium show these thickened ribs branching across the frustule, the enclosures thus formed containing areolae.



You may also come across circular or elliptical voids in a frustule as in the photograph left at 'b'.

These 'holes' usually have a thickened rim and are termed 'ocelli'.

Continued in the next issue.

Are there too many species, variations and forms?

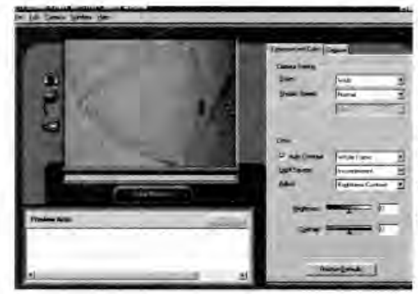
- A diatribe by an anonymous author.

There is, and always has been ,a school of thought which posed the question which comprises the title of this article. Those that have posed it in the past have left themselves open to ridicule from the establishment. Many were castigated for their thoughts. Certainly there was a trend in the Victorian era for species to be named in honour of a colleague and that colleague would then reciprocate. Often these new species were, in fact, species that had been described before but their descriptions had not been communicated to the worker in question or the literature hadn't been studied. Whichever, those days are gone. Or are they?

With the use of SEMs and the like we have an opportunity to find even more minute variations frustule to frustule. This should either allow us to group previously disparate forms back together, as minor variations in the same species due to some hiccup or environmental factor, or it opens up the Pandoras Box of Taxonomy. A look at the list of Genera generated over the years only supports the view that more time should be taken with a single species and its normal varieties before launching off into the 'new discovery syndrome'.

To take a simplistic view, consider a tree, it doesn't matter which tree. The tree grows in a sheltered spot with excellent mineral supplies in a balance ideal for perfect growth. The tree prospers and grows upright, branching as one would expect. The same tree perhaps might have germinated on a hill-side, lashed by driving winds. It grows in a form low to the ground, gnarled and twisted. Is it a different species? No. A mighty oak in a wood, thick trunked and strong has whispy saplings at its base straining to reach the light. They look different, are they different species or simply different. Not even warranting a forma tag. These are environmental considerations. What about seasonal variations? This oak we are talking about, in summer it is verdant, luxuriantly green. In Autumn this tree is brown and russet. Is it the same tree? Yes. In winter its branches are bare. Still the same tree but it looks quite different. Variations exist for all sorts of different reasons, regardless of permanent genetic change but the species remains the same.

Simple Setups Suffice



This article has been prompted by a number of correspondents, all of whom have voiced the same concern over being able to record their observations. All admitted that they were not artists or had any drawing skills at all. Nearly all considered their microscope outfits to be adequate but not outstanding and all had budgetry restrictions. They also considered that digital photography was a./ beyond their capabilities and b./ expensive. All the correspondents had a computer! So digital was a reasonable way to proceed. The problem is that digital cameras and microscope adapters were perceived to be the domain of the professional. Amongst the editors are those that use quite professional microscopes and large megapixel cameras with high quality lenses. There are also those that don't use professional standard microscopes and invested in camera technology some while ago and are stuck with low megapixel models until a lottery win is forthcoming.

On the basis that our correspondents didn't have any digital technology yet, we purchased a second hand Kodak MDS100 for under £60. This digital camera is designed specifically to be attached to a microscope by a simple collar that tightens around the tube of the microscope. We found that by removing the lens and locking a wide field eyepiece into place it was a simply matter of dropping the camera into place and making fine adjustments until an image appeared on the computer screen. The camera is connected to the computer via a USB (Universal Serial Bus) port from which it derives its power. The unit is made of lightweight plastic and does not exert any undue stress on the microscope tube. The CCD produced an image of 640 x 480 pixels. Now this isn't sufficient for printing quality prints of any size but small prints and screeen displays would be fine. However, the image was absolutely dreadful. It was RED and PURPLE and ORANGE, which was quite amazing considering that the image we were viewing was a diatom valve and had no colour whatsoever.

