

## **Stable Isotope Geochemistry**

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by authors that proof of a diagenetic origin for the matrix in graywackes is that "Recent" and Tertiary turbidites are free of detrital matrix, but then what about the Miocene graywackes in Table 6-5 which contain 45 per cent matrix?

There were few chapters in the book that I found poor. The chapter on diagenesis is however not at par with the other sections of the book. It contains many distracting trivial statements and equations.

The quality of both printing and binding is excellent, with my personal choice going to the less expensive paper edition. The editors have done a remarkable job, and there are few printing errors. However no book is immune from such errors and this one is no exception. The French references suffer most. A few authors have their names altered and a few references are not listed. There are many very good photographs in the book, many of thin sections. I do agree with the authors that "under crossed nicols one has great difficulty in distinguishing between somewhat altered rock fragments and recrystallized sericitic and chloritic matrix", which probably explains why they decided to have eight out of nine of the graywacke photographs in crossed nicols.

In summary, the book is not perfect, it has many good things and some bad ones. I do believe that geologists will find that the good is well worth the \$14 investment.

MS received, February 6, 1974.

## Stable Isotope Geochemistry

by J. Hoefs  
Springer-Verlag, New York, 140p, 1973.  
\$14.50.

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The publication of an introductory text for geologists and other scientists interested in the geochemistry of stable isotopes was long overdue. This publication is thus a very welcome edition, especially as it fulfills most of the requirements expected from such a text. It is easy to read and the summary discussions are in general well presented and documented.

The book is divided into three parts: Section A deals with the theory of isotope effects and gives technical information about stable isotope analyses with mass-spectrometers. In Section B isotope abundances and isotope effects controlling the distribution of elements important for geological investigations are discussed, and C is intended as a survey of the most important results from a geologists point of view.

The introduction to the subject and the technical information given in Section A are very clear and amply satisfy the requirements such a text should meet. However some of the topics covered have been discussed in more detail. For example, a more complete discussion of the equilibrium and kinetic fractionation processes such as the Rayleigh process would have been desirable. Also missing is all reference to standards and interlaboratory comparisons of standards available from the Atomic Energy Agency in Vienna.

In Section B geologically important elements are treated individually. Fairly detailed data are presented for the isotopes of hydrogen, carbon, oxygen and sulphur and whatever information was available to the author is given for the isotopes of selenium, boron, nitrogen, silicon, chlorine, bromine, lithium, potassium, magnesium and calcium. The

chapters on D, C<sup>13</sup>, O<sup>18</sup> and S<sup>34</sup> include general remarks on the relative and absolute abundances of the various isotopes, preparation techniques for stable isotope analyses, standards used, and some remarks on fractionation mechanisms.

Unfortunately much of the isotope fractionation data available in the published literature has been omitted and the author often limits himself to a descriptive discussion. This applies for example to the deuterium exchange in the H<sub>2</sub>S – H<sub>2</sub>O system, the distribution of carbon-13 in the H<sub>2</sub>O, CO<sub>2</sub> – CO<sub>3</sub> system and the O<sup>18</sup>-fractionations between minerals and water and minerals – minerals. It is not clear why these data were not presented since they are the basis for many of the interpretations of stable isotope data. However, a fairly complete reference list is provided and the interested reader can easily obtain more detailed information about this subject.

Section C begins with a discussion of the distribution of stable isotopes in meteorites, and lunar rocks. This is followed by a good presentation of stable isotope abundances in igneous rocks and high temperature fluids. Some remarks on mineral – mineral fractionations are made in this chapter. The chapter on volcanic gases and geothermal waters is also fairly complete.

In the discussions of stable isotope abundances in ore deposits (Section B, Chapter 4) one misses a detailed presentation of the geochemical processes and their significance with respect to the distribution of carbon and sulphur isotopes in hydrothermal systems. As a consequence some of the statements made by the author are not readily understood if the reader is not familiar with the literature cited. However, the reader is provided with a good coverage of many recent studies and the references given indicate the more significant publications.

This cannot be said for Chapter 5 in Section B: the Water Cycle. Here the author limits himself to a rather superficial description of the fractionation processes and their control over the distribution of stable isotopes in the hydrosphere. For

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.

## Evolutionary Paleocology 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, "Paleocology, 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 unwieldy 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