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Evolutionary Paleoecology of the Marine Biosphere

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example, most of the important papers published by the Atomic Energy Agency in Vienna (e.g., Isotope Hydrology 1970) are not mentioned. The use of the stable isotope of hydrogen, carbon, oxygen and sulphur in hydrogeological investigations are of increasing importance and a more thorough treatment of this subject from a theoretical and practical point of view would have been greatly beneficial. This chapter includes general remarks on the variations of O^{18} and deuterium in the hydrosphere, the isotope contents of ocean water, a few statements on carbon species in water and the S^{34} contents of sulphur species in freshwater and the oceans, and some remarks on O^{18} in sulphates.

The following chapters on stable isotopes in the atmosphere, the biosphere, in sedimentary and metamorphic rocks provide a fairly detailed picture and are adequate for the purpose of this book. Topics covered include a.o. C^{13}, D and S^{34} in living organic matter, petroleum and coal, O^{18} in sedimentary silicates, a discussion of marine limestones and the paleotemperature scale, O^{18} and C^{13} in freshwater carbonates and dolomites, O^{18} in phosphates and a few remarks on sedimentary sulphides and native sulphur deposits. The last chapter of this book which deals with results of balance calculations of stable isotope abundances in the terrestrial environment appears somewhat unnecessary. As the author points out such calculations "are very problematical, because the numbers used are very rough estimates with a high degree of uncertainty".

In total this book will fulfill a useful purpose, especially if used as a guide for introductory lectures on the geochemistry of stable isotopes. Many of its shortcomings can then be overcome by supplementing the basic information given with data provided in the published literature for which in most cases the references are found within this text. As most chapters give only a summary of the more important results of stable isotope studies and not enough detailed data, this text unfortunately cannot be used for advanced studies in stable isotope geochemistry.

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Evolutionary Paleoecology of the Marine Biosphere

by James W. Valentine
Prentice-Hall, 512 p., 1973. $18.00.

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In the Preface to the Second Edition of "Search for the Past", J. R. Beerbower states: "The revolutionary ardor cools, however, and one begins to wonder if it really was tiger's milk we drank as graduate students". He goes on to lament, "Paleoecology, I fear, is marking time", a statement which, in 1968, was undoubtedly true. We may view this "marking time" period, in retrospect, more as a time of marshalling of forces, or of consolidation of data gleaned from marine biology, genetics, geochemistry and geophysics. In particular, paleoecologists have just begun to realize the implications of plate tectonics for questions of diversification, migrations and extinctions of marine biota.

One of the first scientists to attempt to integrate plate tectonics into a unified view of the history of life on earth is James Valentine, whose new book (despite its unwiedly title), is so good, in so many aspects, that professors will itch to set up new courses, just so they can assign it as a text.

The organization of the book permits orderly development of the synthesis of ideas that makes it so valuable. The book begins with an introductory sequence of four chapters. The first, short, chapter discusses the scope and meaning of the discipline of paleoecology, and emphasizes that uniformitarianism is symmetrical: that is, "the past is a key to the present". Then come three chapters on, respectively, evolution and genetics, population biology, and the marine environment. This introductory section is generally well-done, and will be invaluable to intermediate-level students. There are some minor deficiencies: there is no mention of the significance of the redundancy of the genetic code for a monophyletic origin of life; there are few examples in the population biology section of real populations that have undergone drift, experienced the "founder effect", etc. (this may have simply been due to space limitations); and, in the review of the characteristics of the marine environment, possibly "the single most important factor in the ecology of the benthos" (p. 141), the substrate, receives one page. This particular chapter is handled very well, however, and contains one of the few lucid explanations of the Coriolis effect.

Valentine then begins development of his thesis by describing, in order, functional morphology of individual species, populations, communities, provinces, and the biosphere. These five chapters contain a good mix of review of published work and insertion of new ideas. The sections on functional morphology and numerical methods (in the use of some of which Valentine pioneered) are particularly good. Discussion of species diversity, which occupies most of the "community" chapter, suffers from a few omissions. There is insufficient outlining of the "caveats" which should accompany measurements of species diversity, considerations such as necessity of restricting studies to competing or taxonomically very similar groups, and to (ideally) organisms of similar sizes. Some of the most interesting areas or taxa are those which show reversed diversity gradients, such as benthic algae on the Pacific coast of North America, and these are not discussed. Finally, treatment of resource partitioning in the tropics as a cause of high species diversity could have leaned more heavily on MacArthur's classic papers on the subject.

The final chapter contains a synthesis of the history of life on earth, from the origin of life, through Clark's thesis of the importance of the coelom as an adaptation for burrowing, to a discussion of community evolution in the geologic record.

The chapters on biotic provinces and the biosphere contain much of Valentine's own contribution to our understanding of the relationship between continental drift and the history of marine organisms. Plate

tectonics is shown to be directly linked to migration barriers and oceanic currents, and Valentine makes an eloquent case for this as a cause of fossil provinciality, endemism, community development and extinctions. Again, there are minor objections: the whole section on taxonomic diversity through the Phanerozoic must be reconsidered in the light of suggestions, notably by Raup, that the total number of species in an era is correlated with the total volume of sedimentary rocks preserved.

One of Valentine's most significant contributions in the book is his contention that paleoecological data may be ranked into hierarchies which have the property of "near decomposability". This means that each level of the ecosystem may be studied independently, and that paleoecologists may compare provinces without completely understanding the workings of the constituent populations. This has allowed discussion of global paleo-provinces, but obviously depends on previous good taxonomy of at least some of the groups.

This book should be on every paleontologist's shelf and would be a good choice for a text in senior undergraduate courses in paleoecology, although in that instance, one would want to supplement with readings on nuts-and-bolts matters such as field and laboratory techniques, sampling, and taxonomy. In today's economy, the price cannot be considered excessive. One gets the impression that, in many cases, Valentine has used 100 elegant words when 50 concise ones would have sufficed, but this does not greatly detract from the value of the book as a whole.

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