

Tectonic Uplift And Climate Change

This book provides a comprehensive overview of the geological evolution of the Northern Andes and contiguous shield areas, with a focus upon Colombia. Updated geological interpretations are supported by modern litho-geochemical, seismic, gravity and magnetic data and radiogenic isotope and radiometric age determinations. The composite data permits a detailed interpretation of the tectono-magmatic history of the Northern Andean Block, including the Andes of Colombia, northern Ecuador, western Venezuela and eastern Panamá. Tectonic reconstructions based upon characterization of more than thirty litho-tectonic and morpho-structural units, terrane assemblages and tectonic realms, and their bounding suture and fault systems, highlight the intimate and complementary Mesozoic-Cenozoic history of the Northern Andean Block and the Pacific and Caribbean Plates. The complex nature of Northern Andean assembly contrasts with "classical" Central Andean "Cordilleran-type" orogenic models. Differences render the application of typical Cordilleran-type models inappropriate for the Colombian Andes. The importance of underlying Proterozoic through mid-Mesozoic elements, in the development of Meso-Cenozoic Northern Andean orogeny-phase tectonic configurations is analyzed in the light of spatial-temporal studies and reconstructions related to basin formation, sedimentation, deformation, uplift mechanisms, structural style and magmatic evolution. The pre-Andean architecture of north western South America has played a pre-determinative role in the development of the Northern Andean orogenic system. 16 contributions analyze key stratigraphic, structural, metamorphic, magmatic and tectonic questions, and provide solutions as far as the most recent published field-based studies permit. The volume provides geological interpretations and tectonic models which contrast with repetitive theoretical proposals frequently found in the available literature.

Earth Surface Processes is an introductory text for those studying the dynamics of fluid and sediment transport in the environments, in the context of both present-day patterns as well as the environmental changes decipherable in the geological record. The book is divided into two parts. The first deals with the global-scale aspects of the earth's surface system. The second part focuses on the physical underpinnings for fluid and sediment transport in a number of settings, found at the earth's surface and in its oceans. Earth Surface Processes fits into the literature of the broad holistic discipline of 'Earth System Science.' The author illustrates the physical principles of earth's surface processes and explains the relevant theories by quantitative practical exercises. The pioneering textbook on the "new sedimentology" One of the first textbooks to adopt the Earth Systems approach to geology, developed at Penn State and Stanford Should reinvigorate more traditional courses in physical sedimentology and dynamical sedimentology Successfully marries the innovative holistic approach to Earth Systems with the traditional reductionist approach to sedimentary processes Explains both the global-scale Earth Surface System and the fluid dynamics and sedimentary transport processes that underlie this Quantitative approach is reinforced with worked examples and solutions Richly illustrated with original diagrams and a colour plate section

The Origins of Mountains approaches mountains from facts about mountain landscapes rather than theory. The book illustrates

that almost everywhere, mountains arose by vertical uplift of a former plain, and by a mixture of cracking and warping by earth movements, and erosion by rivers and glaciers, the present mountainous landscapes were created. It also gives evidence that this uplift only occurred in the last few million years, a time scale which does not fit the plate tectonics theory. Another fascinating part of the evidence, shows that mountain uplift correlates very well with climatic change. Mountain building could have been responsible for the onset of the ice age. It certainly resulted in the creation of new environments. Fossil plants and animals are used in places to work out the time of mountain uplift, which in turn helps to explain biogeographical distributions.

A New York Times-bestselling author explains how the physical world shaped the history of our species. When we talk about human history, we often focus on great leaders, population forces, and decisive wars. But how has the earth itself determined our destiny? Our planet wobbles, driving changes in climate that forced the transition from nomadism to farming. Mountainous terrain led to the development of democracy in Greece. Atmospheric circulation patterns later on shaped the progression of global exploration, colonization, and trade. Even today, voting behavior in the south-east United States ultimately follows the underlying pattern of 75 million-year-old sediments from an ancient sea. Everywhere is the deep imprint of the planetary on the human. From the cultivation of the first crops to the founding of modern states, *Origins* reveals the breathtaking impact of the earth beneath our feet on the shape of our human civilizations.

