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Meteorite Craters and Impact Structures of the Earth Cambridge University Press **Over 150 crater-producing events have been identified, and this book describes all 139 sites worldwide at which evidence of the impacts can be seen. They range in age from recent craters formed this century to highly eroded billion-year-old craters. Some are spectacular to visit, such as the Barringer Crater in Arizona, the ring-shaped mountains of Gosses Bluff, Australia, and the huge crater at Ries in Germany. The author has visited many of the sites and his photographs enrich this thorough survey. For each site there is a summary table giving location, size, age and present condition. Maps are included where necessary. Meteorite craters are fascinating to visit, so the descriptions include guidance about access and suggested itineraries for the large structures. TERRESTRIAL IMPACT STRUCTURES The TanDEM-X Atlas Terrestrial Impact Structures The TanDEM-X Atlas Impact Craters in South America** Springer **A complete and updated catalogue of impact craters and structures in South America from 2014 is presented here. Approximately eighty proven, suspected and disproven structures have been identified by several sources in this continent. All the impact sites of this large continent have been exhaustively reviewed: the proved ones, the possible ones and some very doubtful. Many sites remain without a clear geological "in situ" confirmation and some of them could be even rejected. Argentina and Brazil are leading the list containing almost everything detected. In Bolivia, Chile, Colombia, Guyana, Paraguay, Perú, Uruguay and Venezuela only a few were observed. Only Ecuador is waiting for new discoveries. So far, the largest well stated impact site is still the Araguainha structure in Brazil with its 40 kilometers in diameter. However, two possible impact**

structures are larger than Araguainha: Malvinas, (with 250 kilometers in diameter) and Vichada in Colombia, (50 kilometers). This study also reports the existence of some Tertiary-Quaternary glassy impactite layers: the "escorias" and "tierras cocidas" of the pampas in Argentina. Europa University of Arizona Press **Few worlds are as tantalizing and enigmatic as Europa, whose complex icy surface intimates the presence of an ocean below. Europa beckons for our understanding and future exploration, enticing us with the possibilities of a water-rich environment and the potential for life beyond Earth. This new volume in the Space Science Series, with more than 80 contributing authors, reveals the discovery and current understanding of EuropaÕs icy shell, subsurface ocean, presumably active interior, and myriad inherent interactions within the Jupiter environment. Europa is the foundation upon which the coming decades of scientific advancement and exploration of this world will be built, making it indispensable for researchers, students, and all who hold a passion for exploration. Large Meteorite Impacts III** Geological Society of America **"The third volume of the series “Large Meteorite Impacts” provides an updated and comprehensive overview of modern impact crater research. In 26 chapters, more than 90 authors from Europe, the United States, Russia, Canada, and South Africa give a balanced, firsthand account of the multidisciplinary field of cratering science, with reports on field studies, geophysical analyses, and experimental and numerical simulations. Nine chapters focus on structure, geophysics, and cratering motions of terrestrial craters. Recent advances in impact ejecta studies and shock metamorphism are assembled, each with seven chapters, and three chapters extend the scope from a terrestrial to a planetary perspective."--pub. desc. Impact Cratering Processes and Products** John Wiley & Sons **Impact cratering is arguably the most ubiquitous geological process in the Solar System. It has played an important role in Earth’s history, shaping the geological landscape, affecting the evolution of life, and generating economic resources. However, it was only in the latter half of the 20th century that the importance of impact cratering as a geological process was recognized and only during the past couple of decades that the study of meteorite impact structures has moved into the mainstream. This book seeks to fill a critical gap in the literature by providing an overview text covering broad aspects of the impact cratering process and aimed at graduate students, professionals and researchers alike. It introduces readers to the threat and nature of impactors, the impact cratering process, the products, and the effects – both destructive and beneficial. A series of chapters on the various techniques used to study impact craters provide a foundation for anyone studying impact craters for the first time. Large Meteorite Impacts and Planetary Evolution VI** Geological Society of America **"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"-- Catastrophic Events and Mass Extinctions Impacts and Beyond Geological Society of America **Global Catastrophes in Earth History; An Interdisciplinary Conference on Impacts, Volcanism, and Mass Mortality** Geological Society of America **The conference was held in Snowbird, Utah, October 