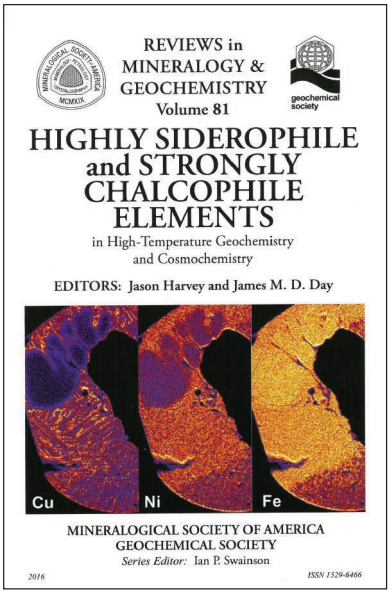
Book Review

Book Review: Highly Siderophile and Strongly Chalcophile Elements in High-Temperature Geochemistry and Cosmochemistry, RIMG Volume 81. Edited by Jason Harvey and James M.D. Day (2016) Reviews in Mineralogy and Geochemistry, i–xiv + 774 p., ISBN 978-0-939950-9-73.

Highly siderophile elements (HSE) have been studied in high-temperature settings for several decades. Their peculiar affinity to metal and sulfide phases provides complementary insights into geological processes compared to those gained from lithophile or atmophile elements, notably planetary accretion and differentiation. The HSE comprise the noble metals (Ru, Rh, Pd, Re, Os, Ir, Pt, Au), and include two long-lived isotope systems: the Re-Os and the Pt-Os system. The RIMG volume edited by Harvey and Day presents the current state of HSE research in 12 chapters devoted to geo- and cosmochemical applications of the HSE and their isotope systems.

After a preface by Harvey and Day providing an overview about HSE geochemistry, the first chapters present experimental and analytical methods. Chapter 1 by Brenan et al. summarizes experimental studies on HSE, discussing the partitioning of HSE between metals, sulfides, oxides, and silicates at various temperatures and pressures. The following chapter by Meisel and Horan details the analytical methods and available reference materials. Chapters 3 and 4 cover the cosmochemical applications of HSE. Chapter 3 by Yokoyama and Walker focuses on nucleosynthetic isotope variations, while chapter 4 by Day et al. deals with the application of HSE to study processes on Mars, the Moon, and asteroids as meteorite parent bodies; as well the comparison of processes on these solar system bodies to Earth. Chapters 5, 6, 7, and 11 deal with HSE in different settings in the Earth's mantle. Chapters 5 and 6 highlight the insights on mantle geochemistry obtained by studies of mantle xenoliths from the cratonic lithospheric mantle representative for the Archean (chapter 5 by Aulbach et al.) and from basalt-hosted non-cratonic xenoliths representing the post-Archean mantle (chapter 6 by Luguet and Reisberg). Chapter 7 by Becker and Dale discusses HSE behavior in tectonically emplaced mantle massifs, such as orogenic massifs, ophiolites, and abyssal peridotites. In chapter 11, Gannoun et al. discuss the HSE systematics in volcanic settings both at plate margins and intraplate, covering a range from MORB via OIB to subduction-related volcanism. In between, chapters 8 to 10 focus on the host phases of HSE in high-temperature processes. Lorand and Luguet (chapter 8) highlight the importance of sulfides as the main host phases for siderophile and chalcophile elements in the Earth's mantle, followed by a chapter on the mineral phases formed by the HSE as main components (platinum-group minerals) by O'Driscoll and González-Jiménez. The role of mantle sulfides in the applications of the Re-Os and Pb isotope systems on geochronology is discussed in chapter 10 by Harvey et al. The final chapter by Barnes and Ripley covers the importance and behavior of HSE in ore forming processes.



The volume provides a comprehensive review of the current state of HSE research and offers an excellent overview of the field, making it an essential source of information for researchers in the field. Tables of reference values for meteorite and recommended terrestrial reservoir compositions make this volume a good source for looking up database information. Information that is not included in this volume itself can be easily looked up due to the excellent and comprehensive bibliography provided in every chapter. The volume is suited as well for readers looking for an introduction into HSE research or particular aspects thereof, because the individual chapters briefly rehash important concepts at the beginning before addressing their respective subjects in depth. While some chapters feature a steep learning curve, the reiteration of important concepts makes the volume accessible to both readers less familiar with the HSE and readers interested only in a single aspect or geological setting.

Overall, there is a lot to like about this volume and little to criticize. In some places, the artwork would have benefited from color reproduction, due to the large numbers of different samples and sample suites presented, which are difficult to distinguish from each other in grayscale. This small criticism aside, the volume is highly recommended for both experienced and novice readers seeking an overview of HSE geochemistry, as it presents the developments in the application of HSE geochemistry over the last few decades in a concise and complete manner.

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0003-004X/16/0011–2576$05.00/DOI: http://dx.doi.org/10.2138/am-2016-668