## CD Publications of interest to Diatomists

**All titles available from Savona Books**

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

*Send copy for publication to:*

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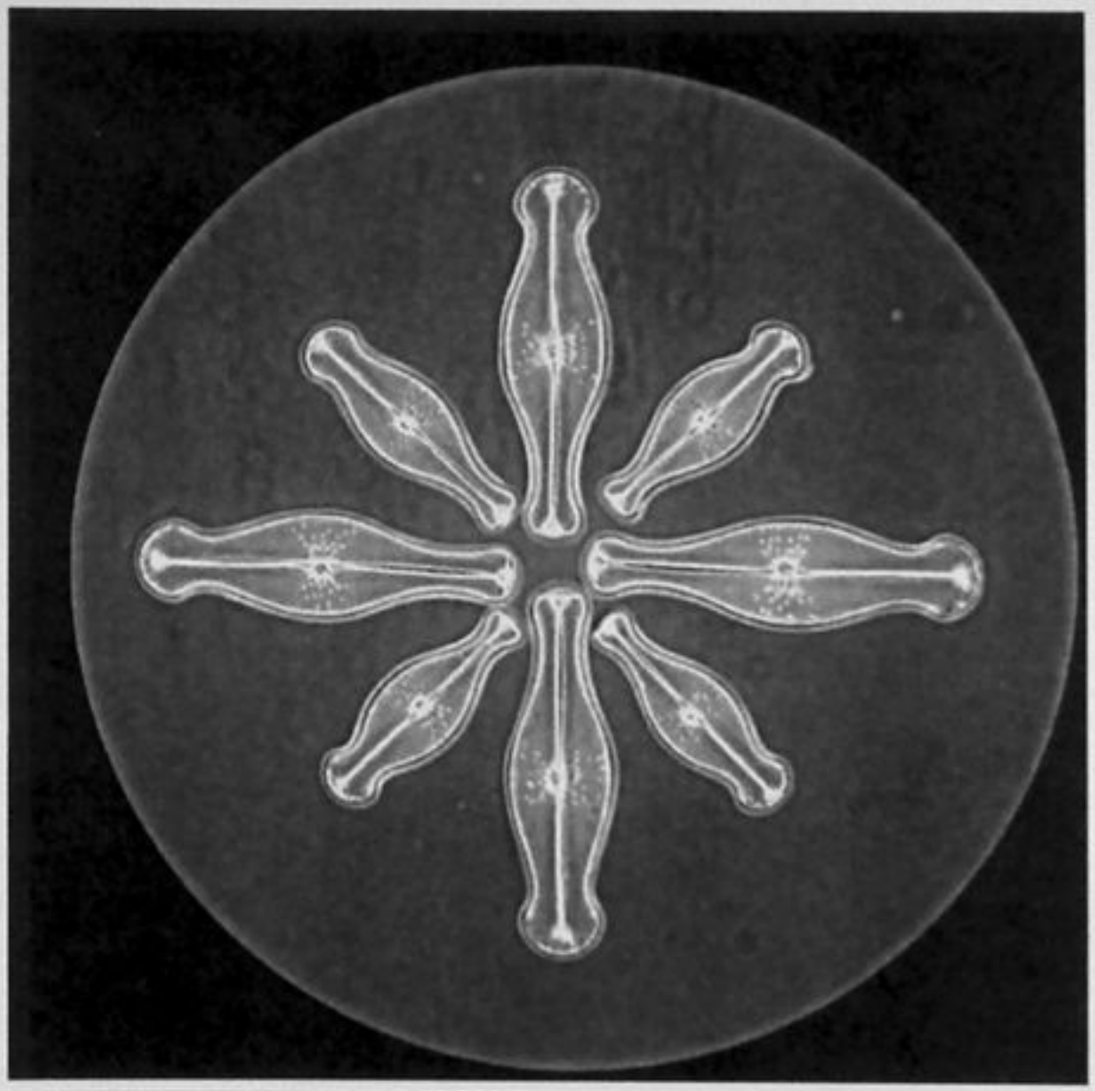
# The Amateur Diatomist

**Vol. IV. No. III.** **Jan 2009**

Little Imp Publications



## Klaus-Dieter Kemp's Diatom Database

**Access via a web browser (IE5.5 or above) - requires 1024x768 display minimum.**

**Includes:- over 15,000 species images**
**124 genus description**
**from over 60 publications**

Order via Microlife Services (address inside front cover).

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**The following paper was amongst a number of anonymously authored papers recently acquired courtesy of Bill Krause at Savona Books (see inside front cover). It reiterates much of what has been printed already concerning the cleaning of Diatoms but includes further practical snippets.**

# The Collection and Mounting of Diatoms

### 1. Collection

Diatoms are found wherever there is moisture and light, in three definable areas; Fresh Water, Marine Water, and Brackish Water.

Marine collection can be done with a plankton net (Harris Biological [*Editor's Note: Alana Ecology can supply these - or consult the pages of The Postal Microscopical Society publication Balsam Post where Ernie Ives as published a number of do-it-yourself articles concerning plankton nets*]) operated by hand like a shrimp net or towed behind a boat. In rich estuary sites at low tide the brownish scum containing Diatoms can be scraped up with a child's spade, or plastic spatula, and stored in a jar. The digestive tracts of marine animals tend to be poor in content and guano is generally not available these days. Fossil marine Diatoms are not found in the U.K. as far as I know. Freshwater Diatoms can be obtained by removing brownish coated stones or plants and scraping or brushing the crust into a jar. Underwater plants like moss can be removed from the water and compressed so that the fluid drips into a collecting jar. The plankton net has a use in large lakes. After flooding stranded pools are often rich in Diatoms. Many of the fossil deposits are from a freshwater origin. There is considerable seasonal variation at any chosen site, in the winter clean colonies can be found on or under melting ice.

### 2. Decalcification

This operation rids the sample of Calcium carbonate ($CaCO_3$) which would combine with Sulphuric acid ($H_2SO_4$) to produce insoluble Calcium sulphate ($CaSO_4$). Dilute Hydrochloric acid (HCl) is added until no more bubbles are given off. Careful heat may be used. The jar is then filled up with water, allow an hour to settle and pour off much of the water but be careful not to pour out the Diatoms as well. Repeat to remove the resultant salts. Settle and pour off much of the fluid. Pour out residue into a large Pyrex conical flask (500ml) and use gentle heat to drive off the water.

### 3. Carbonisation

Allow the flask to cool and carefully add pure Sulphuric acid ($H_2SO_4$) and gently heat. The liquid will char a blackish colour as the strong acid removes the organic substances from the water.

### 4. Oxidation

Next an oxidising agent must be added, and at this stage there is considerable danger. The gentlest substance seems to be Potassium nitrate ($KNO_3$). The operation must take place outdoors using some form of remote control (*Editor's note: using a remote control device might*

*be taking things to extremes*). Even Potassium nitrate ($KNO_3$) gives off the oxides of Nitrogen (N) and Nitric acid ($HNO_3$) fumes but these are better than the Chlorine (Cl) given off by Sodium Chlorate ($NACIO_3$) which is also very explosive. It can convert your local village into a WWI battlefield scene and even bring about the premature demise of your good self (*Editor's note: Crikey, is the author really trying to encourage us all to clean Diatoms?*). The slow application of tiny doses of dry crystals is the key to safety. The fluid will change colour and clear but the heating and application of Potassium nitrate ($KNO_3$) should continue a while to make sure that all the organic content has been oxidised.

**5. Acid dilution**

Allow the flask to cool off and decant the fluid slowly into a large mass of tap water. Settle for an hour and pour off much of the fluid. This dilution routine must be repeated several times. When the acid has been removed the mass of water can be poured off after settling and the residue can have the grit removed.

**6. Panning**

Pour some of the residue into a round dish and gently rock or swirl the contents rather like panning for gold. The grit will settle on the bottom but the Diatoms will remain in suspension and can be poured off. Inspect the sample and repeat the panning is this is required.

**7. Cleaning**

Even after panning there may be a flocculent deposit which leaves the sample unsightly. A rapid boiling in 1% solution of Caustic soda (NaOH) may remove this. The remaining pieces of grit will also be seen to clear.

**8. Remove the tap water replace with distilled water**

Change the water at least five times. Since the hour wait is a long time a centrifuge may be used to speed up proceedings or a 25um sieve may be used although small Diatoms will be lst down the drain.

**9. The strew**

Dilute the white cloud of Diatoms so that it is just visible as a cloud and set up a number of coverslips 0's or 1's on a 3x1 slide. Put one drop on each from a height of about 2 inches. A large slip may require several drops, in order to cover it. Dry off, but do not boil, and examine the strew. If a white cast is visible this would indicate that the water is not so clean so go back to stage 7.; Ammonia ($NH_3$) will assist in the even distribution of the Diatoms. Many mounters dry off the water and replace it with iso-Butyl alcohol ($CH_3[CH_2]_3OH$) which gives even distribution as well as enabling the sample to be stored without fungal growth appearing.

**10. Mounting**

Using a marked card put a small drop of Naphrax onto a clean slide and invert one of the



prepared coverslips onto the mountant. *N.B.* Slides today are sold ready for use in the medical world and do not usually need cleaning. The solvent must now be driven from the cell. I use an electric iron clamped upside down on a bench. The slide is put on this and the thermostat is turned up just until the Toluene ($C_7H_8$) solvent boils. Use a limited amount of mountant rather than the application of pressure. The NBS dispenser for mountants is a good investment (*Editor's note: No longer available!*). Cool quickly after having checked for centralisation on the card. If there is seepage clean with Toluene ($C_7H_8$). (The boiling is limited to seconds.)

**11. Ringing**

The NBS Shellac (*Editor's note: I use Smooth Black Hammerite as NBS are no longer extant*) can be run in to seal the cell and make the slide attractive. This should not be soluble n oil immersion conditions.

**Material List**

| | | |
|---|---|---|
| Toluene ($C_7H_8$) 250ml | Naphrax mountant | Electric iron |
| 16mm round slips thickness 0 or 1 | Potassium nitrate ($KNO_3$) 200gm | |
| Sulphuric acid ($H_2SO_4$) B.P. | Hydrochloric acid (HCl) pure | Distilled water |
| Small sample jars | 500ml conical flask | Ringing table |
| Small droppers with teats | Various lab jars and containers | Labels |
| Round glass dish | Brushes for ringing | 3 by 1 slides |
| Spirit solvent for washing | NBS mountant dispenser | |
| A recent will! | | |

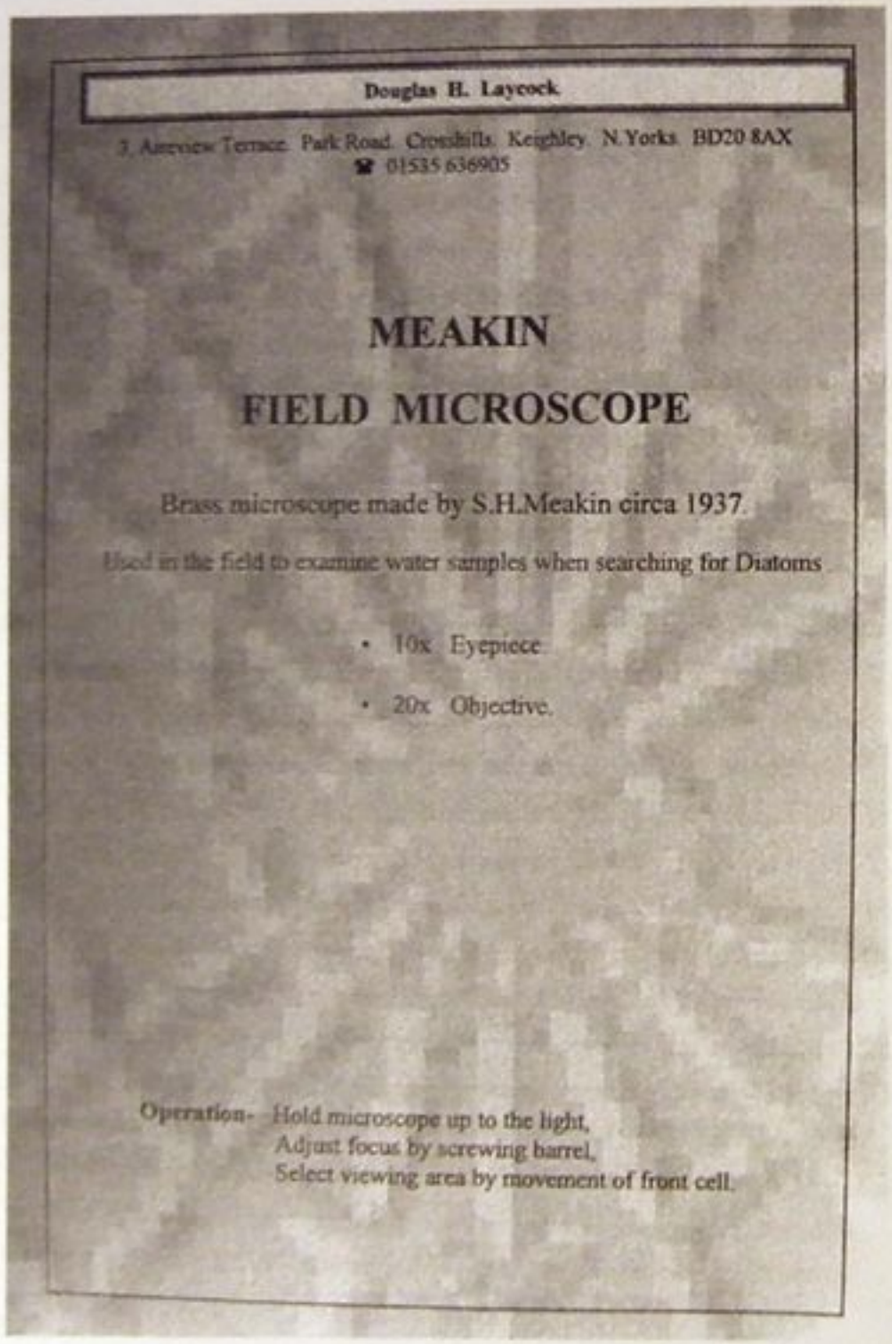
**A warning**

Several of these operations are very dangerous and considerable care is required at all times. One must be familiar with lab safety rules.

