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Book Review

Noble gases in geochemistry and cosmochemistry edited by Donald P. Porcelli, Chris J. Ballentine, and Rainer Wieler. Mineralogical Society of America and Geochemical Society, Washington, DC, USA, 2002, 844 p., $40, (ISBN 0–939950–59–6).

This recently released book will quickly become an essential element on the desks and bookshelves of researchers involved in the study of the noble gases. In the preface, Alex Halliday states that "this volume is nothing short of a fantastic accomplishment." On balance, this volume, number 47 in the series *Reviews in Mineralogy and Geochemistry*, sponsored by the Geochemical Society and the Mineralogical Society of America, lives up to this billing.

This volume consists of 18 peer-reviewed individual articles, each authored by researchers having extensive experience in their respective area of expertise. Enough detail is provided in the table of contents to allow the book to be used as a reference. In general, the individual articles are sensibly organized and generously illustrated by various isotope plots, schematics, and data tables. Finally, each of the articles is thoroughly referenced, allowing the reader the option of digging deeper into the archive of research upon which this work is based.

The volume opens with introductory chapters reviewing noble gas geochemistry (written by the editors) and a chapter summarizing the noble gas inventories within our solar system. These opening chapters contain numerous data tables ranging from the composition of the terrestrial atmosphere, nuclear reaction producing noble gases, half-lives of noble gas progenitors, etc. I found these data tables to be of immediate utility.

The following chapters are organized by research discipline. There are three chapters devoted to the study of noble gases in meteorites. The author of the chapter on trapped components does an admirable job of organizing and explaining the various members of the noble gas bestiary and, as such, this chapter sets the stage for some of the work presented on terrestrial planets. The author also suggests a naming convention for these components—only time will tell whether this convention is used.

Of particular note is the chapter on cosmic-ray-produced noble gases in meteorites. This chapter is simply the best treatise on this topic I have read. It explains the techniques, the nuclear physics in back of the technique, and the interpretation of the measurements.

These chapters are followed by one on Martian noble gases and a chapter on the provenance of noble gases in the terrestrial planets.

The mechanisms responsible for the incorporation of volatiles into terrestrial planets, degassing, formation of atmospheres—primary and secondary, and the alteration of the fractionation of the noble gas isotopic structures are topics about which entire books could be written. The authors summarized the state-of-the-art of this work in a well-organized, concise, and lucid manner. As I read the sections on the acquisition of noble gases and their subsequent alteration, I could sense the excitement and scientific urgency that these problems instill in researchers.

The balance of the book, roughly two-thirds by volume, is largely devoted to terrestrial noble gas geochemistry. All of the individual chapters present interesting material that is accessible to non-practitioners of the black art of noble gases but, nonetheless, has sufficient depth to hold the interest of noble gas researchers.

Of particular note is the chapter on the noble gas geochemistry of mid-ocean ridge and ocean island basalts. Not only does this chapter presents decades of noble gas measurements of mantle-derived basalts and critiques the various interpretations, but these results are placed within the larger context of the evolution of the other isotopic systems used to study mantle and crustal evolution. For good measure, other major volatile data are also discussed in light of the noble gas data.

The final chapter on terrestrial noble gases discusses cosmic-ray-produced noble gases in terrestrial rocks. Relative to the mature status of many other noble gas endeavors, this is essentially a new field and, I believe, the author did a superb job of explaining both the phenomenology and much of the detailed work that goes into determining terrestrial exposure ages. Topics range from consideration of shielding effects to the different means of extracting cosmogenic Ne from minerals. Practitioners of this work will appreciate the consolidation of all this information into one concise article.

The volume closes with two chapters concerning themselves with dating techniques: K-Ar and Ar-Ar and the (U-Th)/He techniques.

The editors and authors of this massive volume have succeeded in collecting into one volume the disparate research utilizing noble gases and presenting it in a fashion that summarizes the state-of-the-art in noble gas research, presents data tables that are useful as reference material, and at the same time, shows the field as a dynamic one in which many solid contributions have yet to be made. Perhaps the

best testimony to their efforts is that, since I received my copy, I find myself referring to articles or tables constantly. I believe my experience will not be unique in this regard. The editors and authors are to be commended.

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