W M White Geochemistry Chapter 2 Solutions

This extensively revised, restructured, and updated edition continues to present an engaging and comprehensive introduction to the subject, exploring the world's landforms from a broad systems perspective. It covers the basics of Earth surface forms and processes, while reflecting on the latest developments in the field. Fundamentals of Geomorphology begins with a consideration of the nature of geomorphology, process and form, history, and geomorphic systems, and moves on to discuss: structure: structural landforms associated with plate tectonics and those associated with volcanoes, impact craters, and folds, faults, and joints process and form: landforms resulting from, or influenced by, the exogenic agencies of weathering, running water, flowing ice and meltwater, ground ice and frost, the wind, and the sea; landforms developed on limestone; and landscape evolution, a discussion of ancient landforms, including palaeosurfaces, stagnant landscape features, and evolutionary aspects of landscape change. This third edition has been fully updated to include a clearer initial explanation of the nature of geomorphology, of land surface process and form, and of land-surface change over different timescales. The text has been restructured to incorporate information on geomorphic materials and processes at more suitable points in the book. Finally, historical geomorphology has been integrated throughout the text to reflect the importance of history in all aspects of geomorphology. Fundamentals of Geomorphology provides a stimulating and innovative perspective on the key topics and debates within the field of geomorphology. Written in an accessible and lively manner, it includes guides to further reading, chapter summaries, and an extensive glossary of key terms. The book is also illustrated throughout with over 200 informative diagrams and attractive photographs, all in colour.

It has long been realized that the mineral assemblages of igneous and metamorphic rocks may reflect the approach of a rock to chemical eCluilibrium during its formation. However progress in the application of chemical thermodynamics to geological systems has been hindered since the time of Bowen and the other early physical-chemical petrologists by the recurring Cluandary of the experimental geologist. His systems are complex and are experimentally intractable, but if they were not so refractory they would not be there to study at all. It is only recently that accurate measurements of the thermodynamic properties of pure, or at least well-defined minerals, melts and volatile fluid phases, combined with experimental and theoretical studies of their mixing properties, have made it possible to calculate the eCluilibrium conditions for particular rock systems. Much work is now in progress to extend the ranges of com position and conditions for which sufficient data exist to enable such calculations to be made. Moreover the routine availability of the electron microprobe will ensure that the demand for such information will continue to increase. The thermodynamic techniClues reCluired to apply these data to

geological problems are intrinsically simple and merely involve the combination of appropriate standard state data together with corrections for the effects of solution in natural minerals, melts or volatile fluids.

The book summarizes the knowledge and experiences concerning the role of halogens during various geochemical processes, such as diagenesis, ore-formation, magma evolution, metasomatism, mineralization, and metamorphism in the crust and mantle of the Earth. It comprises the role of halogens in other terrestrial worlds like volatile-rich asteroids, Mars, and the ice moons of Jupiter and Saturn. Review chapters outline and expand upon the basis of our current understanding regarding how halogens contribute to the geochemical/geophysical evolution and stability of terrestrial worlds overall.

Magma Redox Geochemistry Magma Redox Geochemistry The redox state is one of the master variables behind the Earth's forming processes, which at depth concern magma as the major transport agent. Understanding redox exchanges in magmas is pivotal for reconstructing the history and compositional make-up of our planet, for exploring its mineral resources, and for monitoring and forecasting volcanic activity. Magma Redox Geochemistry describes the multiple facets of redox reactions in the magmatic realm and presents experimental results, theoretical approaches, and unconventional and novel techniques. Volume highlights include: Redox state and oxygen fugacity: so close, so far Redox processes from Earth's accretion to global geodynamics Redox evolution from the magma source to volcanic emissions Redox characterization of elements and their isotopes The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity. Its publications disseminate scientific knowledge and provide resources for researchers, students, and professionals.