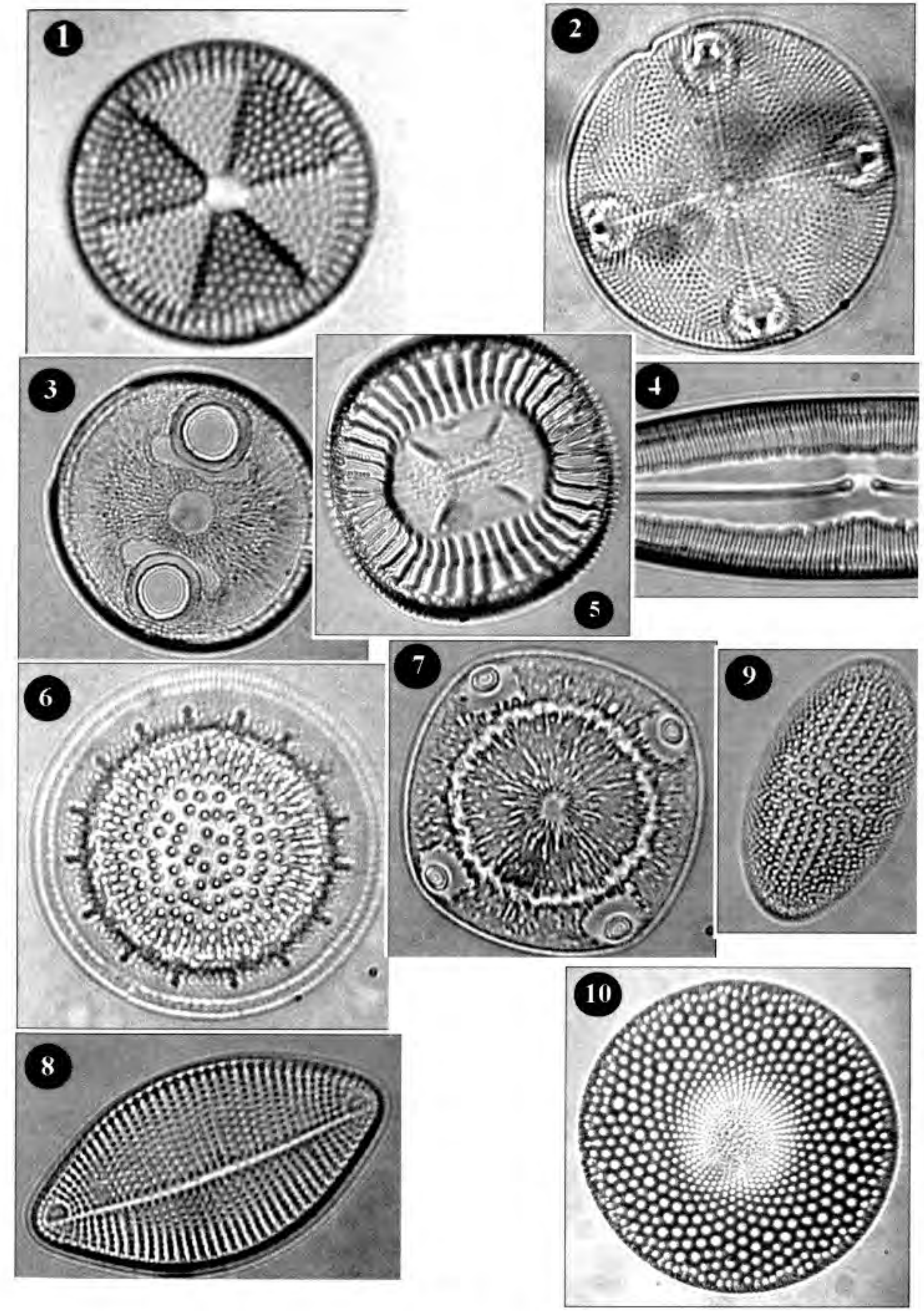
A couple of issues ago we printed an image by Dr. Stephen Nagy. We remembered that this image had been taken with an MDS100. He informed us that the CCD was particularly sensitive to Infra-red and the simple act of placing an IR filter in the light path cleared up those awful colours. We transferred the camera to the most Heath-Robinson of setups, worse than any of our readers will contemplate using and set about recording some images. The microscope setup was a Baker Illuminating Base originally designed for the Series 4, a Negretti and Zambra students microscope from the 1940s, a Leitz No. 3 (2/3inch) objective and a Watson 1/6th Para. The condenser was something we found in the scrap box (we think from a Baker student stand).

