

Geochronology And Thermochronology By The 40ar 39ar Method

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Geochronology and thermochronology

Encyclopedia of Geochemistry William M. White 2018-07-24 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.

Geochronology and Thermochronology Peter W. Reiners 2017-11-21 This book is a welcome introduction and reference for users and innovators in geochronology. It provides modern perspectives on the current state-of-the-art in most of the principal areas of geochronology and thermochronology, while recognizing that they are changing at a fast pace. It emphasizes fundamentals and systematics, historical perspective, analytical methods, data interpretation, and some applications chosen from the literature. This book complements existing coverage by expanding on those parts of isotope geochemistry that are concerned with dates and rates and insights into Earth and planetary science that come from temporal perspectives. Geochronology and Thermochronology offers chapters covering: Foundations of Radioisotopic Dating; Analytical Methods; Interpretational Approaches: Making Sense of Data; Diffusion and Thermochronologic Interpretations; Rb-Sr, Sm-Nd, Lu-Hf, Re-Os and Pt-Os; U-Th-Pb Geochronology and Thermochronology; The K-Ar and 40Ar/39Ar Systems; Radiation-damage Methods of Geo- and Thermochronology; The (U-Th)/He System; Uranium-series Geochronology; Cosmogenic Nuclides; and Extinct Radionuclide Chronology. Offers a foundation for understanding each of the methods and for illuminating directions that will be important in the near future Presents the fundamentals, perspectives, and opportunities in modern geochronology in a way that inspires further innovation, creative technique development, and applications Provides references to rapidly evolving topics that will enable readers to pursue future developments Geochronology and Thermochronology is designed for graduate and upper-level undergraduate students with a solid background in mathematics, geochemistry, and geology. Read an interview with the editors to find out more: https://eos.org/editors-vox/the-science-of-dates-and-rates

Encyclopedia of Scientific Dating Methods W. Jack Rink 2015-08-15 This volume provides an overview of (1) the physical and chemical foundations of dating methods and (2) the applications of dating methods in the geological sciences, biology, and archaeology, in almost 200 articles from over 200 international authors. It will serve as the most comprehensive treatise on widely accepted dating methods in the earth sciences and related fields. No other volume has a similar scope, in terms of methods and applications and particularly time range. Dating methods are used to determine the timing and rate of various processes, such as sedimentation (terrestrial and marine), tectonics, volcanism, geomorphological change, cooling rates, crystallization, fluid flow, glaciation, climate change and evolution. The volume includes applications in terrestrial and extraterrestrial settings, the burgeoning field of molecular-clock dating and topics in the intersection of earth sciences with forensics. The content covers a broad range of techniques and applications. All major accepted dating techniques are included, as well as all major datable materials.

Periodico di Mineralogia Vol. 84. 3B (Special Issue), December, 2015 Eugenio Fazio 2016-02-04 CONTENTS Omar Bartoli, Antonio Acosta-Vigil and Bernardo Cesare High-temperature metamorphism and crustal melting: working with melt inclusions Igor M. Villa 39Ar-40Ar geochronology of mono- and polymetamorphic basements Antonio Langone and Massimo Tiepolo U-Th-Pb “multi-phase” approach to the study of crystalline basement: application to the northernmost sector of the Ivrea-Verbano Zone (Alps) Gabriele Cruciani, Chiara Montomali, Rodolfo Carosi, Marcello Franceschelli and Mariano Puxeddu Continental collision from two perspectives: a review of Variscan metamorphism and deformation in northern Sardinia Rosolino Cirrincione, Eugenio Fazio, Patrizia Fianacca, Gaetano Ortolano, Antonino Pezzino and Rosalia Punturo The Calabria-Peloritani Orogen, a composite terrane in Central Mediterranean; its overall architecture and geodynamic significance for a pre-Alpine scenario around the Tethyan basin Gisella Rebay, Maria Fa Riccardi and Maria Iole Spalla Fluid rock interactions as recorded by Cl-rich amphiboles from continental and oceanic crust of italian orogenic belts Guido Gosso, Gisella Rebay, Manuel Roda, Maria Iole Spalla, Massimo Tarallo, Davide Zanoni and Michele Zucali Taking advantage of petrostructural heterogeneities in subduction-collisional orogens, and effect on the scale of analysis