This book provides a comprehensive introduction to the field ofgeochemistry. The book first lays out the 'geochemicaltoolbox': the basic principles and techniques of moderngeochemistry, beginning with a review of thermodynamics andkinetics as they apply to the Earth and its environs. These basicconcepts are then applied to understanding processes in aqueoussystems and the behavior of trace elements in magmaticsystems. Subsequent chapters introduce radiogenic and stableisotope geochemistry and illustrate their application to suchdiverse topics as determining geologic time, ancient climates, andthe diets of prehistoric peoples. The focus then broadens to theformation of the solar system, the Earth, and the elementsthemselves. Then the composition of the Earth itself becomes thetopic, examining the composition of the core, the mantle, and thecrust and exploring how this structure originated. A final chaptercovers organic chemistry, including the origin of fossil fuels andthe carbon cycle's role in controlling Earth's climate,both in the geologic past and the rapidly changing present. Geochemistry is essential reading for all earth sciencestudents, as well as for researchers and appliedscientists who require an introduction to the essentialtheory of geochemistry, and a survey of its applications in theearth and

environmental sciences. Additional resources can be found at: ahref="http://www.wiley.com/go/white/geochemistry"www.wiley.com/go/white/geochemistry/a
Proceedings of the NATO Advanced Research Workshop on Petrology and Geochemistry of Granulites, Clermont-Ferrand, France, September 5-9, 1988
A detailed overview of Saturn's formation, evolution and structure written by eminent planetary scientists involved in the Cassini Orbiter mission.
A concise introduction to the basics of open access, describing what it is (and isn't) and showing that it is easy, fast, inexpensive, legal, and beneficial. The Internet lets us share perfect copies of our work with a worldwide audience at virtually no cost. We take advantage of this revolutionary opportunity when we make our work “open access”: digital, online, free of charge, and free of most copyright and licensing restrictions. Open access is made possible by the Internet and copyright-holder consent, and many authors, musicians, filmmakers, and other creators who depend on royalties are understandably unwilling to give their consent. But for 350 years, scholars have written peer-reviewed journal articles for impact, not for money, and are free to consent to open access without losing revenue. In this concise introduction, Peter Suber tells us what open access is and isn't, how it benefits authors and readers of research, how we pay for it, how it avoids copyright problems, how it has moved from the periphery to the mainstream, and what its future may hold. Distilling a decade of Suber's influential writing and thinking about open access, this is the indispensable book on the subject for researchers, librarians, administrators, funders, publishers, and policy makers.
Exploring the links between Large Igneous Provinces and dramatic environmental impact An emerging consensus suggests that Large Igneous Provinces (LIPs) and Silicic LIPs (SLIPs) are a significant driver of dramatic global environmental and biological changes, including mass extinctions. Environmental changes caused by LIPs and SLIPs include rapid global warming, global cooling (‘Snowball Earth’), oceanic anoxia events, mercury poisoning, atmospheric and oceanic acidification, and sea level changes. Continued research to characterize the effects of these extremely large and typically short duration igneous events on atmospheric and oceanic chemistry through Earth history can provide lessons for understanding and mitigating modern climate change. Large Igneous Provinces: A Driver of Global Environmental and Biotic Changes describes the interactions between the effects of LIPs and other drivers of climatic change, the limits of the LIP effect, and the atmospheric and oceanic consequences of LIPs in significant environmental events. Volume highlights include: Temporal record of large igneous provinces (LIPs) Environmental impacts of LIP emplacement Precambrian, Proterozoic, and Phanerozoic case histories Links between geochemical proxies and the LIP record Alternative causes for environmental change Key parameters related to LIPs and SLIPs for use in environmental change modelling Role of LIPs in Permo-Triassic, Triassic-Jurassic, and other mass extinction events The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity. Its publications disseminate scientific knowledge and provide resources for researchers, students, and professionals.
A comprehensive guide to carbon inside Earth - its quantities, movements, forms, origins, changes over time and impact on planetary processes. This title is also available as Open Access on Cambridge Core.

