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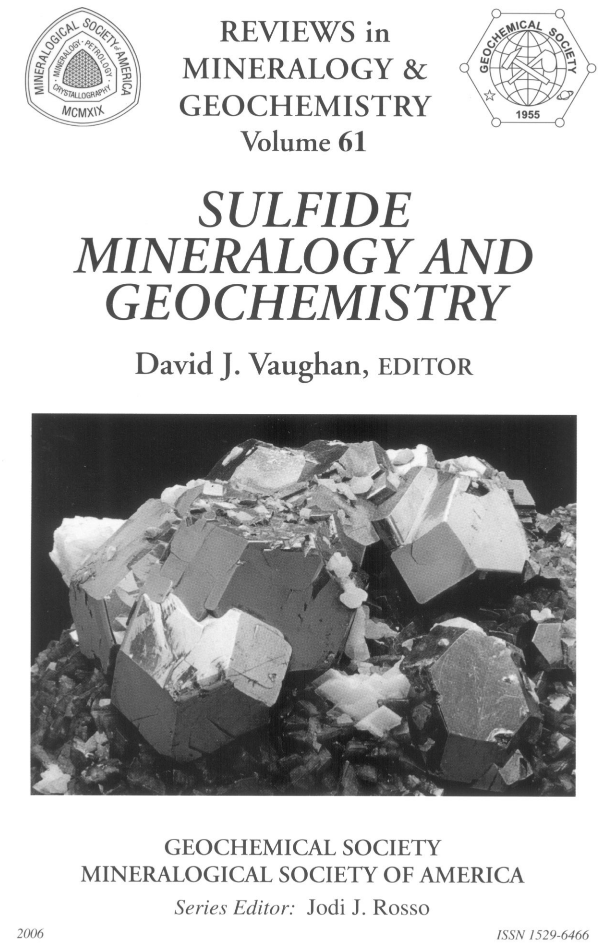
Book Review

Sulfide mineralogy and geochemistry, edited by D. J. Vaughan. Mineralogical Society of America and the Geochemical Society, 2006, 714 p., $40, paperback (ISBN 0-939950-73-1).



Sulfide minerals are a ubiquitous component in meteorites and other planetary materials, and they play an important role in planetary science from core formation to being likely surface minerals on Mars and Venus. This book has a decidedly terrestrial emphasis with only brief mention of sulfide mineralogy and geochemistry in meteorites. This isn't really a problem as the majority of research has been conducted in the terrestrial realm, and can potentially be applied to understanding sulfides in systems of interest to readers of this journal. But if you are looking for a review of sulfides in extraterrestrial systems, you will not find it here (unless you count one page on sulfur isotopes in meteorites in chapter 10 and another page or two on sulfide solid solutions in chapter 6). I tried to read the entire 714-page review volume (in the typical small font of the later volumes of this series), but alas, I failed, as this volume is not meant to be read cover to cover. In my reading attempts, I have found the chapters to be well referenced and written in a logical order. The editor has done a good job with this volume, likely because he is an author or co-author on 6 of the 13 chapters. This somewhat singular perspective could be a weakness, but the editor is undoubtedly one of the most knowledgeable researchers in the area of sulfide mineralogy, and thus I think the volume is actually strengthened by his role.

The book begins with an overview chapter by the editor, David Vaughan, who does an excellent job of placing this volume in the context of other reviews on sulfide minerals, including the first volume of this series, *Sulfide mineralogy,* published in 1974. Vaughan also updates the reader on how the scientific fields pertaining to sulfide mineralogy have evolved in the last 30 years, from primarily an ore-studies emphasis to include present-day interests in geomicrobiology, acid mine drainage, and seafloor hydrothermal vents. With the advent of new technologies and interests, the importance of sulfide mineral surfaces in influencing their properties and chemical reactivity is also emphasized.

Chapter 2 by Emil Makovicky provides a thorough review of the crystal structures of sulfide and related chalcogenide compounds, with an emphasis on minerals with some discussion of synthetic compounds. This 100-page chapter is one of the more valuable in the book. Chapter 3 (Carolyn Pearce, Richard Patrick, and David Vaughan) on the electrical and magnetic properties of sulfides, mostly from a theoretical and synthetic compound perspective, is a useful review. Chapter 4 (Paul Wincott and David Vaughan) provides a brief overview of spectroscopic studies of sulfides including sections on absorption and reflectance spectroscopy, infrared and Raman, X-ray and electron emission spectroscopies (such as XPS and Auger electron), X-ray absorption spectroscopies (primarily XANES and EXAFS), and Mössbauer. Chapter 5 (David Vaughan and Kevin Rosso) is an overview of chemical bonding in sulfide minerals. Chapter 6 (Richard Sack and Denton Ebel) examines the thermochemistry of sulfide mineral solutions. This chapter provides an excellent review of experimental sulfide petrology and contains some discussion relevant to sulfide thermochemistry in meteorites. This is followed by chapter 7 (Michael Fleet) on phase equilibria of sulfides at high temperatures, which has a different perspective on topics aimilar to those in the preceding chapter. The next few chapters represent topics not previously considered in volume 1 of this series. Chapter 8 (David Rickard and George Luther) is on metal sulfide complexes and clusters in aqueous solutions, chapter 9 (Kevin Rosso and David Vaughan) reviews the experimental and theoretical advances of surface chemistry with emphasis on sulfide mineral surfaces, and chapter 10 (Kevin Rosso and David Vaughan) is on the chemical reactivity of sulfide mineral surfaces. Chapter 11 (Mark Reed and James Palandri) considers sulfide mineral precipitation from hydrothermal fluids using available computer models to simulate possible sulfide mineral precipitation and dissolution scenarios. Chapter 12 (Robert Seal) reviews the sulfur isotope geochemistry of sulfide minerals. Chapter 13 (Mihály Posfai and Rafal Dunin-Borkowski) is on sulfide minerals in biosystems.

While chapters 2, 4, 6, 7, 12, and 13 are of obvious importance, I found several of the other chapters to be of potential use to members of our community, which might not be obvious on first inspection. Sulfide complexing in aqueous systems (chapter 8) may be of limited use to materials-oriented scientists, but could have potential interest for future researchers in the new, burgeoning field of extraterrestrial aqueous geochemistry. Similarly, chapters on the surface properties of sulfide minerals (chapters 9 and 10) may be of more interest in the future as we work on smaller and smaller extraterrestrial particles (e.g., aerogel captured materials of Stardust and future planetary missions).

As a meteoriticist or planetary scientist, if you can envision that your research or teaching endeavors may at some time in the next 20 years involve sulfide minerals, then I highly recommend this book to fill a place on your shelf next to the many other invaluable volumes of this wonderful, and uniquely affordable, reference series on mineralogy and geochemistry. At the least, make sure your library purchases a copy so that you will have ready access to this review volume in the future.

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