1988, as a sequel to the Conference on Large Body Impacts held in 1981, also in Snowbird. This volume contains 58 peer-reviewed papers, arranged into sections that cover the major themes of the conference: catastrophic impacts, volcanism, and mass mortality; geological signatures of impacts; environmental effects of impacts; patterns of mass mortality; volcanism and its effects; case histories of mass mortalities; and events and extinctions at the K/T boundary. Annotation copyrighted by Book News, Inc., Portland, OR Rock Formations and Unusual Geologic Structures Exploring the Earth's Surface** Infobase Publishing **Praise for the previous edition: ...refreshingly clear...will entertain the reader with the wonders of the rock world, and will enhance an understanding of the natural environment... Recommended for all audiences, from high school upward. -- CHOICE Clearly written and illustrated The Chesapeake Bay Crater Geology and Geophysics of a Late Eocene Submarine Impact Structure** Springer Science & Business Media **The authors have synthesized 16 years of geological and geophysical studies which document an 85-km-wide impact crater buried 500 m beneath Chesapeake Bay in south eastern Virginia, USA. In doing so, they have integrated extensive seismic reflection profiling and deep core drilling to analyze the structure, morphology, gravimetrics, sedimentology, petrology, geochemistry, and paleontology of this submarine structure. Of special interest are a detailed comparison with other terrestrial and extraterrestrial craters, as well as a conceptual model and computer simulation of the impact. The extensive illustrations encompass more than 150 line drawings and core photographs. The Geology of the Arab World---An Overview** Springer **This book is the result of the work of the first international congress of the ArabGU (Arabian Geosciences Union) which took place in Algiers (Algeria) in February 2016. It presents research articles and review papers on geology of the North Africa and Arabian Middle East . It provides information to the public on various fields of earth sciences and encourages further research in this field in order to attract an international audience. Impacts in Precambrian Shields** Springer Science & Business Media **The present volume is the result of activities within the scientific programme "Response of the Earth System to Impact Processes" (IMP ACT) of the European Science Foundation (ESF). The ESF is an association of 67 national member organisations devoted to scientific research in 24 European countries. The IMPACT programme is aimed at understanding meteorite impact processes and their effects on the Earth System. Launched in 1998 for a duration of 5 years, the programme is now supported by 15 ESF membership countries. The programme of meteorite impact research and operates through deals with all aspects workshops, exchange programs, and short courses. The 4th IMPACT programme workshop "Meteorite Impacts in Precambrian Shields" took place on**

May 24-28, 2000, in Lappajarvi, western Finland. A total of 84 scientists from 19 countries from Europe, North America, and Africa participated in the workshop. During the workshop, 43 oral, 31 poster, and several video presentations were made. An exhibition of impactite rocks from Finnish craters and two excursions were organised. The excursion to impact melt rock outcrops of the Lappajarvi structure took place during the workshop. The Karikkoselka and Saaksjarvi impact structures in south-central Finland were visited during the post-meeting excursion. Encyclopedic Atlas of Terrestrial Impact Craters Springer **This comprehensive atlas explains the genesis and evolution of impact known craters on Earth, presenting a wealth of radar images from the Italian COSMO-SkyMed satellites that were acquired at the same frequency, spatial resolution, operating mode, and illumination, allowing excellent comparison of different impact structures. It also discusses in detail the processes that have hidden or erased terrestrial impact craters, and clearly explains the basic principles of remote sensing and the COSMO-SkyMed system and radar instruments. Also, the optical satellite remote sensing technique used to produce the optical images is described. The main section documents each of the exposed craters officially recognized as caused by meteoritic impact, presenting a table with the COSMO-SkyMed radar image and, where available, a Sentinel optical image and a photograph taken in situ. A short accompanying text reports the location, context, geographical coordinates, and other ancillary information to support future researches. Planetary Surface Processes** Cambridge University Press **Planetary Surface Processes is the first advanced textbook to cover the full range of geologic processes that shape the surfaces of planetary-scale bodies. Using a modern, quantitative approach, this book reconsiders geologic processes outside the traditional terrestrial context. It highlights processes that are contingent upon Earth's unique circumstances and processes that are universal. For example, it shows explicitly that equations predicting the velocity of a river are dependent on gravity: traditional geomorphology textbooks fail to take this into