



**Early Earth Systems: A Geochemical Approach**, by Hugh R. Rollinson, 2007, Blackwell Publishing, 285 p., paperback, ISBN: 978-1-4051-2255-9, USD 88.00.

I was absolutely delighted to accept the assignment of reviewing for PALAIOS the latest text by Hugh Rollinson, *Early Earth Systems—A Geochemical Approach*. As a long-time student of Earth history through the Archean, the focus of this book, I knew it potentially would be a valuable summary of many difficult-to-integrate topics that my students and I consider on a near daily basis. I have given my copy of Rollinson's earlier superb textbook a beating in the last decade, therefore I hoped the present text would meet the same high quality.

A book, no matter how well written, will languish on my shelf if all its parts are not of high quality. Who wants to spend considerable sums of money to own a book that is poorly organized and not properly illustrated? Readers of Rollinson's text will be pleased with the overall production of the effort. In reading the book, I found very few typographical errors, which is indicative of a thorough proofing process. I am also pleased to report that all the figures have been redrafted for consistency at an excellent quality. All illustrations are in black and white but are done very well. The book has an extensive and up-to-date reference list that appears at the end of the text in a user-friendly format, as well as a thoughtful and meaningful subject index. All these things bode well and mean I will pull this text off my shelf. But what's inside it?

*Early Earth Systems* is divided into six chapters, roughly organized from The Origin and Differentiation of the Earth (Chapter 2) to The Origin of Life on Earth (Chapter 6). Each is written in the comfortable and very readable hand of Rollinson, who makes use of his broad understanding to demystify complex approaches and techniques. Chapter 1 represents a short introduction to the book's greater purpose. A sense of evolution on Earth, in fact, of Earth itself, is given from the first sentence of the book, which draws on the notion of a planet experiencing incessant change through time. Without question, the book is aimed at establishing the nature of Earth history in its first two billion years, using what Rollinson calls a systems approach, but written in the language of geochemistry, isotope geochemistry, and biogeochemistry as a vehicle to get there. From the descriptions in Chapter 1, I expected the book to draw important connections between difficult or not often considered topics, and it did not disappoint. One concern readers of PALAIOS may have is with the Gaian undertone that surfaces

from place to place through the text, but this does not interfere with the transfer of knowledge.

The remaining five chapters, which form the meat of the book, begin with an abstractlike summary of the entire chapter, setting the tone for the covered material, an approach that worked for me. Each contains well-utilized and now familiar text boxes that highlight important topics, commonly geochemical techniques and necessary glossaries, so that the surrounding language can be placed in proper context. Given the broad scope of the endeavor and the wide target readership I believe the book intends to reach, these sidebars represent necessities and not just niceties.

Chapters 3 (The Evolution of Earth's Mantle) and 4 (The Origin of the Continental Crust) are both well written and provide balanced arguments about the origin and evolution of each and their significance in understanding surficial conditions and habitability. Chapter 3 is the longest of the book, and draws on Rollinson's familiarity with the topic, rightly pointing out that the mantle represents Earth's largest geochemical reservoir and critical driver of surficial processes. Appreciating the importance, and uniqueness, of a differentiated continental crust on Earth (Chapter 4), the text does a fine job in highlighting necessary points and controversies, including a discussion of the prescient paper "No water, no granites—no oceans, no continents," by Campbell and Taylor.

I suspect readers of PALAIOS will be most interested in the contents of Chapters 5 (The Origin of the Oceans and Atmosphere) and 6 (The Origin of Life). Rollinson does a good job at integrating the importance of volatile exchange between parts of the planet in describing the origin of the oceans and atmosphere. The chapter utilizes recent research in the carbon, nitrogen, and sulfur cycles in concert with geologic data to address compositional changes through the Archean and Proterozoic, including the Great Oxidation Event. A short chapter discussing the origin of life and challenges and controversies in recognizing fossilized remnants of life concludes the book. Rollinson provides the basics here and cites plenty of recent papers pertaining to early Earth conditions, environments, and the fossil record, giving the reader a sense of where the basic understanding is today. I applaud the effort to integrate so many varied topics, although this chapter is not the strongest of the book.

Determining how this book will fit in with the regular readership of PALAIOS, who would have more interest in *Cruziana* than the primordial mantle, presents a dilemma, given the notoriously sparse and contentious nature of both the fossil and sedimentary records during Earth's childhood and the fact this is primarily a geochemistry text. Nevertheless, from the geochemistry of Precambrian atmosphere and oceans to stromatolites, it should be clear that understanding deep earth matters are important for determining processes occurring at Earth's surface.

For any student of the Precambrian, *Early Earth Systems* will be an essential shelf text and constant companion for thinking about interdisciplinary problems. In choosing to use the common language of chemistry, Rollinson comfortably leaps from one

major sphere to another. For those whose interests lie in younger problems, this will be an excellent prequel for setting up an understanding of a more modern Earth as well as be invaluable to anyone teaching the history of the Earth. As with his previous text, this book is very well written in a hand that doesn't require one to be a geochemist to understand it, and that is worth plenty in and of itself. You might decide to buy *Early Earth Systems* for the last third of the book, but then you will be delighted that the previous chapters are there once you start reading.

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