Exhumation Processes Uwe Ring 1999

Caldera Volcanism Joachim Gottsmann 2011-09-22 This volume aims at providing answers to some puzzling questions concerning the formation and the behavior of collapse calderas by exploring our current understanding of these complex geological processes. Addressed are problems such as: - How do collapse calderas form? - What are the conditions to create fractures and slip along them to initiate caldera collapse and when are these conditions fulfilled? - How do these conditions relate to explosive volcanism? - Most products of large caldera-forming eruptions show evidence for pre-eruptive reheating. Is this a pre-eruptive to produce large volume eruptions and large calderas? - What are the time-scales behind caldera processes? - How long does it take magma to reach conditions ripe enough to generate a caldera-forming eruption? - What is the mechanical behavior of magma chamber walls during caldera collapse? Elastic, viscoelastic, or rigid? - Do calderas form by underpressure following a certain level of magma withdrawal from a reservoir, or by magma chamber loading due to deep doming (underplating), or both? - How to interpret unrest signals in active caldera systems? - How can we use information from caldera monitoring to forecast volcanic phenomena? In the form of 14 contributions from various disciplines this book samples the state-of-the-art of caldera studies and identifies still unresolved key issues that need dedicated cross-boundary and multidisciplinary efforts in the years to come. * International contributions from leading experts * Updates and informs on all the latest developments * Highlights hot topic areas and identifies and analyzes unresolved key issues

Southern and Central Mexico: Basement Framework, Tectonic Evolution, and Provenance of Mesozoic–Cenozoic Basins Uwe C. Martens 2021-12-23

The 40Ar/39Ar Geochronology and Thermochronology of the Latir Volcanic Field and Associated Intrusions: Implications for Caldera-related Magmatism Matthew J. Zimmerer 2008 After resurgent plutonism, three plutons, probably cupolas of a larger, single intrusion, were emplaced and are now exposed along the southern caldera margin. Biotite ages from the Red River, Sulfur Gulch, and Bear Canyon plutons are 24.8, 24.5, and 24.3 Ma, respectively, suggesting incremental emplacement of the larger intrusion along the southern caldera margin. K-feldspar monotonic MDD thermal histories from the individual plutons display differences of rates and timing of cooling. MDD models suggest the Red River pluton experienced a period of isothermal cooling at 300°C between 24 and 22 Ma, followed by rapid cooling at 21 Ma. One K-feldspar MDD thermal model from the Bear Canyon indicates rapid cooling at 21 Ma, but another Bear Canyon K-feldspar thermal model indicates rapid cooling at 23 Ma, followed by isothermal conditions at 200°C between 22 and 18 Ma. The unconstrained MDD thermal models suggest reheating by younger thermal events possibly related to magma emplacement.