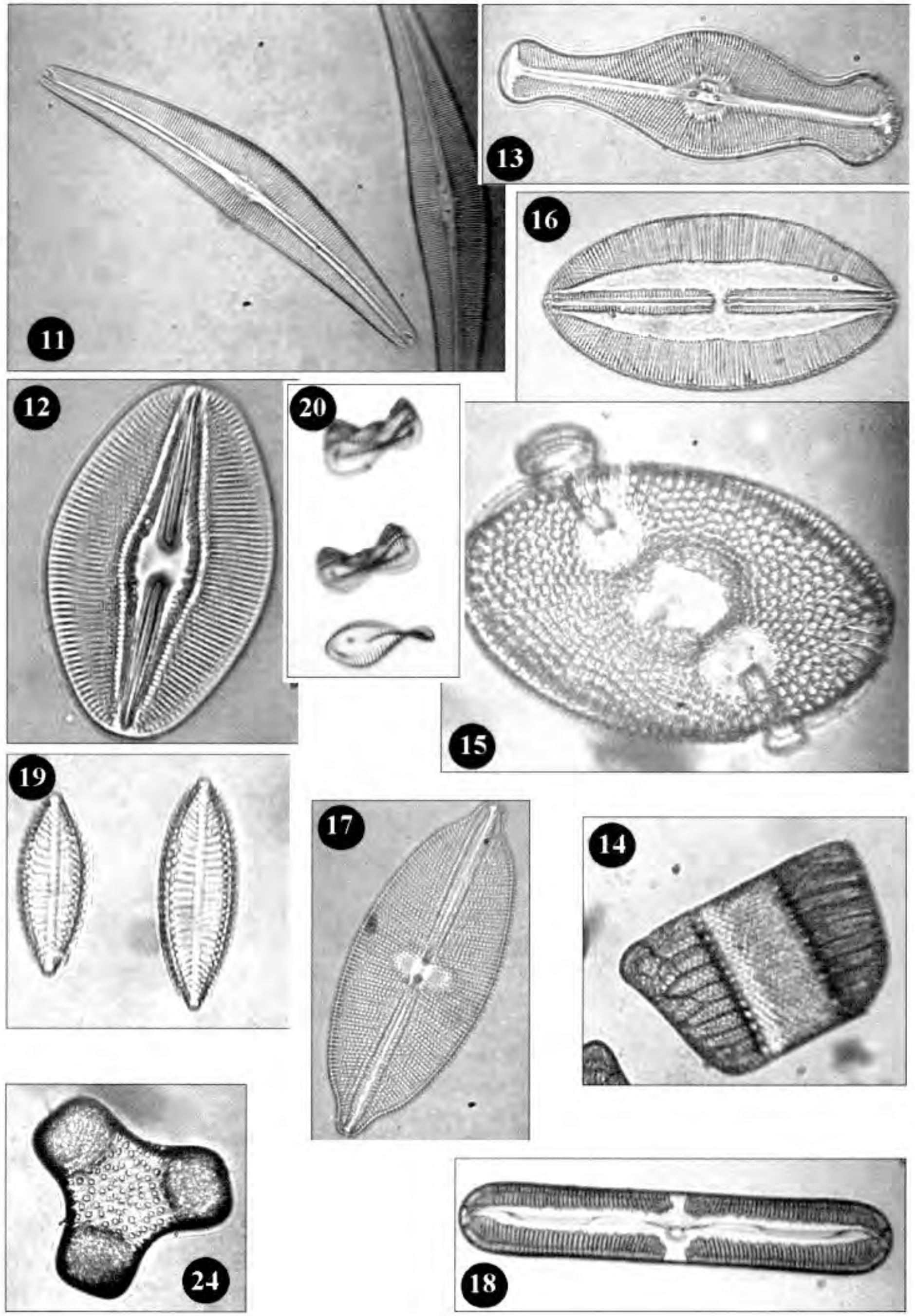
Basically it gave an image and you could adjust diaphragms in the light source and below the condenser. The IR filter sat on a blank slide above the mirror housing of the base. We allowed ourselves a quality Zeiss Widefield eyepiece.

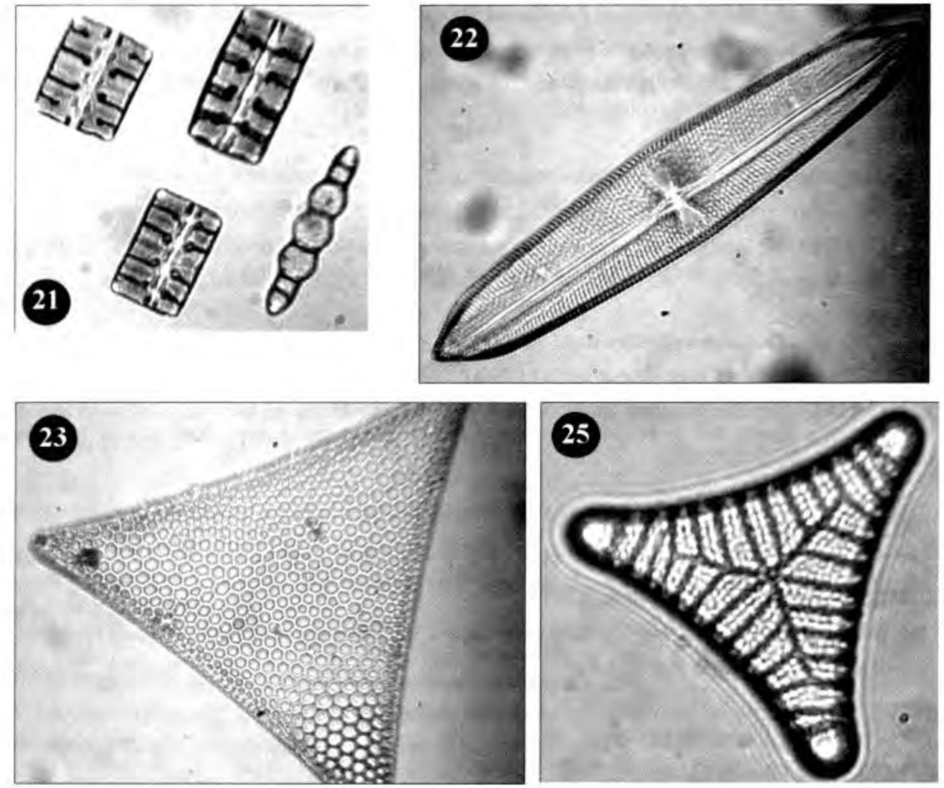
The computer was a Pentium II with 64Mb memory and a 2 gigabyte hard disc. It was nothing special in this day and age. The software is easy to use and you are able to control the camera from the screen using Mouse clicks on the appropriate function. It took us a while to settle on the right settings as regards illumination type but then we were away. The next three pages show some of our results, which we think are acceptable though not of the highest technical merit.