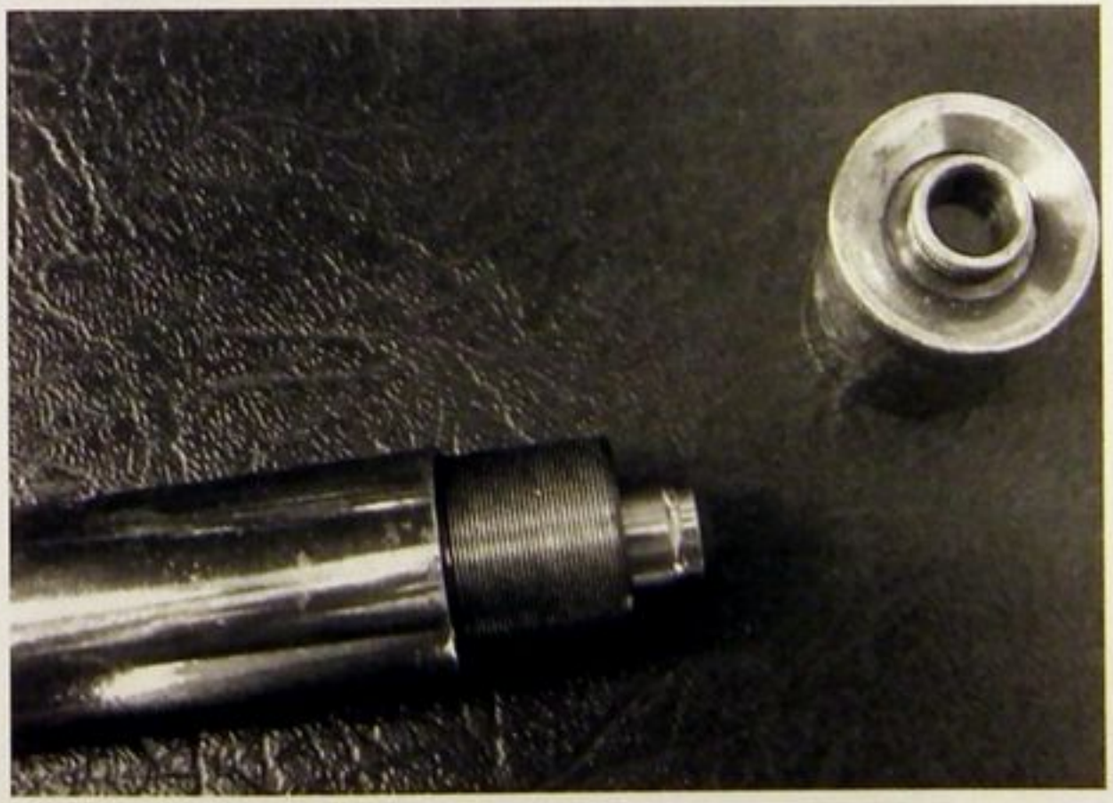
*Editor's note: This paper may well have been written by Eric Marson who was the founder and owner of NBS. Unfortunately Eric is no longer with us and NBS no longer trades. Whether this paper was or wasn't written by Eric we should all be grateful to him for setting up a company whose main purpose was to supply the amateur with microscopical requisites. Without his dedication microscopy amongst the amateur would likely have failed due to lack of material supply.*

# Field Microscopes (VII)

The field microscope that is the subject of this numbers article is a custom built device rather than a commercially available instrument. We are indebted to Douglas H. Laycock for permission to reproduce a display he created for a Postal Microscopical Society/Quekett Microscopical Club meeting.









# Samuel H. Meakin

## 1876 - 1955

**1923 - 66, Sandford Grove, Sheffield.**

**1931 - 11, Hartington Avenue, Sheffield.**

**1937 - 54, Pingle Road, Sheffield.**

**Supplied mounted Diatom slides for resale to both Watsons and Baker.**

Included with the display was an extract from The Microscope and Entomological Monthly.

## THE STUDY OF DIATOMS

S. H. MEAKIN

I

THE possessor of a microscope who treats its use as a spare time hobby usually acquires a number of varied slides prepared and sold by the opticians, and generally these slides are used as one uses a picture book. In time he becomes satiated with viewing his slides, and this is the stage at which these notes may prove useful.

To make the hobby continuously interesting the owner of a microscope needs to have new interests, and one of the most prolific is the minute life, animal and vegetable to be found in water—marine, brackish and fresh. Animals in the live state are, of course, the most interesting, but one cannot make permanent slides of the animals alive and when dead these subjects soon retreat to the "Picture-book" state. The vegetable inhabitants of water,—algae, desmids, and diatoms are perhaps the easiest objects to handle.

The study of Diatoms is one of the most exciting and far reaching hobbies one can adopt, for one never gets to the end. Diatoms are always easy to procure, as almost every clean pond, ditch, swamp, marsh, river, as well as the sea, contains unbelievable quantities and varieties of these tiny plants. The cost of obtaining unlimited quantities is nil and the collecting of them lends interest to any excursion.

### Requirements for collecting

All that is needed to collect diatoms are a few corked tubes 2½ ins. long, about ½ in. diameter, an old tablespoon, and a walking stick, some means of fixing the spoon to the end of the stick being required. A pocket field microscope which is easy to construct is a great advantage, but not absolutely necessary. One of the eyepieces and objectives belonging to the microscope can be used for this pocket

Diatom—*Navicula maculata*, ×450
See "Camera and Microscope," p. 172).

microscope and the body to contain them can easily be made, as the sketch and description below shows.

Examination in the field prevents rubbish being gathered and brought home, but with a little experience one soon finds out what is likely to be good even if the field microscope is not used. So it is by no means necessary to go to the expense of a field microscope, if one is prepared to take a sporting chance of the contents of some tubes not being as good as might otherwise be the case. There will always be plenty of diatoms of some kind, as soon as the necessary knowledge of what to look for is acquired. Generally speaking any brownish-green, or yellowish-green patches on stones, mud, roots of trees, and on stems and leaves of water plants, will prove to be rich in diatoms.

Having arrived home, take a 3 inch × 1 inch micro-slip, and with a fountain pen filler or forceps take up a spot of the brownish material and place it on the slip with one drop of water. Just loosely lay on this drop a ⅛ inch cover glass and inspect under the microscope. If the gathering happens to be of Naviculas or Pleurosigmas it will be difficult to convince the novice that he is looking at plants and not animals. The whole field of view will be alive with moving diatoms, pushing and jostling each other all over the place.

Now the microscopist is up against his first diatom problem, which is—By what means do these plants move about so vigorously? If he solves this problem he can call himself a genius. The next problem will probably be—How is it that there are so many thousands of these tiny plants and by what means do they grow and multiply so enormously? That is another very difficult and controversial subject. In fact there are so man solved problems connected with minute plants that he will have e interests in the hobby to last a lifeti

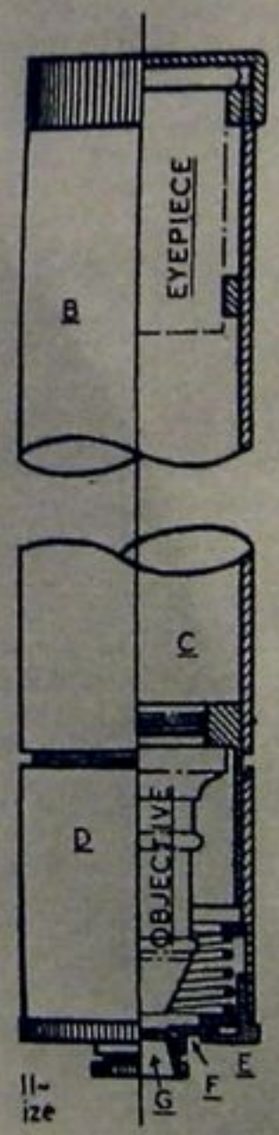
What to do next with the col material had better be left till later, budding diatomist will be so busy ing the antics of his little plants th will refuse to leave his microscope f time being.

### The Field Microscope

To make the microscope illustrat a piece of light brass tube six inche the diameter of which will accomm the eyepiece. If slightly too lar diameter the tube can be bushed to s shown, but the proper diameter tul easily be purchased from the opticia








A. A light brass cap screwed on the outside of the body tube to protect the eyepiece.

B. Body tube 120 millimetres long, but if preferred it may be made 160 millimeters to suit the tube length for which objectives are made. It is preferable to have this tube 1 $\frac{1}{16}$ inches internal diameter so that the flange of the objective will go inside the bush C.

C. Brass bush with internal thread to fit objectives and external thread 40 per inch. This bush is screwed permanently into the end of the Body tube.

D. A piece of tube about 35 millimetres long of same diameter as the body tube. The exact length must be made to suit the objective which is used. This tube is screwed with internal thread to fit the bush C. This thread is then bored out for a length of ½ inch, to form a seat for the spring washer. It is best to solder the spring to this washer. A new thread is then cut for a length of ½ inch in this tube to receive cap E.

E. This cap is bored out as large as possible internal diameter. Externally it has thread to fit tube D and is screwed firmly therein, thus compressing spring and causing pressure on cup F. Bore the end of the cap out to ½ inch diameter.

F. Cup with internal thread and recessed to take a ½ inch diameter cover glass, which is cemented in with gold size. This cup slides about in the space between cap E and the spring washer.

G. Small cap which screws easily into the cup F. It has a glass disc bezelled securely in the end. This cap is removed and the specimen placed in the centre of the glass disc. It is then screwed into cup F. It is really a small Compressor.

If the body tube is procured 1 $\frac{1}{16}$ inch internal diameter it will be necessary to provide two ring bushes tightly forced into the body tube. The internal diameter of these bushes will be made to accommodate a standard eyepiece. If the body tube is procured the correct size to fit the eyepiece, it becomes necessary to reduce the flange on the objective so that it will go into the bush C.

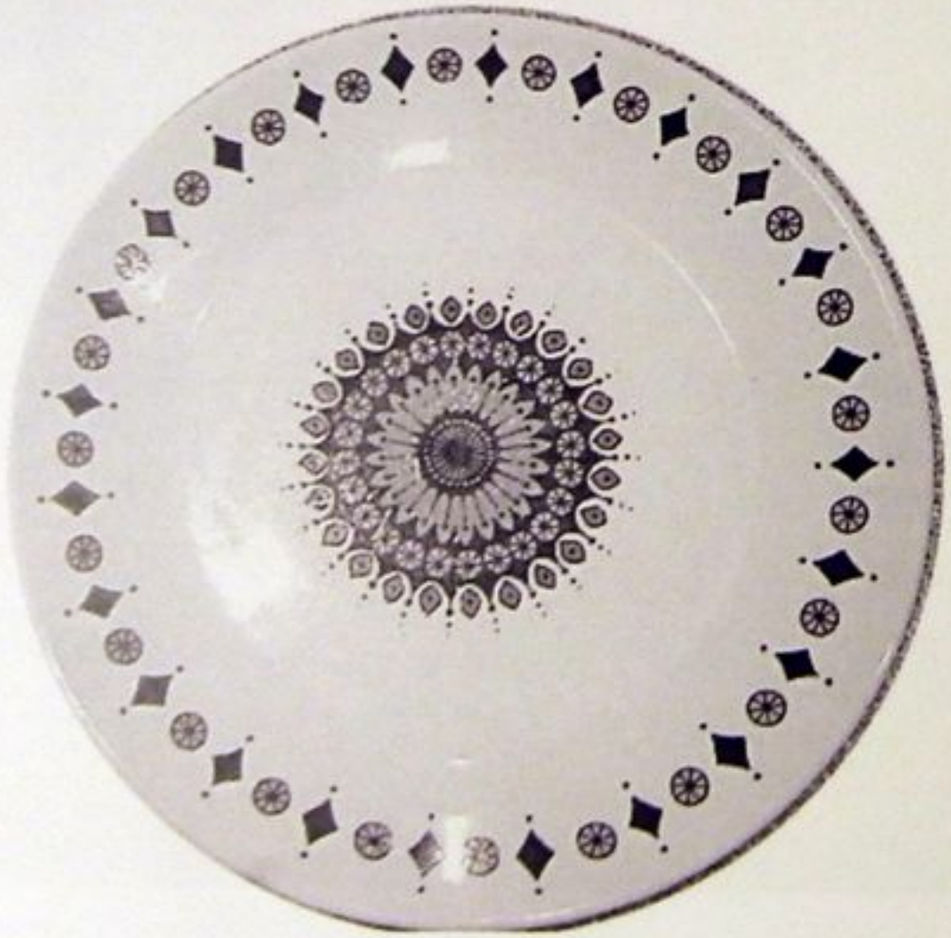
The microscope is held pointing to the sky when viewing objects, plenty of illumination for the ½ inch objective is then obtained.

manufacture microscopes. Cut off 1¼ ins. from one end and in the long piece fit a brass bush screwed internally with thread to fit objective and externally with a fine thread which screws into the end of long piece of tube. Now screw with same fine thread the interior of the short piece of tube throughout its whole length, so that it turns easily, but is a good fit on the thread on the brass bush. This is used for focussing, but only about one revolution is ever required to correctly focus, once the selected objective has been focussed.

Near the other end of this short tube, screw a ring to act as stop for spring, and at the end fit a brass cap which carries the small sliding fitting which acts as the microscope slide, and on which a tiny speck of the material to be examined is placed. The sliding motion is necessary to enable the spot of material to be examined in various portions as required. After years of use, this field microscope has proved entirely satisfactory, and does everything the hobby requires. Of course it is just as adaptable and useful for all microscopical field work. A × 10 eye-piece and ⅛ inch objective are very suitable for diatoms and would be just as useful and suitable for algae or desmids. Perhaps for animal water life a lower power objective would prove more suitable.

*Editor's Note.*

Following the article on the Meakin plate in the last issue another Meakin plate design has been sent in which contains similar icons, This design was known as the Inca pattern.





# Uses of Diatomaceous Earth

Unfortunately the subject of this 'use' , like many inventions including the Nobel Dynamite in the last issue, has a dark historical significance.


**Zyklon B**

Zyklon B or in English, Cyclone B was a trade name of the German firm Degesch which supervised the distribution of this product during World War II. The product was designed as a fumigant for the purpose of pest and vermin control. Zyklon B was a special preparation which contained hydrocyanic acid (HCN). HCN was used as a fumigant even prior to World War I by the United States. Zyklon B was HCN absorbed in a carrier, typically wood pulp or diatomaceous earth. This preparation of pellets was sealed in an airtight can to make handling and transportation safer. Zyklon B would be a forgotten footnote of World War II except that it was used as a poisonous gas to execute millions of concentration camp inmates.

