

Diatoms – the jewels of our biodiversity

Leszek Wolnik delves into the miniscule world of Irish diatoms

Diatoms are remarkable and beautiful microscopic organisms that are abundant in freshwater and marine ecosystems. They are found in almost every habitat containing water or moisture; oceans, rivers and streams, lakes and ponds, soils as well as aerial niches such as tree bark and mosses. The word diatom means 'cut in two' in Greek and the silica shell of the frustules comes in two halves or valves, one fitting over the other like a petri dish or pill box.



Diatoms – *Pinnularia* species (Leszek Wolnik)

They range widely in size from 2 microns (one five-hundredth of a millimeter) to 500 microns which is approximately the width of a human hair. Their exquisitely lovely glass 'shells' are spectacularly marked and ornamented and have an astonishing range of forms which are species specific. Their outline varies considerably and may be; circular, elliptical, lunate or polygonal whilst the valve surfaces may be flat; convex, concave, conical or undulating as illustrated in figure 1.

Over 20,000 species and counting...

About 20,000 bona fide species have been described while senior researchers believe the real number is in excess of 200,000! This disparity in range exists because there is debate about the basic parameters of what constitutes a diatom species and because diverse new genera and species are being discovered every year. It is amusing to note that with 600 new species found each year it will take 300 years to describe all of them!

Diatoms first appeared in the Cretaceous, 100 million years ago, and flourished in the Miocene, ten million years ago. They were then so abundant that they left enormous deposits of their shells, known as diatomaceous earth or diatomite, to a depth of 900 metres. One of these deposits is located in Northern Ireland where a diatomite factory operated in Toomebridge until the 1990's. Diatomite has significant industrial applications and is widely used in filtering wine, abrasives, reflective road paint and insulation. Interestingly, Nobel couldn't have made dynamite without it and during the second World War large quantities of Toomebridge diatomite were exported to English munitions factories to act as an absorbent for explosives!

Diatoms are essential in ecosystem functioning

Diatoms are remarkable for having a disproportionate influence on global ecology as they probably contribute 20-25% of the world's net primary production in the oceans. They are key to the ocean carbon cycle which in turn determines the carbon dioxide component of the atmosphere. Diatoms are consumed by zooplankton thus removing carbon from the oceans and also from the atmosphere as they use it to grow.

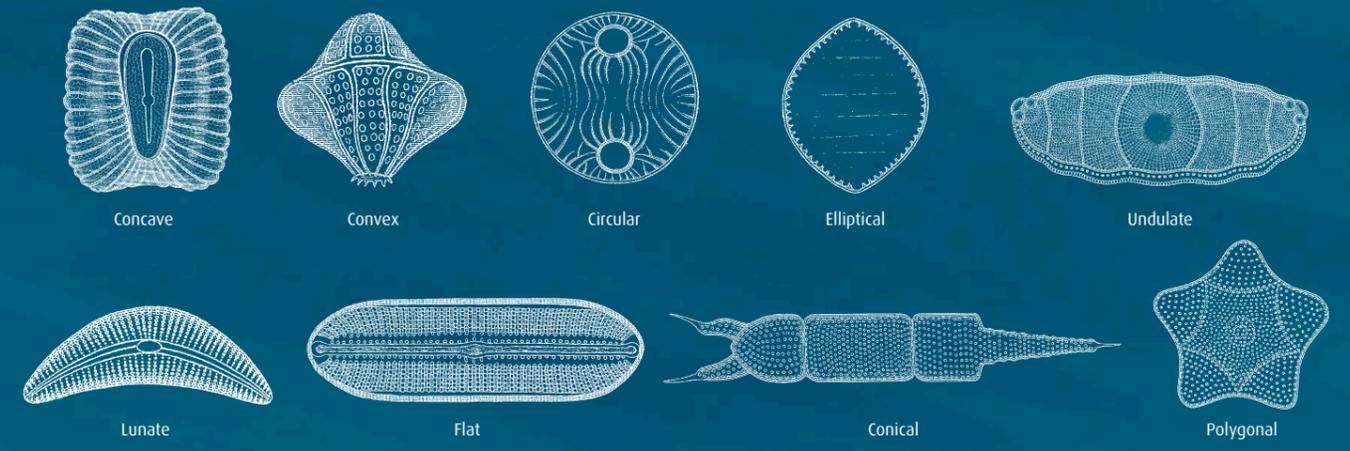


Figure 1. A compilation of beautiful early illustrations showing the diverse forms, surfaces and decoration of the diatom frustule. The links between diatoms, art and engineering are very strong and many examples can be seen in daily life.

When diatoms die their siliceous shells sink to the ocean floor, effectively locking away their carbon and slowing the build up of carbon dioxide in the atmosphere. There is a theory that the diatom silica shell is a reaction flask with the silica catalysing the extraction of carbon dioxide before turning it into sugary food. In salt-marsh systems, where grasses are the most visible plants, diatoms provide as much as half of the carbon passing through the ecosystem.



Marine, tube dwelling diatoms from a low tide stream, Sandymount Strand, Dublin, *Navicula pseudocomoides* (Leszek Wolnik)

Diatoms as bioindicators

Biodiversity research begins with the mapping of present day species distribution coupled with ecological preferences and this knowledge can also be employed to reconstruct the past. Organisms with determined environmental preferences are called 'bioindicators' and are used to record the impact of varying environmental conditions, both current and historic, with one such group being the diatoms. The role of diatoms is very important in assessing changes in the hydrology and ecology of freshwater systems. Diatoms play their part in determinations as diverse as lake acidification, sea level reconstruction and anthropogenic influences on estuaries, rivers and other aquatic ecosystems.

They are particularly suited for water monitoring as they represent a simple biological method that avoids tedious and expensive chemical analysis. They easily colonise a wide variety of habitats and are sensitive to very subtle environmental changes that only affect other organisms at greater levels of disturbance. They are quick and easy to sample with the sampling having a negligible effect on the ecosystem. The protection of freshwater ecosystems is crucial and diatoms provide information about natural, baseline conditions in pristine rivers and lakes against which polluted bodies of water might be measured.

Irish diatoms

We don't yet know how many diatom species there are in Ireland nor do we accurately know which species we do have as there is no checklist or national collection of diatoms with confirmed taxonomy. We can take a very good guess at species numbers



Two marine chain forms, *Melosira moniliformis* (upper left, circular) and *Rhabdonema arcuatum* (rectangular, centre) about a brown alga smothered in the oval, epiphytic *Cocconeis pinnata*. Note the gelatinous pads linking the corners of the *Rhabdonema* chain. (Leszek Wolnik)

based on the work of Foged and Hartley with an estimated 800 freshwater species and another 1,000 brackish and marine.

At Diatoms Ireland we are examining the biodiversity of Irish diatoms by compiling a checklist of Irish diatoms. We will validate the list as far as possible by building a voucher collection of all the listed species. Our website presently contains a freshwater list, information on collecting and mounting diatoms and a section on the remarkable diatomite deposits in Toomebridge and will soon be expanded to contain a live database of collection sites linked to species lists and environmental information.

We would be delighted to hear from anyone interested in diatoms or in learning more about these fascinating organisms. We would also welcome assistance with the Irish Diatom Checklist compilation. For further information on Irish diatoms go to: <http://www.diatomsireland.com/>.