Key: (names as per slide labels)

1. Actinoptychus undulatus
2. Aulacodiscus africabnus
3. Auliscus lacunosus
4. Caloneis permagna
5. Campylodiscus Kittonianus
6. Cestodiscus superbus
7. Clyphodiscus stellatus
8. Cocconeis sublittoralis
9. Coscinodiscus Lewisianus
10. Craspedodiscus pyxidiculus
11. Cymbella lanceolata
12. Diploneis Smithii
13. Gomphonema geminatum
14. Isthmia nervosa
15. Kittonia elaborata
16. Navicula lyra
17. Navicula maculata
18. Pinnularia cardinalis
19. Surirella biseriata
20. Surirella spiralis
21. Terpsinoe intermedia
22. Trachyneis aspera var. oblonga
23. Triceratium favus
24. Triceratium fractum
25. Triceratium venosum







Notes:- OK, the objectives needed cleaning and the light source wasn't quite bright enough but the results were, we feel adequate for ordinary recording purposes. It is true that they wouldn't win a prize in a competition but then we wouldn't enter them into a competition.

Note:-Diatomaceous Earth is included in the "List of tobacco additives permitted in the UK in March 2000"

WWW - Sites of Interest

The following sites are ones that we either have visited or visit regularly. Some are good, some indifferent. If you are the web designer of a site we have criticised then we are sorry, but we tell it as we see it. We expect you to do the same with this publication.

URL: http://www.indiana.edu/~diatom/diatom.html
SITE: Biology Department, Indiana University
COMMENTARY: Linked to by large numbers of sites but changes very infrequently.
What is there is good, but once you have read it, it is only any good for its links page.

URL: http://www.umich.edu/~phytolab/GreatLakesDiatomHomePage/top.html

SITE: Great Lakes Diatoms

COMMENTARY: A useful site with a reasonable amount of information concerning Great Lakes Species. Photographs are disappointing.

URL: http://www.calacademy.org/research/diatoms/

SITE: California Academy of Sciences Diatom Collection

COMMENTARY: Really good site, well worth repeated visits. Plenty of information, good but not many photographs. Includes Hanna database. Highly recommended.

URL: http://rathbun.si.edu/botany/ing/

SITE: The Index Nominum Genericorum (ING),

COMMENTARY: The original intent of the ING was to bring all generic names of plants together in a single list to reveal homonymy between groups. A must for all you budding taxonomists.

URL: http://www.isdr.org/

SITE: INTERNATIONAL SOCIETY FOR DIATOM RESEARCH

COMMENTARY: The professionals.

The annual fee to be a member is a very reasonable £30. There are some very eminent members.

Worth a visit to see what they're up to.

URL: http://www.soton.ac.uk/~ibg/

SITE: Marine Diatom Index

COMMENTARY: Based in the UK at Southampton University. Nice collection of SEMs.

Worth a visit and maybe you can use the SEMs to identify features that you just can't quite make out with the light microscope.

URL: http://www.math.ualberta.ca/~bowman/diatom/

SITE: Diatom Image Archive (DIA)

COMMENTARY: Looks to have potential, but disappointing images.

URL: http://www.euronet.nl/users/janpar/virtual/diatoms.html

COMMENTARY: A really well put together site with some beautiful images from members of the Dutch Microscopical Society, we think.

Links through to articles on Micscape which is run from the UK.

URL: http://hjs.geol.uib.no/Diatoms/index.html-ssi

COMMENTARY: One of our favourite sites for beginners. It includes plenty of information and some nice images. Also, a little on the diatomists of the past. Recommended.

URL: http://www.rbge.org.uk/ADIAC/

SITE: ADIAC: Automatic Diatom Identification And Classification

COMMENTARY: A site that really needs watching as their on-line database grows. Images mostly nice.

URL: http://www.umich.edu/~mongolia/

SITE: Mongolian Diatom Home Page

COMMENTARY: A colourful and certainly not boring site.

Includes a checklist of Mongolian Diatoms and nice images, but they seem to take a long time to load.Worth a few visits.

URL: http://www.diatoms.co.uk/

SITE: Microlife Services - Klaus D. Kemp.

COMMENTARY: Good commercial site. Buy your diatom slides here.

URL: http://www-personal.umich.edu/~asalger/HomePage/Home.html

SITE: Diatom taxa of the Taylor Dry Valleys, Antarctica

COMMENTARY: Great site. Lots of information, reasonable photographs of diatoms and some nice images of Antarctica

URL: http://perso.club-internet.fr/clci/diatom-ADLaF.htm

SITE: Association des Diatomistes de Langue Française

COMMENTARY: French speaking diatomists only.