Edited by two very well-known and respected scientists in the field, this excellent practical guide is the first to cover the fundamentals and a wide range of applications, as well as showing readers how to efficiently use this increasingly important technique. From the contents: * The Isotopic Composition of the Elements * Single-Collector ICP-MS * Multi-Collector ICP-MS * Advances in Laser Ablation - Multi-Collector ICP-MS * Correction for Instrumental Mass Discrimination in Isotope Ratio Determination with Multi-Collector ICP-MS * Reference Materials in Isotopic Analysis * Quality Control in Isotope Ratio Applications * Determination of Trace Elements and Elemental Species Using Isotope Dilution ICP-MS * Geochronological Dating * Application of Multi-Collector ICP-MS to Isotopic Analysis in Cosmochemistry * Establishing the Basis for Using Stable Isotope Ratios of Metals as Paleoredox Proxies * Isotopes as Tracers of Elements Across the Geosphere-Biosphere Interface * Archaeometric Applications * Forensics Applications * Nuclear Applications * The Use of Stable Isotope Techniques for Studying Mineral and Trace Element Metabolism in Humans * Isotopic Analysis via Multi-Collector ICP-MS in Elemental Speciation A must-have for newcomers as well as established scientists seeking an overview of isotopic analysis via ICP-MS.

Volume 43 of Reviews in Mineralogy and Geochemistry reviews Stable Isotope Geochemistry. In terms of new technology, new sub-disciplines, and numbers of researchers, the field has changed more in the past decade than in any other since that of its b

Bioavailability refers to the extent to which humans and ecological receptors are exposed to contaminants in soil or sediment. The concept of bioavailability has recently piqued the interest of the hazardous waste industry as an important consideration in deciding how much waste to clean up. The rationale is that if contaminants in soil and sediment are not bioavailable, then more contaminant mass can be left in place without creating additional risk. A new NRC report notes that the potential for the consideration of bioavailability to influence decision-making is greatest where certain chemical, environmental, and regulatory factors align. The current use of bioavailability in risk assessment and hazardous waste cleanup regulations is demystified, and acceptable tools and models for bioavailability assessment are discussed and ranked according to seven criteria. Finally, the intimate link between bioavailability and bioremediation is explored. The report concludes with suggestions for moving bioavailability forward in the regulatory arena for both soil and sediment cleanup.

Ron DiPippo, Professor Emeritus at the University of Massachusetts Dartmouth, is a world-regarded geothermal expert. This single resource covers all aspects of the utilization of geothermal energy for power generation from fundamental scientific and engineering principles. The thermodynamic basis for the design of geothermal power plants is at the heart of the book and readers are clearly guided on the process of designing and analysing the key types of geothermal energy conversion systems. Its practical emphasis is enhanced by the use of case studies from real plants that increase the reader's understanding of geothermal energy conversion and provide a unique compilation of hard-to-obtain data and experience. An important new chapter covers Environmental Impact and Abatement Technologies, including gaseous and solid emissions; water, noise and thermal pollutions; land usage; disturbance of natural hydrothermal manifestations, habitats and vegetation; minimisation of CO2 emissions and environmental impact assessment. The book is illustrated with over 240 photographs and drawings. Nine chapters include practice problems, with solutions, which enable the book to be used as a course text. Also includes a definitive worldwide compilation of every geothermal power plant that has operated, unit by unit, plus a concise primer on the applicable thermodynamics. * Engineering principles are at the heart of the book, with complete coverage of the thermodynamic basis for the design of geothermal power systems * Practical applications are backed up by an extensive selection of case studies that show how geothermal energy conversion systems have been designed, applied and exploited in practice

* World renowned geothermal expert DiPippo has including a new chapter on Environmental Impact and Abatement Technology in this new edition

This book is written as a practical field manual to effective. Each geolOgist has to develop his/her be used by geologists engaged in mineral explo own techniques and will ultimately be judged on ration. It is also hoped that it will serve as a text results, not the process by which these results and reference for students in Applied Geology were reached. In mineral exploration, the only courses of universities and colleges. The book 'right' way of doing anything is the way that aims to outline some of the practical skills that locates ore in the quickest and most cost-effective turn the graduate geologist into an explo manner. It is preferable, however, for an individ rationist:. It is intended as a practical 'how to' ual to develop his/her own method of operation book, rather than as a text on geological or ore after having tried, and become aware of, those deposit theory. procedures which experience has shown to work An explorationist is a professional who search well and which are generally accepted in indus try as good exploration practice. es for ore bodies in a scientific and structured way. Although an awkward and artificial term, The chapters of the book approximately fol this is the only available word to describe the low the steps which a typical exploration pro totality of the skills which are needed to locate gramme would go through. In Chapter 1, the and define economic mineralization.