Geochronology and Thermochronology of Precambrian Basement Drill Core Samples in Nebraska and Southeastern South Dakota Angela Lynn Hull 2013 The ancient geology of midcontinent North America preserves a unique glimpse into tectonic processes that culminated in the formation of stable continental lithosphere. Such is known about the tectonic and crustal evolution in regions where Precambrian bedrock is exposed for direct observation (i.e. Rocky Mountains and the Lake Superior region). However, thick Phanerozoic sedimentary cover overlying the central Yavapai Province, between the Rockies and the Great Lakes, limits our knowledge of that important region. Drill core samples provide the only means to directly survey this zone of the midcontinent. Here I present the results of U-Pb and Lu-Hf zircon geochronology, and Ar-Ar thermochronology obtained from Paleoproterozoic basement drill core samples of the central Yavapai Province from easternmost Colorado and Nebraska, and from older rocks in southern South Dakota. LA-ICP-MS U-Pb geochronology analyses yielded six new zircon ages ranging from 1694 Ma to 1825 Ma in the central Yavapai Province and one age of 2653±11 Ma from southern South Dakota. The same zircon separates were analyzed for Lu-Hf tracer data and yielded overall, positive mean initial eHf values ranging from +1.65 to +8.45 with the exception of the Archean S.D. sample which yielded a slight negative initial eHf value of -0.28. 40Ar-39Ar mineral analyses from mainly micas yielded age spectra that varied from well-behaved to complex. Mineral ages from the central Yavapai Province were consistently younger than anticipated, ranging in age from ca. 1138-1267 Ma for micas and 1487 Ma for hornblende. Mineral ages from the South Dakota region ranged from ca. 1728-1869 Ma (micas) and 2449 Ma (hornblende), consistent with previous results in the area. The new Hf results analyzed here provide the first regional perspective of midcontinent crustal provenance. Overall positive initial eHf values from the central Yavapai samples demonstrate crust across a broad region of the Midcontinent was largely derived from a juvenile source with contributions of slightly older reworked crust. This is consistent with the long held arc accretion model for the formation of Laurentia. Ar-Ar mineral ages are the first supplied for South Dakota and the central Yavapai Province. In South Dakota, Ar-Ar results provide a thermochronologic context to the relatively sparse basement data that exists here, extending boundaries of the East-Central Minnesota Batholith farther westward, revealing Archean crust within the Proterozoic Mobile Belts, and supplying post-metamorphic cooling details to nearby Trans Hudson and Penokean Orogenic events. Anomalously young Ar-Ar mica ages across the central Yavapai Province, stretching from eastern Colorado across Nebraska, are most striking and indicate a regional Neoproterozoic thermal overprinting event. We attribute overprinting to be the result of “squeezee” tectonics in which Grenvillian thrusting caused transport of warm, hydrothermal fluids from buried margin sediments into the continental interior inducing laterally extensive thermal resetting and fluid alteration there.

Encyclopedia of Georchaology Allan S. Gilbert 2016-08-15 Georchaology is the archaeological subfield that focuses on archaeological information retrieval and problem solving utilizing the methods of geological investigation. Archaeological recovery and analysis are already georchaeological in the most fundamental sense because buried remains are contained within and removed from an essentially geological context. Yet georchaeological research goes beyond this simple relationship and attempts to build collaborative links between specialists in archaeology and the earth sciences to produce new knowledge about past human behavior using the technical information and methods of the geosciences. The principal goals of georchaeology lie in understanding the relationships between humans and their environment. These goals include (1) how cultures adjust to their ecosystem through time, (2) what earth science factors were related to the evolutionary emergence of humankind, and (3) which methodological tools involving analysis of sediments and landforms, documentation and explanation of change in buried materials, and measurement of time will allow access to new aspects of the past. This encyclopedia defines terms, introduces problems, describes techniques, and discusses theory and strategy, all in a format designed to make specialized details accessible to the public as well as practitioners. It covers subjects in environmental archaeology, dating, materials analysis, and paleoecology, all of which represent different sources of specialist knowledge that must be shared in order to reconstruct, analyze, and explain the record of the human past. It will not specifically cover sites, civilizations, and ancient cultures, etc., that are better described in other encyclopedias of world archaeology. The Editor Allan S. Gilbert is Professor of Anthropology at Fordham University in the Bronx, New York. He holds a B.A. from Rutgers University, and his M.A., M.Phil., and Ph.D. were earned at Columbia University. His areas of research interest include the Near East (late prehistory and early historic periods) as well as the Middle Atlantic region of the U.S. (historical archaeology). His specializations are in archaeozoology of the Near East and georchaeology, especially mineralogy and compositional analysis of pottery and building materials. Publications have covered a range of subjects, including ancient pastoralism, faunal quantification, skeletal microanatomy, brick geochemistry, and two co-edited volumes on the marine geology and georchaeology of the Black Sea basin.

Radiogenic Isotope Geology Alan P. Dickin 2018-02-08 The new edition of Radiogenic Isotope Geology examines revolutionary changes in geochemical thinking, evaluating them in historical context.