account. This textbook is a one-stop source of information on planetary surface processes, providing readers with the necessary background to interpret new data from NASA, ESA and other space missions. Based on a course taught by the author at the University of Arizona for 25 years, it is aimed at advanced students, and is also an invaluable resource for researchers, professional planetary scientists and space-mission engineers. The Earth Through Time, Binder Ready Version** John Wiley & Sons **The Earth Through Time, 11th Edition, by Harold L. Levin and David T. King chronicles the Earth's story from the time the Sun began to radiate its light, to the beginning of civilization. The goal of The Earth Through Time is to present the history of the Earth, and the science behind that hsitory, as simply and clearly as possible. The authors strived to make the narrative more engaging, to convey the unique perspective and value of historical geology, and to improve the presentation so as to stimulate interest and enhance the reader's ability to retain essential concepts, long after the final exam. The New**

Solar System Cambridge University Press **Discusses the interplanetary explorations of the last quarter century, revealing the new discoveries and findings due to the technological advancements which have enabled man to visit all the planets except Pluto Encyclopedia of Earth and Space Science** Infobase Publishing **Provides a comprehensive reference for Earth and space sciences, including entries on climate change, stellar evolution, tsunamis, renewable energy options, and mass wasting. The Puchezh-Katunki Impact Crater Geology and Origin** Springer Nature **This book presents essential data on the geology of the Puchezh-Katunki crater – an early Jurassic crater located on the East European Platform, with an impact structure that is ca. 80 km in diameter. Offering a comprehensive guide, it reviews the studies carried out during the last several decades on this prominent but not well-known impact structure. It offers the international community state-of-the-art information on the crater with regard to e.g. structural mapping, drilling (including the Vorotilovo well, which is 5374 m deep), geophysical research, and the petrological analysis of impactites and various breccias. In addition, the book includes new results from the mineralization and crystallizations beneath this large impact crater, and suggests new models for crater formations. Astronaut's Guide to Terrestrial Impact Craters** Createspace Independent Publishing Platform **Impact cratering of the earth's surface is discussed and compared with lunar craters. The basic types found on earth are either simple craters or complex impact structures and basins. Meteorite fragments and shock metamorphism provide evidence of a crater's formation by meteorite impact. Known craters on earth are ordered by location and a few principal facts are given for each crater and the general terrain in which it is located. A satellite picture of each crater and maps identifying crater locations are provided. Grieve, R. A. F. and Wood, C. A. and Garvin, J. B. and Mclaughlin, G. and Mchone, J. F., Jr. Goddard Space Flight Center; Johnson Space Center... Accretion of Extraterrestrial Matter Throughout Earth’s History** Springer Science & Business Media **Every year Earth is bombarded with about 40,000 tons of extraterrestrial material. This includes microscopic cosmic dust particles shed by comets and asteroids in outer space, meteorites, as well as large comets and asteroids that have led to catastrophic events in the geologic past. Originally considered only a curiosity, extraterrestrial matter found on Earth provides the only samples we have from comets, asteroids and other planets. Only recently mankind has started to actively collect extraterrestrial matter in space (Apollo program, Stardust mission) rather than to wait for its delivery to Earth. Still, most of our knowledge of the origin and evolution of our solar system is based on careful studies of meteorites, cosmic dust, and traces of large impact events in the geologic record such as the mass extinction that terminated the Cretaceous Period and led to the extinction of the dinosaurs. This book summarizes our current knowledge of the properties, origin, orbital evolution and accretion mechanism of extraterrestrial matter accreted on Earth and sheds light on accretion processes and fluxes in the geologic past. The chapters in the first part of the book**

