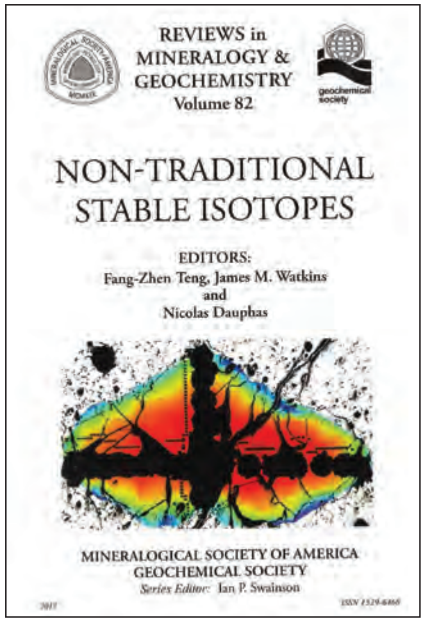
Book Review

Book Review: Non-Traditional Stable Isotopes. Edited by Fang-Zhen Teng, James Watkins, and Nicolas Dauphas. (2017) RiMG Volume 82, Mineralogical Society of America, i–xvi + 885 pages. Price, 978-0-939950-98-0.



Thirteen years have passed since the publication of the pioneering *Geochemistry of Non-Traditional Stable Isotopes* (RiMG 55). This early review summarized the incipient promise of non-traditional isotope research. This second volume (RiMG 82), more sparingly entitled *Non-Traditional Stable Isotopes,* shows that this promise has been fulfilled and non-traditional isotope research has now expanded into a major discipline of isotope geochemistry. It has broadened into a mature field; not only in the range of cosmological, geological, biogeochemical, oceanographic, hydrological, and even medicinal questions addressed, but also in the range of isotopic systems being studied. Much of this progress reflects the development of multicollector-inductively coupled plasma mass spectrometer (MC-ICPMS) techniques, particularly the increased use of double spike methods. But in-situ techniques such as ion probe and laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS) are increasingly making their mark. Equilibrium or kinetic, and mass-dependent or non-mass-dependent isotope fractionation phenomena are all manifested in non-traditional isotope systems, and the theoretical foundations have recently expanded to include nuclear field effects to account for the unusually large fractionations associated with heavy elements.

The coverage of this RiMG volume is extensive, and for any practitioner, be they established researchers or a graduate student new to research, this book presents an excellent starting point and summary. The volume is written by a first-rate team of authors. Each chapter is a comprehensive statement of the current status of the field, varying from the relatively long established isotopic systems such as Fe, Mo, Cu isotopes and Li and Mg isotopes, or the relatively new developing fields such as Cr, Ni, and U isotopes. The chapter structure mostly follows a path of: notation, methodological developments, principal mass reservoirs, fractionation systematics (both equilibrium and kinetic), and applications. A useful addition to most chapters is a statement of anticipated future directions. Extensive bibliographies at the end of each chapter are a distinct bonus.

The book content begins with two chapters on theoretical modeling and experimental perspectives of equilibrium fractionation followed by an intriguing chapter on a topic already shown to be important in traditional isotope systems, the kinetics of diffusional and crystal growth fractionation. These introductory chapters are followed by systematic accounts of the major non-traditional isotope systems currently studied today (with the exception of Ca isotopes, which are already covered in a separate review paper). The chapters begin with the light elemental systems (Li, Mg, Si, Cl), followed by the transition metals Cr, Fe, Ni, Cu, Zn, Mo, semi-metals Ge and Se, and concluding with the heavy elemental systems Hg, Tl, U. The book concludes with a chapter on the medical applications of non-traditional isotopes. A detailed reading of the chapters on the transition metal isotopes close to my own interests (Fe, Cu, Zn, and the amazing "moly") reveals them as topical, insightful, fine expositions of the current challenging questions in planetary sciences, biogeochemistry, and natural redox processes. I think this statement also holds true for coverage of the equilibrium and kinetic fractionations of the Li, Mg, and Si isotopes and their applications to weathering and geospeedometry, Cr and Ni isotopes in cosmochemistry, the mass-independent fractionation of Hg isotopes, and the ocean modeling potential of U isotopes, among other subjects. I see this book as a benchmark text for a number of years to come. Yet, at the same time, non-traditional isotopes is a growing, versatile field, providing insights into geochemical and mineralogical processes that complement those of the traditional stable isotopes. Thus, it will not be surprising to see follow up volumes being published in the future.

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