Zyklon B was originally developed as a pesticide and was initially used as such. The SS then employed the poison gas in large quantities as the means to murder millions of individuals. Between 1942-43 the Hamburg firm delivered 19 tonnes of Zyklon B to Auschwitz II (Birkenau) alone.

In 1946, the firm's two managers were sentenced to death, by a British military court, and executed. The history of the Meberghof building is further blackened by having been renamed by the Nazis. It was originally called Ballin-Haus after Albert Ballin (1857-1918), the famous Jewish general director of the Hamburg-Amerikanische Packetfahrt- Actiengesellschaft (Hapag), which in 1970 merged with Norddeutscher Lloyd (Bremen) to become Hapag-Lloyd. Because Ballin was a Jew the Nazis initially renamed Ballin-Haus "Bauhof", and then "Meberghof".

It took until June 1997, before a memorial plaque was erected on the Meberghof building. The plaque that recalls this dark chapter in Hamburg's history was affixed only after conflict with the owner of the building, a property company belonging to the Deutsche Bank. According to newspaper reports the company feared that such a plaque would be detrimental to the letting of the building. A spokesman for the Deutsche Bank later apologised for not initially showing the necessary sensitivity.


*Labels taken from canisters of Zyklon B from the Dachau Gas Installation*

Description: The first and third panels contain the German Pest Control Company emblem and the brand name Zyklon. The center panel reads "Poison Gas!" "Cyanide Preparation! [skull and crossbones] to be opened and used only by trained personnel." The labels were used as evidence at the International Military Tribunal trial of war criminals at Nuremberg.

# A Useful Accessory

## The Diatom Stage

On stands that don't have the ability to offset the condenser (and there were and are currently many of them) how could you achieve oblique illumination?

The answer is - With a Diatom stage!

This simple device sat atop the main stage and held the slide. The following extract from "The Microscope Collection at the Science Museum" by Dr. Brian Bracegirdle, a CD catalogue available from Savona Books, decribes the model.

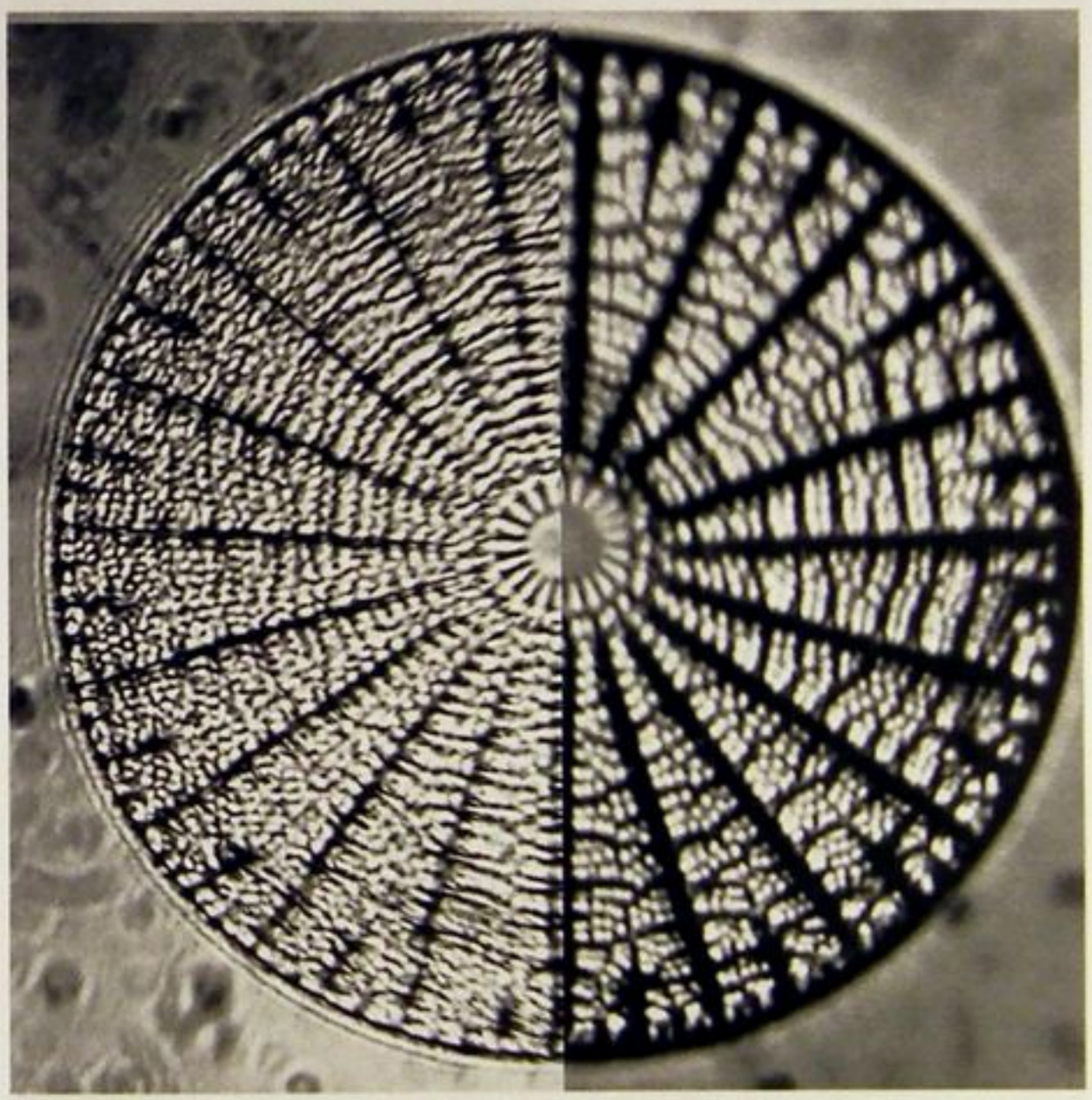
| | |
|---|---|
| 28/6 - DIATOM STAGE | STAGES, ON-STAGE ACCESSORIES & APPARATUS, STAGE MICROMETERS etc<br>ACCESSORIES: All DATES |
| Period: 1650-1670<br>Origin: English: Unsigned<br>Instrument: Stage Tube<br>Case/Box: No case<br>Inventory No.: A199413<br>Negative No.: G152 [154] | The stage is a brass plate with what may be sectioned Stanhope lens held in a collar, with a sliding square stop between. On top are two blued stage clips. The device provided a sharply-focussed wide-angle cone of illumination when used above the ordinary substage illuminator of the time.<br><br>Purchased at Stevens's auction, August 1926; price not noted |

The photograph below shows the underside.



As can be seen from the preceding photograph the lens is offset and the illuminating rays can be masked to a greater or lesser degree using the square 'diaphragm'.

The results one might obtain can be gauged from the following image.



The half image on the left is taken using the diatom stage whilst that on the right is taken with ordinary transmitted light. The diatom stage will give a relief map picture of the object and gives a real impression of viewing the object as a solid entity as opposed to a transparent object.

## Two further examples of recording sample information

We recently examined a collection of slides made from samples collected in Northamptonshire and prepared by one Paul L. Chapman. Each slide was accompanied by a piece of paper the same size as the slide and sat beneath it in the slide trays.

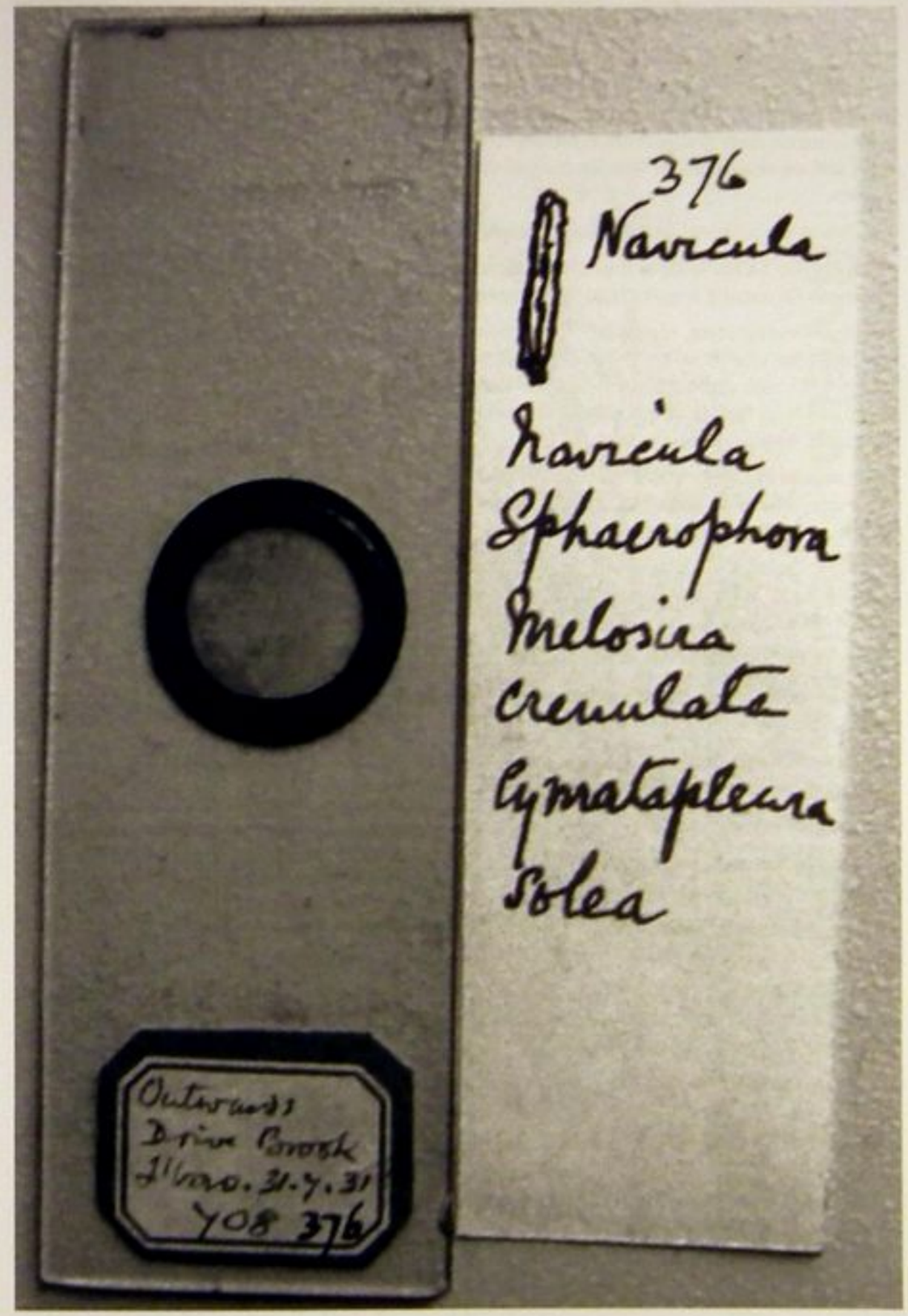
The second example was picked up at a meeting and has no indication as to preparer. It uses the same technique of recording.


The slides from this collection are the subject of the CD that accompanies this issue.

The CD contains files that run within an Internet Browser. If the CD doesn't automatically start when you insert it into the CD drive of your computer then open your browser and using your file explorer drag the file 'index.htm' onto the browser window.

Please don't make copies of the CD as further sales of these go towards the funding of the Amateur Diatomist itself.





## Collecting Opportunities

The pages of Amateur Diatomist have contained a number of water mill locations. This article covers a series of 20 water mill and wheel sites within a 2 mile stretch of the River Rivelin in the Rivelin Valley. No wheels now exist but the dams, and channels together with the bases for the wheels are all there and provide excellent collecting points. Lakes formed by the dams, the river itself and an abundance of heavily mossed old walls should provide a considerable diversity of species.

The following information has been gleaned from http://www.rivelinvalley.org.uk/valley.htm

"The Rivelin Valley is three and a half miles long and with over 700 lime trees lining the road making it the second longest lime tree avenue in Britain.

The fast flowing river, regulated by its constant release from moorland peat proved ideal for powering the wheels of up to twenty mills along its course. One of the oldest being the Hind Wheel 1581 with some still working up to the 1950's. Perhaps the most famous being Mousehole Forge at Malin Bridge which produced world famous anvils and is being carefully restored by its present owner.

What remain are the ponds which used to feed them and with support of the Ponds Conservation Trust and Yorkshire Water, the group intends to restore as many as possible for the wildlife to inhabit and the public to enjoy.

Membership is £3 per household per year (this includes quarterly newsletter, work days on the last Sunday of each month, regular walks, talks from enthusiasts and experts and other events throughout the year).

Membership/Newsletter M. Sanderson - (0114) 230 6790"

The Rivelin Valley is situated on the western outskirts of the city of Sheffield in South Yorkshire (in the UK).

The River Rivelin rises on the moors above Hollow Meadows, then flows eastwards for about 8 kilometres before merging with the River Loxley at Malin Bridge.

The western end of the valley lies within the Peak District National Park.

The Nature Reserve is very easy to find. Wherever you come from the landmark is the Rivelin Valley Post Office where when I visited they did an excellent Apple Pie.

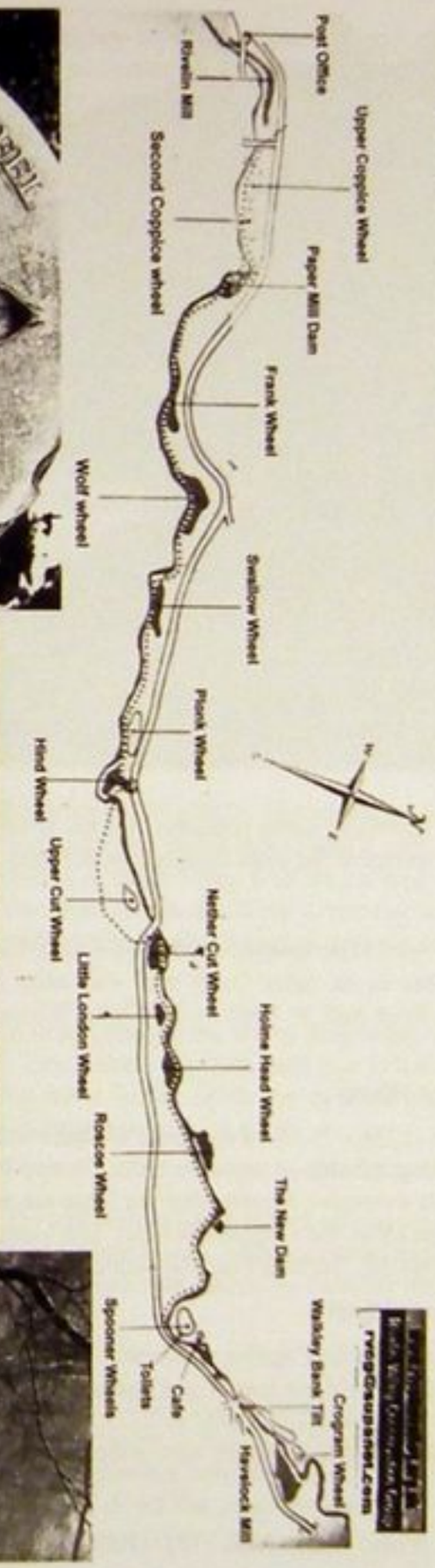
From the West travel along the A57 toward Sheffield and the nature reserve is just before the junction of the A57 with the A5101 on the left hand side. Post Office on your left hand side.

