PALAIOS
Emphasizing the impact of life on Earth's history

PALAIOS 2008
Book Review
DOI: 10.2110/palo.2008.BR43

A Reef in Time: The Great Barrier Reef from Beginning To End, John E. N. Veron, 2008, Belknap Press of Harvard University Press, Cambridge, Massachusetts, 304 p., USD 35.00, ISBN-13: 978-0-674-02679-7

A Reef in Time is a passionate appeal to the beauty of and threats to coral reefs, written by one of the world's most renowned reef scientists. Contrary to the title, the book is not just about the Great Barrier Reef (GBR). Most of the 16 chapters are devoted to or at least touch on global patterns and processes. The fossil record of reefs gains considerable attention as well. The book is well organized, starting with an introduction of coral reef biology and GBR dynamics. After an account of the current degradation of the GBR, Veron jumps directly into the deep time record of reefs. The two deep time chapters emphasize the role of mass extinctions in reef evolution and analyze in some detail the role of physicochemical parameters on reef development at the million-year time scale. The later chapters stress finer temporal and spatial scales detailing the Cenozoic (one chapter) and Pleistocene (two chapters) climate and reef history, before focusing on the geological origin of the GBR proper. Veron masters with ease the different temporal and spatial scales at which he considers reef development and climate change. After a somewhat speculative chapter on human occupation of late Pleistocene GBR caves, the final chapters explore current, horrifying threats to coral reefs in general and the GBR in particular. As many other scientists today, Veron paints a rather bleak future for coral reefs. Because the GBR does not face the typical local problems of reefs in developing countries, Veron identifies global warming and ocean acidification as the major hazards, whereby ocean acidification is identified as the single most important factor. Ocean acidification is clearly the central theme of the book. Not only does Veron devote an entire chapter to this theme, but he argues that pH changes in the oceans were also the major trigger of ancient reef crises.

The vivid text is supplemented by a glossary, an up-to-date reference list, and a fairly comprehensive subject index. Although referencing is somewhat selective, the reader receives the latest information on reef research as well as on global change science. A highlight of the book is the 57 color illustrations, which supplement the well-designed, black-and-white graphs. The color plates depict the beauty of healthy reefs, model scenarios of climate change, outcrop photographs of ancient reef limestones, and shocking pictures of threatened or dead reefs.

Veron must be admired for his insight into all aspects of reef research. He is one of the very few individuals able to combine the essentials of deep time patterns, coral reef biology, and climate change without leaving one with the impression that one part of the puzzle is strongly neglected. Veron has been studying coral reefs for more than 40 years. He has worked in every major coral reef region in the world and is also the author of the leading reference book on modern reef corals (*Corals of the World*).

After all this praise, some criticism must be allowed as well. Although Veron demonstrates more insight into the paleontological and geological literature than many other reef biologists, he misses some quite important aspects in his line of reasoning for a common cause of ancient reef collapses. Veron argues that ocean acidification is the most likely common cause of reef crises based on two observations: the prevalence of million-year reef gaps after mass extinctions and the nonselectivity in extinctions between zooxanthellate and azooxanthellate corals. These observations, however, are not universally true. They fail especially at the end-Cretaceous mass extinction, the last and best explored of the Big Five. First, the postextinction reef gap was geologically very brief (less than a million years), and Danian coral reefs are indeed more common than Maastrichtian reefs (Flügel and Kiessling, 2002). Second, there is good evidence that zooxanthellate corals experienced significantly greater extinctions than azooxanthellate corals (Kiessling and Baron-Szabo, 2004; Rosen and Turnšek, 1989). Veron is, thus, too fast to discharge the bolide impact as a culprit of the end-Cretaceous mass extinction and to blame high CO_2 levels and ocean acidification instead. Although he might err on the generality of ocean acidification as a cause of ancient and modern reef crises, his emphasis should be welcomed by paleobiologists. Testing the role of ocean acidification in ancient reef crises will possibly develop into a major research theme in the coming years.

This book is an excellent introduction to coral reefs. *A Reef in Time* gives a fascinating introduction into the theme for students and laities, because it shows the big picture, the interrelationships between global warming, ocean acidification, mass extinctions, coral reefs, and humans. The current literature on coral reefs is so extensive that students can be overwhelmed and textbooks often lack one of the important aspects, which are all covered by Veron. Although the book is written as a popular science book, even the experienced researcher will benefit, as hardly anyone will have the full insight that Veron shares with the readers.

Overall the book is well written and organized, suitable for experts and nonexperts, and, despite some errors and

speculations, it broadens or refreshes the understanding of biological, chemical, and physical influences on reef ecosystems of the past, present, and future. *A Reef in Time* is a must-read for anyone who is interested in coral reefs and global change. Last but not least, the book is a real bargain for its layout.

REFERENCES

FLÜGEL, E., and KIESSLING, W., 2002, Patterns of Phanerozoic reef crises, *in* Kiessling, W., Flügel, E., and Golonka, J., eds., Phanerozoic Reef Patterns: SEPM Special Publication, v. 72, p. 691–733.

KIESSLING, W., and BARON-SZABO, R., 2004, Extinction and recovery patterns of scleractinian corals at the Cretaceous-Tertiary boundary: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 214, p. 195–223.

ROSEN, B.R., and TURNŠEK, D., 1989, Extinction patterns and biogeography of scleractinian corals across the Cretaceous/Tertiary boundary: Memoirs of the Association of Australasian Palaeontologists, v. 8, p. 355–370.

Wolfgang Kiessling and Heike Mewis
Museum für Naturkunde
Humboldt-Universität zu Berlin
Invalidenstr. 43
D-10115 Berlin
Germany
wolfgang.kiessling@museum.hu-berlin.de