URL: http://www.fhsu.edu/biology/Eberle/DiatomListHomepage.html

SITE: RECENT DIATOMS REPORTED from the CENTRAL UNITED STATES: REGISTER of TAXA and SYNONYMS

COMMENTARY: Checklist of 84 Genera and 707 Species, Varieties, and Forms Comprising the Recent Diatom Flora of the Central United States (Nebraska, Kansas, Oklahoma, Eastern Colorado, and Western Missouri). A really useful web site. Would benefit from some images. Nonetheless a must for Stateside diatomists.

URL: http://www.arts.monash.edu.au/ges/research/Cpp/Diatoms/

SITE: Australian Diatom Homepage

COMMENTARY: Good lists, small images.

URL: http://thalassa.gso.uri.edu/flora/arranged.htm

SITE: Diatom Art

COMMENTARY: Some nice images of arranged diatoms.

By navigating to their Image gallery you can see some really spectacular images.

From there go to http://thalassa.gso.uri.edu/rines/

URL: http://serc.fiu.edu/periphyton/database.htm

SITE: The South Florida Diatom database.

COMMENTARY: It looked promising but when we went to the species list the links stopped working. Keep an eye on this, it might be good, when it's finished!

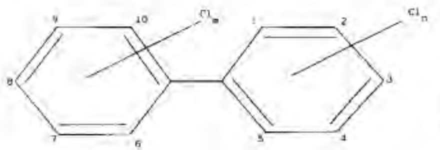
URL: http://www.staff.ncl.ac.uk/r.j.telford/diatoms/flashglossary.html

SITE: The Diatoms

COMMENTARY: Really good introductory site. Well thought out and well implemented. Easy to use. Images not so good, though.

That should do you for now and keep you out of mischief, we don't want to keep you away from the microscope too long.

If you know of any other sites that ought to be listed then send the URL (Universal Resource Locator) and your comments to us for inclusion in the future issues.



Notes on Aroclor

by Mike Smith

Polychlorinated biphenyls (PCB's) are members of a class of chlorinated hydrocarbons based on the biphenyl nucleus in which the chlorine atoms are substituted on either or both of the benzene rings. This can produce 209 different combinations or congeners (isomers and homologues). For ease of identification each PCB is assigned a number from 1-209 (Ballschmitter & Zell)

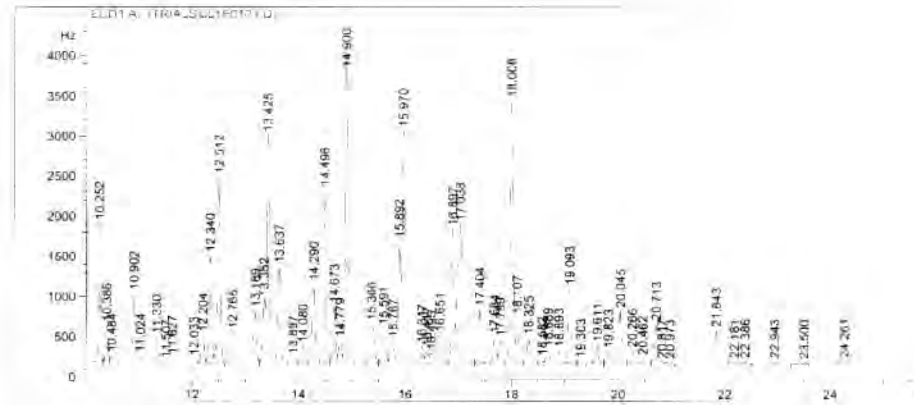
Commercially, PCB's have been marketed under many trade names such as Askarels & Aroclors (USA), Phenochlor & Pyrolene (France), Clophen (Germany), and Kanechlor (Japan). They all contain a mixture of chlorinated biphenyls. The last two digits of the commercial name indicate the percentage of chlorine in each mixture. E.g. Aroclor 1242 contains 42% by weight of chlorine. Similarly Aroclor 1254 contains 54% chlorine. Corresponding to an average of about five chlorine atoms per biphenyl. The main commercial use of these compounds was as an insulating medium in transformers and switchgear.

PCB's are, therefore, mixtures that contain variable numbers and amounts of congeners and traces of impurities, both of which are potentially toxic to animals and humans. The reputed toxic and carcinogenic properties of PCB's are attributed to long term exposure to high concentrations and the subsequent cumulative absorbtion by fatty tissues. Large-scale manufacture is now banned in many countries. The literature provides differing accounts as to absolute limits, so it would be wise to treat these compounds with the utmost care.

The choice of Aroclor 1254 as a component in diatom mounting media must have been made on the basis of its high refractive index and its clarity (water white).

The graph below is a gas chromatographic analysis of Aroclor 1254. Each peak represents a

different congener in the mixture. The height of each peak is proportional to the amount of each congener present.



TIMSTAR have agreed to supply Diatomists with the necessary acids for cleaning Diatom samples. The supply of Concentrated Hydrochloric is a particularly sensitive issue as some of you will be aware. Concentrated Sulphuric Acid and Concentrated Hydrochloric Acid are available in a minimum quantity of 1 litre. When ordering you should mention this publication. TIMSTAR are also able to supply your sample cleaning glassware.

