Section 1 The Fossil Record Study Guide A Key Silooo

Phytolith analysis has high potential for reconstructing past vegetation with higher spatial resolution compared other high-resolution proxies, such as pollen and spores. Phytolith assemblages are used in paleoecology to reconstruct changes in vegetation structure through time. In addition, spatial variability of the phytolith signal (across samples collected along a single stratigraphic level) is interpreted as indicative of habitat heterogeneity based on the notion that phytolith assemblages are derived from vegetation that died and decayed in place and therefore hold a local signal. However, this and other assumptions have not yet been tested directly in modern environments; current data are insufficient to establish modern calibrations for the deep time phytolith record, and thus understand the fossil phytolith records in different vegetation types. In Chapter 1 and 2 of this dissertation I aim at helping bridging this gap, by 1) defining an appropriate methodology to sample phytolith for modern analogue studies that is applicable to the deep-time phytolith record; 2) and by providing a modern reference study of soil phytolith along transects in two Neotropical vegetation types in Costa Rica: a rainforest and a dry forest. I investigate the following questions: 1) how many samples and from which part of the (phytolith-rich) soil A-horizon are needed to reflect accurately the standing vegetation? (Chapter 1); 2) are gradients in vegetation structure, composition, and diversity recorded in phytolith assemblages across transects in rainforest and dry forest soils? (Chapter 2); and 3) can we use one or more phytolith assemblages to characterize these two vegetation types, and distinguish them in the fossil record? (Chapter 2). In Chapter 3, I apply the lessons learned from Chapter 1 and 2 to the study of vegetation heterogeneity and vegetation change in Patagonia, at the onset of the Middle Miocene Climatic Optimum (MMCO) -the last global warming event taking place on Earth before the current one, between ~17 and 14.5 Ma. The MMCO is poorly documented in the Southern Hemisphere and at high latitudes. The Santa Cruz Formation (SCF), in southern Patagonia, is an exception, preserving one of the most diverse and well-preserved fauna assemblages on Earth. Fauna and stable isotope data from the SCF suggest that global warming associated with increased aridity favored heterogeneous habitats characterized by many ecological niches which were able to support abnormally high fauna diversity. The phytolith record of SCF has been so far poorly studied but constitute the best line of evidence for high resolution reconstruction of vegetation change through time as well as of spatial patterns of vegetation variability (heterogeneity). Using phytolith assemblages from the SCF I investigate the following questions: 1) How did vegetation structure change in response to the initial warming pulse of the MMCO? 2) How did grass community composition change in response to warmer and drier conditions at the onset of the MMCO? 3)Was the remarkably high diversity of the Santa Cruz fauna supported by habitats characterized by vegetation heterogeneity (i.e., a mix of forested and open vegetation areas) throughout the onset of the MMCO as would be predicted based on modern ecology and SCF faunal data? In Chapter 1 phytolith from modern soil assemblages from two Neotropical forests in Costa Rica (a dry forest and a rainforest) are studied to determine a sample strategy for future modern analogue studies that is applicable to the phytolith deep-time record. Results suggest that the typical approach in deep-time paleoecology of taking point samples from the lower A-horizon of paleosols is justifiable (at least for paleosols reflecting rainforest and dry forest soils), and should therefore be implemented in future

phytolith modern analogues studies that aim at improving interpretations of the deep-time phytolith record. Thus, the results of Chapter 1 constitute the basis upon which the modern analogue study described in Chapter 2 was conducted In Chapter 2, additional soil phytolith assemblages collected along vegetation transects are used to investigate whether and how soil phytoliths reflect gradients in vegetation structure, composition and diversity across the two habitat types (dry forest and rainforest). In all, our results demonstrate that phytolith assemblages can definitely distinguish dry and wet forest habitats. In addition, our results also suggest that phytolith assemblage characteristics within vegetation types do not capture all aspect of environmental and plant community gradients. However, overall higher environmental heterogeneity of the dry forest results in higher heterogeneity of the phytolith assemblages. This result suggest that overall, spatial sampling (along a transect) and the analysis of phytolith assemblage composition allow to reconstruct some structural, and compositional aspects of habitat heterogeneity, and that that phytolith assemblage heterogeneity within a habitat might be indicative of habitat heterogeneity. In Chapter 3, phytolith assemblages from The Santa Cruz Formation (Patagonia) spanning the onset of the Middle Miocene Climatic Optimum (MMCO) are analyzed to reconstruct vegetation response to the climatic event as well as to reconstruct vegetation heterogeneity across two stratigraphic layers, representing two snapshots of the SCF vegetation at two different times. Results show that before the onset of the MMCO southeastern Patagonia was characterized by heterogeneous habitats with abundant pooid C3 grasses and a woody component represented by conifers, dicots, as well as palms in varying abundance. This habitat corresponded to woodland or open woodland/shrubland, including palm shrubland. In the upper SCF, at the onset of the MMCO (inferred from isotopic data to be drier), grass abundance decreased, and phytolith assemblages indicate that the landscape was dominated by a woody component of the vegetation. In addition, grass communities were dominated by C3 pooid grasses whereas grasses of the tropical PACMAD clade (which includes both C3 and C4 grasses) were only a minor component of grass communities. We interpret these trends as reflecting the expansion of dry-adapted woody vegetation in response to MMCO climate change, and to the detriment of a C3 grass community which was not adapted to dry conditions. Further, we suggest that PACAMD grasses at the SCF were likely primarily C3, and the expansion of dry-adapted C4 grasses and grass-dominated open habitats did not take place in Patagonia until after the early middle Miocene.

