Diagenesis by numbers

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Early Diagenesis: A Theoretical Approach. By Robert A. Berner. Pp.241. (Princeton University Press: 1980.) Hardback $25, £13.70; paperback $9.50, £5.25.

THIS most readable and helpful book should be welcomed by all who wish to understand chemical processes in diagenesis, be they students, teachers or research workers. Berner's approach is rigorously logical: he selects various problems in early diagenesis, shows how these may be clarified and simplified, and how to pose sensible questions about them, and, finally, indicates how to derive models that are both testable quantitatively and valuable as guides to prediction. His mode of thought combines a rigorous quantitative approach (calculus at the level of simple integration) with a careful appreciation of such seemingly unquantifiable processes as bioturbation and bacterial decay. Above all, he is concerned with the rates at which different processes work. In this book he deals only with diagenesis in the first 100m or so of burial, thus avoiding complicating factors such as higher temperatures, uplift, weathering and metamorphism.

In Part I there are five chapters devoted to theory. After a short introduction, he presents a quantitative approach to basic concepts such as rates of burial, steady-state diagenesis and diffusive and advective fluxes. Next he examines in detail the quantitative expression of compaction, rate of deposition, rate of flow of water across a sediment–water interface, molecular diffusion and the application of Fick's laws, and how to accommodate bioturbation into a quantitative model. The following two chapters cover various chemical processes that are the driving forces for diagenetic change. These include adsorption, ion exchange, radioactive decay, microbial metabolic reactions, the energetics of precipitation, nucleation, crystal growth, transport control and dissolution, and the general matter of diagenetic redistribution, with a section on causative factors in authigenic processes.

Part II is about applications and in it Berner discusses and enlarges upon work that has been carried out in real situations. He starts with a consideration of marine sediments of the continental margins; topics include diagenesis within the zone of bioturbation, relying on work done in Long Island Sound, touching upon such matters as irrigation and molecular diffusion of ammonia into burrows constantly flushed with oxygenated water, bacterial sulphate reduction, ammonia formation, phosphate diagenesis and methane formation. He then comes to pelagic (deep-sea) sediments, dealing with carbonate dissolution and the lysocline and compensation depth, burial flux and compaction, the dissolution of opaline silica, the diagenesis of suboxic organic matter and of radioisotopes, and volcanic–seawater reactions. The final chapter embraces non-marine sediments (fresh to brackish water) and treats salinity fluctuations, iron and manganese diagenesis and hypersaline sediments. There is a 13-page bibliography and an efficient index. The chapters each have running headlines and these, combined with clear paragraph headings, make it easy for the reader to find his way around.

Berner's writing is superbly clear and readers should find the book both interesting and stimulating. It excels as an exercise in controlled scientific imagination and sets a high standard for future studies of recent diagenesis. □

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Attractions of magnetic interactions

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Interactions in Magnetically Ordered Solids. By K. P. Sinha and N. Kumar. Pp.180. (Oxford University Press: 1980.) £12.50, $36.50.

THIS short book covers a lot of ground, although the authors explain at the outset that they have restricted themselves to localized moments in insulators and semiconductors. They reveal some ambivalence, however, towards conduction electrons, recognizing their importance as mediators of magnetic interactions (albeit in a rather concentrated treatment in which the sudden appearance of the word "impurity" may confuse many readers) but rather oddly entitling their last chapter "Conduction electron magnon interaction in ferromagnetic *insulators*" — a contradiction in terms not clarified by a brief final paragraph on spin-disorder resistivity which introduces de Gennes and Friedel's treatment of magnetic metals.

The problem of over-compression of the subject matter runs right through the book, perhaps the most glaring example being a section of one and a half pages of text and three figures which is introduced as "a brief survey of the thermodynamic properties of magnetic insulators".

As a result, it is difficult to see for whom the book is intended. Any given topic is dealt with so briefly as to constitute little more than a signpost to an area of interest, any real understanding of which by a student will require extensive reading elsewhere. Furthermore, the guidance to such reading is often very limited. For example, no reference to the book of Marshall and Lovesey (from the same publishers) is given in the short chapter on neutron–magnon interactions, which devotes two pages to magnon dispersion relations and nothing (in spite of the section introduction's claim) to magnon lifetimes. Perhaps the more theoretically inclined graduate student will use this book to pick up hints about arenas in which he can flex his mathematical muscles without having to acquire much feeling for the nature of the materials in which the fascinating phenomena of magnetism manifest themselves. □

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Art of catalysis

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Heterogeneous Catalysis in Practice. By C.N. Satterfield. Pp.416. (McGraw-Hill: 1980.) $36.30, £16.15.

IN this book Professor Satterfield has squeezed into less than 400 pages the essential characteristics of catalysis and many of the major industrial catalytic processes. He has not attempted to be either up to date (there are few references later than 1976), or comprehensive in his coverage, but instead presents overviews that give the reader an appreciation for the processes and the associated practical problems ever present in "real" systems. The "art" side of catalysis is given a fairly complete coverage. Throughout, the references are secondary rather than primary; for example, few patents are cited. Overall, the treatment is directed toward the chemical engineer rather than the chemist.

The first half of the book deals with the necessary physical–inorganic chemistry of catalysis and catalysts, with chapters on sorption, kinetics, catalyst preparation and characterization. These are brief, and often only define the terms, nomenclature and methods of catalytic chemistry. The reader is supplied with appropriate