Lectures in Isotope Geology E. Jäger 2012-12-06 Our colleagues from the French-speaking parts of Switzerland - the Suisses romands - and above all the committee of the 3rd Cycle, e Earth Sciences (3 Cycle, Sciences de la Terre) honored us by asking us to give a course on Isotope Geology for the year 1977. The course, entitled Evaluation et Interpretation des Donnees Isotopiques (eval uation and Interpretation of Isotopic Data), was intended to inform earth scientists, graduate and postgraduate, from the western Swiss Universities on the subject of Isotope Geology. Such courses usually consist of two parts: lectures and excursions. Thus, in March 1977, we gave such a two-week course at the Miner alogical Institute of the University of Berne. The first week was devoted essentially to the methods of dating, the second week to the behavior of stable isotopes. In July 1977, on the occasion of an excursion to the Central and Western Alps, we were able to demonstrate our results. Guest professors were invited to make contributions to the course.

40AR/39AR Muscovite Thermochronology and Geochronology of New Mexico Pegmatites Lisa Anne Gaston 2014

The Tectonic Evolution of the Connecticut Valley Synclinorium Cory K. McWilliams 2008 Consequently, early Devonian loading and subsequent metamorphism of the CVS took place during the Acadian orogeny. One-dimensional thermal modeling of Acadian metamorphism in southeastern Vermont constrained by new and existing 40Ar/39Ar thermochronology, U-Pb geochronology, and thermobarometry has revealed that the Devonian thermal evolution of the crust is strongly influenced by residual heat from Ordovician, Taconian metamorphism. Moreover, a comparison between models of upper and lower crustal rocks suggest final emplacement of gneissic domes was not entirely an Acadian event but was surprisingly delayed until sometime after the Mississippian and may represent Alleghanian deformation.

Structural and Thermal Evolution of the Himalayan Thrust Belt in Midwestern Nepal P. G. DeCelles 2020-06-16 "Spanning eight kilometers of topographic relief, the Himalayan fold-thrust belt in Nepal has accommodated more than 700 km of Cenozoic convergence between the Indian subcontinent and Asia. Rapid tectonic shortening and erosion in a monsoonal climate have exhumed greenschist to upper amphibolite facies rocks along with unmetamorphosed rocks, including a 5-6-km-thick Cenozoic foreland basin sequence. This Special Paper presents new geochronology, multisystem thermochronology, structural geology, and geological mapping of an approximately 37,000 km2 region in midwestern and western Nepal. This work informs enduring Himalayan debates, including how and where to map the Main Central thrust, the geometry of the seismically active basal Himalayan detachment, processes of tectonic shortening in the context of postcollisional India-Asia convergence, and long-term geodynamics of the orogenic wedge"--Publisher's website

Encyclopedia of Geochemistry C.P. Marshall 1999-07-31 This is a complete and authoritative reference text on an evolving field. Over 200 international scientists have written over 340 separate topics on different aspects of geochemistry including organics, trace elements, isotopes, high and low temperature geochemistry, and ore deposits, to name just a few. *Cases That Changed Our Lives* Ian McDougall 2014-08-01 Following the international success of Volume 1 in 2010, Volume 2 presents a brand new selection of cases that have changed our lives. This collection of essays examines key cases (both UK and international) that have changed or created the rules and procedures which govern our lives and which we abide by. It takes a retrospective look at the circumstances behind the results of these great cases, examining the facts and the lasting legacies, as well as revealing a human side to the events that is not always apparent from the law reports. The themes addressed by the book demonstrate the rule of law, showing that through something as abstract as judicial reasoning, we create a set of rules and procedures which govern our lives. In support of the rule of law and the causes championed by LexisNexis, a sum of £1 from every copy of the book sold will be donated to Stop the Traffik, a global movement of activists around the world who passionately give their time and energy to build resilient communities and prevent human trafficking.