The first edition of this book was published in 1973, the second, totally rewritten, followed 7 years later in 1980. Because the field of stable isotopes is still grow ing and exerting an increasing influence on geosciences in general, it seems to be necessary, after a further 7 years, to revise the edition again accordingly. Not only has the previous edition been updated, but two completely new chapters on the isotopic composi tion of mantle-derived material and on the isotopic composition of the ocean during the geologie past, have been added. The references concentrate on re cent literature. In some cases, older references have been omitted to save space. I do not intend to underrate the value of older publications, but only to keep the reference list - al ready very voluminous in relation to the totallengt- from becoming even larger. An early draft has been reviewed by Russell Harmon and Alan Matthews. John Valley has se nt me a preprint of an artic1e on metamorphie rocks. To all three of them I owe my deepest thanks.

Current and authoritative with many advanced concepts for petroleum geologists, geochemists, geophysicists, or engineers engaged in the search for or production of crude oil and natural gas, or interested in their habitats and the factors that control them, this book is an excellent reference. It is recommended without reservation. AAPG Bulletin.

Building on the success of its 1993 predecessor, this second edition of Geochemistry, Groundwater and Pollution has been thoroughly re-written, updated and extended to provide a complete and authoritative account of modern hydrogeochemistry. Offering a quantitative approach to the study of groundwater quality and the interaction of water, minerals, gases, pollutants and microbes, this book shows how physical and chemical theory can be applied to explain observed water qualities and variations over space and time. Integral to the presentation, geochemical modelling using PHREEQC code is demonstrated, with step-by-step instructions for calculating and simulating field and laboratory data. Numerous figures and tables illustrate the theory, while worked examples including calculations and theoretical explanations assist the reader in gaining a deeper understanding of the concepts involved. A crucial read for students of hydrogeology, geochemistry and civil engineering, professionals in the water sciences will also find inspiration in the practical examples and modeling templates.

Introducing the essentials of modern geochemistry for students across the Earth and environmental sciences, this new edition emphasises the general principles of this central discipline. Focusing on inorganic chemistry, Francis Albarède's refreshing approach is brought to topics that range from measuring geological time to the understanding of climate change.

The author leads the student through the necessary mathematics to understand the quantitative aspects of the subject in an easily understandable manner. The early chapters cover the principles and methods of physics and chemistry that underlie geochemistry, to build the students' understanding of concepts such as isotopes, fractionation, and mixing. These are then applied across many of the environments on Earth, including the solid Earth, rivers, and climate, and then extended to processes on other planets. Three new chapters have been added – on stable isotopes, biogeochemistry, and environmental geochemistry. End-of-chapter student exercises, with solutions available online, are also included.

This book is intended to serve as a text for an introductory course in geochemistry for undergraduate/graduate students with at least an elementary?level background in earth sciences, chemistry, and mathematics. The text, containing 83 tables and 181 figures, covers a wide variety of topics ? ranging from atomic structure to chemical and isotopic equilibria to modern biogeochemical cycles ? which are divided into four interrelated parts: Crystal Chemistry; Chemical Reactions (and biochemical reactions involving bacteria); Isotope Geochemistry (radiogenic and stable isotopes); and The Earth Supersystem, which includes discussions pertinent to the evolution of the solid Earth, the atmosphere, and the hydrosphere. In keeping with the modern trend in the field of geochemistry, the book emphasizes computational techniques by developing appropriate mathematical relations, solving a variety of problems to illustrate application of the mathematical relations, and leaving a set of questions at the end of each chapter to be solved by students. However, so as not to interrupt the flow of the text, involved chemical concepts and mathematical derivations are separated in the form of boxes. Supplementary materials are packaged into ten appendixes that include a standard?state (298.15 K, 1 bar) thermodynamic data table and a listing of answers to selected chapter?end questions. Additional resources for this book can be found at: www.wiley.com/go/misra/geochemistry.