The quaternary sciences constitute a dynamic, multidisciplinary field of research that has been growing in scientific and societal importance in recent years. This branch of the Earth sciences links ancient prehistory to modern environments. Quaternary terrestrial sediments contain the fossil remains of existing species of flora and fauna, and their immediate predecessors. Quaternary science plays an integral part in such important issues for modern society as groundwater resources and contamination, sea level change, geologic hazards (earthquakes, volcanic eruptions, tsunamis), and soil erosion. With over 360 articles and 2,600 pages, many in full-color, the *Encyclopedia of Quaternary Science* provides broad ranging, up-to-date articles on all of the major topics in the field. Written by a team of leading experts and under the guidance of an international editorial board, the articles are at a level that allows undergraduate students to understand the material, while providing active researchers with the latest information in the field. Also available online via ScienceDirect (2006) – featuring extensive browsing, searching, and internal cross-referencing between articles in the work, plus dynamic linking to journal articles and abstract databases, making navigation flexible and easy. For more information, pricing options and availability visit www.info.sciencedirect.com. 360 individual articles written by prominent international authorities, encompassing all important aspects of quaternary science. Each entry provides comprehensive, in-depth treatment of an overview topic and presented in a functional, clear and uniform layout. Reference section provides guidance for further research on the topic. Article text supported by full-color photos, drawings, tables, and other visual material. Writing level is suited to both the expert and non-expert.

This book is the first of its kind on environmental change research devoted to monsoon-arid environment evolution history and its mechanism involved. Capturing the most prominent features of Asian climate and environmental changes, it gives a

comprehensive review of the Asian Monsoon records providing evidence for spatial and temporal climatic and environmental changes across the Asian continent since the Late Cenozoic. The dynamics underlying these changes are explored based on various bio-geological records and in particular based on the evidence of loess, speleothems as well as on mammal fossils. The Asian monsoon-arid climate system which quantifies the controlling mechanisms of climate change and the way it operates in different time scales is described. Attempts to differentiate between natural change and human-induced effects, which will help guide policies and countermeasures designed to support sustainable development on the Chinese Loess Plateau and the arid west.

A significant advance in climatological scholarship, *Tectonic Uplift and Climate Change* is a multidisciplinary effort to summarize the current status of a new theory steadily gaining acceptance in geoscience circles: that long-term cooling and glaciation are controlled by plateau and mountain uplift. Researchers in many diverse fields, from geology to paleobotany, present data that substantiate this hypothesis. The volume covers most of the key, dramatic transformations of the Earth's surface.

These results show that a transcontinental connection of the Amazon drainage basin occurred at ~8 Ma, and the small shift at ~4.5 was related to continued Andean uplift.

Advances in Climate Change and Global Warming Research and Application / 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Climate Change and Global Warming. The editors have built *Advances in Climate Change and Global Warming Research and Application / 2012 Edition* on the vast information databases of ScholarlyNews.™ You can expect the information about Climate Change and Global Warming in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of *Advances in Climate Change and Global Warming Research and Application / 2012 Edition* has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

'Earth's Climate' summarises the major lessons to be learned from 550 million years of climate changes, as a way of evaluating the climatological impact on and by humans in this century. The book also looks ahead to possible effects during the next several centuries of fossil fuel use.