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Low-Temperature Thermochronology: Peter W. Reiners 2018-12-17 Volume 58 of Reviews in Mineralogy and Geochemistry presents 22 chapters covering many of the important modern aspects of thermochronology. The coverage of the chapters ranges widely, including historical perspective, analytical techniques, kinetics and calibrations, modeling approaches, and interpretational methods. In general, the chapters focus on intermediate- to low-temperature thermochronology, though some chapters cover higher temperature methods such as monazite U/Pb closure profiles, and the same theory and approaches used in low-temperature thermochronometry are generally applicable to higher temperature systems. The widely used low- to medium-temperature thermochronometric systems are reviewed in detail in these chapters, but while there are numerous chapters reviewing various aspects of the apatite (U-Th)/He system, there is no chapter singularly devoted to it, partly because of several previous reviews recently published on this topic.

Folding and Fracturing of Rocks C.E. Bond 2020-01-02 This Special Publication is a celebration of research into the Folding and Fracturing of Rocks to mark the 50th anniversary of the publication of the seminal textbook by J. G. Ramsay. Folding and Fracturing of Rocks summarised the key structural geology concepts of the time. Through his numerical and geometric focus John pioneered and provided solutions to understanding the processes leading to the folding and fracturing of rocks. His strong belief that numerical and geometric solutions, to understanding crustal processes, should be tested against field examples added weight and clarity to his work. The basic ideas and solutions presented in the text are as relevant now as they were 50 years ago, and this collection of papers celebrates John’s contribution to structural geology. The papers explore the lasting impact of John and his work, they present case studies and a modern understanding of the process documented in the Folding and Fracturing of Rocks.

Origin and Evolution of the Ontong Java Plateau Geological Society of London 2004

Feldspars and their Reactions Ian Parsons 1994-02-28 Feldspar minerals make up 60% of the crust of the Earth. They are stable in the upper mantle, and are so abundant in the crust that they form the basis of the classification of igneous rocks. At the surface, feldspars weather to form clay minerals which are the most important mineral constituent of soils. The articles in this book review the chemical reactions of feldspars over the whole sweep of pressure and temperature regimes in the outer Earth, and describe the fundamental aspects of crystal structure which underlie their properties. The book covers intracrystalline reactions, such as order-disorder transformations and exsolution, and transfer of stable and radiogenic isotopes, which can be interpreted to provide insights into the thermal history of rocks. It is suitable for final year undergraduates or research workers.

Quantitative Thermochronology Jean Braun 2006-05-04 Thermochronology, the study of the thermal history of rocks, enables us to quantify the nature and timing of tectonic processes. First published in 2006, Quantitative Thermochronology is a robust review of isotopic ages, and presents a range of numerical modeling techniques to allow the physical implications of isotopic age data to be explored. The authors provide analytical, semi-analytical and numerical solutions to the heat transfer equation in a range of tectonic settings and under varying boundary conditions. They then illustrate their modeling approach built around a large number of case studies. The benefits of different thermochronological techniques are also described. Computer programs on an accompanying website at www.cambridge.org/9781107407152 are introduced through the text and provide a means of solving the heat transport equation in the deforming Earth to predict the ages of rocks and compare them directly to geological and geochronological data. Several short tutorials, with hints and solutions, are also included. **Airless Bodies of the Inner Solar System** Jennifer Grier 2018-10-15 Airless Bodies of the Inner Solar System: Understanding the Process Affecting Rocky, Airless Surfaces focuses on the airless, rocky bodies in the inner solar system as a host unto themselves, with a unique set of processes that require a specific set of investigative techniques. The book allows readers to understand both the basic and advanced concepts necessary to understand and employ that information. Topics covered past exploration of these surfaces, changes with time, space weathering, impact cratering, creation and evolution of regolith and soils, comparison of sample and remote sensing data, dust characterization, surface composition and thoughts for future exploration. Together these authors represent the unique combination of skills and experience required to produce an excellent book on the subject of the surfaces of airless, rocky bodies in the solar system, which will be useful both for graduate students and for working scientists. Written by experts with a unique combination of skills and experience on the subject of the surfaces of airless, rocky bodies in the solar system Addresses the unique nature of airless bodies not done in any other reference Organized into subjects that can be easily translated into classroom lecture points Represents topics that scientists will want to pinpoint and browse