This book provides a comprehensive introduction to radiogenic and stable isotope geochemistry. Beginning with a brief overview of nuclear physics and nuclear origins, it then reviews radioactive decay schemes and their use in geochronology. A following chapter covers the closely related techniques such as fission-track and carbon-14 dating. Subsequent chapters cover nucleosynthetic anomalies in meteorites and early solar system chronology and the use of radiogenic isotopes in understanding the evolution of the Earth’s mantle, crust, and oceans. Attention then turns to stable isotopes and after reviewing the basic principles involved, the book explores their use in topics as diverse as mantle evolution, archeology and paleontology, ore formation, and, particularly, paleoclimatology. A following chapter explores recent developments including unconventional stable isotopes, mass-independent fractionation, and isotopic ‘clumping’. The final chapter reviews the isotopic variation in the noble gases, which result from both radioactive decay and chemical fractionations.

This book aims to explore basic principles, concepts and applications of geochemistry. Topics include chemical weathering, impacts on living beings and water, geochemical cycles, oxidation and redox reactions in geochemistry, isotopes, analytical techniques, medicinal, inorganic, marine, atmospheric, and environmental applications, as well as case studies. This book helps in understanding the chemical composition of the earth and its applications. It also includes beneficial effects, bottlenecks, solutions, and future directions in geochemistry.

Applications of radioactive and stable isotopes have revolutionized our understanding of the Earth and near-earth surface processes. The utility of the isotopes are ever-increasing and our sole focus is to bring out the applications of these isotopes as tracers and chronometers to a wider audience so that they can be used as powerful tools to solve environmental problems. New developments in this field remain mostly in peer-reviewed journal articles and hence our goal is to synthesize these findings for easy reference for students, faculty, regulators in governmental and non-governmental agencies, and environmental companies. While this

volume maintains its rigor in terms of its depth of knowledge and quantitative information, it contains the breadth needed for wide variety problems and applications in the environmental sciences. This volume presents all of the newer and older applications of isotopes pertaining to the environmental problems in one place that is readily accessible to readers. This book not only has the depth and rigor that is needed for academia, but it has the breadth and case studies to illustrate the utility of the isotopes in a wide variety of environments (atmosphere, oceans, lakes, rivers and streams, terrestrial environments, and sub-surface environments) and serves a large audience, from students and researchers, regulators in federal, state and local governments, and environmental companies.

Often thought of as a volcanically dominated planet, the last several decades of Mars exploration have revealed with increasing clarity the role of sedimentary processes on the Red Planet. Data from recent orbiters have highlighted the role of sedimentary processes throughout the geologic evolution of Mars by providing evidence that such processes are preserved in a rock record that spans a period of over four billion years.

Core text on principles, laboratory/field methodologies, and data interpretation for fluorescence applications in aquatic science, for advanced students and researchers.

It is the policy of the federal Canadian Forestry Service to sponsor research initiatives from the private sector that are judged to be pertinent to its mandate and offer particular promise towards the optimal management of Canadian forest resources. This book is based on such an initiative. It represents the philosophy of the author himself and is in no way constrained by the views of the sponsoring agency. Over the past two decades Dr J. A. C. Fortescue has become well known at a number of research centers throughout the world. He has pioneered the approach to environmental understanding that is comprehensively developed in this text. The limitations of traditional compartmentalized approaches are depre cated and the case is made for a holistic rethinking of basic concepts and princi ples. Landscape Geochemistry is the disciplinary outcome that gives expression to this rethinking. It may be viewed as the minimum scale of conceptual approach necessary in the environmental sciences to solve present-day problems and to exploit future opportunities.

Throughout the book, attention is continually directed to the relations between theoretical formulas and results of controlled laboratory experiments, as well as to geologic field observations. The book begins with an introduction to chemical equilibrium, concentrating on the carbonate and silicate equilibria that are important in geologic environments. Next comes a brief look at the chemistry of crystalline solids and reactions at mineral surfaces.