are arranged in order to follow extraterrestrial matter from its origin in space, its orbital evolution on its way to Earth, its interaction with the Earth magnetosphere and atmosphere to its more or less violent collision with the Earth's surface. In the second part of the book several chapters deal with the present?day flux of cosmic dust and meteorites to Earth. Finally, several chapters deal with the reconstruction of the accretion history of extraterrestrial matter on Earth, starting with the most recent geologic past and ending with the very early, violent accretion period shortly after the formation of Earth, Moon and other solid planets in our solar system. Radioactive Geochronometry A derivative of the Treatise on Geochemistry Academic Press **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 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 Bombarded Britain A Search for British Impact Structures** World Scientific **This book describes a search for geological evidence of meteorite impact structures in Britain. The statistics of impact structures indicate that Britain should have Phanerozoic impact structures up to tens of kilometres in diameter. A constant theme is the importance of atmospheric break-up of small asteroids and comets. These fragmenting bodies produce anomalously shallow craters with low rims and central peaks; three British structures of this type are identified. Analysis of fireball statistics implies that damaging fireball explosions occur over the British Isles on a time-scale of decades. On a time-scale of millennia, however, more damage is done by Atlantic impact tsunami. Contents: Impacts and Geology:A Curious OmissionOf Calculations and CratersThe Search for Impact StructuresThe Shetland CratersMidlands GeologyThe Ashby InlierCharnwood ForestThe Midlands Basin — A Cometary Impact Structure?The Herefordshire DomesThe Rochford Basin — A Digression into EssexFuller's Earth and Bagshot Sands — A Surrey Crater?Gabbro, Granite, and GrampiansOther Circular StructuresImpacts in History:Small Craters, Airbursts, and TsunamiDozmary Pool and Other CraterletsLevin–Bolt and BlastBritish Atlantis? Readership: Upper level undergraduates and post-graduate students in**

geology and planetary science. Keywords:Meteorite Craters;Terrestrial Impact Structures;Atmospheric Break-Up;British Geology;St Magnus Bay;Midlands Impact Structure;Woolhope Dome;Scottish Younger Gabbros;Dozmary Pool;AirburstsReviews:“In his search for bombarded Britain, the author delivers a master class in impact and air blast processes … I believe that Bombarded Britain is going to make an impact.”Astronomy Now Impact Markers in the Stratigraphic Record Springer Science & Business Media **The present volume is an outcome of the scientific programme “Response of the Earth System to Impact Processes” (IMPACT) by the European Science Foundation (ESF). The ESF is an association of 67 national member organizations devoted to scientific research in 24 European countries. The IMPACT programme is aimed at understanding meteorite impact processes and their effects on the Earth System. Launched in 1998 for duration of 5 years, 15 ESF member organizations now participate in this programme, which will officially end in late 2003, although the momentum gained for European (and worldwide) impact research will be carried on in other programs and organizations. The programme deals with all aspects of meteorite impact research and operates through workshops, exchange programs, publications, and short courses. This particular book is the third in an informal series on “Impact Studies”, which is published by Springer and intended to go beyond the ESF IMPACT programme by providing a venue for high quality (and peer-reviewed) monographs and conference and workshop proceedings on general topics connected to impact cratering and related research. th The 6 ESF-Impact workshop “Impact makers in the stratigraphic record” was held in Granada (Spain) on May 2001, with about sixty scientists from Europe, Taiwan, and North America attending the workshop. During the workshop 30 oral, 32 poster, and 3 keynote contributions were presented. Asteroids Impacts, Crustal Evolution and Related Mineral Systems with Special Reference to Australia** Springer **This book presents a comprehensive overview of Australian impact structures and related mineralization, including a discussion of the significance of many of these structures for crustal evolution. The book focuses in particular on Archaean impact ejecta/fallout units in the Pilbara Craton of Western Australia, large exposed and buried impact structures, and on the geophysical evidence for possible to probable impact structures. Thanks to their long-term geological stability, Precambrian and younger terrains in the Australian continent contain 38 confirmed impact structures and 43 ring and dome structures, many of which constitute possible to probable asteroid impact structures. The impact structures have been the subject of more than half a century of studies and range from several tens of meter-large craters to buried structures larger than 100 km in diameter. Discoveries of impact fallout units in the Pilbara Craton have defined the Pilbara as one of the two best documented terrains where Archaean impact ejecta/fallout deposits are identified, the other terrain being the Kaapvaal Craton in southern Africa. A synthesis of evidence from both cratons indicates periods of large asteroid bombardments during ~3.47 – 2.48 billion**