The end-Permian Mass Extinction (EPME) caused the largest biodiversity loss and had the most severe impact on both marine and continental ecosystems in the Phanerozoic. Trace fossil analysis has proven useful for deciphering patterns of Early Triassic biotic recovery worldwide. In this study, a review of global Permian-Triassic trace fossil data from pre- and post-extinction intervals indicates that habitable zones preferentially developed in siliciclastic settings in high-latitude regions and mixed carbonate-siliciclastic settings in low latitude regions during the Griesbachian. These zones expanded greatly during the Spathian. The review also highlighted diachronous recovery of infaunal organisms between low- and high-latitude regions potentially reflecting greater stress from elevated Late Permian temperatures on equatorial to low-latitude oceans. Trace fossil and facies analysis was undertaken on two Lower-Middle Triassic stratigraphic sections in South China. The Susong section (Lower Yangtze Sedimentary Province) comprises a range of carbonate and mudstone facies that record overall shallowing from offshore to intertidal settings. The Tianshengqiao section (Upper Yangtze Sedimentary Province) consists of mixed carbonate and siliciclastic facies which were deposited in shallow marine to offshore settings. Griesbachian to Dienerian

ichnological records in both sections are characterized by low ichnodiversity, low ichnofabric indices (1-2) and low bedding plane bioturbation indices (1-2). Higher ichnofabric indices (3 and 4), corresponding to a dense population of diminutive ichnotaxon, in the Tianshengqiao section suggests opportunistic infaunal biotic activity during the earliest Triassic. Ichnological data from the Susong section show an increase in ichnodiversity during the late Smithian with 12 ichnogenera identified including Arenicolites, Chondrites, Didymaulichnus, Laevicyclus, Monocraterion, Palaeophycus, Phycodes, Plaolites, Rhizocorallium, Thalassinoides, Treptichnus, and Trichichnus. This is matched by increased ichnofabric indices of 4-5 and bedding plane bioturbation indices of 3-5. Although complex traces such as Rhizocorallium are present in Spathian-aged strata in this section, low ichnodiversity and ichnofabric indices and diminutive Planolites suggest a decline in recovery. In the Tianshengqiao section, ichnofabric indices are moderate to high (3-5) although only six ichnogenera are present and Planolites burrows are consistently small in Smithian strata. These stressed ichnological parameters remain unchanged during the Spathian. Complex traces such as large Rhizocorallium and Thalassinoides, and large Planolites, did not appear until the Anisian. Ichnological results from both sections record the response of organisms to unfavourable environmental conditions although the Susong section shows earlier recovery during the Smithian prior to latest Smithian-Spathian decline. This decline may have resulted from a temperature spike at the Smithian/Spathian boundary recognised in South China and elsewhere. Ichnological data from the Tianshengqiao section indicate protracted recovery throughout the Early Triassic. This is similar to previous studies in other parts of South China. Comparison of the South China trace fossil records with ichnological data from elsewhere highlights a diachronous pattern of recovery of trace makers and the influence of regional factors (such as paleogeography, tectonic and depositional history including location with respect to siliciclastic influx) on the rate of recovery.
This updated, illustrated guide to the fossil record of human evolution brings together for easy reference, in one source, all the major finds of fossil hominoids and hominids. An essential source in physical anthropology classrooms and laboratories. 1. Introduction 2. Dawn Apes: Oligocene and Miocene Hominoids 3. Australopithecus: Pliocene-Pleistocene Hominids 4. Homo Habilis: Pliocene-Pleistocene Hominids 5. Homo Erectus: Pleistocene Hominids 6. Early Archaic Homo Sapiens: Middle Pleistocene Hominids 7. Late Archaic Homo Sapiens: Upper Pleistocene Hominids 8. Modern Homo Sapiens: Late Pleistocene-Holocene Hominids

Community Ecology, Stable Isotope Ecology, and Taxonomy of Small Mammal Fossils from Rancho La Brea, Los Angeles, CA

The Fossil Record

The Adaptive Landscape in Evolutionary Biology

Bulletin 53

Human Origins

Intelligence" has long been considered to be a feature unique to human beings, giving us the capacity to imagine, to think, to deceive, to make complex connections between cause and effect, to devise elaborate stategies for solving problems. However, like all our other features, intelligence is a product of evolutionary change. Until recently, it was difficult to obtain evidence of this process from the frail testimony of a

few bones and stone tools. It has become clear in the last 15 years that the origins of human intelligence can be investigated by the comparative study of primates, our closest non-human relatives, giving strong impetus to the case for an "evolutionary psychology", the scientific study of the mind."