This book consists of a collection of papers presented at the NATO Advanced Research Workshop (ARW) on "Crust/mantle Recycl ing at Convergence Zones," held in Antalya, Turkey, between May 25 to 29, 1987. The workshop was attended by 36 earth scientists from ten countries and 28 papers were presented. Crust/mantle recycling is one of the most fundamental processes in the Earth. The study and understanding of this process requires the consideration of the Earth as a whole system including the atmosphere, the hydrosphere and the core, as well as the crust and the mantle; effective interdisciplinary collaboration is therefore essential to our progress. The Antalya ARW gave us the opportunity to assemble key specialists from relevant branches of the earth sciences and to address our state of knowledge. This ARW proved to be very useful in attaining an interdisciplinary, mutual understanding among specialists from diverse fields such as isotope and trace element geochemistry, mineral physics, theoretical geophysics, seismology, experimental petrology, and structural geology.

This new volume on boron isotope geochemistry offers review chapters summarizing the cosmochemistry, high-temperature and low-temperature geochemistry, and marine chemistry of boron. It also covers theoretical aspects of B isotope fractionation, experiments and atomic modeling, as well as all aspects of boron isotope analyses in geologic materials using the full

range of solutions and in-situ methods. The book provides guidance for researchers on the analytical and theoretical aspects, as well as introducing the various scientific applications and research fields in which boron isotopes currently play a major role. The last compendium to summarize the geochemistry of boron and address its isotope geochemistry was published over 20 years ago (Grew &Anovitz, 1996, MSA Review, Vol.33), and there have since been significant advances in analytical techniques, applications and scientific insights into the isotope geochemistry of boron. This volume in the “Advances in Isotope Geochemistry” series provides a valuable source for students and professionals alike, both as an introduction to a new field and as a reference in ongoing research. Chapters 5 and 8 of this book are available open access under a CC BY 4.0 license at link.springer.com

The Encyclopedia is a complete and authoritative reference work for this rapidly evolving field. Over 200 international scientists, each experts in their specialties, have written over 330 separate topics on different aspects of geochemistry including geochemical thermodynamics and kinetics, isotope and organic geochemistry, meteorites and cosmochemistry, the carbon cycle and climate, trace elements, geochemistry of high and low temperature processes, and ore deposition, to name just a few. The geochemical behavior of the elements is described as is the state of the art in analytical geochemistry. Each topic incorporates cross-referencing to related articles, and also has its own reference list to lead the reader to the essential articles within the published literature. The entries are arranged alphabetically, for easy access, and the subject and citation indices are comprehensive and extensive. Geochemistry applies chemical techniques and approaches to understanding the Earth and how it works. It touches upon almost every aspect of earth science, ranging from applied topics such as the search for energy and mineral resources, environmental pollution, and climate change to more basic questions such as the Earth’s origin and composition, the origin and evolution of life, rock weathering and metamorphism, and the pattern of ocean and mantle circulation. Geochemistry allows us to assign absolute ages to events in Earth’s history, to trace the flow of ocean water both now and in the past, trace sediments into subduction zones and arc volcanoes, and trace petroleum to its source rock and ultimately the environment in which it formed. The earliest of evidence of life is chemical and isotopic traces, not fossils, preserved in rocks. Geochemistry has allowed us to unravel the history of the ice ages and thereby deduce their cause. Geochemistry allows us to determine the swings in Earth’s surface temperatures during the ice ages, determine the temperatures and pressures at which rocks have been metamorphosed, and the rates at which ancient magma chambers cooled and crystallized. The field has grown rapidly more sophisticated, in both analytical techniques that can determine elemental concentrations or isotope ratios with exquisite precision and in computational modeling on scales ranging from atomic to planetary.

Diet and Health examines the many complex issues concerning diet and its role in increasing or decreasing the risk of chronic disease. It proposes dietary recommendations for reducing the risk of the major diseases and causes of death today: atherosclerotic cardiovascular diseases (including heart attack and stroke), cancer, high blood pressure, obesity, osteoporosis, diabetes mellitus, liver disease, and dental caries.

The Treatise on Geochemistry is the first work providing a comprehensive, integrated summary of the present state of geochemistry. It deals with all the major subjects in the field, ranging from the chemistry of the solar system to environmental geochemistry. The Treatise on Geochemistry has drawn on the expertise of outstanding scientists throughout the world, creating the reference work in geochemistry for the next decade. Each volume consists of fifteen to twenty-five chapters written by recognized authorities in their fields, and chosen by the Volume Editors in consultation with the Executive Editors. Particular emphasis has been placed on integrating the subject matter of the individual chapters and volumes. Elsevier also offers the Treatise on Geochemistry in electronic format via the online platform ScienceDirect,

the most comprehensive database of academic research on the Internet today, enhanced by a suite of sophisticated linking, searching and retrieval tools.

