

BOOK REVIEW

Book Review: *Geology of the Lassen Country: The Geologic Story of Lassen Volcanic National Park and Vicinity*. (2019)

By Forrest Hopson and Michael Clynne. Backcountry Press, Humboldt County, California. ISBN: 978-1-941624-07-4. 176 pages. Available in: Paperback, PDF \$29.95.

In 1981, a field guide changed my life. A year out of high school, I was happily employed at a recording studio when I purchased Stephen Whitney's (1979) *A Sierra Club Naturalists Guide: The Sierra Nevada*. That guide opened a door into a world that was strangely absent from high school science curricula, and still is. Whitney's book explained not just the "what" (how to identify trees, birds, landscapes, etc.) but also the "why" of what I saw hiking in the Sierra Nevada and southern California mountains. With guide in hand, I thought, "Perhaps instead of having music as a career and science as a hobby I should switch the two." A terrific new field guide by Hopson and Clynne, *Geology of the Lassen Country*, does for Lassen geology what Whitney's book does for Sierra Nevada Natural History.

This book is for park visitors with a passion for volcanoes. The title refers to the "Lassen Country" because relevant geologic features do not stop at the Lassen Volcano National Park boundary. And at a slim 176 pages, it is both surprisingly comprehensive and fits easily into the pocket of a daypack. The scientific descriptions are often quite technical for a general audience, but the glossary is comprehensive. Novices should expect to make frequent use of the glossary, but readers will find a very detailed and accurate view of the volcanic history of the region, as well as up-to-date descriptions and explanations of hot springs, active faults, glacial activity and weathering processes and how these affect the Lassen Country landscape.

A key strength of the book is that it is nearly encyclopedic in detail. The text nonetheless seems to be designed with geologists in mind. Readers who are underwhelmed by the lack of detail in the *Roadside Geology* (Mountain Press) series will not be disappointed here. The tables and maps alone are well worth the purchase price as they succinctly organize a very complex geologic history. My students and I are engaged in research in the Park and this book will be a valuable reference when in the field. The authors' approach is also innovative within the genre. The first nine chapters (three-quarters of the book) are effectively an introductory course in Geology, entirely driven towards understanding Lassen Country outcrops, with most sections identifying locations where geological phenomena can be observed. The remainder of the book consists of an excellent 6-page summary of Lassen geologic history, a 1-day geologic road guide, and 8 hiking trail descriptions. This ap-

proach allows readers to use the book in different ways. If one is interested in seeing, for example, a shield volcano, or pahoehoe lava, the introductory chapters show where these can be found. A reader taking a lunch break at Chaos Crags can readily find maps, tables, and descriptions of rock types and eruption sequences for that location. Some place names, such as Cinder Cone, Fantastic Lava Beds, and Lassen Peak, are unfortunately not in the index, but they can be found by flipping through the pages. The road and hiking guides provide the more typical follow-the-yellow-brick road tours that are helpful to most visitors, whether geologically trained or not. Many of the photos and tables are also in Muffler and Clynne (2005), but this guide (at 337 g/11.9 oz and 21.6 × 14 × 1.3 cm/ 8.5 × 5.5 × 0.5 inches) is much easier to pack and carry. The only advantage of the Muffler and Clynne (2005) guide is that it provides charts that would interest petrologists and geochemists. Lassen enthusiasts will likely want both.

I would also recommend the book for non-geologists, or perhaps students enrolled in a college-level introductory geology class that is focused on Lassen, but with caveats. Technical terms are densely employed, and the publishers have blundered badly—in their Preface, the authors note that "technical words are in boldface and listed in the glossary." The glossary is there, but the boldface is not. A saving grace is that the authors have judged well in placing nearly all terms into the glossary. In any case, non-geologists will need to make use of that glossary to understand each page, if not each paragraph. Non-scientists are also likely to be curious about how Nature creates an array of volcanic rock types, and some clearer connections between field observations and genetic processes, like crystal-liquid separation and magma mixing might also be helpful to people new to geology or petrology. In addition, the authors bypassed an opportunity to educate readers about a geologic view of climate change: the book contains an excellent summary of glaciation, but a revised edition would benefit from a figure that shows how "ice ages" are connected to the rise and fall of CO₂, and how our current global warming is different from these events; park visitors would then understand why geologists are uniformly concerned about anthropogenic inputs of CO₂ into the atmosphere.

There are a few geologic errors that one could quibble over (for example, the upwelling limbs of a deep-seated convection cell should not be placed beneath a mid-ocean ridge), and I think a new edition could make use of some very recent advances in Lassen geology. For example, the authors should probably mention the very important work of Klemetti and Clynne (2014), who address timescales of volcanic rejuvenation (tens to thou-

sands of years) and magma storage (200 ka). Such results are probably the single most important advance since Clynne (1999) and are likely to interest non-geologists who often wonder about “the next eruption.” My own student, Melissa Scruggs, has also shown in Scruggs and Putirka (2018) that magma mixing is an unlikely proximate cause of eruption, based on observations of post-mixing cooling; she concludes that at least Chaos Crags magmas likely erupt only after reaching vapor saturation, just as Clynne (1999) had inferred for the 1915 eruption, in his now-classic study of the latest eruptive events.

Since I mostly visit Lassen for research purposes, I was curious about how the text might be received by teachers interested in leading field excursions to the region. I thus showed the book to our Lecturer, Kerry Workman Ford, who leads biannual trips to Lassen for non-Geology majors at Fresno State. She finds the text a truly excellent resource for teachers (but too jargon rich to be a required text). She also helpfully suggests that future editions include hiking guides to Fantastic Lava Beds, Cinder Cone, and Painted Dunes.

Perhaps the best way to describe this book is to imagine a scale, with the *Roadside Geology* series on one side, and geologic guidebooks produced for scientific meetings on the other. This book falls quite close to the latter, but with enough introductory material to be self-contained and likely to satisfy avid, self-taught readers. It may indeed fill an important niche. Geologists produce many field guides, but few if any reach the hands of the average tourist. But I can think of no more power-

ful way to advance a public appreciation and understanding of science than to show how science can inform what the visitor sees when touring public lands. I wonder if this new guidebook by Hopson and Clynne could serve as a model for other National Parks. I could easily envision this book being part of a series that would include any number of Parks in the U.S. I'd happily sign up for the version that covers Yosemite or Kings Canyon-Sequoia.

References cited

- Clynne, M.A. (1999) A complex magma mixing origin for rocks erupted in 1915, Lassen Peak, California. *Journal of Petrology*, 40, 105–132.
- Hopson, R.F., and Clynne, M.A. (2019) *Geology of the Lassen Country: The Geologic Story of Lassen Volcanic National Park and Vicinity*. Backcountry Press, Kneeland, California, 176 p., ISBN 978-1-941624-07-4.
- Klemetti, E.W., and Clynne, M.A. (2014) Localized rejuvenation of a crystal mush recorded in zircon temporal and compositional variation at the Lassen Volcanic Center, northern California. *PLOS one*, doi: 10.1371/journal.pone.0113157.
- Muffler, L.J., and Clynne, M.A. (2005) *Geologic field-trip guide to Lassen Volcanic National Park and Vicinity, California*. U.S. Geological Survey, Scientific Investigations Report 2015-5067.
- Scruggs, M.A., and Putirka, K.D. (2018) Eruption triggering by partial crystallization of mafic enclaves at Chaos Crags, Lassen Volcanic Center, California. *American Mineralogist*, 103, 1575–1590.

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