Evolution is an important concept in Biology. Textbooks on this subject list a number of evidences for organic evolution. One such evidence is what comes from the study of Fossils. In Part I of the book, in chapters 1 to 3, a definition for fossils is put forth and the methods of their study are briefly outlined, thereby introducing the reader to Paleontology, the science of fossil study, Chapters 4 to 7 in Part II of the book, give an exposition of the Thoughts, Observations, Concepts and Theories pertaining to Organic Evolution, the subject matter of Part II in general. These initial chapters are intended to lead the reader to a better understanding of the Fossil Evidences for Evolution among the various groups of organisms, including man, dealt with in the remaining chatters of this part, beginning with the Protists in chapter 8. Volume One terminates at this point, leaving the remaining 11 chapters of Part II to be covered in Volume Two that would also contain Part III on my Faith.

This textbook introduces research on dinosaurs by describing the science behind how we know what we know about dinosaurs. A wide range of topics is covered, from fossils and taphonomy to dinosaur physiology, evolution, and extinction. In addition, sedimentology, paleo-tectonics, and non-dinosaurian Mesozoic life are discussed. There is a special opportunity to capitalize on the enthusiasm for dinosaurs that students bring to classrooms to foster a deeper engagement in all sciences. Students are encouraged to synthesize information, employ critical thinking, construct hypotheses, devise methods to test these hypotheses, and come to new defensible conclusions, just as paleontologists do. Key Features Clear and easy to read dinosaur text with well-defined terminology Over 600 images and diagrams to illustrate concepts and aid learning Reading objectives for each chapter section to guide conceptual learning and encourage active reading Companion website (teachingdinosaurs.com) that includes supporting materials such as in-class activities, question banks, lists of suggested specimens, and more to encourage student participation and active learning Ending each chapter with a specific "What We Don’t Know" section to encourage student curiosity Related Titles Singer, R. Encyclopedia of Paleontology (ISBN 978-1-884964-96-1) Fiorillo, A. R. Alaska Dinosaurs: An Ancient Arctic World (ISBN 978-1-138-06087-6) Caldwell, M. W. The Origin of Snakes: Morphology and the Fossil Record (ISBN 978-1-4822-5134-0)

Patterns of evolution, as illustrated by the fossil record

Living in Stone

Fossil Record 3

Fossil Vertebrates of Greece Vol. 1

The Platyrrhine Fossil Record

Fossil Fungi

Extinction is the ultimate fate of all biological species - over 99 percent of the species that have ever inhabited the Earth are now extinct. The long fossil record of life provides scientists with crucial information about when species became extinct, which species were most vulnerable to extinction, and what processes may have brought about extinctions in the

geological past. Key aspects of extinctions in the history of life are here reviewed by six leading palaeontologists, providing a source text for geology and biology undergraduates as well as more advanced scholars. Topical issues such as the causes of mass extinctions and how animal and plant life has recovered from these cataclysmic events that have shaped biological evolution are dealt with. This helps us to view the biodiversity crisis in a broader context, and shows how large-scale extinctions have had profound and long-lasting effects on the Earth's biosphere.

Chapter Discussion Question: Teachers are encouraged to participate with the student as they complete the discussion questions. The purpose of the Chapter Purpose section is to introduce the chapter to the student. The Discussion Questions are meant to be thought-provoking. The student may not know the answers but should answer with their, thoughts, ideas, and knowledge of the subject using sound reasoning and logic. They should study the answers and compare them with their own thoughts. We recommend the teacher discuss the questions, the student's answers, and the correct answers with the student. This section should not be used for grading purposes. DVD: Each DVD is watched in its entirety to familiarize the student with each book in the course. They will watch it again as a summary as they complete each book. Students may also use the DVD for review, as needed, as they complete each chapter of the course. Chapter Worksheets: The worksheets are foundational to helping the student learn the material and come to a deeper understanding of the concepts presented. Often, the student will compare what we should find in the fossil record and in living creatures if evolution were true with what we actually find. This comparison clearly shows evolution is an empty theory simply based on the evidence. God's Word can be trusted and displayed both in the fossil record and in living creatures. Tests and Exams: There is a test for each chapter, sectional exams, and a comprehensive final exam for each book.