Applied Geochemistry: Advances in Mineral Exploration Techniques is a book targeting all levels of exploration geologists, geology students and geoscientists working in the mining industry. This reference book covers mineral exploration techniques from multiple dimensions, including the application of statistics - both principal component analysis and factor analysis - to multifractal modeling. The book explains these approaches step-by-step and gives their limitations. In addition to techniques and applications in mineral exploration, Applied Geochemistry describes mineral deposits and the theories underpinning their formation through worldwide case studies. Includes both conventional and nonconventional techniques for mineral exploration, including lithogeochemical methods Highlights the importance and applications of multifractal models, 3D - mineral prospectivity modeling Features case studies from mines and mineral exploration ventures around the world

Volume 16 of Reviews in Mineralogy inroduces to high-temperature stable isotope geochemistry and should provide an entry into the pertinent literature, as well as some understanding of the basic concepts and potential applications. The first three chapters focus on the theory and experimental data base for equilibrium, disequilibrium, and kinetics of stable isotope exchange reactions among geologically important minerals and fluids. The fourth chapter discusses the primordial oxygen isotope variations in the solar system prior to formation of the Earth, along with a discussion of isotopic anomalies in meteorites. The fifth chapter discusses isotopic variations in the Earth's mantle and the sixth chapter reviews the variations in the isotopic compositions of natural waters on our planet. In Chapters 7, 8, 9 and 10, these isotopic constraints and concepts are applied to various facets of the origin and evolution of igneous rocks, bringing in much material on radiogenic isotopes as well, because these problems require a multi-dimensional attack for their solution. In Chapters 11 and 12, the problems of hydrothermal alteration by meteoric waters and ocean water are considered, together with discussions of the physics and chemistry of hydrothermal systems and the 18O/16O history of ocean water. Finally, in Chapters 13 and 14, these concepts are applied to problems of metamorphic petrology and ore deposits, particularly with respect to the origins of the fluids involved in those processes.

This volume has its roots in the distant past of more than 20 years ago, the International Hydrologic Decade (IHD), 1964-1974. One of the stated goals of the IHD was to promote research into groundwater situations for which the state of knowledge was hopelessly inadequate. One of these problem areas was the hydrology of carbonate terrains. Position papers published early in the IHD emphasized the special problems of karst; carbonate terrains were supposed to receive a substantial amount of attention during the IHD. There were indeed many new contributions from European colleagues but, unfortunately, in the United States the good intentions were not backed up by much in the way of federal funding. Some good and interesting work was published, particularly by the U. S. Geological Survey (USGS), but in the academic community the subject languished. About this same time the Cave Research Foundation (CRF), organized in 1957 to promote the systematic exploration, survey, and scientific study of the great cave systems of Mammoth Cave National Park, was casting about for a broader scope for its research activities. Up until that time, CRF

research had been largely restricted to detailed mineralogical and geological investigations within the caves, with the main part of the effort concentrated on exploration and survey. The decision to investigate the hydrology required a certain enlargement of vision because investigators then had to consider the entire karst drainage basin rather than isolated fragments of cave passage.

Archaean Geochemistry 1972 - 1984 The realisation that the continental crust contains well-preserved relics which date as far back as 4/5 of the Earth's age has given a great impetus to the study of early Precambrian terrains. As late as the mid-sixties the Archaean still constituted the 'terra-in cognita' of earth science. High metamorphic grades, poor out crop, and not least a widely assumed obliteration of early crustal records by convective recycling and thermal reworking had com bined to discourage research in this field. Many excellent local studies existed, notably around gold mining centres, but remained unrelated to a broader regional and theoretical understanding. This situation has changed as the consequence of two inter-related factors: (1) advances in isotopic methods and their application to Precambrian rocks, and (2) the recognition that some of the oldest terrains have retained a wealth of primary igneous and sedi mentary textures and even geochemical characteristics.