There is little dispute within the scientific community that humans are changing Earth's climate on a decadal to century time-scale. By the end of this century, without a reduction in emissions, atmospheric CO₂ is projected to increase to levels that Earth has not experienced for more than 30 million years. As greenhouse gas emissions propel Earth toward a

warmer climate state, an improved understanding of climate dynamics in warm environments is needed to inform public policy decisions. In *Understanding Earth's Deep Past*, the National Research Council reports that rocks and sediments that are millions of years old hold clues to how the Earth's future climate would respond in an environment with high levels of atmospheric greenhouse gases. *Understanding Earth's Deep Past* provides an assessment of both the demonstrated and underdeveloped potential of the deep-time geologic record to inform us about the dynamics of the global climate system. The report describes past climate changes, and discusses potential impacts of high levels of atmospheric greenhouse gases on regional climates, water resources, marine and terrestrial ecosystems, and the cycling of life-sustaining elements. While revealing gaps in scientific knowledge of past climate states, the report highlights a range of high priority research issues with potential for major advances in the scientific understanding of climate processes. This proposed integrated, deep-time climate research program would study how climate responded over Earth's different climate states, examine how climate responds to increased atmospheric carbon dioxide and other greenhouse gases, and clarify the processes that lead to anomalously warm polar and tropical regions and the impact on marine and terrestrial life. In addition to outlining a research agenda, *Understanding Earth's Deep Past* proposes an implementation strategy that will be an invaluable resource to decision-makers in the field, as well as the research community, advocacy organizations, government agencies, and college professors and students.

Glacier Science and Environmental Change is an authoritative and comprehensive reference work on contemporary issues in glaciology. It explores the interface between glacier science and environmental change, in the past, present, and future. Written by the world's foremost authorities in the subject and researchers at the scientific frontier where conventional wisdom of approach comes face to face with unsolved problems, this book provides: state-of-the-art reviews of the key topics in glaciology and related disciplines in environmental change cutting-edge case studies of the latest research an interdisciplinary synthesis of the issues that draw together the research efforts of glaciologists and scientists from other areas such as geologists, hydrologists, and climatologists color-plate section (with selected extra figures provided in color at www.blackwellpublishing.com/knight). The topics in this book have been carefully chosen to reflect current priorities in research, the interdisciplinary nature of the subject, and the developing relationship between glaciology and studies of environmental change. *Glacier Science and Environmental Change* is essential reading for advanced undergraduates, postgraduate research students, and professional researchers in glaciology, geology, geography, geophysics, climatology, and related disciplines.

To understand climate change today, we first need to know how Earth's climate changed over the past 450 million years. Finding answers depends upon contributions from a wide range of sciences, not just the rock record uncovered by

geologists. In *Earth's Climate Evolution*, Colin Summerhayes analyzes reports and records of past climate change dating back to the late 18th century to uncover key patterns in the climate system. The book will transform debate and set the agenda for the next generation of thought about future climate change. The book takes a unique approach to the subject providing a description of the greenhouse and icehouse worlds of the past 450 million years since land plants emerged, ignoring major earlier glaciations like that of Snowball Earth, which occurred around 600 million years ago in a world free of land plants. It describes the evolution of thinking in palaeoclimatology and introduces the main players in the field and how their ideas were received and, in many cases, subsequently modified. It records the arguments and discussions about the merits of different ideas along the way. It also includes several notes made from the author's own personal involvement in palaeoclimatological and palaeoceanographic studies, and from his experience of working alongside several of the major players in these fields in recent years. This book will be an invaluable reference for both undergraduate and postgraduate students taking courses in related fields and will also be of interest to historians of science and/or geology, climatology and oceanography. It should also be of interest to the wider scientific and engineering community, high school science students, policy makers, and environmental NGOs. Reviews: "Outstanding in its presentation of the facts and a good read in the way that it intersperses the climate story with the author's own experiences. [This book] puts the climate story into a compelling geological history." -Dr. James Baker "The book is written in very clear and concise prose, [and takes] original, enlightening, and engaging approach to talking about 'ideas' from the perspective of the scientists who promoted them." -Professor Christopher R. Scotese "A thrilling ride through continental drift and its consequences." - Professor Gerald R. North "Written in a style and language which can be easily understood by laymen as well as scientists." - Professor Dr Jörn Thiede "What makes this book particularly distinctive is how well it builds in the narrative of change in ideas over time." - Holocene book reviews, May 2016 "This is a fascinating book and the author's biographical approach gives it great human appeal." - E Adlard

