

Geochemistry of Organic Matter in the Ocean

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This monograph essentially sums up the results of investigations on the distribution, composition, transformation, balance and biogeochemical cycling of organic matter in the seas and oceans at the stages of sedimentogenesis and early diagenesis—a formidable task by any standard considering the wealth of information now available in the field.

In the book an attempt has been made to establish the magnitude of masses of dissolved, suspended and living organic matter which are in a state of dynamic equilibrium in the oceans, based mostly, on the works of the Russian scientists. The sources of organic matter in the oceans are examined in Chapter 1 and the inputs from the phytoplankton and benthic plants as well as from the land are estimated. The next two chapters deal with the distributions of the dissolved and particulate forms of organic matter, expressed as carbon (DOC and POC), and the factors controlling them. Total quantities of the dissolved, suspended and living organic carbon have been estimated to be 1800, 30 and 2.8 billion tons, respectively.

A synthesis of available information on the organic carbon content of the bottom sediments has been made in Chapter 4. The organic carbon content of the sediments shows strong circumcontinental distribution, inherited from the suspended matter. About 87% of the total organic carbon deposition is shown to occur on the continental margin, the rest being deposited on the marginal ocean floor (10%) and abyssal oceanic basins (3%). It is also estimated that of the c. 26.6×10^9 tons of the organic carbon produced by the phytoplankton and benthic plants and derived from the land annually, $1.2-3.7 \times 10^9$ tons settle at the bottom in the particulate form. Of this, 92-97% undergoes mineralization and only 0.4% of the carbon of photosynthetic origin gets buried in the sediments, mostly on the continental margin.

The remaining chapters are devoted mostly to the fates of all major types of biochemical compounds and their fragments in the marine environment. Distributions of organic nitrogen and phosphorus in the organisms, water and sediments are discussed in

Chapter 5, and the large-scale differentiations in organic nitrogen and phosphorus accompanying sedimentogenesis and diagenesis are assessed. Data on the distributions of proteinaceous compounds and amino acids, carbohydrates and lipids in marine organisms, water and sediments are summarized in Chapters 6 through 8; the transformations in these compounds from living matter to suspended matter and bottom sediments are investigated.

Finally, Chapter 9 deals with the humic substances: their distribution in the suspended matter and the bottom sediments in various oceanic regimes is examined. The humic and fulvic acids in the sediments and seawater differ from their terrestrial counterparts in that they have different elemental composition and are mostly aliphatic. Within the continental margin these are probably formed *in situ* during the decomposition of organic matter of lower algae; therefore, a plea has been made to discard the existing terminology and to use the term "water humus" for the marine geopolymers representing a major part of the organic matter of bottom sediments and seawater.

The quantitative treatment has enabled the author to present estimates on the principal components of the organic carbon budget in the ocean. However, in view of the high variability in the concentrations of various constituents, inadequate spatial and temporal coverage, uncertainties associated with diverse analytical techniques followed by different workers and the consequent inconsistencies in the results, all such estimates should be considered as order-of-magnitude approximations. For example, the POC and DOC data generated during the Soviet expeditions have invariably been higher than those reported by most workers outside the USSR. Hence, the estimates on the total quantities of the DOC and POC in the oceans would be higher than the values arrived at by most of the western workers. However, they do reflect the magnitude of cycling of organic matter in the ocean.

As is the case with most of the translated works of this kind, the monograph suffers from frequent lack of clarity in expression. The important question, i.e.,

whether or not there exist regional differences in the DOC content of the deep layers and whether there is any real correlation between DOC and primary productivity, remains unanswered. Some of the important published works [for example by Deuser W G, *Deep-Sea Res*, **18** (1971) 995, and Deuser W G & Ross E H, *Nature*, **283** (1980) 364] have not been referred to. The estimated global river runoff (44700 km³—Table 7) appears to be considerably higher than the generally accepted value 39700 km³ [Baumgartner A & Reichel E, *The world water balance* (Elsevier, Amsterdam) 1975]. On a small matter, ammonia in seawater does not undergo oxidation to molecular nitrogen as stated on p. 163. Expression of N_{org}/C_{org} ratios in percent units is ambiguous. Some of the work referred to in the text is not included in the references [e.g. Qasim S Z, in

The biology of the Indian Ocean, edited by B Zeitzschel (Springer-Verlag, Berlin) 1973, 143-154]. Lately, a lot of information has been made available as a result of sediment-trap experiments; this aspect has not been covered adequately.

The above shortcomings notwithstanding, this translation of the original Russian work provides valuable informations about ongoing geochemical works in USSR, which are otherwise difficult to come across due mainly to their publication in Russian. This book will be a useful guide to the students of marine geochemistry for quite some time to come, and will also be a valuable acquisition for libraries on marine science.

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