From the South take the A61 to Sheffield and turn left onto the inner ring road until you see a sign for the A57. Follow this for about three miles until you pass the A5101 joining the A57 on your right. Continue a hundred yards or so and you will see the Post Office on your right.

From the North take the A61 to Sheffield and turn right onto the inner ring road until you see a sign for the A57. Follow this for about three miles until you pass the A5101 joining the A57 on your right. Continue a hundred yards or so and you will see the Post Office on your right.

From the East take the A57 to Sheffield and turn left onto the inner ring road until you see a sign for the A57. Follow this for about three miles until you pass the A5101 joining the A57 on your right. Continue a hundred yards or so and you will see the Post Office on your right.



The following historical notes published by the Rivelin Valley Conservation Group may be of interest as you examine the sites depicted on the map.

**Rivelin Mill**

Rivelin Bridge Mill (The Hollins Mill 1794-1909). Used mainly as a cutlers mill for most of its working life, but in its latter years was also used for grinding optical glass. The mill was converted to a flour mill in 1868 by Mr. John Wilson, who also owned the flour mill at Main Bridge.

**Upper Coppice Wheel**

Upper Coppice (1736 - ?) All of the three Coppice mills followed one another and were probably indistinguishable as separate mills. Owned by the Norfolk estates they failed to sell the mills despite extensive repairs after the lease ran out in 1794 until 1854 when the Water company bought all of the Coppice Wheels. The Upper Coppice was then rented to a Mr. William Rose and Mr. Samuel Fox (the founder of the giant steelworks at Stocksbridge).

**Second Coppice Wheel**

Second Coppice (Middle Coppice or Darwin Wheel 1736-1905). Built by Joseph Spooner, a Grinder in 1736, he held the lease for 47 years. Known locally as the Darwin Wheel after the widow Darwin, became a sub tenant in 1815. It included a Grinding mill and a wire drawing mill. Also included in the complex were shops, stables and dwellings.

**Paper Mill**

Third Coppice Wheel (Paper Mill 1758-1905). This mill had the longest tail gate in the valley,



the reason for this is that the wheel pit was set below the level of the river and to stop backwatering stopping the wheel the water had to be taken a long way down the river before being re-introduced. Four men at four trows were employed grinding cutlery in 1794 but by 1814 the mill had been converted to a paper mill. Paper making required good clean water and this was brought across from Black Brook by means of a conduit just above the waterfall.

**Frank Wheel**

Frank Wheel (1737-1905). The dam of the Frank Wheel is still in a fair condition but heavily silted, used for the grinding of cutlery in its early years, in 1854 it had been converted to a paper mill. The last known lease on the mill was between the Corporation and Horatio & Thomas Marsden in 1889.

**Wolf Wheel**

Wolf Wheel (Rocher Wheel 1722-1930s). One of the biggest dams along the valley, the Wolf Wheel measured 15ft x6ft and in 1830 worked 17 knife trows and 2 razor trows. James and Samuel Windle owned the wheels between 1810 and 1852. During this period they also built the houses that stand above the river, still called The Windle Houses today.

**Swallow Wheel**

Swallow Wheel (1692-1905). The wheel pit can still be seen today and on a dry day the stone floor and foundations can still be seen. Its first occupier was a Joseph Swallow, a cutler from Stannington, and the lease was held in trust for years for the Swallow children. A huge increase in size around 1794 saw the wheel running 13 trows and employing 18 people.

**Plonk Wheel**

Plonk Wheel (Saw Bridge, Siddall or Bobby Wheel 1737-1814). The wheel pit was recorded as having a fall of 13ft 4inches and by 1794 was running 5 trows employing 8 men. By 1852 the property list shows the owner of a ruined mill as a Maria Kirby who after a long dispute with the Water Company accepted £500 for it. For some reason the Water Company never re-sold or allowed the mill to be used again and it could have been abandoned as early as 1814.

**Hind Wheel**

Hind Wheel (Iron Wheels 1581-1920s). The oldest dam in the valley first being recorded in 1581 and having been rebuilt around 1820. Two wheels ran from here one 11ft 6in. x 5ft, the other 12ft x 5ft 6in., each running 8 grinding trows. In the 1830s one of these wheels was turned over to the making of steel strip for ladies stays.

**Upper Cut Wheel**

Upper Cut Wheel (Glen Bridge). Some of the best remains of a wheel pit can be found at this wheel which was only a small wheel employing some 8 men, with an annual rent of £7 per annum. The dam for this wheel was long and thin and was said to be used for the hire of rowing boats.

**Nether Cut Wheel**

Nether Cut (New Wheel 1718-1954, rebuilt around 1717). This mill was attacked in 1874 during the Rattening offences for using non-union labour in the grinding of scythes. The Kay family took the lease around 1920 and carried on grinding here until 1940. The shell of the building remained until 1954 when it was knocked down due to safety issues.

**Little London Wheel**

Little London Wheel (1752-1911). Leased for 21 years with part of the river by Mr. Robert Greaves in 1752 for an annual rent of £1 with a liberty to erect a cutler's wheel. In ruins by 1903 it was leased for a nominal sum to a Mr. Samuel Dawson (a file grinder), it was empty by 1907 and knocked down in 1911.

**Holme Head Wheel**

Holme Head Dam 1794-?. The Holme head has some of the best examples of a Pen trough and wheel spindle still remaining, and there is still a good example of an overflow. Largely overgrown now the dam was one of the largest and the mill employed some 15 men.

**Roscoe Wheel**

Roscoe Dam Wheel (Hoole's-Holme Intake or Willow Dam 1725-1936). Used for the better part of its life as a grinding hull for fender and saw, the largest grinding wheels in the valley were used, some measuring up to 7ft in diameter. The mill had an upper storey that was used for the polishing wheels. One of the main cart tracks running through the valley ran past the Roscoe Mill linking Hallam Head with Stannington and onto Bradfield.

**The New Dam**

The New Dam (1853/4-1930). The new dam was as its name suggests the last dam to be built in the valley and its purpose was to act as a supplementary water supply for the Spooners Wheels. The dam was turned into an open-air swimming pool in 1909. The water was always Arctic cold and only the most hardy braved the elements.

**Spooner Wheels**

Spooner's Wheels (1794-1930). Two mill houses and two wheels stood on the site of the cafe and the dam was located where the children's play area now stands. Used mainly for the grinding of files, saws, scythes and cutlery. Part of the complex was also used for forging knives.

**Walkley Bank Tilt**

The Walkley Bank Tilt (Havelock Dam 1750-1950) was on land owned by the 12 capital burgesses of Sheffield and its history as a cutlers wheel can be traced back to 1750. The wheel was converted to a tilt forge in 1762 and then a wire mill in 1901. Oil engines were introduced in 1907 and electricity in the 1920s.

*******

Take plenty of pots for your diatom collections.

If you do visit then maybe you would let us know what you found.

There's plenty more to see there as regards wildlife - Long-tailed Tits, Nuthatches, Dippers to name but three bird species.

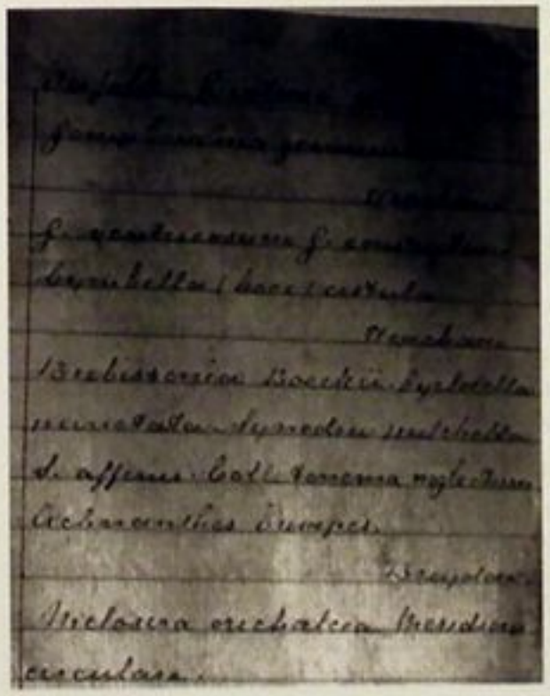
Take the family with you and have a picnic - there are picnic areas provided.

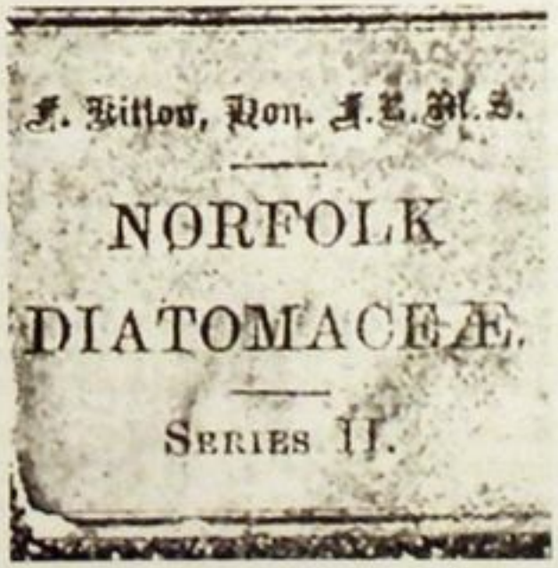
My family seemed to enjoy it despite the dull, misty weather.



# Norfolk Diatoms by Fred Kitton

Following the article Norfolk Diatoms (Vol. III No. II pg.3-23) we have since seen Series I, II, and IV. These are presented in black slip cases with a printed label on the spine. The slides, however, bear handwritten labels.



# Pigments and Chromatography

The last few issues of Amateur Diatomist have contained notes and articles relating to the various pigments to be found in plants and Diatoms and algae in particular. Those with no sophisticated laboratory to hand have had to take our word that these pigments exist in the varieties and forms stated. However, using paper chromatography you can see this for yourself. This is a simple exercise and whilst you cannot absolutely positively identify each and every pigment you can see that different compounds exist and have a jolly decent guess at what they are.

At Malham Tarn in 2006 a small group spent a little time extracting pigments from various samples and produced a number of chromatograms, simply as something to do before the bar opened.

The notes that follow were compiled as a result of some fairly decent results and a few disasters.

The illustrations, unfortunately are in grey scale, but the colours are noted on the chromatogram images.

**Malham Tarn - Paper Chromatography Workshop**
**August Bank Holiday 2006**
**Separation of Pigments from Plants**

Time required - From 2-4 hours

Objectives

1. Demonstrate the existence of the pigments of photosynthesis by isolating them using paper chromatography.

2. Compare the types of photosynthetic pigments in a number of distinct plant forms.

**Introduction**

Background

In 1906 the Russian botanist Alexander Tswett discovered that he could extract plant pigments that produce the autumn colours in leaves by grinding the leaves up in a solvent and then pouring the solvent through a column of chalk. He carefully removed the column of chalk and split it up into sections, each section containing a different band of colour. By re-dissolving the pigment he ended up with a solution containing a single pigment.

Photosynthetic Pigments

Photosynthesis is the process by which plants use the energy in sunlight to convert carbon dioxide to glucose (in simple terms). Almost all living organisms directly or indirectly rely on photosynthesis to provide the basic building blocks for cells and tissues.

The first step of the photosynthetic process involves the absorption of sunlight by various pigment molecules in the plant. These pigment molecules absorb certain wavelengths of visible light very strongly, giving them characteristic colours.

The major pigments of photosynthetic organisms are the chlorophylls. Chlorophylls are responsible for the green colouring of most plants, as these pigments absorb light strongly in the red and blue-violet regions of the visible spectrum, and transmit or reflect most light in the green region. There are two types of chlorophyll found in higher plants, chlorophyll a and chlorophyll b. Other chlorophylls occur in some types of single-celled organisms and algae as can be seen in the table below.



| Pigment | Occurrence |
|---|---|
| Chlorophyll a | All oxygen-evolving organisms |
| Chlorophyll b | Higher plants and green algae |
| Chlorophyll c | Diatoms and brown algae |
| Chlorophyll d | Red algae |
| ?-carotene | Higher plants, most algae |
| ?-carotene | Most plants, some algae |
| Luteol | Higher plants, green and red algae |
| Violaxanthol | Higher plants |
| Fucoxanthol | Brown algae, diatoms |
| Phycoerythrin | Red algae, some blue-green and red algae |
| Phycocyanin | Blue-green algae, some red algae |
| Allophycocyanin | Blue-green algae, red algae |
| Bacteriochiorophyll a | Purple and green bacteria |
| Bacteriochlorophyll b | Some purple bacteria |

As well as chlorophylls, plants also contain other pigments used to collect light energy. Sometimes known as accessory pigments, these molecules include carotenes, xanthophylls, and phycobilins. Normally, the abundant chlorophylls mask the colours of these relatively scarce other pigments. However, in autumn, as chlorophylls begin to break down, it is these accessory pigments which give autumn leaves their brilliant red, yellow, and orange colours.

Plant Pigment Chromatography

The different structures of the plant pigment molecules cause them to have different properties. The structure of a molecule also determines its polarity. These variations in polarity make it possible to separate plant pigments using a process known as chromatography.

Chromatography is probably the most useful method of separating organic compounds for identification or purification. There are many different types of chromatography but most work on the concept of absorbance. The two important components of chromatography are the absorbent and the eluent. A good absorbent is usually a solid material that will attract and absorb the materials to be separated. Paper, silica gel, or alumina are all very good absorbents. The eluent is the solvent that carries the materials to be separated through the absorbent.