The Earth's climate varies through geological time as a result of external, orbital processes, as well as the positions of continents, growth of mountains and the opening and closure of oceanic gateways. Climate modelling suggests that the intensity of the Asian monsoon should correlate, at least in part, with the uplift history of the Tibetan Plateau and the Himalaya, as well as the evolution of gateways and the retreat of shallow seas in Central Asia. Long-term reconstructions of both mountain building and monsoon activity are key to testing the proposed links. This collection of papers presents a series of new studies documenting the variations of the Asian monsoon on orbital and tectonic timescales, together with the impact this has had on environmental conditions. The issue of which proxies are best suited to measuring monsoons is addressed, as is the effect that the monsoon has had on erosion and the formation of the stratigraphic record both on

and offshore.

The collision of the Indian and Eurasian plates 50 million years ago created the Himalaya, along with massive glaciers, intensified monsoon, turbulent rivers, and an efflorescence of ecosystems. Today, the Himalaya is at risk of catastrophic loss of life. Maharaj Pandit outlines the mountain's past in order to map a way toward a sustainable future.

"The Liwu River runs a short course; its channel head at the water divide in Taiwan's Central Range is a mere 35 km from its outflow into the Pacific Ocean. But in those short 35 km, the Liwu has carved one of the world's geographic wonders: the spectacular Taroko Gorge with marble and granite walls soaring nearly 1000 m above the river channel. Taroko Gorge was a fitting venue for a 2003 Penrose Conference that addressed the coupled processes of tectonics, climate, and landscape evolution. The young mountains, extreme weather, and dramatic landforms provided an appropriate backdrop to wide-ranging discussions of geomorphic processes, climate and meteorology, sediment generation and transport, the effects of erosion on tectonics, and new analytical and modeling tools used to address these processes and problems. This volume's papers extend that discussion, reaching across fields that have experienced rapid advances in the past decade."--Publisher's website.

The Asian monsoon is one of the most dramatic climatic phenomena on Earth, with far-reaching environmental and societal effects. Almost two thirds of humanity lives within regions influenced by the monsoon. With the emerging Asian economies, the importance of the region to the global economy has never been more marked. The Asian Monsoon describes the evolution of the monsoon, and proposes a connection between the tectonic evolution of the solid Earth and monsoon intensity. The authors explain how the monsoon has been linked to orbital processes and thus to other parts of the global climate system, especially glaciation. Finally, they summarize how monsoon evolution since the last Ice Age has impacted human societies, as well as commenting on the potential impact of future climate change. This book presents a multi-disciplinary overview of the monsoon for advanced students and researchers in atmospheric science, climatology, oceanography, geophysics, and geomorphology. A synthesis of the environmental and climatic history of every major desert and desert margin, for researchers and advanced students.

Accessibly written by a team of international authors, the Encyclopedia of Environmental Change provides a gateway to the complex facts, concepts, techniques, methodology and philosophy of environmental change. This three-volume set illustrates and examines topics within this dynamic and rapidly changing interdisciplinary field. The encyclopedia includes all of the following aspects of environmental change: Diverse evidence of environmental change, including climate change and changes on land and in the oceans Underlying natural and anthropogenic causes and mechanisms Wide-ranging local, regional and global impacts from the polar regions to the tropics Responses of geo-ecosystems and human-environmental systems in the face of past, present and future environmental change Approaches, methodologies and techniques used for reconstructing, dating, monitoring, modelling, projecting and predicting change Social, economic and political dimensions of environmental issues, environmental conservation and management and environmental policy Over 4,000 entries explore the following key themes and more: Conservation

Demographic change Environmental management Environmental policy Environmental security Food security Glaciation Green Revolution Human impact on environment Industrialization Landuse change Military impacts on environment Mining and mining impacts Nuclear energy Pollution Renewable resources Solar energy Sustainability Tourism Trade Water resources Water security Wildlife conservation The comprehensive coverage of terminology includes layers of entries ranging from one-line definitions to short essays, making this an invaluable companion for any student of physical geography, environmental geography or environmental sciences.

