

Bafflers, binders and coral relations

Anthony Hallam

The Evolution of Reef Communities. By J. A. Fagerstrom. Wiley: 1987. Pp. 600. \$74.95, £65.

OVER 30 years ago the distinguished American oceanographer Roger Revelle wrote that "of all earth's phenomena, coral reefs seem best calculated to excite a sense of wonder", a remark that Charles Darwin would probably have endorsed. Since that time our knowledge of them has expanded enormously, and the question has naturally arisen for palaeontologists and geologists as to how good a model modern coral reefs are for the ancient reefs in the rock record. Fagerstrom's book is the first comprehensive attempt to compare reefs ancient and modern from a variety of biological and geological aspects, and to attempt an interpretation of reef community evolution.

Reefs are mainly biological phenomena. They are characterized by structural rigidity and topographic relief produced by the rapid growth of large colonial or gregarious skeletal organisms living in close proximity to each other, and (compared with adjacent non-reef areas) by their high taxonomic diversity; they are *not* characterized either by water depth or geological location. A bewildering variety of organisms make up the reef communities, including algae, sponges, coelenterates, bryozoans, molluscs, brachiopods and crinoids. As the taxonomic composition has changed significantly through time, there is a need to generate another kind of classification for purposes of effective comparison. This Fagerstrom does by proposing an ecological classification of five guilds, termed constructor, baffler, binder, destroyer and dweller.

Part 1 of the book is devoted to the development of a series of models for Cenozoic reefs, Part II to an account of the autecology of the main reef-building taxa, and Part III to the synecology and history of pre-Cenozoic reef communities, from the late Precambrian to the Cretaceous. Fagerstrom argues that the Cenozoic, more particularly Holocene, photic-zone reefs, dominated as they were by rapidly growing members of the constructor guild, the zooxanthellate scleractinian corals, provide a very unsatisfactory ecological model for older reefs, especially the late Palaeozoic ones dominated by members of the baffler and binder guilds, notably algae, sponges and bryozoans. By the late Triassic, scleractinians became of major importance for the first time, but in the Cretaceous they became subordinate to rudistid bivalves.

Cenozoic models are far more adequate

and useful for recognizing and interpreting the predominantly non-biological aspects of earlier times, involving the destruction, transport and deposition of calcareous sediment. Nevertheless comparison of changing guild structure provides an illuminating means of comparing reef communities through time. Fagerstrom concludes that these communities have exhibited long periods of surprising stability punctuated by shorter episodes of more rapid change resulting from mass extinctions and macroevolutionary events.

The style of writing leaves little to be desired, being lucid and comparatively free of jargon. Descriptions are satisfyingly thorough, arguments well presented and interpretations generally well balanced and reasonable, while the overall organization is sensible and user-friendly. The subject matter is comprehensive rather than exhaustive, with important examples such as the spectacular Devonian reefs of Morocco being omitted, but my only serious complaint about an otherwise

admirable book concerns the photographs. Rather than being interspersed with the text, where they would have been most useful, they are grouped together at the end with the stratigraphic horizons and locations divorced from the captions and put together on separate pages.

Even more frustrating, however, is their poor quality and lack of labelling, so that it is often difficult to perceive anything distinctive. Surely the grouping together of photographs should have allowed the insertion of glossy paper to give much higher quality of reproduction? □

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• Also recently published by Wiley is *Coral Reef Geomorphology* by André Guilcher. The book is primarily geomorphological rather than biological in content, dealing with the shape and types of reefs, their structure, damage caused by human activity, and the requirements for reef protection and recovery. Price is £29.50, \$67.95.

Soft engineering

A. Serafini-Fracassini

Biological Materials: Structure, Mechanical Properties, and Modeling of Soft Tissues. By Frederick H. Silver. New York University Press: 1987. Pp.229. \$42.50.

G. H. MEYER's classical paper, dealing with the correlation between the disposition of the systems of platelets in the spongiosa of the metatarsal head and the pattern of the lines of maximal pressure and tension, was published in 1867. Since then, two developments have had a profound effect on our understanding of the structure-function relationship of stress-bearing animal tissues.

The first was the acquisition of a detailed knowledge of the chemical structure of two classes of extracellular biopolymers, collagen and elastin; these are capable of determining the mechanical properties of tissues by the provision of elastic components that cover a wide range of values for the Young's modulus. The second development was the discovery of elaborately textured ultrastructural interactions of collagen and elastin with extracellular glycoprotein and proteoglycans. Such interactions lead to the formation of architectural patterns, on a scale from the macromolecular to the macroscopic, which respond effectively and economically to intrinsic and extrinsic stimuli, and which exhibit a high degree of mechanical appropriateness.

In this monograph, Dr Silver skilfully presents an integrated view of the structure and the engineering properties of soft connective tissues, with useful appraisals

of recent developments in this field and concise but clear surveys of fundamental technologies. The book is not intended for specialists. Rather, it will meet the needs of students whose interest lies in the use of biomaterials and who want to acquire a sound reading knowledge of biomechanical engineering.

Chapters 1, 2 and 3 provide short introductions to the nature of the different classes of biomaterials, the chemistry of the constituent macromolecules, and the structure of connective and cardiovascular tissues. Chapter 4 deals with the gross conformational analysis of connective tissue biopolymers in solution, and introduces techniques suitable for the estimation of their size and shape and for the evaluation of their frictional properties. The self-assembly of collagen is discussed thoroughly in Chapter 5.

In the remainder of the book, Silver develops the analysis of the mechanical properties of tendon, skin, aorta and articular cartilage. Moreover, he attempts to set out, in as elementary a form as possible, the way in which stress-strain relationships can be idealized to provide a basis for a mathematical theory suitable for biomechanical modelling.

The book's usefulness is somewhat reduced by the unduly narrow focus on collagen. Also, little or no attention is given to such important topics as the molecular theory of elastic recoil and the generation of osmotic pressure in cartilage by steric macromolecular exclusion and Donnan effect. But overall Dr Silver has written a volume that will be a valuable addition to the literature. □

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