World record fever grips the second grade, and soon Ivy and Bean are trying to set their own record by becoming the youngest people to have ever discovered a dinosaur. But how hard is it to find one? Includes bonus material! - Sneak peek chapter from the next book in the Ivy + Bean series Ivy and Bean Take Care of the Babysitter by Annie Barrows, illustrated by Sophie Blackall

Coevolution and Paleoparasitological Techniques

Bulletin 16

Some Problems and Methods in Historical Biology

Bulletin 11

Ivy and Bean Break the Fossil Record

Rereading the Fossil Record

Contemporary species are undergoing population declines and extinction at rates unprecedented in recorded history. These ongoing global biodiversity losses are largely caused by human overpopulation and other anthropogenic impacts on the environment such as natural habitat destruction driven by urbanization, deforestation, agriculture, pollution, overconsumption of natural resources, and climate change. Understanding how species are influenced by - and respond to - various changes in their environment is critical for predicting and mitigating future biodiversity loss. These predictions are challenging, however, because

humans have been heavily modifying ecosystems for centuries - well before the advent of modern ecology as a field of study. Disentangling species responses to naturally occurring changes in their environment versus anthropogenic changes is thus extremely challenging. Paleoecological studies of fossil organisms can help establish the baseline responses of biota to natural environmental changes at times before humans dominated terrestrial ecosystems. However, these studies have their own set of challenges. For example, it can be difficult to determine how representative a preserved fossil community is of the original living community because the fossil record is inherently incomplete and often biased. It is also difficult to quantify species-specific responses to environmental change if the identity of species is unknown or imprecise; and due to the fragmentary nature of the fossil record, it can be difficult to identify isolated elements to species. The incompleteness of the fossil record does not only apply to the organisms preserved, but also to the environmental data documenting the contexts in which they operated while alive and during preservation. Most paleontological assemblages are affected by time-averaging and incomplete depositional sequences to some degree. Depending on the severity of time averaging, and the resolution of data collected, these temporal gaps can erase fine-scale and geologically rapid events that are important for understanding ecological patterns and processes. These unique opportunities and challenges of working with paleoecological data are what motivate my research. Within the scope of my dissertation, my goals are twofold. Foremost, I strive to quantify long-term biotic composition, diversity, and trait changes in response to pre-anthropogenic environmental change at population and community levels to establish baselines of organismal responses to natural ecosystem perturbations. However, to accomplish this, it is first necessary to quantify the strengths and limitations of paleontological data in these systems and maximize data resolution to mitigate erroneous interpretations. The main data types I focus on improving here are those of taxonomic fidelity and age control. The first three chapters of my dissertation focus on the former, using morphometric techniques to improve identification accuracy of closely related and morphologically similar species, thus extending paleoecological data resolution from genus to species for several taxa. The last two chapters of my dissertation focus on the latter, examining paleoecological data at various levels of temporal precision using a combination of radiocarbon-dated and time-averaged data to determine how analytical results and conclusions are affected by time-averaging. Once these limitations have been quantified and mitigated to the extent possible, I determine how the focal taxa of my study system were impacted by long-term environmental changes using multidisciplinary approaches. Chapter 3 focuses on intraspecific phenotypic responses to climate change using geometric morphometrics, Chapter 4 evaluates long-term changes in biotic community structure using diversity and trait metrics, and Chapter 5 quantifies the relative impacts of climate and biotic interactions on species niches over the last 50,000 years using stable isotope analysis. My study system for addressing all these topics is Rancho La Brea (RLB), a world renowned late Quaternary paleontological locality in Los Angeles, California, USA. I specifically examine the small mammals (e.g., rodents, lagomorphs, and soricomorphs) of this locality because they are ubiquitous across most Quaternary fossil assemblages, thus facilitating large sample sizes. In addition, small mammals are generally short lived and confined to small home ranges, so I am relatively certain that the paleoecological signals I track within samples are local

and geologically instantaneous rather than substantially spatially or temporally averaged. Results of the three taxonomic studies indicate that, although closely related and speciose small mammals are difficult to differentiate due to morphological variation and overlap, they can be identified to species with relatively good accuracy, usually> 80%, using quantitative techniques including morphometric and geometric morphometric measurements and statistical grouping analyses (Chapters 1-3). However, results can deviate considerably if data acquisition processes are not standardized. For example, geometric morphometric data collected by different personnel and, to a lesser extent, with different instruments can generate substantially different classification statistics (Chapter 2). It is therefore recommended that data acquisition procedures are standardized as much as possible to facilitate analytical replicability. Comparisons of time-averaged trait datasets (Chapters 4 and 5) to those with good age control (Chapter 5) further show that much information can be lost from geologically rapid events when data is time-averaged or time-binned versus continuous data. Such loss of information can then result in profoundly different interpretations regarding the probable drivers of observed paleoecological patterns (Chapter 5). With these insights and limitations in mind, I show that local environments of RLB during the last glacial period (specifically Marine Isotope Stage (MIS) 3, ~60,000 to 29,000 years BP) were generally similar to that of the Los Angeles Basin today based on overall similarities between contemporary and fossil small mammal faunas (Chapter 4). Changes in taxonomic abundances and trait diversity among deposits of different mean ages suggest that the small mammal communities of RLB were responding to slight or moderate changes in temperature and precipitation during that time (Chapter 4). Unfortunately, precise information on the timing and pattern of environmental changes cannot be discerned at the community level due to the time-averaged nature of the deposits and faunas examined, combined with the variable climates during MIS 3. By subsequently examining the isotopic niches of individually-dated specimens, however, it becomes clear that geologically rapid environmental changes were occurring at RLB throughout the late Quaternary that largely reflect regional climate patterns (Chapter 5). Further, the isotopic niches of small mammals appear to be shaped more strongly by those climatic oscillations than by biotic interactions over the last 50,000 years. Insights on the paleoenvironments of RLB (Chapter 4) and climatic changes that likely occurred there during the late Quaternary (Chapter 5) have significant implications for studies of other RLB biota in that species responses to changing environments can be better contextualized now that those changes are better understood. In a broader context, my work quantifying geometric morphometric error (Chapter 2) and time-averaging error (Chapter 5) may facilitate best practices protocols for similar study systems. Finally, my taxonomic identification protocols for lagomorphs (Chapter 1) and woodrats (Chapter 3) should be useful for other small mammal studies because lagomorph remains are common at most late Quaternary sites and woodrat species are good indicators of paleoecological conditions and change.