One of Springer's Major Reference Works, this book gives the reader a truly global perspective. It is the first major reference work in its field. Paleoclimate topics covered in the encyclopedia give the reader the capability to place the observations of recent global warming in the context of longer-term natural climate fluctuations. Significant elements of the encyclopedia include recent developments in paleoclimate modeling, paleo-ocean circulation, as well as the influence of geological processes and biological feedbacks on global climate change. The encyclopedia gives the reader an entry point into the literature on these and many other groundbreaking topics.

No one in America would deny that the weather has changed drastically in our lifetime. We read about El Niño and La Niña, but how many of us really understand the big picture beyond our own front windows or even the headlines on the Weather Channel? Hydrologists and climatologists have long been aware of the role of regional climate in predicting floods and understanding droughts. But with our growing sense of a variable climate, it is important to reassess these natural disasters not as isolated events but as related phenomena. This book shows that floods and droughts don't happen by accident but are the products of patterns of wind, temperature, and precipitation that produce meteorologic extremes. It introduces the mechanics of global weather, puts these processes into the longer-term framework of climate, and then explores the evolution of climatic patterns through time to show that floods and droughts, once considered isolated "acts of God," are often related events driven by the same forces that shape the entire atmosphere. Michael Collier and Robert Webb offer a fresh, insightful look at what we know about floods, droughts, and climate variability—and their impact on people—in an easy-to-read text, with dramatic photos, that assumes no previous understanding of climate processes. They emphasize natural, long-term mechanisms of climate change, explaining how floods and droughts relate to climate variability over years and decades. They also show the human side of some of the most destructive weather disasters in history. As Collier and Webb ably demonstrate, "climate" may not be the smooth continuum of meteorologic possibilities we supposed but rather the sum of multiple processes operating both regionally and globally on different time scales. Amid the highly politicized discussion of our changing environment, *Floods, Droughts, and Climate Change* offers a straightforward scientific account of weather crises that can help students and general readers better understand the causes of climate variability and the consequences for their lives.

Trees, CO2 concentration, climate change, herbivores, temperature.

"Physical Geology is a comprehensive introductory text on the physical aspects of geology, including rocks and minerals, plate

tectonics, earthquakes, volcanoes, glaciation, groundwater, streams, coasts, mass wasting, climate change, planetary geology and much more. It has a strong emphasis on examples from western Canada, especially British Columbia, and also includes a chapter devoted to the geological history of western Canada. The book is a collaboration of faculty from Earth Science departments at Universities and Colleges across British Columbia and elsewhere"--BCcampus website.

Global Climate Change presents both practical and theoretical aspects of global climate change from across geological periods. It addresses holistic issues related to climate change and its contribution in triggering the temperature increase with a multitude of impacts on natural processes. As a result, it helps to identify the gaps between policies that have been put in place and the continuously increasing emissions. The challenges presented include habitability, biodiversity, natural resources, and human health. It is organized into information on the past, present, and future of climate change to lead to a more complete understanding and therefore effective solutions. Placing an emphasis on recent climate change research, Global Climate Change helps to bring researchers and graduate students in climate science, environmental science, and sustainability up to date on the science of climate change so far and presents a baseline for how to move into the future effectively. Addresses the variety of challenges associated with climate change, along with possible solutions Includes suggestions for future research on climate change Covers climate change holistically, including global and regional scales, ecosystems, agriculture, energy, and sustainability Presents both practical and theoretical research, including coverage of climate change over various geological periods

