Carbon in Earth

FROM THE SERIES EDITOR

Every RiMG volume is unique and special and, over the years, RiMG volumes have cumulatively covered the atomic to global scales for a variety of topics related to mineralogy and geochemistry. *Carbon in Earth* continues in this tradition. In *Carbon in Earth*, the reader will learn about the intricate aspects of atomic mineral crystal structures, models of carbon emissions from volcanoes, and how to probe the hidden secrets of carbon in the Earth's mantle and core, in addition to much, much more. It is an enjoyable read even for those not actively involved in this area of research. *Carbon in Earth* is the result of the monumental efforts by volume editors Bob Hazen, Adrian Jones, and John Baross, who deftly organized and wove together the diverse subjects covered in this volume. Gentlemen, a job well done.

The RiMG series has spanned several generations of publishing technologies since its inception almost 40 years ago. In its earliest days, handwritten manuscripts were scrupulously typed and typewriters were the cutting edge. For years, Paul Ribbe painstakingly cut, positioned, and pasted figures and tables onto paper. Thankfully, the late 80's and 90's brought the advent of personal computers and desktop publishing. The publishing world went digital and so did RiMG. Since 2003, RiMG has been produced electronically and volumes are now readily available in both print and electronic formats. This volume has brought the RiMG series into yet another new technological direction through incorporation of *interactive* digital elements. I hope you take the time to check it out! As an Open Access volume, any interested reader can easily find and access *Carbon in Earth* through the MSA website (*www.minsocam.org/MSA/RIM*).

All supplemental materials associated with this volume can be found at the MSA website. Errata will be posted there as well.

Jodi J. Rosso, Series Editor
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PREFACE

Carbon in Earth is an outgrowth of the Deep Carbon Observatory (DCO), a 10-year international research effort dedicated to achieving transformational understanding of the chemical and biological roles of carbon in Earth (*http://dco.ciw.edu*). Hundreds of researchers from 6 continents, including all 51 coauthors of this volume, are now engaged in the DCO effort. We proposed this volume of the Reviews in Mineralogy and Geochemistry (RiMG) series as a benchmark for our present understanding of Earth's carbon—both what we know and what we have yet to learn. Our ambition is to produce a second, companion volume to mark the progress of this decadal initiative.

This volume addresses a range of questions that were articulated in May 2008 at the First Deep Carbon Cycle Workshop in Washington, DC. At that meeting 110 scientists from a

dozen countries set forth the state of knowledge about Earth's carbon. They also debated the key opportunities and top objectives facing the community. Subsequent deep carbon meetings in Bejing, China (2010), Novosibirsk, Russia (2011), and Washington, DC (2012), as well as more than a dozen smaller workshops, expanded and refined the DCO's decadal goals. The 20 chapters that follow elaborate on those opportunities and objectives.

A striking characteristic of *Carbon in Earth* is the multidisciplinary scientific approach necessary to encompass this topic. The following chapters address such diverse aspects as the fundamental physics and chemistry of carbon at extreme conditions, the possible character of deep-Earth carbon-bearing minerals, the geodynamics of Earth's large-scale fluid fluxes, tectonic implications of diamond inclusions, geosynthesis of organic molecules and the origins of life, the changing carbon cycle through deep time, and the vast subsurface microbial biosphere (including the hidden deep viriosphere). Accordingly, the collective authorship of *Carbon in Earth* represents laboratory, field, and theoretical researchers from the full range of physical and biological sciences.

A hallmark of the DCO is our desire to implement advanced strategies in communications, data management, engagement, and visualization. Accordingly, this volume incorporates some novel aspects. Thanks to sponsorship by the Alfred P. Sloan Foundation, which continues to provide significant support for the DCO, this is the first of the RiMG series to be published as an open access volume. We have thus been able to focus on the electronic publication to incorporate a number of novel features, including hyperlinks to websites and databases, video and animations, and direct links to many references.

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