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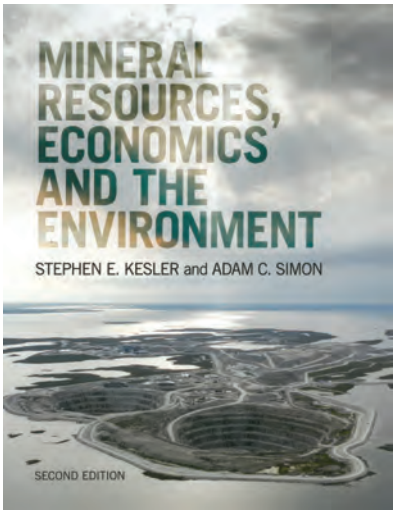
Book Review

Book Review: Mineral Resources, Economics and the Environment, 2nd edition. By Stephen E. Kesler and Adam C. Simon. (2016) Cambridge University Press. ISBN: 9781107074910, 446 p. $89.99 (available as e-book).

The second edition of *Mineral Resources, Economics and the Environment* by Stephen E. Kesler and Adam C. Simon is a welcome update and expansion of the 1994 (first) edition by S.E. Kesler. As a teacher and researcher of both environmental geochemistry and geochemistry of hydrothermal ore deposits, I used the first edition of this book as a resource in my graduate-level class called "Mineral Resources and the Environment." Although the book is written at a level consistent with first to second year undergraduate science students in geology and mineralogy, it could and should have a broad appeal and uses for upper level undergrads and graduate students in other fields of science, engineering, business, law, and even liberal arts. Like all businesses, extractive mineral resource companies (e.g., mining and hydrocarbon extraction) need to be profitable to remain viable. Exploration for new mineral resources is an expensive proposition and the time between the discovery of a valuable deposit and its ultimate extraction is increasing worldwide, most notably in the U.S.A. As a result, and because "time is money," the cost of finding and then producing new mineral resources is increasing. In addition to the expense of exploration, it is also a risky business. Potential changes in political environment (e.g., elections, wars, or terrorism), fluctuations in interest and tax rates, corruption, and new government regulations and laws are just some of the risks discussed in detail by Kesler and Simon.

In the last few years in my class, we have discussed significant changes in the world in the 20+ years since the first edition of Kesler's book. Students hit on such issues as more recognizable effects and general acceptance of global climate change, the BP oil spill, a significant *increase* in U.S.A. hydrocarbon production due to horizontal drilling and "fracking" and other "non-traditional" hydrocarbon production practices including tar-sand extraction, advances in green energy and technologies, important new mineral deposit discoveries and debate over their environmental impacts, and last, a massive change in the elements on the Periodic Table that mineral resource geologists are now interested in finding and extracting. Thus, it is heartening to see the second edition of *Mineral Resources, Economics and the Environment* updated to include these new aspects of mineral resource production and related issues.



The principal change to the book is the addition of a whole new chapter called "Technology Elements" to the list of other mineral resources covered in both editions such as ferrous and ferro-alloy metals, base metals, precious metals, industrial minerals, energy mineral resources, agricultural and chemical minerals, and gemstones. This chapter adds elements such as rare-earths, semi-conductors, metalloids (Se, Te), lithium, etc., which are increasingly used in next generation batteries, magnets, solar cells, cell phones, and other new technologies. Both editions also have chapters on the environmental geochemistry of mineral resources, mineral economics, mineral laws and land acquisition issues, and global mineral reserves and resources. Topics covered are updated, as are the appropriate references. In addition to expansion and updates of topics covered, most of the tables and graphs have been updated to include data from as recent as 2015. These represent an astonishing compilation of data on the locations of global mineral resource production, resource values and production statistics, and global consumption, relative contributions of mineral resource production to the gross domestic products (GDP) on countries globally, changes in prices and production rates of mineral resource commodities, and the changing energy market and underlying use of energy minerals, global energy uses, etc. In the first edition of this book, there were no color photographs, which apparently was an unfortunate sacrifice to keep the printing costs manageable. This has only been partially rectified in the second edition by adding an unnumbered, 30-page inset in the center of the book that contains color versions of some of the black and white photographs in the text. It is certainly nice to see these color photographs, but the book could certainly benefit from a more refined professional presentation. I suspect

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once again this is an issue of printing costs.

International readers might find the book a bit U.S.A.-North America-centric, which, for a couple of reasons, I would argue does not detract from the book. First, North America (and U.S.A. in particular) is perhaps further along than most countries in moving toward developing a sustainable mining industry due to public concerns and government regulations. This of course adds costs to exploring for and producing mineral resources. That is one reason for decline in non-energy mineral production in North America, as production has shifted to countries with less environmental regulations and enforcement, lower labor costs, and perhaps lower taxes as well. But North American mining standards undergirds informal international "best practices" for mining as the world moves toward understanding the costs of extractive mining without proper environmental regulations. Also, North America leads the world in development of new mine cleanup technologies and in how to mine with the least environmental impact possible.

In summary, the three topics in the title of this book are intimately interrelated and an understanding of all three is required to best plan for increased demand for minerals as global population grows and economic development advances. This book contains a plethora of data and information that cannot be found easily elsewhere and provides a good gateway into the pertinent literature. It should be required reading for anyone taking a side in the "development vs. environmental preservation" debates related to mineral and energy extraction. This should include policy makers both nationally and internationally. I see this book as a nice companion textbook for geosciences classes in mineral deposits and also in environmental science, and it is an excellent choice of a textbook for a class for upper-level undergraduate and graduate students designed to bridge the fields of mineral resources, environmental science, the law, and perhaps even ethics.

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