Paleoclimatology Gilles Ramstein 2020-11-09 This two-volume book provides a comprehensive, detailed understanding of paleoclimatology beginning by describing the “proxy data” from which quantitative climate parameters are reconstructed and finally by developing a comprehensive Earth system model able to simulate past climates of the Earth. It compiles contributions from specialists in each field who each have an in-depth knowledge of their particular area of expertise. The first volume is devoted to “Finding, dating and interpreting the evidence”. It describes the different geo-chronological technical methods used in paleoclimatology. Different fields of geosciences such as: stratigraphy, magnetism, dendrochronology, sedimentology, are drawn from and proxy reconstructions from ice sheets, terrestrial (speleothems, lakes, and vegetation) and oceanic data, are used to reconstruct the ancient climates of the Earth. The second volume, entitled “Investigation into ancient climates, ” focuses on building comprehensive models of past climate evolution. The chapters are based on understanding the processes driving the evolution of each component of the Earth system (atmosphere, ocean, ice). This volume provides both an analytical understanding of each component using a hierarchy of models (from conceptual to very sophisticated 3D general circulation models) and a synthetic approach incorporating all of these components to explore the evolution of the Earth as a global system. As a whole this book provides the reader with a complete view of data reconstruction and modeling of the climate of the Earth from deep time to present day with even an excursion to include impacts on future climate.

Geochronology and Thermochronology Peter W. Reiners 2017-12-26 This book is a welcome introduction and reference for users and innovators in geochronology. It provides modern perspectives on the current state-of-the-art in most of the principal areas of geochronology and thermochronology, while recognizing that they are changing at a fast pace. It emphasizes fundamentals and systematics, historical perspective, analytical methods, data interpretation, and some applications chosen from the literature. This book complements existing coverage by expanding on those parts of isotope geochemistry that are concerned with dates and rates and insights into Earth and planetary science that come from temporal perspectives. Geochronology and Thermochronology offers chapters covering: Foundations of Radioisotopic Dating; Analytical Methods; Interpretational Approaches: Making Sense of Data; Diffusion and Thermochronologic Interpretations; Rb-Sr, Sm-Nd, Lu-Hf, Re-Os and Pt-Os; U-Th-Pb Geochronology and Thermochronology; The K-Ar and 40Ar/39Ar Systems; Radiation-damage Methods of Geo- and Thermochronology; The (U-Th)/He System; Uranium-series Geochronology; Cosmogenic Nuclides; and Extinct Radionuclide Chronology. Offers a foundation for understanding each of the methods and for illuminating directions that will be important in the near future Presents the fundamentals, perspectives, and opportunities in modern geochronology in a way that inspires further innovation, creative technique development, and applications Provides references to rapidly evolving topics that will enable readers to pursue future developments Geochronology and Thermochronology is designed for graduate and upper-level undergraduate students with a solid background in mathematics, geochemistry, and geology. Read an interview with the editors to find out more: https://eos.org/editors-vox/the-science-of-dates-and-rates

Crustal thickening leading to exhumation of the Himalayan metamorphic core of central Nepal L. Godin 2001