Usage and World Reserves of Diatomite

The percentages of use for diatomite in filtration and filler applications is approximately 73% and 14%, respectively. Although worldwide diatomite reserves amount to something like 2 billion tons, diatomite filters are being gradually replaced by membrane filters, and alternative fillers for paints are being explored as there is a growing concern about crystalline silica (Roskill website).

Policy Statement - Names, Synonyms and Taxonomy

The editors of this publication will not presume to alter names to 'conform to the current taxonomy'. Taxonomists maintain a state of flux and what might be correct today will be wrong tomorrow. Where a species name is given we (and authors) should where possible state the authority they are using when naming. This simply means that if someone else has subsequently renamed the species or re-categorised it in some fashion the basis for the identification will be clear.

Sales, Wants and Exchanges

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

Diatomaceous Earth - from Oamaru. Small samples exchanged for fossil earths from other locations. Mike Samworth Tel. 01969 667119 or email apochrom@ukgateway.net 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.

Material from exotic locations - wanted. Contact Klaus Kemp (see advertisement - inside front cover). Exchange for slides of material supplied.

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

Postcards - The publishers have printed a set of six colour postcards, 4 depicting diatoms and two polarising objects

These are available direct from Mike Samworth 07801 819954 @ £2.50/set.

Correspondence

Dear Editors,

I refer to your article on R.I. Firth (Vol I. No.2) the great diatomist and slide maker.

I knew him very well and spent some time with him developing a special test slide to determine the performance of microscope objectives. To do this I visited him at his home in Lewes, Sussex. Together, we produced a slide which was silvered all over except for a round circle in the middle, into this four species of diatoms were introduced. A coverslip plus mountant covered these and a small section of the silver. Each species of diatom was suitable for a different aperture of objective. It was found that good resolution or visibility was obtained when the objective was corrected for spherical aberration as shown by the star test on the slide. Sometimes a form of artefact was obtained with lines of pores floating over the raphe when there was poor correction for spherical aberration. This observation negates the theory that old objectives only resolve when there is a lack of spherical correction in their outer zones.

The accuracy with which Firth made these slides was unbelievable.

Coverglass plus mountant thickness was 0.17mm. plus or minus 1% for the diatoms and star test, thus there could be no excuses! The slide was made in a whole range of mountants of varying refractive index. This work was published as a paper in Engineering - Bingley, M.S. & Firth, R. I. (1975) Tests for a microscope, Engineering. 215, 133-135.

Firth kept an excellent but heavy lathe on the top floor of his house, this induced Peter Sartory to make an aside that one day this lathe would go crashing through the floors of his house. Thankfully it did not.

When such as Firth are gone we are all the losers since a great source of expertise is lost to us, but we should be grateful that many of his slides survive.

Dr. Michael S. Bingley., Surrey

Dear Editors,

Along with some books that I had bought, Bill Kraus included a copy of the first issue of The Amateur Diatomist.....

It was so wonderful, and I enjoyed that first issue so much, I sent Bill an Email, and asked where/how I might subscribe....

I just wanted to confirm that I have VERY MUCH enjoyed the first two issues, as Bill sent along issue Vol 1 No. 2.

I would like to continue to receive this wonderful publication, so when subscriptions start, please let me know how much to send where. I have also sent xerox copies of several pages of the first issue to Mac McLaughlin, who used to write the diatom column each quarter for The Microscope. Again, thank you for a splendid publication.

John Gustav Delly, U.S.A.

The Diatom Visibility Index

The following table details Refractive Index of many mountants and other media together with their Diatom Visibility Index (DVI) which is determined by multiplying the difference between the mountant and Silex by 100. The Refractive Index of Diatom Silex is generally accepted to be 1.434. Our first introduction to the DVI was from a manuscript by C. N. Walter who detailed 20 media.

The following R.Is have been taken at 20 degrees Celcius.

Mountant/ Compound	Refractive Index	DVI	Notes
Acetic acid	1.370	6.4	
Acetone	1.357	7.7	
Air	1.0003	43.37	
Albumen	1.350	8.4	
Aquaperm			Liquid Coverslip from Shandon
Aroclor			
Aroclor 1262			Possible mix with Aroclor 4465 to make stable mountant
Aroclor 4465	1.66	22.6	
Aroclor 5460	1.66	22.6	
Benzene	1.498	6.6	
Caedax			
Camphor Oil (Rectified)	1.5375	10.35	
Canada Balsam	1.526	9.2	
Cassia Oil	1.585-1.60	15.1-16.6	
Castor Oil	1.49	5.6	
Cedarwood Oil	1.51	7.6	
Chloroform	1.45	1.6	
Cinnamon Oil	1.53-1.59	9.6-15.6	
Clearax	1.666	23.2	
Clove Oil	1.53	9.6	
Consul Mount			From Shandon (normally for use on automated coverslippers)