ABSTRACT: The magnitude of global sediment flux from streams to the oceans over the last 5 Ma is poorly quantified, yet important for predicting future fluxes and deciphering the relative control of tectonic uplift, climate change, vegetation, and related feedback mechanisms on landscape evolution. Despite numerous proxy studies on global sediment delivery to the oceans, it remains uncertain whether bulk sedimentation increased, decreased, or remained approximately constant across one of the most significant global climate changes: the Plio-Pleistocene transition. New developments and strategies in the application of cosmic-ray-produced isotopes, in part developed by this thesis, provide records of pre-historic denudation of confined fluvial catchments in Texas and Yukon. Non-glaciated, tectonically passive regions were targeted in contrast to other studies on modern sedimentation rates in order to isolate the climate influence from glacial and tectonic controls. The results suggest that average catchment temperature, and surficial processes and other factors such as vegetation cover associated with temperature, are the primary controls on the variation in landscape denudation in regions lacking tectonics and direct glacial cover. Specifically, warmer temperatures yield higher denudation rates, both at the scale of glacial-interglacial climate change and over the Plio-Pleistocene transition. The implication is that stream sediment flux to the ocean from tropical and temperate regions was higher during the Pliocene than in the Quaternary. However, this may have been balanced by an increase in sediment flux from regions covered by warm-based glaciers during glacial periods, or by increased temporary continental storage during interglacial periods.

The book focuses on geological history as the critical factor in determining the present biodiversity and landscapes of Amazonia. The different driving mechanisms for landscape evolution are explored by reviewing the history of the Amazonian Craton, the

associated sedimentary basins, and the role of mountain uplift and climate change. This book provides an insight into the Meso- and Cenozoic record of Amazonia that was characterized by fluvial and long-lived lake systems and a highly diverse flora and fauna. This fauna includes giants such as the ca. 12 m long caiman *Purussaurus*, but also a varied fish fauna and fragile molluscs, whilst fossil pollen and spores form relics of ancestral swamps and rainforests. Finally, a review of the molecular datasets of the modern Amazonian rainforest and aquatic ecosystem, discussing the possible relations between the origin of Amazonian species diversity and the palaeogeographic, palaeoclimatic and palaeoenvironmental evolution of northern South America. The multidisciplinary approach in evaluating the history of Amazonia has resulted in a comprehensive volume that provides novel insights into the evolution of this region.

This book offers an interdisciplinary view of the biophysical issues related to climate change. Climate change is a phenomenon by which the long-term averages of weather events (i.e. temperature, precipitation, wind speed, etc.) that define the climate of a region are not constant but change over time. There have been a series of past periods of climatic change, registered in historical or paleoecological records. In the first section of this book, a series of state-of-the-art research projects explore the biophysical causes for climate change and the techniques currently being used and developed for its detection in several regions of the world. The second section of the book explores the effects that have been reported already on the flora and fauna in different ecosystems around the globe. Among them, the ecosystems and landscapes in arctic and alpine regions are expected to be among the most affected by the change in climate, as they will suffer the more intense changes. The final section of this book explores in detail those issues.

Geology is the Component of Encyclopedia of Earth and Atmospheric Sciences, in the global Encyclopedia of Life Support Systems (EOLSS)), which is an integrated compendium of twenty Encyclopedias. The theme on geology in the Encyclopedia of Earth and Atmospheric Sciences, presents many aspects of geology under the following nine different topics: The Organized Earth.; Tectonics and Geodynamics; Igneous and Metamorphic Petrology; Sedimentary Geology and Paleontology; Overview of the Mineralogical Sciences; Geology of Metallic and Non-Metallic Mineral Resources; Regional Geology; Geology of Petroleum, Gas, and Coal; Environmental and Engineering Geology.

