

# MARINE AND OCEAN CHEMISTRY

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3. Salinity, chlorinity, conductivity, and density
4. Major constituents of seawater
5. Simple gases
6. Salts in solution
7. Carbon dioxide
8. Nutrients
9. Trace metals and other minor elements
10. Chemical extraction of useful substances from the sea

## **References:**

1. An Introduction to the Chemistry of the Sea, Michael E. Q. Pilson
2. Marine Chemistry & Geochemistry, John H. Steele et al.
3. Chemistry in the Marine Environment, R. E. Hester and R. M. Harrison
4. Marine Chemistry, P. J. Wangersky

# ORGANIC MATTER IN THE SEA

1. Primary production
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# PRIMARY PRODUCTION

Phytoplankton floating in the sunlit surface layers make most of the organic matter in the sea.

The photosynthetic formation of this organic matter is called **primary production**.

Relatively much smaller amounts of organic matter enter the sea from rivers, from the atmosphere, from photosynthesis, and by bacterial chemosynthesis on parts of the sea floor.

- Most of the organic matter in the sea is included within the operationally defined fraction called **dissolved organic matter** (DOM), usually measured as **dissolved organic carbon** (DOC); all of this is ultimately derived from living organisms.

## Several common terms are defined as follows:

1. **Gross production:** total amount of carbon fixed by phytoplankton ( $\text{CO}_2$  converted to organic matter) per unit time; expressed per unit volume or per unit area.
2. **Net production:** total carbon fixed, as above, corrected for carbon respired by the phytoplankton themselves.
3. **New production:** that fraction of the net production for which the nutrients are supplied from outside the region where the production takes place.

4. **Export production:** that fraction of the net production that is not consumed and regenerated as inorganic carbon and nutrients in the surface layer, but instead is transported out of this region, generally downward by sinking particles of organic debris and often whole phytoplankton cells.
- Export production may also include the harvest of fish in areas where this is important.
  - At steady state, export production should equal new production.
  - The concentration of dissolved organic matter is higher in surface water than in deeper water.



## OTHER SOURCES OF ORGANIC MATTER

- The second important source of organic matter to the ocean is river transport of some of the residual product from photosynthesis on land and in fresh water.
- There are, however, fairly good relationships between type of drainage basin and the concentrations of dissolved, particulate, and total organic carbon (DOC, POC, and TOC, respectively) in rivers.
- The organic carbon is derived from soil organic matter that has aged a considerable time in the soil. It is also likely that some particulate carbon in rivers is derived from the breakdown and erosion of rocks carrying resistant organic matter from ancient sediments

# MEASUREMENT OF ORGANIC CARBON IN SEAWATER

- Organic carbon in seawater occurs in a vast and bewildering range of forms, all present in small concentrations.
- These range from methane ( $\text{CH}_4$ ) to balaenoptera musculus (blue whale, maximum weight about 114 tons).
- The separation of organic materials by size classes is therefore quite arbitrary and largely dependent on empirical details of measurement or separation technique. Conventionally the following classes of organic matter are distinguished:

**POC** = particulate organic carbon, also **POM** = particulate organic matter; and

**DOC** = dissolved organic carbon, also **DOM** = dissolved organic matter.

# NATURE OF MARINE ORGANIC MATTER

- Marine Snow
- Vitamins
- Volatile Hydrocarbons
- Fatty Acids And Other Lipids, Amino Acids, And Sugars
- Humic Acid
- Black Carbon