Chromatography works on the concept that the compounds to be separated are slightly soluble in the eluent and will spend some of the time in the eluent (or solvent) and some of the time on the absorbent. When the components of a mixture have varying solubilities in the solvent, they can then be separated from one another. The polarity of the molecules to be separated and the polarity of the eluent are very important. Changing the polarity of the eluent will only slightly change the solubility of the molecules but will greatly change the degree to which they are held by the absorbent. This affinity for the eluent versus the absorbent is what separates the molecules.

To separate complex organic molecules, paper chromatography is frequently used. In paper chromatography, the absorbent is chromatograph or filter paper; and the eluent is an organic solvent. The polarity of the eluent is very important in paper chromatography since a small change in polarity can dramatically increase or decrease the solubility of some organic molecules. Many times, a mixture of a non-polar solvent (petroleum ether) and a polar solvent (acetone) is used to achieve an optimum polarity. When placed in a chromatography chamber, the eluent (chromatography solvent) moves up the plate, being drawn by both capillary action

and by the paper itself. The plant pigments, which were "spotted" onto the chromatography paper, separate, based on their polarity, as they are carried with the eluent up the paper at different rates.

The choice of the eluent or solvent is the most difficult task. Choosing the right polarity is critical because this determines the level of separation that will be achieved. Common solvents used in paper chromatography, in order of increasing polarity, are: petroleum ether or hexanes, cyclohexane, toluene, chloroform, ethyl ether, acetone, ethanol, and methanol. Sometimes mixtures of solvents are used to achieve the desired degree of polarity. A general rule of thumb is if the substances to be separated are polar, the developing solvent should be slightly less polar. Likewise, non-polar substances would require slightly polar solvents.

Materials

Beakers
Acetone
Plan material
Chromatography chambers (jars, test tubes or milk bottles)
Chromatography solvents
Ruler
Chromatography paper or filter paper
Pencil
Capillary tubes or Straws

General Notes:

Keep an eye on the Chromatography paper. Don't let the solvent get to the top!

When you remove the Chromatography paper, be sure to mark with pencil the solvent front while it is still wet and visible.

Safety Precautions

Acetone and the chromatography solvent are dangerous fire risks; flammable; toxic by ingestion and inhalation. This exercise should be performed only in an operating chemical fume hood or a well-ventilated area. Wear chemical splash goggles, chemical resistant gloves, and a chemical-resistant apron or old clothes.

Disposal

The chromatography papers can be kept but should be photographed by Mike or Steve before you take them away. The acetone solution and any remaining organic solvents from the exercise should be returned to Mike or Steve.

**Procedure**

1. Collect material from chosen herbaceous plant (leaves), tree (leaves), algae mass or diatom collection. Some worthwhile plants you might consider are

a) Oak leaves
b) Copper Beech leaves
c) Spinach leaves (if you can get such from the kitchen)
d) Ivy leaves
e) Carrot Tops
f) Grass
g) Ferns



h) Algal mats or accumulations from the tarn
i) Aquatic plants from the tarn
j) Diatoms from the springs or tarn (stones or outfall)

2. If you have leaf material then snip this into small pieces or grind up if you can find a pestle and mortar.

3. Take a test tube and add to it a couple of centimetres of acetone.

4. Add the plant material to the test tube.

5. Run some hot water into a beaker.

6. Dip the test tube into the beaker thereby warming the acetone.

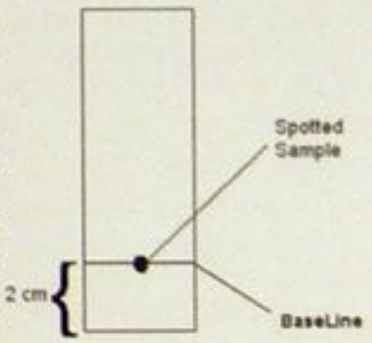
7. Agitate gently until the acetone takes up a significant amount of colour. (the darker the better).

8. If necessary, remove the plant material and add more.

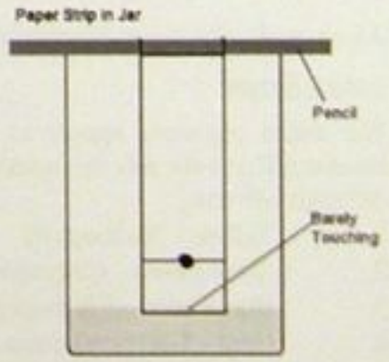
9. The more concentrated the solution the better your results are likely to be. If possible drive off some of the solvent until the remainder is very dark indeed. DO NOT HEAT OVER A FLAME.

10. Prepare Chromatography paper by cutting the sheet into strips long enough to be folded over at the top and stapled to form a loop and to reach to within 1.5cm of the bottom of the chromatography vessel.

11. Using a pencil, draw a line approximately 2 cm from the bottom edge and joining the long sides of the chromatography paper and mark it BL (BaseLine)




12. You are now ready to spot the chromatography paper using the capillary tubes or straws. The spot will be placed on the pencilled baseline (BL) and in the centre of that line. Dip the capillary tube or straw into the slurry of one of the plant extracts. The solution will be drawn up the tube. Remove the capillary and a small volume of solution should remain in the tube due to capillary action. Briefly and gently touch the tip of the capillary tube or straw to the baseline (BL) on the chromatography paper, keeping your index finger over the end of the tube, so that only a small amount of solution is transferred with each touch. It is important to keep the spot as small as possible. Let the solvent evaporate before touching the capillary tube to the paper again. Blow gently on the spot to help it evaporate. Touch the capillary tube or straw to the same spot again. Remove the capillary tube or straw and gently blow on the spot to evaporate the solvent. Repeat this procedure eight to ten times or until a nice dark spot is present on the chromatography paper. The spot should be approximately 5-6 mm in diameter when completed.




13. Place the chromatography paper in the chromatography chamber with the sample end down. Important: (1) Do not drip the chromatography solvent directly onto the chromatography paper, and (2) the sample spot should remain above the solvent. Do not add too much solvent, or your sample will dilute into the solvent! Carefully cover the

chamber with a suitable cap i.e. a watch glass or piece of cling film to minimise evaporation of the solvent.

14. The solvent will be drawn up the chromatography paper. As it is drawn up, it will carry the pigments in the sample up the paper at different rates depending on the characteristics of the individual compounds.

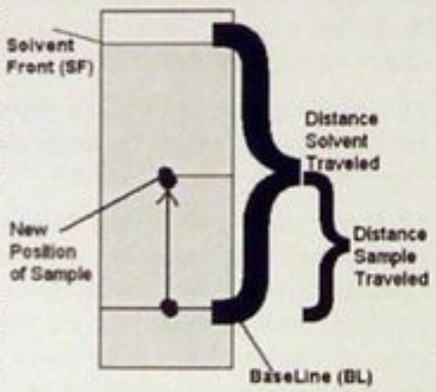
15. When the solvent front is within 0.5-1.0 cm of the top of the chromatography paper, the run is stopped by removing the paper from the chamber. Allow the paper to dry after marking the solvent front with a pencil line marked SF.

16. It is a good idea to mark the location of each of the separated bands on the chromatography paper and you must mark the final solvent front, again using a pencil. This is done because some of the colour and brightness of each of the spots may be lost over time.

17. Repeat steps 3 through 17 for the other plant pigment extracts.

**Data Analysis**

Since most of the natural products isolated from plants are pigments, they are relatively easy to see. A digital photograph of the chromatography paper (now called a chromatogram) will provide a permanent record of your results. When photographing the paper place a ruler adjacent to the paper along one of its longest sides and ensure that this is included in the final image.




Processing the Data

To compare and identify compounds separated by paper chromatography, you can calculate the Rf (relative front [also sometimes called rate of flow, and also retention factor) values for each pigment, using the formula:

$$Rf = \frac{\text{Distance travelled by pigment (baseline to pigment spot)}}{\text{Distance travelled by solvent front (baseline to solvent front)}}$$

An example of a chromatogram and the results you are likely to see are depicted below:

Colour Bands

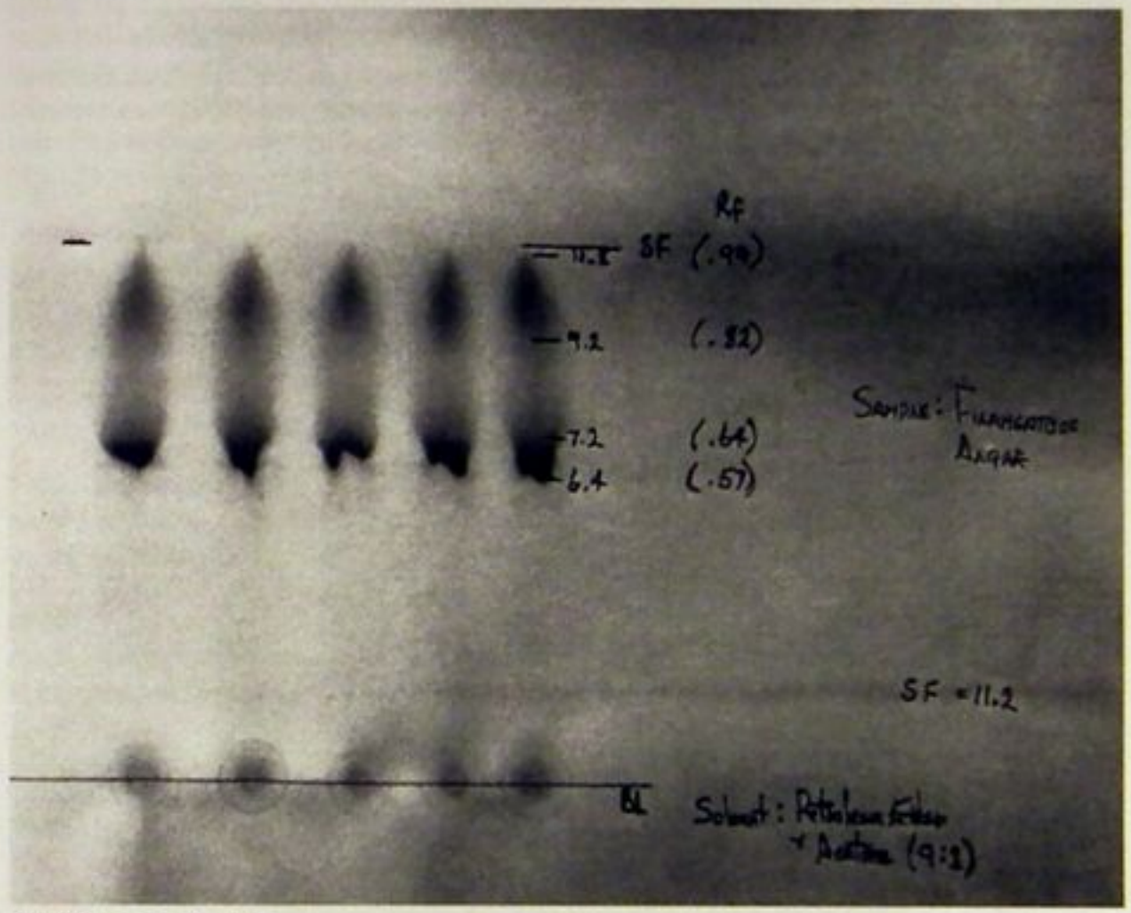
The major pigments appear in a number of bands. The list below is in order from the baseline(BL) to the solvent front(SF) [this order, though not the colour, may change when using different solvents]:

1. Yellow - Xanthophyll
2. Olive Green - Chlorophyll a
3. Blue Green - Chlorophyll b
4. Grey - Leaf breakdown product - ignore
5. Yellow - Violaxanthin
6. Yellow - Lutein



7. Yellow Orange - beta-Carotene

You may be able to distinguish other bands -particularly when you compare two or more different plant samples.




Variations on a Theme

Rf values differ when using different solvents and you can achieve a greater or lesser spread of pigments.

We have the following solvents which can be mixed in various combinations.

The standard eluent is a 9:1 mixture of petroleum ether:acetone.

Other common ratios are 7:3, 4:1.

1. Petroleum ether
2. Toluene
3. Acetone
4. Iso-propyl Alcohol (Rubbing Alcohol)
5. Ethanol
6. Methanol

It is important to record which solvents you have used as your eluent and in what ratio.

You can also vary the method of applying the solvent.

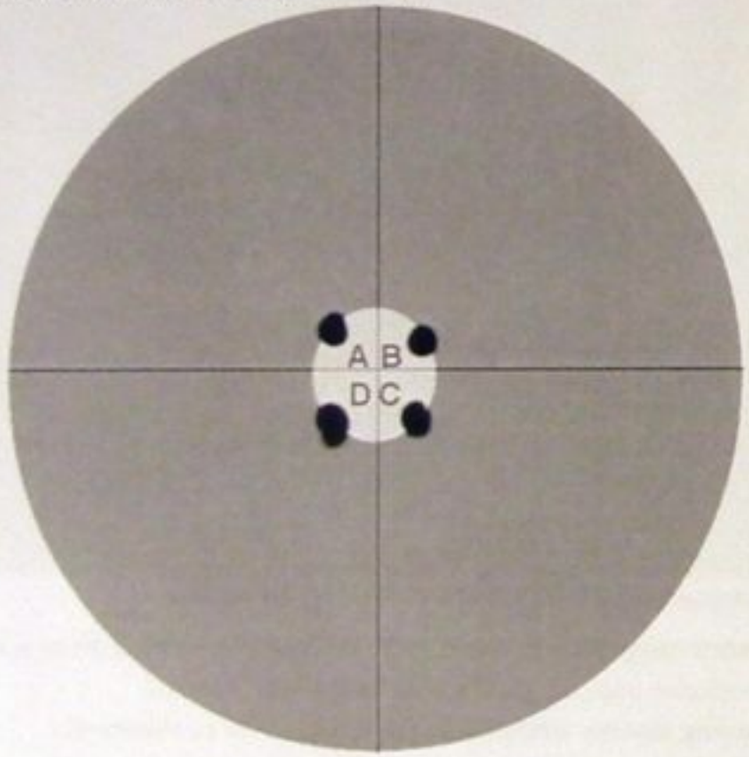
For instance you could cut a filter paper in half and form a cone. Apply a line of the plant extract 1.5 cm from the point and place into a suitable beaker using 1cm of eluent.

If you wish to be even more creative you could create a filter paper chromatogram.

Take a filter paper and draw two lines across its centre at 90 degrees to each other. This quarters the filter paper. Take a 2p piece and place I over the centre point. Draw round the coin and mark the small segments A, B, C and D.