 Australia's Meteorite Craters Western Australian Museum **On Earth, catastrophic impact of an asteroid or comet with truly global consequences has not happened during our written history, and the threat seems very small. Giant scars on our planet’s surface are relics of an impact history stretching back more than 2 billion years, and there is no assurance it cannot happen again. In Australia there are 36 structures ranging from tens of metres to tens of kilometres in diameter, and recognised to varying degrees of certainty as having been formed by giant meteorite impact. In clear and concise language this book begins with ancient beliefs and myths about craters and then explains how they are actually formed and provides details of their structure. Using the record in the rocks, the authors also assess the likelihood of future impacts and their possible effects. Cratering in Marine Environments and on Ice** Springer Science & Business Media **Despite their global importance, little is known about the few existing examples of impacts into marine environments and icy targets. They are among the least understood and studied parts of impact crater geology. The icy impacts are also of great importance in understanding the developments of the outer planets and their satellites such as Mars or Europa. Furthermore, the impact mechanisms, crater formation and collapse, melt production and the ejecta distribution are scarcely known for impact on targets other than the "classical" solid silicates of the continental crust. The reaction of water and ice to impacts clearly deserves a more thorough study. The understanding of impact effects and consequences in the case of aqueous hits, soft sediments and icy targets has not been thoroughly explored and comprises the main focus of this book. A number of papers in the field of hypervelocity impacts on ice are included. These cover a review of available literature in the field of laboratory studies of such impacts, large impact structures on Titan, predicting impact cratering on a comet nucleus, and a novel report on the survival of bacteria fired at hypervelocity into icy surfaces. This latter paper is concerned with**

astrobiology and in particular Panspermia (natural migration of life through space). Impacts on Earth Springer Science & Business Media **Impact phenomena play an essential role in the formation of planets and great influence during their evolution. The first part of this book describes the dynamics that propels asteroids in our solar system; the second part is devoted to impact phenomena; the third inspects terrestrial impacts of asteroids and the hazards due to space debris orbiting our planet. The book addresses scientists working in astronomy, extraterrestrial physics and geophysics. But it should also be of great interest to a learned public that wants to know about the most recent developments in this fast-moving field of theoretical and observational research. Impact Tectonics** Springer Science & Business Media **A collection of international contributions presenting current knowledge of impact tectonics, geological and geophysical investigations of terrestrial impact structures, and suggested new impact structures, resulting from the IMPACT program. Encyclopedia of Earthquakes and Volcanoes** Infobase Publishing **Presents alphabetically arranged entries on issues related to volcanoes and earthquakes, including causes of volcanic eruptions and earthquakes, notable occurrences throughout history and the study of these natural phenomena. Analysis of Geological Structures** Cambridge University Press **A knowledge of structural geology is fundamental to understanding the processes by which the earth's crust has evolved. It is a subject of fundamental importance to students of geology, experienced field geologists and academic researchers as well as to petroleum and mining engineers. In contrast to many structural textbooks which dwell upon geometrical descriptions of geological structures, this book emphasises mechanical principles and the way in which they can be used to understand how and why a wide range of geological structures develop. Structures on all scales are considered but the emphasis of the book is on those that can be seen on the scale of hand specimen or outcrop. Drawing on their considerable teaching experience the authors present a coherent and lucid analysis of geological structures which will be welcomed by a wide variety of earth scientists. Large Meteorite Impacts and Planetary Evolution II** Geological Society of America **Research in Terrestrial Impact Structures** Springer Science & Business Media **Expedition 364 Summary Abstract: The Chicxulub impact crater, on the Yucatán Peninsula of México, is unique. It is the only known terrestrial impact structure that has been directly linked to a mass extinction event and the only terrestrial impact with a global ejecta layer. Of the three largest impact structures on Earth, Chicxulub is the best preserved. Chicxulub is also the only known terrestrial impact structure with an intact, unequivocal topographic peak ring. Chicxulub's role in the Cretaceous/Paleogene (K-Pg) mass extinction and its exceptional state of preservation make it an important natural laboratory for the study of both large impact crater formation on Earth and other planets and the effects of large impacts on the Earth's environment and ecology. Our understanding of the impact process is far from complete, and despite more than 30 years of intense debate, we are still striving to answer**

