

Journeys west



Rough-Hewn Land: A Geologic Journey from California to the Rocky Mountains

Keith Heyer Meldahl

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If all of life is a play, then geology is the study of how the stage was built. As such, making an interesting and popular geology book presents a challenge to authors. After all, patrons of the arts don't arrive a few days early to observe set construction. Many geology guides essentially amount to a somniferous how-to-build-this-landscape manual. A different tack has been to focus less on the geology and more on the geologists studying it, an approach brilliantly executed by the writer John McPhee in his collection of works on geologists struggling to interpret US geology in terms of plate tectonics. In our stage analogy, you learn about a lighting director and why he has chosen to focus one light on one part of the set.

In *Rough-Hewn Land*, Keith Meldahl plays the role of the chatty backstage guide, who might tell you about the unusual way one stage prop was built, or the odd material in another. Covering much of the same ground as his earlier volume, *Hard Road West*, which examined the geology of the region through the eyes of those caught up in the California Gold Rush, the book meanders through the landscapes of western North America, looping from offshore California to the easternmost edges of the Rockies. This time, though, the focus is more geological. Meldahl directs the reader off the beaten track to some interesting spots, where he shares the aspects of the landscape that make the place special, such as the oddity of giant rounded boulders at Register Rock in southern Idaho, or abundant trilobites in the House Range of western Utah. Just in case you want to make the physical journey with him, Meldahl includes a list of locations, with their latitudes and longitudes, in an appendix. A glossary of technical terms helps the non-geologist follow along.

Each chapter covers a different aspect of the geology of the region, and most are entwined with a non-geologic story. The Gold Rush frames the assembly of the Sierran metamorphic belt. The Donner Party tragedy — when a group of California-bound emigrants got trapped in snow in the Sierra Nevada in 1846–47 — winds through an exposition of Pleistocene glaciation and the life and death of Lake Bonneville, the huge ice-age predecessor to the Great Salt Lake. The routes of interstate highways and the transcontinental railroad are noted for avoiding the steep topography created over the past 10 million years as the Rockies were exhumed. The text is accompanied by clear and graphically clean grayscale drawings and maps, although the specific locations mentioned in the text are rarely highlighted on the maps. Professional earth scientists unfamiliar with a topic can learn of the source material from endnotes and a bibliography; those already familiar with the subject matter will appreciate seeing the way in which Meldahl has enlivened the material for more casual readers.

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The places visited in the book are interesting, and range from sections of the ocean floor near San Francisco and gold mining sites in the Sierra Nevada, to the sub-summit plateaus of the Rockies. Most of the choices illustrate the way in which the modern landscape formed, and so the overall focus is on tectonics and geomorphology. However, some chapters focus on life history and ore formation. Only one chapter, on the evolution of life just over 500 million years ago, seems orphaned. The others hook together in one way or another to help form a broad picture of the geologic evolution of the western United States.

As a popular science book, the volume is a success, blending some of the most recent science with semi-folksy examples using beer cans, inviting images of hippos under porches and reminders of historical events. Meldahl moves past the basic plate tectonic framework and into the more nuanced

geology of the twenty-first century. We learn that the boundary between the North American and Pacific plates is not the knife edge of the San Andreas Fault, as typically thought, but extends well into Nevada, implying a greater level of seismic risk to cities like Reno and Salt Lake City. The horizontal subduction of an oceanic plate is trotted out to explain a period of mountain building in western North America around 50 to 75 million years ago, and that slab's demise is tied to volcanism and lithospheric extension in the Basin and Range region.

However, ongoing scientific controversies are papered over, leaving some odd discrepancies to puzzle a careful reader. For instance, an argument that the elevation of the Sierra Nevada has not changed over the past 45 million years faces a diagram showing several thousand feet of uplift in the past 5 million years. This accompanies the statement that most geologists had thought that the mountain range was located close to sea level before this work, a statement only defensible if you think the Appalachians are near sea level today. Sierran granites are described as rising bubbles of molten rock, a view now very much in dispute. And, on another occasion, the author hypothesizes that gold deposits in the Sierra Nevada came from somewhere far to the east, an appealing speculation that is, so far, unsupported. Finally, the development of the Basin and Range region simply from the motion of the Pacific plate might surprise some readers of the professional literature over the past thirty years, in which the role of gravitational potential energy has been emphasized.

It is inevitable in a book this wide-ranging that there are omissions or simplifications that will rankle those familiar with the subject matter. But the book's shortcomings are a small matter compared with its capacity to engage a broad audience with a lively discussion, incorporating recent ideas, on the creation of one of the most dramatic landscapes on Earth. As such, the book can be seen as a great introduction to more in-depth investigations of the geology of this region. □

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