Mountains: The Origins of the Earth's Mountain Systems

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Mountains: The Origins of the Earth's Mountain Systems

By Graham Park. Edinburgh, United Kingdom: Dunedin, 2017. xi + 212 pp. € 42.00, US$ 45.00, ISBN 978-1-78046-0666.6.

At first glance, it would be tempting to describe this attractive book merely as a "geological atlas of mountains," but this would do the author a grave disservice. Yes, it presents a detailed snapshot of our current geological knowledge of the world's mountain belts. However, the text not only describes how the mountains vary in space, but it also explores how they have evolved over time. As the author dissects their anatomy, he also examines the geological processes involved in shaping them, from youth to maturity. Moreover, their development is considered within the context of the whole Earth system and the overarching model of plate tectonics—key concepts that underpin the discipline of geology and that are summarized in one of the early chapters. The author, Graham Park, has a pedigree in accessible, introductory geology textbooks, including *Foundations of Structural Geology* (Park 1997), which I annotated lackadaisically as an undergraduate. His experience has helped craft a, perhaps inevitably, well-structured book with an attractive mix of graphics—photographic and satellite images as well as colorful diagrams—that offers the casual reader a taste of the inimitable variety and vast scope of geology.

The book opens with a rather brief introductory chapter that touches on some ideas that are fundamental to understanding mountains: isostasy, uplift and erosion, plate tectonics—and a short myth-busting paragraph distinguishing the ages of mountains from the ages of the rocks they contain. To nongeologists, mountains seem quintessentially ancient. However, many mountain regions only became mountainous very recently (geologically speaking): The Himalayas, for example, have only existed as mountains for around 50 million years. However, those same mountain peaks contain rocks of many different ages: from 1 million-year-old granites to 1.8 *billion*-year-old gneisses. To unpiece these geological puzzles, some familiarity is required with the model of plate tectonics, the subject of chapter 3. Leading up to this, however, there is an engaging chapter charting the historical development of theories on mountains from the late 16th century into the 20th century, when a critical mass of observations, data, and disparate ideas coalesced into the model we now know as plate tectonics. This historical perspective is another feature that elevates this volume above the simple textbook—it is fascinating to trace how individual scientists shaped and reshaped ideas on the origins of mountains. Chapter 3 then covers the main concepts, background information, and terminology that the reader needs to tackle the main core chapters—though a glossary towards the end of the book will no doubt come in handy for the nongeologist. This chapter provides the essential context for the rest of the book.

With the groundwork laid, a reader can now venture into the core of the book: a comprehensive exploration of the morphology, geological features, and tectonic history of each mountain belt, within the context of its regional plate-tectonic setting. The author focuses first on currently active mountains of the Alpine–Himalayan and western Pacific belts, the western margin of the Americas, and Antarctica, before moving on to consider the largely submerged but no less impressive ocean ridge network. Finally, in true geological fashion, his gaze turns backwards into the vast abyss of time to ancient mountain belts, the inactive remnants of which still adorn the surface of our planet.

I would suggest that these main chapters, 4 through 14, do not repay the reader by being read from end to end. Far more rewarding is the approach of dipping into a chapter or two dealing with a specific region of particular interest. While the review of all the world's mountain ranges is an impressive undertaking in itself—the references listed before the index hint at the scholarship involved—attempting to assimilate that weight of knowledge by reading through it all in order is counterproductive. Because each mountain belt is treated similarly, consuming several chapters consecutively renders the text repetitious and formulaic. However, this consistency is part of the book's strength: It allows rapid comparison of different regions and provides a familiar framework for exploring new areas. The tectonic sketch maps in particular are clear and accessible (even if the coloring is somewhat lurid for my taste!). Geological cross sections are included for many of the belts to illustrate interpretations of the deep subsurface; these are presented at a limited level of detail, since differences of opinion abound among geological researchers on the deeper structure of some mountain belts! More use could have been made of tabular or graphic summaries of the timing of events in some mountain belts (for example, the maps or cross sections showing how an orogenic belt evolved in stages); setting such complex histories down as text alone makes for somewhat indigestible content. However, this minor criticism should not detract from the author's achievement: a guidebook to all the Earth's mountain belts, familiar and unfamiliar, youthful and ancient, those that are still growing vigorously and those worn down to their roots.

This volume could satisfy several different types of reader. I can imagine an undergraduate geology or geography student turning to it for

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authoritative, first-order information on an unfamiliar mountain region, say for an assignment, and dipping in to the appropriate chapter, before perhaps being drawn in to other sections by simple curiosity. Similarly, for a geological researcher skimming rapidly for background information before embarking on investigations in a new mountain belt, it is the perfect place for a swift overview before diving into the expert literature via the references towards the back of the book. However, I can also see this volume on the cluttered bookshelf or coffee table of anyone who is fascinated by mountains—from whatever angle—and has been searching for a book to paint in the geological background of their own mental portrait of what a mountain is. This book is what they have been seeking.

REFERENCE

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