the question as to why this impact was so catastrophic. During International Ocean Discovery Program (IODP) and International Continental Scientific Drilling Program (ICDP) Expedition 364, Paleogene sedimentary rocks and lithologies that make up the Chicxulub peak ring were cored to investigate (1) the nature and formational mechanism of peak rings, (2) how rocks are weakened during large impacts, (3) the nature and extent of post-impact hydrothermal circulation, (4) the deep biosphere and habitability of the peak ring, and (5) the recovery of life in a sterile zone. Other key targets included sampling the transition through a rare midlatitude Paleogene sedimentary succession that might include Eocene and Paleocene hyperthermals and/or the Paleocene/Eocene Thermal Maximum (PETM); the composition and character of suevite, impact melt rock, and basement rocks in the peak ring; the sedimentology and stratigraphy of the Paleocene-Eocene Chicxulub impact basin infill; the geo- and thermochronology of the rocks forming the peak ring; and any observations from the core that may help constrain the volume of dust and climatically active gases released into the stratosphere by this impact. Petrophysical properties measurements on the core and wireline logs acquired during Expedition 364 will be used to calibrate geophysical models, including seismic reflection and potential field data, and the integration of all the data will calibrate models for impact crater formation and environmental effects. The drilling directly contributes to IODP Science Plan goals: Climate and Ocean Change: How does Earth's climate system respond to elevated levels of atmospheric CO2? How resilient is the ocean to chemical perturbations? The Chicxulub impact represents an external forcing event that caused a 75% species level mass extinction. The impact basin may also record key hyperthermals within the Paleogene. Biosphere Frontiers: What are the origin, composition, and global significance of subseafloor communities? What are the limits of life in the subseafloor? How sensitive are ecosystems and biodiversity to environmental change? Impact craters can create habitats for subsurface life, and Chicxulub may provide information on potential habitats for life, including extremophiles, on the early Earth and other planetary bodies. Paleontological and geochemical studies at ground zero will document how large impacts affect ecosystems and biodiversity. Earth Connections/Earth in Motion: What mechanisms control the occurrence of destructive earthquakes, landslides, and tsunami? Drilling into the uplifted rocks that form the peak ring will be used to groundtruth numerical simulations and model impact-generated tsunami, and deposits on top of the peak ring and around the Gulf of México will inform us about earthquakes, landslides, and tsunami generated by Chicxulub. These data will collectively help us understand how impact processes are recorded in the geologic record and their potential hazards. IODP Expedition 364 was a Mission Specific Platform expedition designed to obtain subseabed samples and downhole logging measurements from the post-impact sedimentary succession and the peak ring of the Chicxulub impact crater. A single borehole (Hole M0077A) was drilled into the Chicxulub impact crater on the Yucatán continental

shelf, recovering core from 505.70 to 1334.69 meters below seafloor (mbsf) with ~99% core recovery. Downhole logs were acquired for the entire depth of the borehole Continental Scientific Drilling A Decade of Progress, and Challenges for the Future Springer Science & Business Media **This volume provides a review and synthesizes the accomplishments of the past decade of the International Continental Scientific Drilling Program. More importantly, it defines opportunities for scientific advancement through future drilling projects addressing a broad range of disciplines in the Earth Sciences. In addition there is a review of all past projects that were supported by the ICDP, as well as of technical aspects associated with continental drilling. Terrestrial Impact Structures A Bibliography, 1965-68 This bibliography on impact structures supplements U.S. Geological Survey Bulletin 1220 by citing literature published or reviewed since 1964. It adds 17 new structures to the list of 110 previously considered. It is organized in the same manner as Bulletin 1220. Meteorite Impact! The Danger from Space and South Africa's Mega-Impact The Vredefort Structure** Springer Science & Business Media **PART I CHAPTER 1 T E — , , ... 15 Introduction . . . . . 16 Geological change — the answers within, and without. . . . . 18 Man on the Moon. . . . . 24 Back to the beginning — from the Big Bang to early Earth. . . . . 29 Impact — the ubiquitous process . . . . . 31 The oldest rocks . . . . . 32 Time to cool — birth of the Kaapvaal continent. . . . . 35 Old crust in the Vredefort Dome. . . . . 37 Rifting, oceans, volcanism . . . . . 38 Mountains, fire and ice. . . . . 44 The unique Bushveld magmatic event. . . . . 46 CHAPTER 2 C . . . . . 49 Introduction . . . . . 50 Extinction or survival — our restless Earth . . . . . 53 Meteorite-impact catastrophes. . . . . 67 Normal (background) versus mass extinctions . . . . . 72 A brief look at the impact record in the Solar System . . . . . 76 What are the projectiles capable of causing an impact catastrophe?. . . . . 87 What is an impact crater? . . . . . 90 How can we identify impact structures? . . . . . 92 Shock metamorphism . . . . .**