Radioactive Geochronometry Heinrich D Holland 2010-09-30 The history of Earth in the Solar System has been unraveled using natural radioactivity. The sources of this radioactivity are the original creation of the elements and the subsequent bombardment of objects, including Earth, in the Solar System by cosmic rays. Both radioactive and radiogenic nuclides are harnessed to arrive at ages of various events and processes on Earth. This collection of chapters from the Treatise on Geochemistry displays the range of radioactive geochronometric studies that have been addressed by researchers in various fields of Earth science. These range from the age of Earth thermal and the Solar System to the dating of the history of Earth that assists us in defining the major events in Earth history. In addition, the use of radioactive geochronometry in describing rates of Earth surface processes, including the climate history recorded in ocean sediments and the patterns of circulation of the fluid Earth, has extended the range of utility of radioactive isotopes as chronometric and tracer tools. Comprehensive, interdisciplinary and authoritative content selected by leading subject experts Robust illustrations, figures and tables Affordably priced sampling of content from the full Treatise on Geochemistry *Fission-track Thermochronology and Its Application to Geology* Marco G. Malusà 2019 This book is focused on the basics of applying thermochronology to geological and tectonic problems, with the emphasis on fission-track thermochronology. It is conceived for relatively new practitioners to thermochronology, as well as scientists experienced in the various methods. The book is structured in two parts. Part I is devoted to the fundamentals of the fission-track method, to its integration with other geochronologic methods, and to the basic principles of statistics for fission-track dating and sedimentology applied to detrital thermochronology. Part I also includes the historical development of the technique and thoughts on future directions. Part II is devoted to the geological interpretation of the thermochronologic record. The thermal frame of reference and the different approaches for the interpretation of fission-track data within a geological framework of both basement and detrital studies are discussed in detail. Separate chapters demonstrate the application of fission-track thermochronology from various perspectives (e.g., tectonics, petrology, stratigraphy, hydrocarbon exploration, geomorphology), with other chapters on the application to basement rocks in orogens, passive continental margins and cratonic interiors, as well as various applications of detrital thermochronology.

Geodynamic Evolution of the Eastern Pelagonian Zone in North-western Greece and the Republic of Macedonia Thomas Most 2003

Large Meteorite Impacts and Planetary Evolution VI Wolf Uwe Reimold 2021-09-23 "This volume contains a sizable suite of contributions dealing with regional impact records (Australia, Sweden), impact craters and impactites, early Archean impacts and geophysical characteristics of impact structures, shock metamorphic investigations, post-impact hydrothermalism, and structural geology and morphometry of impact structures - on Earth and Mars"--

Advances in 40Ar/39Ar Dating F. Jourdan 2014-04-02 Decoding the complete history of Earth and our solar system requires the placing of the scattered pages of Earth history in a precise chronological order, and the 40Ar/39Ar dating technique is one of the most trusted dating techniques to do that. The 40Ar/39Ar method has been in use for more than 40 years, and has constantly evolved since then. The steady improvement of the technique is largely due to a better understanding of the K/Ar system, an appreciation of the subtleties of geological material and a continuous refinement of the analytical tools used for isotope extraction and counting. The 40Ar/39Ar method is also one of the most versatile techniques with countless applications in archaeology, tectonics, structural geology, orogenic processes and provenance studies, ore and petroleum genesis, volcanology, weathering processes and climate, and planetary geology. This volume is the first of its kind and covers methodological developments, modelling, data handling, and direct applications of the 40Ar/39Ar technique.

Feldspars and their Reactions Ian Parsons 2012-12-06 Feldspar minerals make up 60% of the crust of the Earth. They are stable in the upper mantle, and are so abundant in the crust that they form the basis of the classification of igneous rocks. At the surface, feldspars weather to form clay minerals which are the most important mineral constituent of soils. The articles in this book review the chemical reactions of feldspars over the whole sweep of pressure and temperature regimes in the outer Earth, and describe the fundamental aspects of crystal structure which underlie their properties. The book covers intracrystalline reactions, such as order-disorder transformations and exsolution, and transfer of stable and radiogenic isotopes, which can be interpreted to provide insights into the thermal history of rocks. It is suitable for final year undergraduates or research workers.

Detrital thermochronology Matthias Bernet 2004-01-01

Using Geochemical Data Hugh Rollinson 2021-04-30 How best to interpret and apply geochemical data to understand geological processes, for graduate students, researchers, and professionals.

Geochronology and Thermochronology by the 40Ar/39Ar Method Ian McDougall 1999 Argon isotopic dating is one of the most important techniques for estimating the ages of rocks and can be used on very small samples. It has been used to assign reliable ages to the Earth and numerous meteorites. This second edition covers the standard principles and methods and incorporates many of new developments from the last decade. It covers the basis of the method, technical aspects, data presentation, diffusion theory, thermochronology, and many applications and case studies.

