Book reviews

Bender, M. L. 2013. *Paleoclimate*. Princeton Primers in Climate Series. Princeton University Press, Princeton, NJ, 309 pp. ($64 cloth, $22.36 paper with 20% PS discount.)

Reviewed by Ellen Thomas (Geology & Geophysics, Yale University).

Paleoclimate is a volume in "Princeton Primers in Climate", according to the publisher a "series of short, authoritative books that explain the state of the art in climate–science research". This concise volume uses fewer than 300 pages (40 B/W figures) to place anthropogenic warming within the long-term, geological context. The book's structure works well intuitively, with an introductory chapter on the workings of Earth's climate followed by travel through time: the origin of the solar system, then Precambrian glaciations, followed by discussion of long-term, Phanerozoic regulation of climate through linkages with the carbon cycle and geochemical modeling to reconstruct atmospheric CO_2 levels. We visit Late Paleozoic Ice ages, Cretaceous–Paleogene warm climates, the Paleocene/Eocene Thermal maximum, long-term Cenozoic cooling, Pleistocene northern hemispheric glaciation, climate variability during the last glacial interval, Holocene climate, and end with anthropogenic global warming. More detailed information is presented on the youngest periods in Earth history, on which the author is a globally recognized expert. The author does not go exhaustively through basic principles, and does not present a complete climate history: he effectively uses examples to illustrate and explain dramatic past climate change, while describing the tools of reconstructing past climate as the need for them comes up naturally in the discourse.

This book is not written for paleontologists: organisms are actors in biogeochemical cycles and makers of compounds to be analyzed. But it complements and gives background for what paleontologists do, and many of us may find it useful. What puzzles me somewhat is the book's intended audience. The preface calls it a "broad introduction to the subject for a scientifically literate audience, a reference for information about specific topics in the field, and a textbook for courses in climate and paleoclimate." The text assumes considerable knowledge about physical aspects of the climate system, while assuming very little knowledge about some other topics, e.g., what an isotope is (box 1). I like it as a "reference for information about specific topics in the field", giving up-to-date reading and references about paleoclimatic topics, thus useful for lecture preparation. It may be a good textbook for students familiar with climatology and oceanography, but not with Earth history. I do not think it would work as a textbook for an undergraduate class of non-science majors or lower-level undergraduate students because the introductory chapter is too concise for students without prior college-level knowledge of the climate system.

Some things irritated me. I read the following repeatedly (p. 16): "Waters thus 'dome' in the center of the ocean basins, exerting a pressure gradient leading to a circular or 'gyre' flow. These waters circulate in a **counterclockwise** direction in the Northern Hemisphere and clockwise in the Southern hemisphere". But this is wrong: the North Atlantic gyre incorporating the Gulfstream rotates clockwise. Minor error, but students have a hard time following why things rotate how, thus this is irksome. Then there is the Paleocene-Eocene Thermal maximum, a focus of my research, so that I am nitpicky about. It is quite a good chapter, but cites authors of a seminal paper incorrectly through inserting later insights, which I am always telling my students not to do. Kennett and Stott 1991 (p. 126) "... found large transient decreases in $\delta^{13}C$ and $\delta^{18}O$ in Foraminifera skeletons at the Paleocene-Eocene boundary. The $\delta^{18}O$ decrease signaled a warming of about 5°C, while the $\delta^{13}C$ decrease signified the addition of a large amount of

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biological CO_2 to the oceans." This is true in hindsight only: these authors did not argue for addition of isotopically light carbon to explain the warming, which was proposed in 1995 (Dickens et al.; Matsumoto). Here is a missed opportunity to discuss how scientific hypotheses are part of society: in 1991, global warming due to fossil fuel burning was not as much in the news as today, and it took years for the scientific community to realize the analog with past geological events. When the time was there, people in different countries made that connection independently.

I liked the last chapter on anthropogenic climate change, explaining clearly that climate change *per se* is not "injurious to our planet." Climate has dramatically changed in the past, and it is our society and institutions, not our planet, that will suffer from the fast rates of climate change caused by our own actions, and illuminated by the geological record of climate change and its effects on biota.

Works Cited

Dickens, G. R., J. R. O'Neil, D. K. Rea, and R. M. Owen. 1995. Dissociation of oceanic methane hydrate as a cause of the carbon isotope excursion at the end of the Paleocene. *Paleoceanography* 10: 965-971.

Kennett, J. P., and L. D. Stott. 1991. Abrupt deep-sea warming, palaeoceanographic changes and benthic extinctions at thed end of the Palaeocene. *Nature* 353: 225-229.

Matsumoto, R. 1995. Causes of the $\delta^{13}C$ anomalies of carbonates and a new paradigm 'Gas-Hydrate Hypothesis'. *Journal of the Geological Society of Japan* 101, 902-924.