On the centre point of each small arc place your drop of plant extract.

Place the filter paper on a tile and then drop the eluent onto the centre point keeping the centre wet as the eluent is drawn across the paper. This is a slightly more intensive way of producing chromatograms but allows you to do four in one go.




## Eul(enstein) Diat(om). spec. typ. Slides

Theodor Eulenstein (d.1875)

**DIATOMACEARUM SPECIES TYPICAE**

Theodor Eulenstein produced two sets of 100 slides - Century I (numbers 1-100) & Century II (numbers 101-200).

Century I went into two Editions - the 1st Edition was produced in Stuttgart in 1867, the 2nd Edition was produced in 1869 in Dresden at which juncture, it is believed, Century II was also produced.

Both editions of Century I consist of the same inventory of taxa on the same numbered slide, however, the stated localities on slide numbers 27 and 49 differ between the two Editions.



The references below relate to the 1st Edition unless the 2nd Edition is stated and information from the 2nd Edition has been entered only if it differs from the 1st Edition.

There is a difference in the way the slides are numbered. Some bear the abbreviation "No." and others "Nr.". This may be a difference between the 1st Edition and 2nd Edition but I don't have sufficient information to be absolutely certain. For the purposes of this list I have chosen simply to use No.

Location names appear on the slides in Late Latin e.g. Ins. = Insula = Island. These have been translated to English and appear in square brackets [ ].

Material sources are specified in Latin as follows:-

*In aqua dulci* - From sweet water (freshwater)
*In aqua subsalsa* - From brackish water
*In mare* - From sea (saltwater)
*In palud maritimis* - From coastal marsh (salt marsh)
*In stratio tertiaro* -
*In stratio turfaceo* -
*In submarinis* -
*In termis* -

These have been *italicised* for ease of reading.

Some slides have a supplementary label attached providing an original publication reference. In the list below such a label has been included as underlined text.

**No. 1.**
*Melosira nummuloides* (Dillwyn, Lyngbye)
Hofmansgave, Dan. *In mare.*
[Hofmansgrave, Odense, Denmark]
Spec. originale Lyngbyeanum. Lyngb. tent. tab. 43.

**No. 2.**
*Orthosira roeseana* Rabenhorst
Aberdeen, Scotia. *In aqua dulci.*
[Aberdeen, Grampian, Scotland]

**No. 3.**
*Orthosira dickiei* Thwaites
Aberdeen, Scotia. *In aqua dulci.*
[Aberdeen, Grampian, Scotland]
Spec. originale. Ann. S. II. v. 1. tab. XII. E.

**No. 4.**
*Orthosira arenaria* (Moore) W. Smith
Port Rush, Hibern. *In aqua dulci.*
[Portrush, Antrim, Northern Ireland]

**No. 5.**
*Cyclotella rectangula* Brébisson
Paris. *In aqua dulci.*
[Paris, Ville-de-Paris, France]
Spec. originale. Ktz. spec. Alg. pag. 19.

**No. 6.**
*Coscinodiscus omphalanthus* Ehrenberg
Bermuda. *In stratio tertiaro.*

Spec. originale.Bailey. Amer. J. 1845. Locus dubius; verisimiliter ad pagum hui. nom. Americae borealis non ad insulas Bermuda referend.

**No. 7.**
*Arachnoidiscus ornatus* Ehrenberg
Prom. bon. spei. *In mare.*
[Cape of Good Hope, South Cape, South Africa]

**No. 8.**
*Aulacodiscus orientalis* Greville
Ins. Sandwich. *In mare.*
[Hawaii, United States or possibly the South Sandwich Islands]

**No. 9.**
*Cerataulus turgidus* Ehrenberg
Ins. Guernsey. *In mare.*
[Guernsey, Channel Islands]

**No. 10.**
*Cerataulus laevis* (Ehrenberg)
Fluv. Hudson. *In aqua subsalsa.*
[Hudson River, New York, United States]

**No. 11.**
*Biddulphia pulchella* S. Gray
Ins. Capri. *In mare.*
[Capri, Campania, Italy]

**No. 12.**
*Triceratium arcticum* Brightwell
Ins. Vancouver. *In mare.*
[Vancouver Island, British Columbia, Canada]

**No. 13.**
*Amphitetras antediluviana* Ehrenberg
Ins. Guernsey. *In mare.*
[Guernsey, Channel Islands]

**No. 14.**
*Isthmia enervis* Ehrenberg
Barmouth, Anglia. *In mare.*
[Barmouth, Gwynedd, Wales]

**No. 15.**
*Terpsinoe musica* Ehrenberg
Comale Creek, Rex. *In aqua dulci.*
[Comal Creek, Texas, United States]

**No. 16.**
a. *Hemiaulus polycistinorum* Ehrenberg
b. (P) *alatus* Greville
Ins. Barbados. *In stratio tertiaro.*
[Barbadoes, West Indies]
Spec. originale.
a. Ehr. Mik. tab. 36. f. 43.
b. Tr. Mic. Soc. XIII. p. 31. f. 14.
Rarius proveniunt ceterae spec. Grevilleanae loc. cit. descriptae.




**No. 17.**
*Chaetcoeros armatum* West
Hornsea, Anglia. *In mare.*
[Hornsea, Norfolk, England]

**No. 18.**
*Surirella biseriata* Brébisson
Alpes Saxoniae. *In aqua dulci.*
[Sachsen Alpen, Germany]

**No. 19.**
*Surirella gemma* Ehrenberg
Hull, Anglia. *In submarinis.*
[Kingston-upon-Hull, Humberside, England]

**No. 20.**
*Surirella ovata* Kützing
Salenelles, Gall. *In aqua subsalsa.*
[Salenelles, Calvados, France]

**No. 21.**
*Campylodiscus clypeus* Ehrenberg
Breydon, Anglia. *In submarinis.*
[Breydon Water, Norfolk, England]

**No. 22.**
*Cymatopleura apiculata* W. Smith
Dresden, Germ. *In aqua dulci.*
[Dresden, Dresden, Germany]

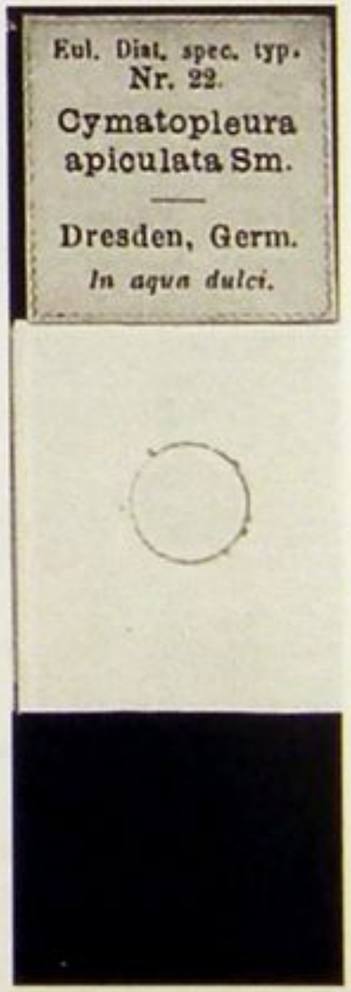
**No. 23.**
*Nitzschia obtusa* W. Smith
Honfleur, Gallia. *In submarinis.*
[Honfleur, Calvados, France]

**No. 24.**
*Nitzschia palea* Kützing
Trieste, Italia. *In aqua dulci.*
[Trieste, Fruili-Venetia-Giula, Italy]
Spec. originale. Ktz. Bac. Tab. 4. fig. 2.

**No. 25.**
*Nitzschia tenuis* W. Smith
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]

**No. 26.**
*Nitzschia lanceolata* W. Smith
= *Sur. curvula* Bréb. [*Surirella*]
Courseules, Gallia.
[Courseulles-sur-Mer, Calvados, France]
Spec. originale. In. Ktz. spec. Alg. pag. 36.

**No. 27.**
*Nitzschia closterium* (Kützing)
Tynemouth, Angl. *In mare.* [1st Edition]]
[Tynemouth, Northumberland, England]
[England (Sussex) Sussex, Anglia [2nd Edition]]



**No. 28.**
*Homoeocladia martiana* C. Agardh
Neyland, Anglia. *In mare.*
[Neyland, Dyfed, Wales]
**No. 29.**
*Homoeocladia martiana* C. Agardh
Valvae.
Neyland, Anglia. *In mare.*
[Neyland, Dyfed, Wales]
**No. 30.**
*Denticula obtusa* W. Smith
Penzance, Anglia. *In aqua dulci.*
[Penzance, Cornwall, England]
Spec. originale. Sm. Syn. tab. 34. fig. 292.

**No. 31.**
*Denticula thermalis* Kützing
Abano, Italia. *In termis.*
[Abano Terme, Veneto, Italy]
Spec. originale. Ktz. Bac. tab. 17. fig. 6.
**No. 32.**
*Epithemia turdiga* (Ehrenberg)
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 33.**
*Epithemia argus* (Ehrenberg)
Ins. Arran, Scotia. *In aqua dulci.*
[Arran, Strathclyde, Scotland]
cum form sporang. /
= Ep. longicornu 'E' in Sm. Syn. t. 30. f. 217 (Spec. originale).
**No. 34.**
*Epithemia sorex*
Amblesdie, Anglia. *In aqua dulci.*
[Ambleside, Cumbria, England]
**No. 35.**
*Epithemia constricta* Brébisson
*Epithemia sorex*
*Epithemia ventricosa*
Ouistreham, Gall. *In aqua subsalsa.*
[Ouistreham, Calvados, France]
Spec. originale.
**No. 36.**
*Eunotia pectinalis* (Dillwyn)
*Eunotia undulata* Ralfs
b. *undulata* (Rlfs)




Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 37.**
*Ceratoneis arcus* (Ehrenberg)
Alpes Saxoniae. *In aqua dulci.*
[Sachsen Alpen, Germany]
**No. 38.**
*Synedra pulchella* (Ralfs ) [a]
*Synedra pulchella* (Ralfs ) [b]
a) Falaise, Gallia.
[Falaise, Calvados, France]
b) Penzance, Angl. *In aqua dulci.*
[Penzance, Cornwall, England]
b) Spec. originale. Ktz. Bac. tab. 29. fig. 87
**No. 39.**
*Synedra vaucheriae* Kützing
Wesissenfels, Germ. *In aqua dulci.*
[Weissenfels, Halle, Germany]
Spec. originale. Linnaea VIII. tab. 15. f. 38.
**No. 40.**
*Synedra splendens* Kützing
Canstatt, Germ. *In aqua dulci.*
[Bad Canstatt, Baden-Württemberg, Germany]
**No. 41.**
*Synedra affinis* Kützing
Trieste, Italia. *In mare.*
[Trieste, Fruili-Venetia-Giula, Italy]
Spec. originale. Ktz. Bac. tab. 15. f. 6.11.
**No. 42.**
*Synedra fulgens* (Greville)
Venezia, Italia. *In mare.*
[Venice, Veneto, Italy]
**No. 43.**
*Synedra fulgens* (Greville)
Valvae
Venezia, Italia
[Venice, Veneto, Italy]
**No. 44.**
*Fragilaria virescens* Ralfs
Stuttgart, Germ. *In aqua dulci.*
[Stuttgart, Baden-Württemberg, Germany]
**No. 45.**
*Fragilaria mesolepta* Rabenhorst
Tondern, Germ. *In aq. subsalsa.*
[Tonder, Tonder, Denmark]
**No. 46.**
*Fragilaria minima* (Ralfs)

Penzance, Anglia. *In mare.*
[Penzance, Cornwall, England]
Spec. originale. Tr. Bot. S. Edin. II. p. 20.

**No. 47.**
*Fragilaria harrisonii* (W. Smith)
Hull, Anglia. *In aqua dulci.*
[Kingston-upon-Hull, Humberside, England]
Spec. originale. Sm. Syn. II. t. 60. f. 373.

**No. 48.**
*Diatoma grande* W. Smith
Allan Water, Scot. *In aqua dulci.*
[Allan Water, Central, Scotland]
Spec. originale. Sm. Syn. II. tab. 40. f. 310.

**No. 49.**
*Diatoma hiemale* (Lyngbye)
Vogesus, Gallia. *In aqua dulci*, [1st Edition]
[Vosges, France]
Ins. Faero [2nd Edition]
[Faeroe Islands]
[Faeroerne, Faero, Denmark]

**No. 50.**
*Tabellaria flocculosa* (Roth)
Naes, Norvegica. *In aqua dulci.*
[Nes, Aust-Agder, Norway]
Spec. originale. Lyngb. Tent. Pag. 179. t. 61.

**No. 51.**
*Hyalosira obtusangula* Kützing
Venezia, Italia. *In mare.*
[Venice, Veneto, Italy]
Spec. originale. Ktz. Bac. tab. 18. f. 111.4

**No. 52.**
*Grammatophora marina* (Lyngbye)
Ins. Faeroe. *In mare.*
[Faeroe Islands, Faero, Denmark]
Spec. originale. Lyngb. Tent. Pag. 180. t. 62.

**No. 53.**
*Striatella unipunctata* (Lyngbye)
Cherbourg, Gall. *In mare.*
[Cherbourg, Manche, France]




**No. 54.**
*Rhabdonema arcuatum* (Lyngbye)
Blyth, Anglia. *In mare.*
[Blyth, Northumberland, England]

**No. 55.**
*Tetracyclus lacustris* Ralfs
Dolgelly, Anglia. *In aqua dulci.*
[Dogellau, Gwynedd, Wales]
Spec. originale. Ann. & Mag. XII. tab. 4.2.