Earth’s Evolving Systems: The History of Planet Earth, Second Edition is an introductory text designed for popular courses in undergraduate Earth history. Written from a “systems perspective,” it provides coverage of the lithosphere, hydrosphere, atmosphere, and biosphere, and discussion of how those systems interacted over the course of geologic time.

1. Papers presented at a joint meeting of the Geological Society of London and the Palaeontological Association held in the

Department of Geology, University College of Swansea, on 20-21 Dec. 1965. 2. Documentation of the fossil record. 3. Computer analysis.

Toward a Modern-based, Quantitative Approach to Reconstruct Vegetation Change During the MMCO of Patagonia, Argentina

Fossil Record 6 Volume 2

New Mexico's Fossil Record One

Evolutionary Origins of Intelligence

The Trace-Fossil Record of Major Evolutionary Events

Unearthing Evolution

Derived from a best seller, The Fossil Record of Primate Evolution has been expanded with a focus on primate phylogeny. This updated edition will include information on living primates as a context for discussing the fossils. Special attention will be paid to the molecular classifications of organisms. With copious illustrations, the delineation of primate evolutionary history is logical and consistent. Uniquely adapted for scholars looking for a core text in this area. *Revised to focus on primate evolution and brings together the very latest information that is available *Ample tables and illustrations that complement the text *Helpful ancillary materials include a comprehensive glossary and a classification chart of order primates

Fungi are ubiquitous in the world and responsible for driving the evolution and governing the sustainability of ecosystems now and in the past. Fossil Fungi is the first encyclopedic book devoted exclusively to fossil fungi and their activities through geologic time. The book begins with the historical context of research on fossil fungi (paleomycology), followed by how fungi are formed and studied as fossils, and their age. The next six chapters focus on the major lineages of fungi, arranging them in phylogenetic order and placing the fossils within a systematic framework. For each fossil the age and provenance are provided. Each chapter provides a detailed introduction to the living members of the group and a discussion of the fossils that are believed to belong in this group. The extensive bibliography (~ 2700 entries) includes papers on both extant and fossil fungi. Additional chapters include lichens, fungal spores, and the interactions of fungi with plants, animals, and the geosphere. The final chapter includes a discussion of fossil bacteria and other organisms that are fungal-like in appearance, and known from the fossil record. The book includes more than 475 illustrations, almost all in color, of fossil fungi, line drawings, and portraits of people, as well as a glossary of more than 700 mycological and paleontological terms that will be useful to both biologists and geoscientists. First book devoted to the whole spectrum of the fossil record of fungi, ranging from Proterozoic fossils to the role of fungi in rock weathering Detailed discussion of how fossil fungi are preserved and studied Extensive bibliography with more than 2000 entries Where possible, fungal fossils are placed in a modern systematic context Each chapter within the systematic treatment of fungal lineages introduced with an easy-to-understand presentation of the main characters that define extant members Extensive glossary of more than 700 entries that define both biological, geological, and mycological terminology

There is great benefit to bringing sedimentary and stratigraphic data into the field of paleontology, bridging the gap between biology and geology. The first two chapters of this work use two large databases to examine interactions between the rock and fossil records. The Paleobiology Database (http://paleobiodb.org) contains extensive data on fossil occurrences; the Macrostrat Database (http://macrostrat.org) includes stratigraphic and lithologic information on rock packages that facilitates the examination of spatiotemporal patterns of sedimentation. Chapter 1 examines how long term non-marine diversity patterns may be influenced by the rock record, by analyzing the proportion of non-marine stratigraphic packages in the

Macrostrat Database that have fossil occurrences cited in the Paleobiology Database. I find no correlation between this proportion and estimates of terrestrial biodiversity in North America, suggesting that sampling bias has imparted little or no signal in these diversity estimates. In Chapter 2, I show that macroevolutionary and macrostratigraphic patterns are correlated more strongly in marine environments than in non-marine. I also examine the relationship between lithologic and taxonomic diversity through time. This relationship differs in the marine and non-marine realms, suggesting a difference between realms in the bias imposed by the rock record on biological patterns. Chapter 3 examines the possible influence of geologic processes on the evolutionary history of grazers and grasslands in North America. I employ the Macrostrat Database to examine the occurrence of volcanic and volcaniclastic deposits in the Cenozoic of North America. I then use this and more detailed sedimentologic information from the Wind River Basin, in conjunction with data on tooth wear and hypsodonty in Eocene mammals, to examine the possible influence of volcanic sediments on mammal evolution. An increase in tooth wear is coincident with an increase in volcanism, suggesting that volcanic grit was an important driver of tooth evolution. The work contained within this dissertation highlights why it is essential to interpret paleontological data in a geologic context.