Coumarone	1.63	19.6	See ref. The Microscope Vol 9 pp. 39 and 63 and Vol 10 p. 207
Dammar (Damar)	1.520	8.6	A soft resin derived largely from dipterocarpaceous trees of southern Asia and used for making colourless varnish. Any of various similar resins from trees of other families. Due to its colourless nature it has become the preferred resin for oil painting in the 20th century..
Dirax	1.65	21.6	
DPX (DePeX), BPS			A mixture of distyrene (a polystyrene), a plasticizer (tricresyl phosphate), and xylene, called DPX, was introduced in 1939 and later modified by the substitution of a more satisfactory plasticizer, dibutylphthalate (butyl, phthalate, styrene - BPS).
Entellan	1.49	5.6	For long life preparations, without bubble formation at high ambient temperatures. It can be used for all dehydrated microscopic preparations. Cure time is 20 minutes at room temperature. It is colourless with an acid number less than 2.50 and a R.I. ND20 approx. 1.49-1.50. (Contains Xylene).
Ethanol	1.359	7.5	
Eukitt	1.51	7.6	45% Acrylic Resin and 55% Xylenes. An adhesive and specimen preservative that can be used manually and in automatic coverslipping equipment. Fast drying. Non Yellowing.
EZ-Mount	1.495	6.1	Xylene based mounting medium from Shandon
Gamvar			Robert Gamblin formulated GAMVAR (pronounced GAM-MAR), a low molecular weight (LMW) synthetic resin varnish, based on research at the National Gallery of Art. Gamvar has a refractive index similar to damar natural resin varnish. Available from most Art Shops.
Glycerin	1.44 - 1.473	3.9	
Gum Arabic	1.512	7.8	
Hymount	1.666	23.2	Edward Gurr Proprietary mountant
Hyrax	1.710 - 1.82	27.6	
Immu-Mount			Aqueous Mounting medium from Shandon (Non-fluorescent)
Meltmount	1.539-1.704	10.5-27	From Cargille Laboratories.

Meltmount	1.539		- R.I. similar to Canada Balsam
Meltmount	1.582		
Meltmount	1.605		
Meltmount	1.662		- R.I. similar to Aroclor 5442
Meltmount	1.680		
Meltmount	1.704		- R.I. similar to Naphrax
Methanol	1.326	10.8	
Methyl iodide	1.740	30.6	
Methyl salicylate	1.522	8.8	
Microps	1.63	19.6	Flatters and Garnett
Mono-bromonapthalene	1.64-1.658	22.4	
Naphrax	1.76	32.6	Naphrax is a synthetic resin dissolved in toluene. Because of its surface contact with the diatom frustules its resolution qualities are equivalent to that of a mountant with a refractive index of 1.74 at the very least.
Numount			
Olive oil	1.471	3.7	
Palm oil	1.456	2.2	
Paraffin oil	1.412	2.2	
Permount (Shandon Synthetic Mount)			A toluene-based synthetic resin mounting medium. It has a refractive index near that of fixed protein.
Pleurax	1.635-1.9	20.1-46.6	
Realgar	2.549	111.5	

Chemistry: AsS, Arsenic Sulphide
Class: Sulphides and Sulphosalts

Uses: A major ore of arsenic, formerly used for pigments, firework colouring agent and as mineral specimens.

Realgar is one of only a few sulphides that are not metallic, opaque or blandly coloured. Its structure is analogous to that of sulphur and resembles sulphur in most respects except for colour (the name "ruby sulphur" has been applied to Realgar). Sulphur has a structure composed of 8 sulphur atoms linked in a ring. Realgar's structure alternates between sulphur atoms and arsenic atoms producing rings of As4S4. The arsenic atoms affect the structure altering it from sulphur's orthorhombic symmetry to Realgar's monoclinic symmetry.

Realgar occurs in hydrothermal veins with valuable metal sulphide ores and its bright red colour can be an aid to prospectors. It also can be found in hot spring deposits and as a volcanic sublimate product (crystallising from vapours). Realgar gets its name from the Arabic words for "powder of the mine" (rahj al ghar). Realgar is famous for some wonderfully beautiful specimens. Some specimens can have a deep ruby red colour with an amazing clarity and a high lustre. The colour of Realgar is truly something to appreciate and cherish. But Realgar's beauty is sometimes fleeting.

It is an unstable mineral and will alter to a different mineral, para-Realgar and eventually to a powder. This process takes time and is accelerated by exposure to light. Specimens should be stored in dark, enclosed containers, and only exposed to light for the brief enjoyment of its owner and friends. This sounds extreme, but wonderfully beautiful Realgar specimens are worth preserving for as long as possible. If you are wondering how quickly the deterioration occurs, the answer is immediately, but fortunately very slowly. Ancient Chinese carvings of Realgar are still in existence, but badly affected by the deterioration. The deterioration of Realgar was thought to produce the closely related yellow orpiment, but this was recently proven to be false and the deterioration product is in fact yellow-orange para-Realgar. In old paintings and manuscripts, Realgar was a common pigment for paints and dyes. Many of these paintings now have a yellow or orange hue where once the colour must have been an original red.