Layered Intrusions Bernard Charlier 2015-05-18 This edited work contains the most recent advances related to the study of layered intrusions and cumulate rocks formation. The first part of this book presents reviews and new views of processes producing the textural, mineralogical and geochemical characteristics of layered igneous rocks. The second part summarizes progress in the study of selected layered intrusions and their ore deposits from different parts of the world including Canada, Southwest China, Greenland and South Africa. Thirty experts have contributed to this update on recent research on Layered Intrusions. This highly informative book will provide insight for researchers with an interest in geology, igneous petrology, geochemistry and mineral resources.

Petrochronology Matthew J. Kohn 2018-03-27 Petrochronology is a rapidly emerging branch of Earth science that links time (ages or rates) with specific rock-forming processes and their physical conditions. It is founded in petrology and geochemistry, which define a petrogenetic context or delimit a specific process, to which chronometric data are then linked. This combination informs Earth’s petrogenetic processes better than petrology or geochronology alone. This volume and the accompanying short courses address three broad categories of inquiry. Conceptual approaches chapters include petrologic modeling of multi-component chemical and mineralogic systems, and development of methods that include diffusive alteration of mineral chemistry. Methods chapters address four main analytical techniques, specifically EPMA, LA-ICP-MS, SIMS and TIMS. Mineral-specific chapters explore applications to a wide range of minerals, including zircon (metamorphic, igneous, and detrital/Hadean), baddeleyite, REE minerals (monazite, allanite, xenotime and apatite), titanite, rutile, garnet, and major igneous minerals (olivine, plagioclase and pyroxenes). These applications mainly focus on metamorphic, igneous, or tectonic processes, but additionally elucidate fundamental transdisciplinary progress in addressing mechanisms of crystal growth, the chemical consequences of mineral growth kinetics, and how chemical transport and deformation affect chemically complex mineral composites. Most chapters further recommend areas of future research. *The Geologic Time Scale 2012 2-Volume* Set F. M. Gradstein 2012-07-31 The Geologic Time Scale 2012, winner of a 2012 PROSE Award Honorable Mention for Best Multi-volume Reference in Science from the Association of American Publishers, is the framework for deciphering the history of our planet Earth. The authors have been at the forefront of chronostratigraphic research and initiatives to create an international geologic time scale for many years, and the charts in this book present the most up-to-date, international standard, as ratified by the International Commission on Stratigraphy and the International Union of Geological Sciences. This 2012 geologic time scale is an enhanced, improved and expanded version of the GTS2004, including chapters on planetary scales, the Cryogenian-Ediacaran periods/systems, a prehistory scale of human development, a survey of sequence stratigraphy, and an extensive compilation of stable-isotope chemostratigraphy. This book is an essential reference for all geoscientists, including researchers, students, and petroleum and mining professionals. The presentation is non-technical and illustrated with numerous colour charts, maps and photographs. The book also includes a detachable wall chart of the complete time scale for use as a handy reference in the office, laboratory or field. The most detailed international geologic time scale available that contextualizes information in one single reference for quick desktop access. Gives insights in the construction, strengths, and limitations of the geological time scale that greatly enhances its function and its utility. Aids understanding by combining with the mathematical and statistical methods to scaled composites of global succession of events. Meets the needs of a range of users at various points in the workflow (researchers extracting linear time from rock records, students recognizing the geologic stage by their content).

Radiogenic Isotope Geology Alan P. Dickin 2005-03-31 New and updated edition of a popular textbook on the geological applications of radiogenic isotopes.

The Road to Jaramillo William Glen 1982 This is the story, told here for the first time, of how an international cast of scientists produced the discoveries that brought about the plate-tectonics revolution. In preparing this book

the author interviewed virtually all of the important contributors to that critical decade of research, 1957-66. Working in the tradition of history of science, he explores personal relationships, institutional support, and the

rivalries and frictions between and within research groups.