The History and Philosophy of Behavior, Morphology, and Traces in the Fossil Record

The Thinking Ape

Dinosaurs

Volume One

Fossils, Evolution and My Faith

Bulletin 74

Although fossils have provided some of the most important evidence for evolution, the discipline of paleontology has not always had a central place in evolutionary biology. Beginning in Darwin's day, and for much of the twentieth century, paleontologists were often regarded as mere fossil collectors by many evolutionary biologists, their attempts to contribute to evolutionary theory ignored or regarded with scorn. In the 1950s, however, paleontologists began mounting a counter-movement that insisted on the valid, important, and original contribution of paleontology to evolutionary theory. This movement, called "paleobiology" by its proponents, advocated for an approach to the fossil record that was theoretical, quantitative, and oriented towards explaining the broad patterns of evolution and extinction in the history of life. Rereading the Fossil Record provides, as never before, a historical account of the origin, rise, and importance of paleobiology, from the mid-nineteenth century to the late 1980s. Drawing on a wealth of archival material, David Sepkoski shows how the movement was conceived and promoted by a small but influential group of paleontologists—including Stephen Jay Gould and Niles Eldredge, among others—and examines the intellectual, disciplinary, and political dynamics involved in the ascendency of paleobiology. By emphasizing the close relationship between paleobiology and other

evolutionary disciplines, this book writes a new chapter in the history of evolutionary biology, while also offering insights into the dynamics of disciplinary change in modern science.
This book presents a comprehensive overview of the science of the history of life. Paleobiologists bring many analytical tools to bear in interpreting the fossil record and the book introduces the latest techniques, from multivariate investigations of biogeography and biostratigraphy to engineering analysis of dinosaur skulls, and from homeobox genes to cladistics. All the well-known fossil groups are included, including microfossils and invertebrates, but an important feature is the thorough coverage of plants, vertebrates and trace fossils together with discussion of the origins of both life and the metazoans. All key related subjects are introduced, such as systematics, ecology, evolution and development, stratigraphy and their roles in understanding where life came from and how it evolved and diversified. Unique features of the book are the numerous case studies from current research that lead students to the primary literature, analytical and mathematical explanations and tools, together with associated problem sets and practical schedules for instructors and students. New to this edition The text and figures have been updated throughout to reflect current opinion on all aspects New case studies illustrate the chapters, drawn from a broad distribution internationally Chapters on Macroevolution, Form and Function, Mass extinctions, Origin of Life, and Origin of Metazoans have been entirely rewritten to reflect substantial advances in these topics There is a new focus on careers in paleobiology
From the Foreword: "Predator-prey interactions are among the most significant of all organism-organism interactions....It will only be by compiling and evaluating data on predator-prey relations as they are recorded in the fossil record that we can hope to tease apart their role in the tangled web of evolutionary interaction over time. This volume, compiled by a group of expert specialists on the evidence of predator-prey interactions in the fossil record, is a pioneering effort to collate the information now accumulating in this important field. It will be a standard reference on which future study of one of the central dynamics of ecology as seen in the fossil record will be built." (Richard K. Bambach, Professor Emeritus, Virginia Tech, Associate of the Botanical Museum, Harvard University)
Extinctions in the History of Life
Life Science (Teacher Guide)
Volume 1: Precambrian and Paleozoic

New Mexico's Fossil Record 2

Connecting Geological and Biological Histories in the Fossil Record of North America

The Growth of Paleobiology as an Evolutionary Discipline

Why and How: Some Problems and Methods in Historical Biology discusses an overall approach to the study of fossils combined with paleontology. This book is divided into six chapters. Chapter 1 consists of a few examples of studies of the fossil record, focusing on its adequacy, and ways of looking at and representing some of its aspects. The most basic aspects of study of the fossil record such as the examination, description, and illustration of the morphology of fossils are described in Chapter 2. Chapter 3 focuses on paleoecology and faunal analysis, while Chapter 4 emphasizes some of the aspects of phylogenetic principles and eclectic taxonomic theory. The essential apparatus for zoological studies that include biometrical statistics both in concepts and in measures are deliberated in Chapter 5. The last chapter deliberates the geographic distribution of organisms. This publication is a good source for paleontologists and biologists interested in historical biology.