**No. 56.**
*Licmophora flabellata* (Carmichael)
Arromanches, Gall. *In mare.*
[Arromanches-les-Bains, Calvados, France]

**No. 57.**
*Licmophora flabellata* (Carmichael)
Arromanches, Gall. *In mare.*
[Arromanches-les-Bains, Calvados, France]

**No. 58.**
*Achnanthes longipes* C. Agardh
Trieste, Italia. *In mare.*
[Trieste, Fruili-Venetia-Giula, Italy]

**No. 59.**
*Achnanthes longipes* C. Agardh
Trieste, Italia. *In mare.*
[Trieste, Fruili-Venetia-Giula, Italy]

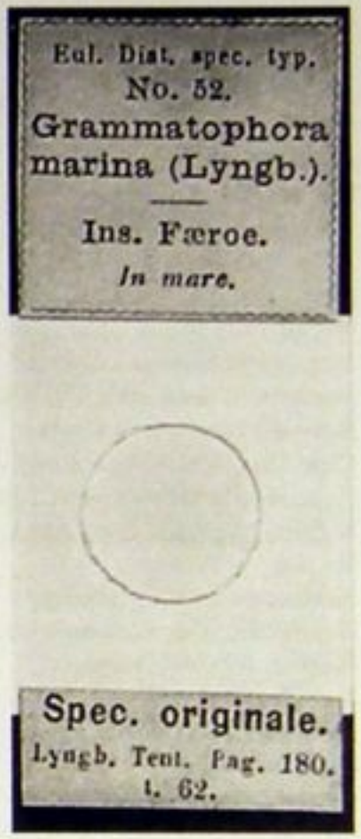
**No. 60.**
*Achnanthes brevipes* C. Agardh
Artern, Germ. *In aqua subsalsa.*
[Artern, Halle, Germany]

**No. 61.**
*Achnanthidium lancoleolatum* Brébisson
*Amphora minutissimum*
*Gomphonema tenellum*
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
Spec. originale. Ktz. Spec. Alg. p. 54.

**No. 62.**
*Achnanthidium lineare* W. Smith
Lasswade, Scotia. *In aqua dulci.*
[Lasswade, Lothian, Scotland]
Spec. originale. Sm. Syn. II. t. 61. f. 381.

**No. 63.**
*Rhoicosphenia curvata* (Kützing)
Carmyle, Scotia. *In aqua dulci.*
[Carmyle, Strathclyde, Scotland]

**No. 64.**
*Cocconeis pediculus* Ehrenberg
Dresden, Germ. *In aqua dulci.*



[Dresden, Dresden, Germany]
**No. 65.**
*Cocconeis scutellum* Ehrenberg
Tillbury Fort, Angl. *In mare.*
[Tilbury, Essex, England]
**No. 66.**
*Cocconeis grevillei* W. Smith
Nova Caledonia. *In mare.*
[New Caledonia]
**No. 67.**
*Mastogloia elegans* Lewis [a]
*Mastogloia lanceolata* Thwaites [b]
*Navicula incomperta* Lewis
Cape May, Am. bor. *In palud. maritimis.*
[Cape May, New Jersey, United States]
b. Spec. originale. Proc. Acad. Philadelph. Dec. 1863. fig. 9.
**No. 68.**
*Navicula nobilis* Ehrenberg
Stehlen Sil., Germ. *In aqua dulci.*
[Strzelin, Wroclaw, Poland]
**No. 69.**
*Navicula oblonga* Kützing
Gleiwitz, Germ. *In aqua dulci.*
[Gleiwitz, Katowice, Poland]
**No. 70.**
*Navicula lata* Brébisson
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
Spec. originale. Bréb. Consid. p. 18, No. 9.
**No. 71.**
*Navicula brebissonii* Kützing
Canstatt, Germ. *In aqua dulci.*
[Bad Canstatt, Baden-Württemberg, Germany]
**No. 72.**
*Navicula cryptocephala* Kützing
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 73.**
*Navicula affinis* Ehrenberg
Strehelen Sil., Germ. *In aqua dulci.*
[Strzelin, Wroclaw, Poland]
**No. 74.**
*Navicula serians* (Brébisson)
Tillowitz, Germ. *In strato turfaceo.*
[Tillowitz, Poland]
**No. 75.**
*Navicula sphaerophora* Kützing
Stuttgart, Germany. *In aqua dulci.*



[Stuttgart, Baden-Württemberg, Germany]
**No. 76.**
*Navicula cuspidata* Kützing
Strehlen Sil. Germ. *In aqua dulci.*
[Strzelin, Wroclaw, Poland]
**No. 77.**
*Schizonema grevillei* C. Agardh
Valvae.
Hartlepool, Angl. *In mare.*
[Hartlepool, Durham, England]
**No. 78.**
*Schizonema grevillei* C. Agardh
Valvae.
Ilfracombe, Angl. *In mare.*
[Ilfracombe, Devon, England]
**No. 79.**
*Amphipleura pellucida* Kützing
Aberdeen, Scotia. *In aqua dulci.*
[Aberdeen, Grampian, Scotland]
**No. 80.**
*Berkeleya fragilis* Greville
Cumbrae, Scotia. *In mare.*
[The Cumbraes, Strathclyde, Scotland]
**No. 81.**
*Berkeleya dillwynii* (C. Agardh)
In situ.
St. Andrews, Scot. *In mare.*
[Saint Andrews, Fife, Scotland]
**No. 82.**
*Berkeleya dillwynii* (C. Agardh)
Valvae.
St. Andrews, Scot. *In mare.*
[Saint Andrews, Fife, Scotland]
**No. 83.**
*Stauroneis phoenicenteron* Ehrenberg
Gleiwitz, Germ. *In aqua dulci.*
[Gleiwitz, Katowice, Poland]
**No. 84.**
*Scoliopleura tumida* (Brébisson)
Honfluer, Gallia. *In submarinis.*
[Honfleur, Calvados, France]
Spec. originale. Ktz. Spec. Alg. p. 77
**No. 85.**
*Pleurosigma strigosum* W. Smith
Blyth, Anglia. *In mare.*
[Blyth, Northumberland, England]
**No. 86.**
*Pleurosigma balticum* (Ehrenberg)

Courseulles, Gallia. *In submarinis.*
[Courseulles, Calvados, France]
**No. 87.**
*Pleurosigma attenuatum* (Kützing)
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 88.**
*Pleurosigma acuminatum* (Kützing)
Canstatt, Germ. *In aqua dulci.*
[Bad Canstatt, Baden-Württemberg, Germany]
**No. 89.**
*Endosigma eximium* (Thwaites)
Hull, Anglia. *In aqua subsalsa.*
[Kingston-upon-Hull, Humberside, England]
**No. 90.**
*Endosigma eximium* (Thwaites)
Valvae
Hull, Anglia. *In aqua subsalsa.*
[Kingston-upon-Hull, Humberside, England]
**No. 91.**
*Donkinia carinata* (Donkin)
Northumberland. *In mare.*
[Northumberland, England]
**No. 92.**
*Amphiprora paludosa* W. Smith [a]
*Amphiprora pokornyana* Grunow [b]
Elmen, Germ. *In aqua subsalsa.*
[Elmen, Tirol, Austria]
b. Teste Grunowio.
**No. 93.**
*Cymbella gastroides* Kützing
Strehlen Sil., Germ. *In aqua dulci.*
[Strzelin, Wroclaw, Poland]
**No. 94.**
*Encyonema prostratum* Ralfs
Ilfracombe, Angl. *In aqua dulci.*
[Ilfracombe, Devon, England]
Spec. originale. Ann. & Mag. XVI. tab. III. 3.
**No. 95.**
*Amphora ovalis* Kützing
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 96.**
*Amphora salina* W. Smith







Isigny, Gallia. *In submarinis.*
[Isigny-sur-Mer, Calvados, France]
**No. 97.**
*Amphora arenaria* Donkin
Cresswell, Angl. *In mare.*
[Cresswell, Dyfed, Wales]
**No. 98.**
*Gomphonema tenellum* Kützing
Canstatt, Germ. *In aqua dulci.*
[Bad Canstatt, Baden-Württemberg, Germany]

**No. 99.**
*Gomphonema acuminatum* Ehrenberg
Falaise, Gallia. *In aqua dulci.*
[Falaise, Calvados, France]
**No. 100.**
*Gomphonema geminatum* (Lyngbye)
Ambleside, Anglia. *In aqua dulci.*
[Ambleside, Cumbria, England]



## Diatom Visibility Index and the slides of C N Walter

by Mike Samworth

Some years ago Cedric N. Walter began work on a Diatom Visibility Index (DVI) and noted his findings in a loose-leaf binder. He calculated the index figures but as far as we are able to tell did not continue or was unable to continue this work. We are indebted to Colin Lamb for bringing these notes to our attention and for loaning us the original manuscripts.

Since C. N. Walter's time a number of other mountants (some not specifically designed for mounting diatoms) have become available and we have extended his list to encompass some more esoteric compounds, and reported this in AD (Vol2/I page 47). This was a report of performing the exercise on two sets of diatoms. The first was a fairly pure gathering of Arachnoidiscus ornatus from California and the second on a freshwater gathering from Malham Tarn and the surrounding area. We split any gatherings and cleanings in two and combined one half of each to make a representative collection of them all.

It may help to remind us of the DVI;

**What is the Diatom Visibility Index?**

The visibility of cleaned diatom frustules depends much on the difference in Refractive Index (R.I.) between the mountant and the material from which frustules are made, Silex. The greater the difference the more contrast there is between the frustule and its surroundings, and thus more detail can be made visible. However, if a frustule is particularly 'robust' (a term used for thick walled frustules) then the R.I. of the mountant may not make a great deal of difference.

In principle the difference can be positive or negative and result in the same characteristic. Thus, Air has a DVI of 43.37 and Pleurax may have a DVI as high as 46. These then should exhibit much the same effect as each other. And this is indeed the case under low power magnification. When we move to Oil Immersion, however, we are now making contact with the glass using an immersion medium that has about the same R.I. as glass and coincidentally about the same as Silex. You can't see the glass and unfortunately you can't see the frustules. So we need to introduce a medium other than Air. Hence the need for a high R.I. (or a very low R.I., we think) medium that itself is in close contact with the frustule.

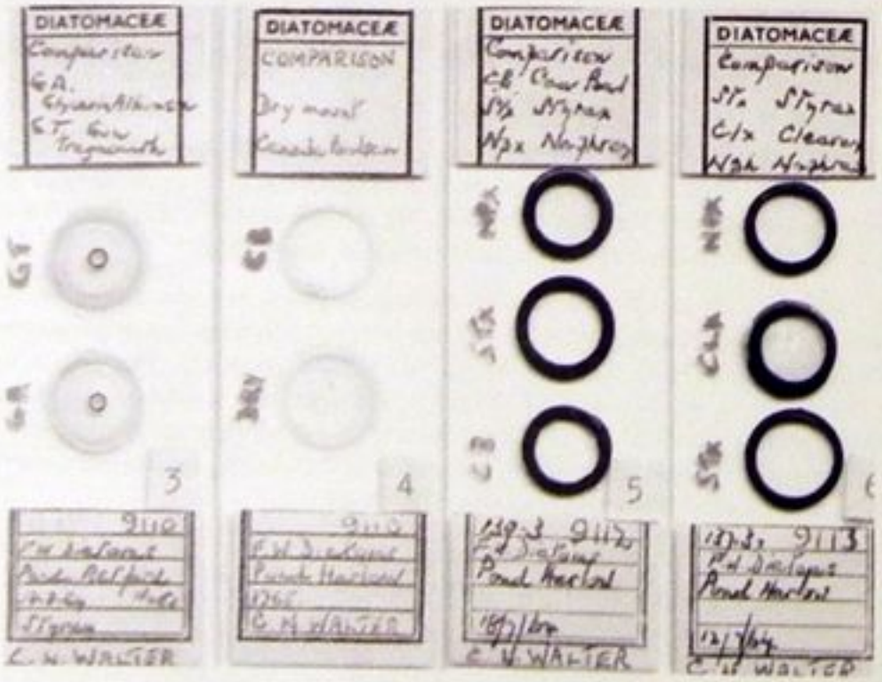
The Diatom Visibility Index (DVI) is determined by multiplying the difference between the R.I of the mountant and that of Silex, by 100. The Refractive Index of Diatom Silex is generally accepted to be 1.434.

A number of eminent microscopists have postulated that the efficacy of a mountant, when applied to viewing the structure of diatoms, may be more to do with the mountants ability to 'adhere' to the frustule than its Refractive Index!

**The C. N. Walter connection**

It is quite obvious from the stimulus provided by reading the papers of Walter, that he was interested in different mountants. Quite recently, this was brought home by a chance discovery of some slides by Walter, which are shown below;

As can be seen, Walter referred to these as 'Comparison' slides, where he had mounted the same






samples in up to three different mountants on the same slide. By complete contrast, his samples contain none of the species as used in our rather cruder tests, but rather a varied mixed strew. As the previous article showed quite clearly, it is very difficult to show up any slight differences by photographic record, especially when done digitally, and then passed through the hands of the computer operator, and then dare I say it, the printer. Being able to easily pass from one to other as on Walters slides is a great help, and perhaps one that we may tackle in future. Or, perhaps one of our members has done such an exercise already? If so, we would be most grateful if they would contact us, and even better of they could report their findings in these pages.

No doubt a number of eagle-eyed readers may have noticed the odd one out in this quartet of slides. In the one on the far left, the mountant is the same, Styrax, but here Walter is looking at the adhesive he has used to attach the diatoms to the slide or cover. Under each cover are three species, arranged in a line. In this case, 'GA' (glycerine albumen) has been most successful, as the diatoms are still in a line, whereas in the other, 'GT' (gum tragacanth) the diatoms have moved somewhat. We shouldn't go by one example though, and if any readers have any comments, then again, please write in.

## Robert Isaac Firth's Ringing Table

by Ernie Ives

A few details of the table.

I have no idea how the table came into the possession of my donor but it is an interesting piece of equipment.

The wooden parts of the table are of pine with the raised hand rest looking like a later addition. The main thing one notices is the weight of the table – 2.5 kilos and most of that it the ringing table itself. Solid brass 100 mm diam. and 18 mm deep. I don't what sort of bearings it has but it runs very smoothly if slower than any of my other tables and yet it keeps going and going and going. Probably the weight/mass of the table precludes a high speed but it is certainly more than sufficient for ringing purposes.