Sirax	1.80	36.6	
Storax/Styrax	1.583	14.9	Storax (Styrax, Stacta, Sweet Oriental gum) The aromatic resin of a Turkish tree. (see article on Styrax)
Styroclor (Styrax/Aroclor)	1.64	20.6	As Aroclor will not harden a mixture of Styrax and Aroclor has been devised.
Toluene	1.50	6.6	
Water	1.33	10.4	
Xylene	1.50	6.6	
Xylene Substitute Mountant			From Shandon

If anyone is able to fill in the missing values or augment the list then we will be pleased to include them in a later issue.

Useful formulae in Microscopy

compiled by Clive Cowen of Micro Instruments Ltd.

Objective Numerical Aperture (NA) = $n(\sin u)$

where n=refractive index, u=half objective acceptance angle

Resolution (brightfield) $= \dfrac{\lambda}{2NA}$

where λ = wavelength (0.55µm standard)

Resolution (darkfield) $= \dfrac{2\lambda}{NA_o + NA_c}$

where Na_o = objective NA, NA_c = condenser NA

Single lens magnification $= \dfrac{250}{f}$

where f=focal length in mm

Objective magnification (finite tube length) $= \dfrac{OTL}{f_o}$

where OTL = optical tube length, f_o = objective focal length

Objective magnification (infinity corrected) $= \dfrac{f_\infty}{f_o}$

where f_∞ = focal length of normal infinity tube lens, f_o = objective focal length (N.B. normal infinity tube lens focal lengths – Leica & Nikon = 200mm, Olympus = 180mm, Zeiss = 160mm)

Eyepiece magnification $= \dfrac{250}{f_e}$

where f_e = eyepiece focal length in mm.

Microscope magnification = objective mag. x eyepiece mag.

Maximum useful visual magnification = 1000 NA

Depth of focus (µm) $= \dfrac{1000\mu m}{7NA_{obj} * mag_{tot}} + \dfrac{\lambda}{2(NA_{obj})^2}$

Consider λ = 0.55

Visual field of view (mm) $= \dfrac{FN}{mag_{obj}}$

where FN = eyepiece field of view number, mag_{obj} = objective magnification.

Example: with 40x objective and 10x/20 eyepiece

$$\text{Field of view} = \frac{20}{40} = 0.5mm$$

Image Intensity $\approx \dfrac{(NA_{obj})^2}{(mag_{obj})^2}$

In the case of epi-illumination use $\dfrac{(NA_{obj})^4}{(mag_{obj})^2}$.

Chemical Hazard Symbols

It is quite important to be aware of the various chemical hazard labels and their meanings. The images below represent those most commonly encountered.

Flammable *Explosive* *Corrosive* *Poison* *Radioactive* *Compressed Gas*

In addition you may also see a number (National Fire Protection Association rating) associated with each label and their meanings are as follows:-

General Rating Summary

Health (Blue)

4	Danger	May be fatal on short exposure. Specialised protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard

Flammability (Red)

4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Flammable liquid flash point below 100° F
2	Caution	Combustible liquid flash point of 100° to 200° F
1		Combustible if heated
0		Not combustible

Reactivity (Yellow)

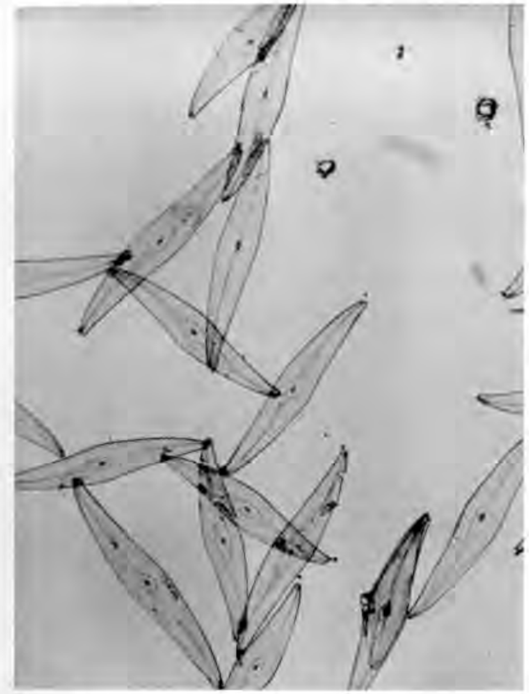
4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

Special Notice Key (White)

W	Water Reactive
OX	Oxidising Agent

The next issue of

The Amateur Diatomist



In the next Issue:-

- Snell's Law
- Cleaning Diatoms
- Famouse Diatomists - Hagelstein
- Diatom Genera List
- Waterfalls
- Dry Storage
- Hunting for Diatoms
- Field Microscopes I
- Useful Notes
- Sales, Wants and Exchanges
- Latitude and Longitude
- Refractive Index
- Numerical Aperture and Resolving Power
- Correspondence

Notes for contributors.

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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.