When future intellectual historians list the books that toppled Darwins theory, The Design of Life will be at the top. So writes Lehigh biochemist Michael Behe, a leading critic of Darwinism and proponent of intelligent design.The scientific community continues to wrestle with deep and fundamental questions: Where did the universe come from? How did life originate? How did a coded language like our DNA come to form the basis of life? How could multicellular life form so suddenly from unicellular life? What is the origin of the complex molecular machines, essential to life, which are inside every cell of our bodies? The Design of Life gives all interested parties in the debate over biological origins the hard scientific evidence they need to assess the true state of Darwins theory and of the theory of intelligent design. But it does much more: it carefully fosters the attitude of open inquiry that science needs not only to thrive but also to avoid becoming subservient to special interests. In this book, authors William Dembski and Jonathan Wells empower readers to navigate the captivating and controversial waters of biological origins.The Design of Life has nine chapters, each of which is accompanied by Endnotes and Discussion Questions. The ninth, an Epilogue, is followed by a 12-page Glossary and a 14-page Index. The General Notes on an accompanying CD supply each

chapter with additional analysis and discussion at a more advanced level. A Foreword by University of South Dakota biologist William S. Harris introduces the book. Chapter 1 Human Origins. This chapter addresses key topics in human origins - the 98% gene identity (base sequences) between chimpanzees and humans, the significance of brain size to intelligence, the uniqueness of human language, and the challenge that altruism poses to evolutionary ethics. Chapter 2 Genetics and Macroevolution. This chapter examines Darwins theory of evolution, Mendelian inheritance, the adaptational package, the molecular basis for genes and evolution, and evolutionary developmental biology (Evo-Devo).Chapter 3 The Fossil Record. This chapter examines major patterns in the fossil record, the failure of Darwins theory to match up with these patterns (a failure Darwin himself regarded as the gravest objection to his theory), and why fossils alone cannot establish evolutionary lines of descent. Chapter 4 The Origin of Species. This chapter describes theories about how new species originate. It explains the critical distinction between evidence for small changes and claims about vast transformations (micro- vs. macroevolution), It also explains why the current examples of alleged new species (observed speciation) provide no evidence for macroevolution.Chapter 5 Similar Features. This chapter discusses analogy and homology do things look alike because they do the same job, like scissors, or because they are related, like siblings? The puzzling story of the pandas provides a useful illustration. It also looks at molecular phylogeny, vestigial structures, and the discredited story of recapitulation.Chapter 6 Irreducible Complexity. This chapter discusses biochemist Michael Behes concept of irreducible complexity and then applies it to molecular machines inside the cell, such as the bacterial flagellum. Conventional evolutionary explanations (coevolution and co-option) are contrasted with intelligent design explanations, which are seen as more powerful and scientifically fruitful. Chapter 7 Specified Complexity. This chapter characterizes specified complexity as an information-theoretic property of structures that places them beyond the reach of chance-based explanations (such as natural selection and random variation). It then applies the theory of specified complexity to biological systems, demonstrating their actual design.Chapter 8 The Origin of Life. This chapter describes why the origin of life is such a difficult problem and examines the main materialistic proposals (Oparins Hypothesis, the Miller-Urey experiment,

the RNA world, self-organization, molecular Darwinism). It summarizes the failure to find a non-intelligent origin.Chapter 9 Epilogue: The Inherit the Wind Stereotype. The Epilogue examines key social interpretations of the issues: The movie Inherit the Wind (Hollywoods stereotype of the Scopes Monkey Trial), the actual Scopes Trial, the importance of keeping science honest, and the 2005 Kitzmiller v. Dover trial.

This dissertation presents the first comprehensive history and philosophy of the "fossil behavior" of organisms, known as paleobehavior, with an emphasis on the study of fossilized traces such as footprints, nests, and burrows, known as ichnology. It consists of two parts: the first is historical, containing three chapters, while the second is philosophical, containing two chapters. Chapter 1 shows how the analysis of fossil footprints in 19th century New England, by Edward Hitchcock, led to a science of these objects that challenged the then dominant non-evolutionary theory of anatomy, making room for evolutionary approaches, as well as served as the first stage of a revision of paleontological research away from focus on organisms to a focus on their impacts and chimeric parts. Chapter 2 shows how the problems raised by chimeric fossils, in the late 19th century, led to a paleontological approach, primarily seen in the work of Henry Osborn, that decentralized the organism, not focusing on the individual but, rather, on its singular characters. Moreover, it shows how the independent evolution of organismal parts was seen by paleontologists as driven by the conscious decisions of organisms, by their choice on what to eat and how to survive even leading to an argument from paleontology to panpsychism, as seen in the work of Edward Cope. Chapter 3 shows how the single-character perspective described in the previous chapter combined with an emphasis on behavior and traces to lead to insights on a new domain of fossils: fossil burrows. It describes how ichnologist Adolf Seilacher learned that fossil burrows had phylogenies, ontogenies, ecologies, and evolutionary trends of their own that were tied more to behavior and the environment than to morphology. The second part of this dissertation, philosophical in nature, explores the themes of novelty (Chapter 4) and incoherence (Chapter 5) in science. Chapter 4 describes a research strategy, called an epistemic boomerang, used by paleontologists to make inferences about fossils that are novel when compared to any forms or behaviors known in the present and describes how paleontologists attempted to infer collections of behaviors

holistically; it also suggests avenues for future research based on the most scientifically fecund of these research strategies. Chapter 5 presents an epistemology, developed using cases from the history described above, which captures the mechanism by which research strategies, initially aiming at coherence, develop to become modular by way of the inclusion of foreign elements via kluges and become suitable for being mixed and matched with external concepts and methods to generate new research methods.