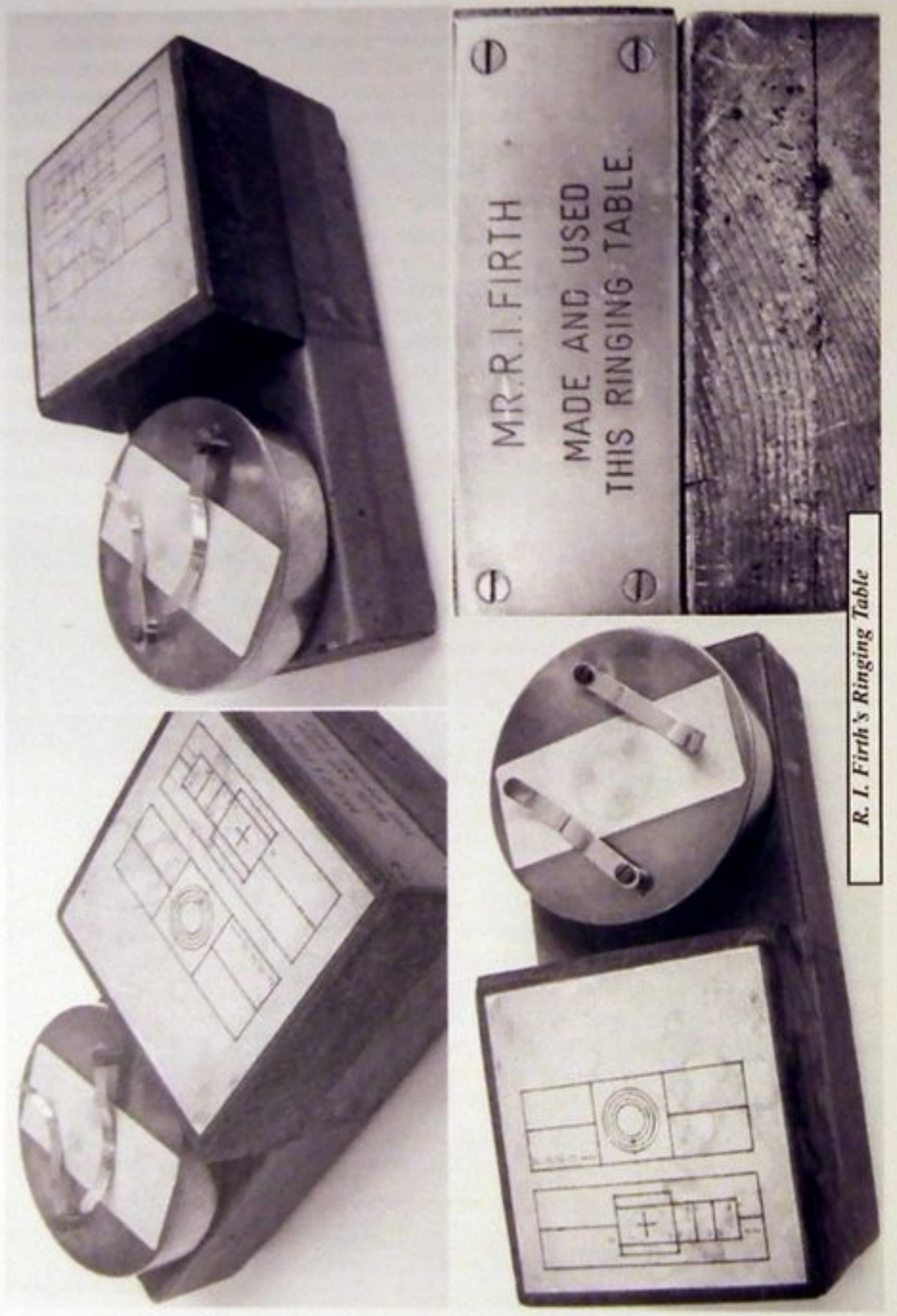
I noticed that the clip pins are arranged diametrically as per my last BP waffle but I suspect that the shiny chromium plated clips are a much later addition as the seem too long to hold the slides correctly if the slide sides are against the pins. They are okay when the slide is over the paper area but they still look modern and new.

Who added the name plate? Obviously it was professionally engraved and from the wording I would suspect it was added after the death of Mr. Firth or at least after he became famous.

The photograph on the right is of a slide with a beautiful black ring often found on R. I. Firth slides.

The photographs on the next page provide some indication of the sheer mass of the turntable.

Robert Isaac Firth (1902-1982).

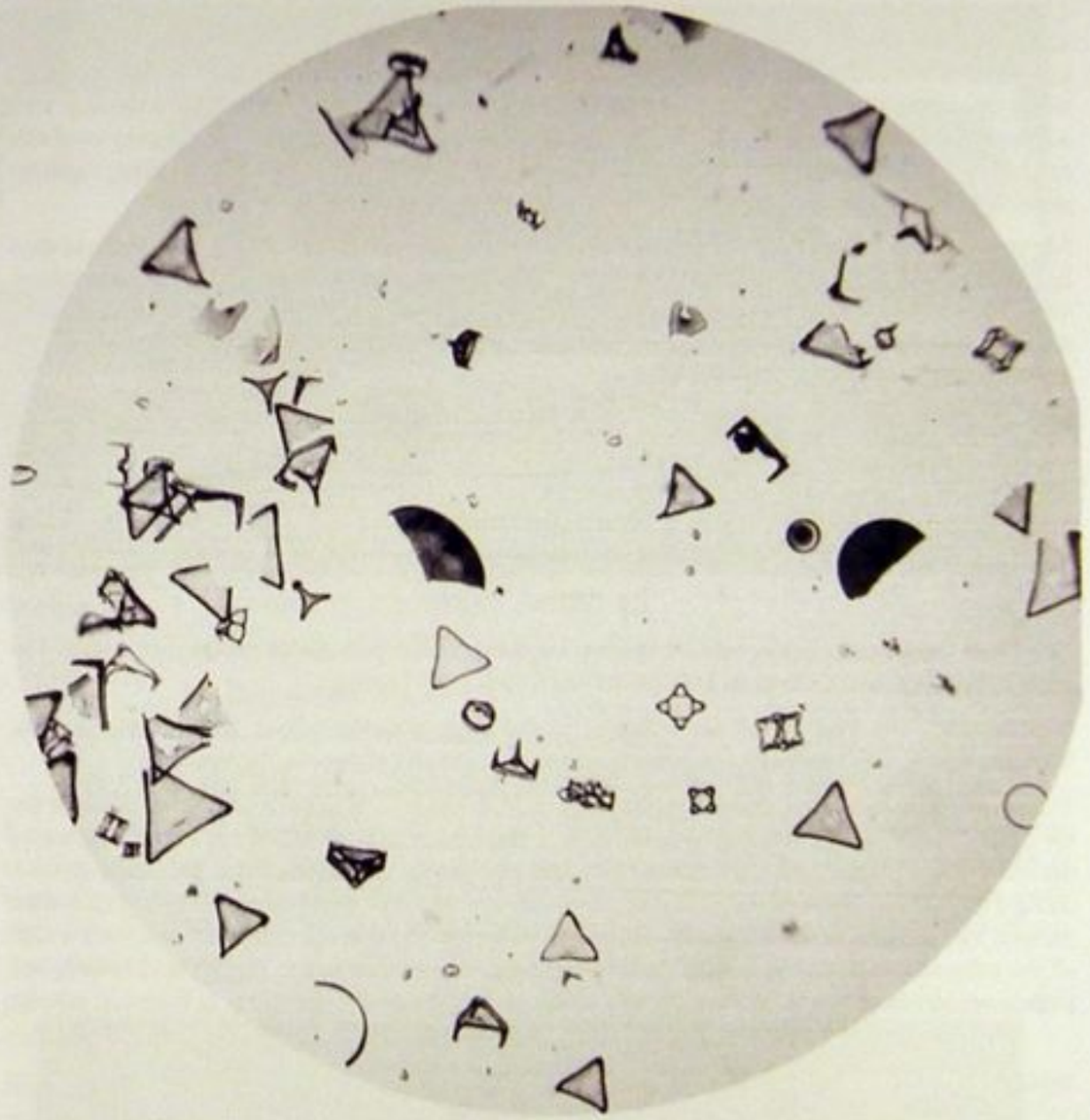



*R. I. Firth's Ringing Table*



# Fur, Jutland

Following the article in Vol IV No. 1 - Danish Diatomite by Klaus Yde, MD - we were sent a beautifully clean strew of diatomite from Fur, Jutland. Similarly clean strews are available from Klaus D. Kemp (address inside front cover).



## Another Stamp

No sooner do we print an image of the only stamp we have ever seen depicting diatoms than another turns up. Are there more?

## Letter to the Editor

Dear Editor,

I read with interest the 'Problems with Depth of Field' article in Vol. III No. IV of AD.

I suspect the photomicrograph shown taken by Thomas Castle may have been taken with oblique illumination to increase apparent depth of field; the image certainly has this feel to it. I did also coe cross a technique used by one of my heroes, James Murray, to increase the depth of field when photographing Antarctic tardigrades. With the slower film emulsions used in the late 19th and early 20th centuries, exposure times of several seconds were the norm and Murray used this to slowly adjust the fine focus of his microscope during the exposure thus capturing a greater depth of field. This may be how Thomas Castle achieved his results with diatoms.

For anyone with a digital camera and microscope, possibly the best use of £60 (+VAT) these days is to buy a copy of the superb Helicon Focus software (obtainable from Brunel Microscopes). This combines 'stacks' of digital images taken at different focus points up a specimen into a three-dimensional picture by removing the out of focus elements of each frame. I am sure Thomas Castle would have loved it!

best regards,

Philip M. Greaves

## LED modification to the O.U. microscope.

by Mike Woof

The Open University microscope is a readily available, cheap and useful pocket instrument. The built-in lighting uses a filament bulb powered by two AAA batteries.

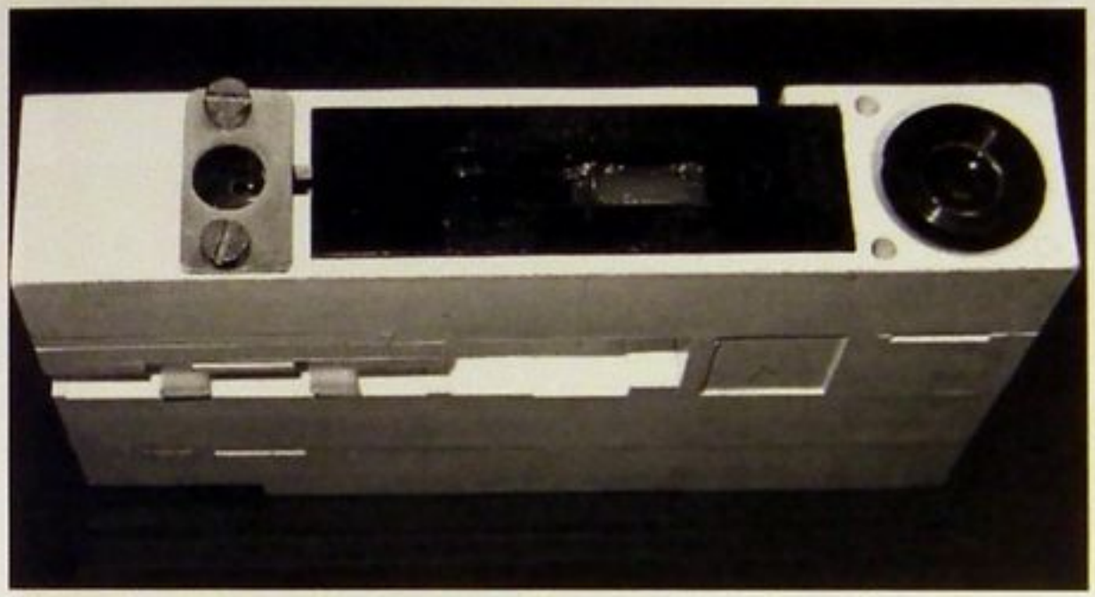
Unfortunately the lifetime of the batteries is not great and the colour temperature is poor. Modification to LED lighting is relatively simple and greatly improves the situation.

The modification involves discarding the original bulb holder and slider and making a holder for the LED consisting of a brass tube soldered to a brass plate drilled with three holes. The top of the microscope already has three holes, the outer two can be tapped M3.5 for the fixing screws, and the middle one takes the LED holder. The LED is fitted into a rubber grommet which is then pressed into the end of the brass tube. Lead-out wires are brought out through a hole in the side of the tube and soldered to a slide switch Araldited to the microscope top plate. Leads to the switch are soldered to the copper strips on the underside of the top plate (observing correct



polarity) which are the battery connections. No dropper resistor is needed.

In use it will be found that the batteries last for months as the LED is only drawing a few milliamps and the illumination intensity is adequate for photography or the use of polarising filters.



Components: Ultrabright 5mm. LED

Miniature slide switch

Thin wall brass tube

## So you think you need a microscope to see diatoms!

Were you to wander abroad, to Seaham perhaps, perchance you would enter East Shore Village and there espy some giant diatoms. You would be forgiven to believe this might be some sort of fairy-tale. But take my word for it, there they are, and not just a single species. And when I say giant I really mean giant - frustule length measured in yards (or metres if you are one of our younger readers).

By now you are, no doubt, convinced that I am under the influence and that these diatoms, like the proverbial elephants, are pink. Well actually they are a sort of uniform rust colour.

Since you obviously don't believe me I'll explain. They are sculptures! Really big diatom sculptures and they are absolutely wonderful! They are fantastic! They are there!

I've probably used up my ration of exclamation marks now.

The sculptor is one Andrew McKeown who works primarily on public sculpture commissions involving local people in the design and creation of permanent artworks for their environment.

The sculptures are cast into durable metals such as iron and steel, bronze and aluminium. Other pieces may be cast or fabricated from steel, stone, wood, plastics and resin.

The inspiration for most of Andrew's public sculpture comes from their immediate environment and these sculptures often symbolise social and environmental regeneration and renewal.

Most recently Andrew has completed works for Groundwork UK (Changing Places Project), Salford City Council, Middlesbrough Council and Gateshead Council. Andrew is based in Middlesbrough and is available for U.K. and International sculpture commissions and exhibitions.

The ones in Seaham are titled 'Jewels of the Sea', East Shore Village, Seaham

The photographs on the following pages are by Gary Pascoe, a Chemistry teacher who was born in Seaham, and one of the editors 'best mates'. The same editor provided the sculptor with photographs of diatoms from which inspiration was so beautifully forthcoming.





The next issue of

# The Amateur Diatomist


Notes for contributors.

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

With the application of technology we are able to take practically any format of contribution, electronic or otherwise. Pictures may be prints, photocopies, negatives, slides, line drawings - basically anything. Material submitted should be your own copyright. Quotes and small extracts from other documentation are acceptable but wholesale plagiarism is unacceptable. Text may be typed, hand-written, or word-processed. Mounted slides may accompany your article and we will endeavour to produce illustrations from these. We cannot, however, guarantee their safety or safe return so only send duplicates.

If you wish to name anyone then get their permission first as seeing your name in print, and perhaps associated with something you would rather was forgotten, can come as something of a shock.We hope that by adopting this relaxed approach to the submission of copy you will all break out the notepads and begin writing. What you have to say concerning Diatoms, mounting and Microscopy is of interest to us all.

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