Diatoms
From Silica Shells to Sustainable Solutions

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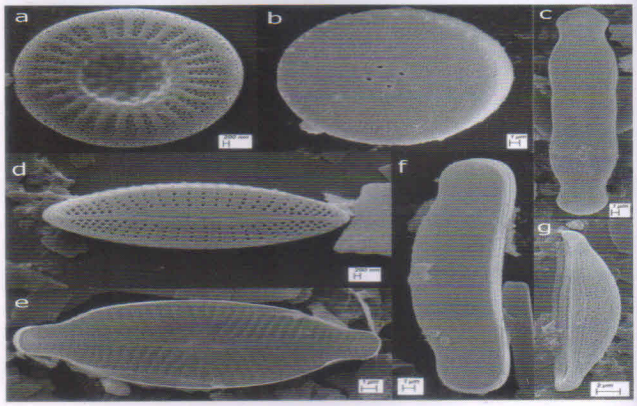
TODAY's ocean is dominated by eukaryotic phytoplankton such as diatoms, dinoflagellates, and coccolithophores. According to fossil records, diatoms were a minor component of the sea until the Cretaceous Era (145.5-66 mya). Modern continents formed when the supercontinent Pangea broke down, creating much space in the marine ecosystem and delivering more nutrients to the oceans. The increase in ocean nutrients favoured the selection of large-celled phytoplankton such as diatoms and other algae. In the Cenozoic era (66-0 mya), diatom diversity increased, and two major speciation events occurred, namely in the boundary interval of the Eocene/Oligocene (33.9-23 mya) and in the mid-to-late Miocene (16-5.3 mya). These events took place because of environmental changes such as changes in ocean chemistry, the availability of silica, a rise in sea level, and predation. Today, diatoms dominate all aquatic habitats where there is sufficient light and nutrients. They are now well adapted to survive in conditions of nutrient and light limitation if silicon is not limiting.

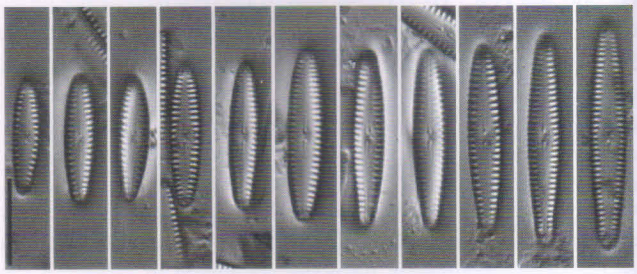
Diatoms are single-celled, microscopic organisms that belong to the class Bacillariophyceae of the kingdom Protista. They are photosynthetic eukaryotic microalgae and the most abundant group across continents and oceans. They are ubiquitous and diverse microalgae across aquatic systems, with almost 64000 to 100000 species belonging to nearly 1200 genera. They are one of the leading primary producers of the ocean and are responsible for about 20–25% of global oxygen production.

Diatoms are found in various shapes and sizes, ranging from 5μm to 0.5mm. They are golden brown because fucoxanthin and beta-carotene mask the green effects of chlorophyll a and c. The main characteristic of diatoms is their siliceous cell wall (SiO_2). Each species has its unique siliceous marking, which is used for identification. They can be planktonic (free-floating) or benthic (attached to a substratum). Some diatoms grow in colonies, and some grow alone.

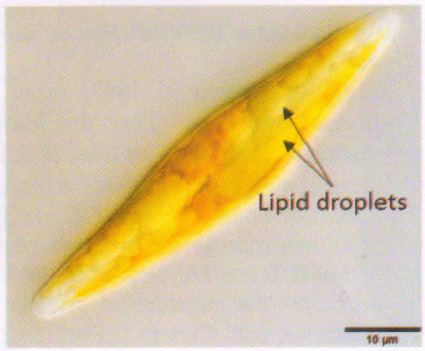
Diatoms are often called "life in glass houses" because they reside inside a glass-like silica shell. This siliceous, box-like cell wall is called a frustule. The word "diatom" is derived from the Greek word 'diatomos' meaning 'cut into two' because the frustule consists of two overlapping valves. The larger valve is called the epivalve, and the smaller valve



Scanning Electron Micrographs showing the morphological groups of diatoms (a & b) Centrics, (c,d & e) Symmetric Pennate, (f & g) Asymmetric pennate (a) *Cyclotella meneghiniana* (b) *Orthoseira roeseana* (c) *Pinnularia sp.* (d) *Achnanthidium subhudsonis* (e) *Placoneis sp.* (f) *Eunotia sp.* (g) *Halomphora sp.*



Differential Interference Contrast (DIC) light micrograph showing the size diminution series of *Gomphonema sp.* The scale bar refers to 10 microns.



Differential Interference Contrast (DIC) light micrograph showing the diatom Gomphonema sp. live with lipid droplets