Implications for Biotic Recovery from the End-Permian Mass Extinction

The Biology of Crustacea

The Fossil Record of Primate Evolution

The Design of Life

Book 3

Basal Vertebrates, Amphibians, Reptiles, Afrotherians, Glires, and Primates

The 'Adaptive Landscape' has been a central concept in population genetics and evolutionary biology since this powerful metaphor was first formulated in 1932. This volume brings together historians of science, philosophers, ecologists, and evolutionary biologists, to discuss the state of the art from several different perspectives.

The Biology of Crustacea

This new text sets out to establish the key role played bysystematics in deciphering patterns of evolution from the fossilrecord. It begins by considering the nature of the species in thefossil record and then outlines recent advances in the methodologyused to establish phylogenetics relationships, stressing why fossilevidence can be crucial. The way species are grouped into highertaxa, and how this affects their utility in evolutionary studies isalso discussed. Because the fossil record abounds with sampling andpreservational biases, the book emphasizes that observed patternscan rarely be taken at face value. It is argued that evolutionarytrees, constructed from combining phylogenetic and biostratigraphicdata, provide the best approach for investigating patterns ofevolution through geologic time. The only integrated text covering the study of evolutionarypatterns from a phylogenetic stance.

How We Know What We Know

Phytoliths from Modern and Ancient Habitats

Why and How

Fossil Record 6 Volume 1
The Evolution and Fossil Record of Parasitism
New Mexico's Fossil Record 1

The Platyrrhine Fossil Record is a compendium of papers presented in a symposium of the 12th Congress of the International Congress of Primatology held in Brazil. One paper reviews evidence from fossil platyrrhines where the author concludes new dating and environmental data where these animals lived. Another paper describes the major changes pertaining to South American mammalian fauna during the Cenozoic Era, which he relates to global and regional geotectonic changes. Other papers review the paleontology and geology of the Miocene Pintura Formation and reassess the morphological transformations traditionally assumed as having been involved in platyrrhine phylogeny. One author also proposes that a prosimian-like ancestor is probably the predecessors of anthropoids; any similarities and primitive mammals can be evolutionary reversals associated with quadrupedal movements. The text also addresses the issue whether anthropoids, including platyrrhines, evolved from a prosimian ancestor or prosimians are just a group with mammalian postcranial skeletal structure. One author also reviews fossil remains found in the Caribbean, citing seven endemic taxa of platyrrhines in Cuba, Hispaniola, and Jamaica. Anthropologists, researchers involved in anatomical sciences, academicians, and administrators whose works are connected with museums of natural history or institutes of primate research will find this collection valuable.

Rereading the Fossil Record presents the first-ever historical account of the origin, rise, and importance of paleobiology, from the mid-nineteenth century to the late 1980s. Drawing on a wealth of archival material, David Sepkoski shows how the movement was conceived and promoted by a small but influential group of paleontologists and examines the intellectual, disciplinary, and political dynamics involved in the ascendency of paleobiology. By tracing the role of computer technology, large databases, and quantitative analytical methods in the emergence of paleobiology, this book also offers insight into the growing prominence and centrality of data-driven approaches in recent science.

Patterns of evolution, as illustrated by the fossil record
Early Triassic Trace Fossils from South China
Origins & Scientific Theory
Fossil Record 5
Systematics and the Fossil Record
Fossil Record Manual - 1
A Symposium with Documentation

This volume addresses major evolutionary changes that took place during the Ediacaran and the Paleozoic. These include discussions on the nature of Ediacaran ecosystems, as well as the ichnologic signature of evolutionary radiations, such as the Cambrian explosion and the Great Ordovician biodiversification event, the invasion of the land, and the end-Permian mass extinction. This volume set provides innovative reviews of the major evolutionary events in the history of life from an ichnologic perspective. Because the long temporal range of trace fossils has been commonly emphasized, biogenic structures have been traditionally overlooked in macroevolution. However, comparisons of ichnofaunas through geologic time do reveal the changing ecology of organism-substrate interactions. The use of trace fossils in evolutionary paleoecology represents a new trend that is opening a window for our understanding of major evolutionary radiations and mass extinctions. Trace fossils provide crucial evidence for the recognition of spatial and temporal patterns and processes associated with paleoecologic breakthroughs.

Unearthing EvolutionConnecting Geological and Biological Histories in the Fossil Record of North America

Earth's Evolving Systems

FOSSIL RECORD 7

Volume 1: Systematics, The Fossil Record, And Biogeography

Predator-Prey Interactions in the Fossil Record

Documenting Evolutionary Patterns

Introduction to Paleobiology and the Fossil Record