

which the book does not claim to cover other than superficially and which are therefore relatively unimportant to its aims.

It begins with a survey of the biology, physiology and ecology of the legume symbiosis and a parallel survey of the non-leguminous symbioses. These are excellent and include a lot of relatively inaccessible but useful source material. The discussion of the free-living genus *Azotobacter* is limited, though it includes many useful ecological data, particularly from rather obscure publications. Comprehensive coverage is given to the related bacteria *Beijerinckia* and *Derxia*, however, and a similarly thorough treatment is given to the nitrogen-fixing clostridia.

The chapter on the blue-green algae misses recent work on the function of heterocysts but is very useful concerning the practical value of these organisms. (It includes a curious, deadpan story about the Goddess of Azolla, responsible for the introduction of *Azolla*, a commensal system of blue-green alga and water fern, in Vietnam. Unhappily the date of the good lady's activities is not given.) The material on "other groups of nitrogen-fixing organisms" is now rather out of date. Nitrogen-fixing strains of *Bacillus*, *Klebsiella*, sulphate-reducing bacteria, coloured sulphur and non-sulphur bacteria are well-authenticated, but few workers wholly accept reports of fixation by yeasts, *Nocardia*, *Pseudomonas*, *Acromobacter* and *Spirillum*, largely because new isolates in these groups prove to be "ghosts" (efficient scavengers of atmospheric fixed nitrogen) and putatively authentic cultures from laboratories or culture collections do not fix. The same is true of the concluding brief survey of the biochemistry of the process, which is so much out of date as to be of little more than historical interest.

Discounting the obsolete portions of the last two chapters, this is the sort of painstaking, comprehensive survey that is rarely produced in the West today. It brings together reports from all sorts of obscure sources as well as from the regular scientific literature. To Western readers it is at times rather uncritical, willing to accept without comment strange claims (for example, that radioactive substances activate nitrogen fixation in *Azotobacter*) and at other times hypercritical (one Sushkina, author of a monograph on *Azotobacter* in 1949, gets severely panned for making an excusable technical mistake in counting azotobacters; an ironical touch is that, since this book was written, another important source of technical error, concerning the use of diluent, has been documented and it is even conceivable that the authors have fallen into this second trap). Specialist students of

Soviet research will be interested to note the authors' view that "azotobacterin", a preparation of azotobacter once heralded in the USSR as a marvellous biological fertilizer, is really of little value and, when it does do some good, it is for reasons unconnected with nitrogen fixation.

The translation is good; a silly mistake has made the running titles of chapters 2 and 3 useless. On its own, this book is perhaps of rather limited value except to specialists but, in conjunction with more recent Western books and reviews, it is essential for libraries where nitrogen fixation is taught or studied in some depth.

JOHN POSTGATE

Coral

Regional Variation in Indian Ocean Coral Reefs. (The Proceedings of a Symposium organized jointly by the Royal Society of London and the Zoological Society of London, May 28 and 29, 1970, No. 28.) Edited by D. R. Stoddart and Sir Maurice Yonge. Pp. xxxv+584. (Academic: New York and London, November 1971.) £9.50; \$28.

DARWIN'S famous theory of the origin of coral reefs and coral atolls, already in his mind before and strengthened during the voyage of the *Beagle*, resulted in the spilling of quantities of ink, often acrimoniously, over rival theories of these tropical structures raised by the "greatest of the world's builders". In spite of these rivals it has stood firm and the results of deep drilling on Pacific reefs during the present century have pretty well confirmed the basic validity of Darwin's ideas. The morphology of reefs and the nature and variety of the corals and array of associated animals and plants are now fairly well known, but coral reefs as ecosystems have only in recent years been contemplated as particularly suitable subjects of study because of their virtually closed biosystems.

For many years reefs of the tropical Pacific have received much attention while the prolific reefs of the Indian Ocean and Red Sea have only been lightly surveyed. This imbalance is now changed, as this volume amply demonstrates. It derives from a symposium held in London in May 1970, organized by the Royal Society and the Zoological Society of London under the leadership of D. R. Stoddart and Sir Maurice Yonge, to bring together reports of research on the Indian Ocean reefs during the past few years by some twenty-eight scientists from Great Britain, France, Germany, India, and the USA, who have contributed eighteen papers grouped under the topics Geo-

logy and Morphology of Reefs, Regional Studies of Reefs, Distribution of Corals, and Other Reef Invertebrate Communities, covering the vast area from the Gulf of Aqaba, the Red Sea, the Seychelles, Aldabra, the Maldives, Southern India, Madagascar, the Nicobars, and other sites. Only the extreme eastern Indian ocean receives scant attention.

Space does not permit special consideration of the papers, but one cannot but applaud the first, Sir Maurice Yonge's tribute to the late Thomas F. Goreau, the outstanding coral biologist, whose untimely death occurred only a month before the symposium that he had intended to attend.

The volume itself is very well produced—typographical errors are very rare, the many diagrams, maps, and tables are uniformly clear and well-captioned, although a few of the many half-tones are too muddied to show much; the three indexes have been carefully prepared, and the bibliographies accompanying the papers are unusually complete and up-to-date. This book will be profitably read by the growing coterie of hermatologists, and there is much in it for the biologist, geologist, geographer, and others concerned with the marine sciences. JOHN W. WELLS

Palaeozoogeography

Faunal Provinces in Space and Time. Science editors, F. A. Middlemiss and P. F. Rawson. Technical editor, G. Newall. (Proceedings of Inter-University Geological Congress, held in London, December 17–19, 1969.) Pp. 236. (Seel House: Liverpool, 1971.) £5.50.

AFTER much neglect, the field of palaeozoogeography is now advancing at high speed. It is propelled by the discoveries of global tectonics which demonstrate that continents are in motion themselves, at rates sufficient to alter completely their geographical configurations during Phanerozoic time. This volume attempts to assess the provincial patterns of much of the Phanerozoic, chiefly of the shelf fauna but including pelagic and terrestrial faunas as well, and usually taking the new concepts of continental drift into account.

It begins with a preview chapter which crisply outlines the principal concepts of palaeozoogeography and of global tectonics, and which includes some post-conference literature. Succeeding chapters, each by a separate authority, examine present zoogeography and then the palaeozoogeographic patterns in the fossil record, roughly in stratigraphic order. Although the treatment is inevitably uneven (the late Palaeozoic is