Tectonic geomorphology is the study of the interplay between tectonic and surface processes that shape the landscape in regions of active deformation. Recent advances in the quantification of rates and physical basis of tectonic and surface processes have rejuvenated the field of tectonic geomorphology. Modern tectonic geomorphology is an exciting and highly integrative field which utilizes techniques and data derived from studies of geomorphology, seismology, geochronology, structure, geodesy, and Quaternary climate change. While emphasizing new insights from the last decade of research, Tectonic Geomorphology reviews the fundamentals of the subject which include the nature of faulting and folding, the creation and use of geomorphic markers for tracing deformation, chronological techniques which

date deformation, geodetic techniques for defining recent deformation, and paleoseismologic approaches to calibrate past deformation. The overall focus of this book is on new interpretations of landform evolution and insights on the interplay between surface processes and tectonics that emerge from integrative studies. The authors have developed an up-to-date interpretation of landscapes in tectonically active environments for upper-level undergraduate and graduate earth science students and practicing geologists. For an instructor's image bank, please visit:

<http://www.geol.ucsb.edu/faculty/burbank> First text to take a broad interdisciplinary approach: integrated geomorphology, geophysics, and paleoclimatology. Includes the latest technological advances used in dating: Uranium series and dating and observation. Emphasizes the role of surface processes. Focuses on landscapes at different time scales. Provides strong coverage on numerical modeling of tectonically active landscapes. Presents the recent approaches to calibrating rates of uplift and erosion. Stresses the tectonics of active plate margins in a detailed yet succinct way. Contains "Chapter introductions," "Chapter summaries," and "References" that reinforce principles and theory as well as provide additional background information.

Life on our planet depends upon having a climate that changes within narrow limits – not too hot for the oceans to boil away nor too cold for the planet to freeze over. Over the past billion years Earth's average temperature has stayed close to 14-15°C, oscillating between warm greenhouse states and cold icehouse states. We live with variation, but a variation with limits. Paleoclimatology is the science of understanding and explaining those variations, those limits, and the forces that control them. Without that understanding we will not be able to foresee future change accurately as our population grows. Our impact on the planet is now equal to a geological force, such that many geologists now see us as living in a new geological era – the Anthropocene. Paleoclimatology describes Earth's passage through the greenhouse and icehouse worlds of the past 800 million years, including the glaciations of Snowball Earth in a world that was then free of land plants. It describes the operation of the Earth's thermostat, which keeps the planet fit for life, and its control by interactions between greenhouse gases, land plants, chemical weathering, continental motions, volcanic activity, orbital change and solar variability. It explains how we arrived at our current understanding of the climate system, by reviewing the contributions of scientists since the mid-1700s, showing how their ideas were modified as science progressed. And it includes reflections based on the author's involvement in palaeoclimatic research. The book will transform debate and set the agenda for the next generation of thought about future climate change. It will be an invaluable course reference for undergraduate and postgraduate students in geology, climatology, oceanography and the history of science.

Traces the unique qualities of the human species to astronomical events that occurred billions of years ago, revealing how the molecular development of human life can be linked to the evolution of the cosmos.

The Great Ice Age documents and explains the natural climatic and palaeoecologic changes that have occurred during the past 2.6 million years, outlining the emergence and global impact of our species during this period. Exploring a wide range of records of climate change, the authors demonstrate the interconnectivity of the components of the Earth's climate system, show how the evidence for such change is obtained, and explain some of the problems in collecting and dating proxy climate data. One of the most dramatic aspects of humanity's rise is that it coincided with the beginnings of major environmental changes and a mass extinction that has the pace, and maybe magnitude, of those in the far-off past that stemmed from climate, geological and occasionally extraterrestrial events. This book reveals that anthropogenic effects on the world are not merely modern matters but date back perhaps a million years or more.

Determining the precise timing for the evolutionary origin of groups of organisms has become increasingly important as scientists from diverse disciplines attempt to examine rates of anatomical or molecular evolution and correlate intrinsic biological events to extrinsic environmental events. Molecular clock analyses indicate that many major groups

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