DOWNLOAD PDF CRETACEOUS FOSSIL VERTEBRATES

Chapter 1 : Chinese Cretaceous fossil highlights avian evolution

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Beringia from a Cretaceous Perspective By A. Elias National Park and Preserve are shown here. National Park Service units in Alaska contain some of the most informative fossil-bearing rocks anywhere in North America. By linking similar aged rock units in National Park Service lands with the fossil resources found on other federally-administered public lands, important paleoecological insights on specific ecosystems can be obtained. Elias , and the North Slope of Alaska provide some of the most significant opportunities to examine a regional ancient terrestrial ecosystem in detail. Additionally, paleontological work on similar aged rocks in southwestern Alaska in Aniakchak National Monument has shown that this ecosystem is recorded across the state Fiorillo and Parrish This ecosystem supported a rich dinosaurian fauna as well as other fossil vertebrates such as mammals, birds, and fishes Fiorillo , Gangloff The Cantwell Formation is an extensive rock unit exposed throughout much of Denali and is now known to contain thousands of fossil vertebrate footprints Fiorillo et al. The rock unit is thousands of meters thick and consists of an upper, dominantly volcanic unit and lower, dominantly fluvial unit. Pollen analysis for the lower Cantwell Formation shows the rock unit to have been deposited during the latest Cretaceous. Sedimentation was dominated by stream and lacustrine environments, at times with a marginal marine influence. The vegetation at the time was dominated by conifer forests, and a mosaic of angiosperms in the forest understory. Unnamed rocks in Yukon-Charley have been mapped as Cretaceous-Tertiary in age based on fossil floral remains Brabb , Dover and Miyaoka The depositional environments of these rocks, like the Cantwell Formation, represent rivers and floodplains. Given that they may be similar in age to those in Denali they are included here. The forest of this park unit was dominated by Metasequoia. No dinosaur remains have been found in these rocks. Cretaceous hadrosaur duck-billed dinosaur footprint from Denali National Park and Preserve. Elias also contains unnamed rocks of Cretaceous age Richter Recent preliminary paleontological field work has now shown that these rocks contain multiple dinosaur footprint types attributable to predatory dinosaurs and herbivorous dinosaurs. Whereas forests dominated the landscape in other regions, the rocks of this park suggest that forest cover was limited and instead the vegetative cover was dominated by expansive fern prairies. The limited forest cover replaced by fern cover may have been the result of a more dynamic river system that flooded the landscape more frequently compared to any of the other regions. NPS units containing a fossil vertebrate record discussed here are so far based solely on fossil footprints. By contrast, comparably aged rocks on the North Slope contain an abundance of fossil bones, mostly dinosaurian, with only a minor record of fossil footprints. These two types of records then provide independent means to test ecosystem hypotheses. Florally, an abundant and diverse assemblage of pollen, spores, amber, algae, and other microscopic plant debris has been recovered from the North Slope. The vegetation for this region of Alaska during the latest Cretaceous was dominated by conifer forests across the coastal plain and a mosaic of broad-leafed deciduous forest in riparian areas. The understory probably consisted of ferns and smaller angiosperms. The depositional environment for the Late Cretaceous dinosaur-bearing units was that of a low-energy alluvial coastal plain. The floodplain was wet, but water levels probably fluctuated from shallow standing water to dry and subaerially exposed, possibly on a seasonal basis. Beringian ecosystems have fostered specializations of flora and fauna over time, as is especially evident among those vertebrates that leave abundant fossils. Striking faunal and floral structural parallels in ecosystems are manifest in the Cretaceous of this region. Current paleontological investigations on correlative fossil-bearing rocks in these three regions, combined with revised tectonic reconstructions of the region lead us to conclude that Beringia originated some million years ago Fiorillo This extension of Beringia back in time re-quires a reordering of the importance we assign to under-lying mechanisms. Atmospheric and oceanic phenomena remain important climate variables to explain the Quaternary changes in Beringia. In other words, tectonics has been the defining parameter for Beringia Paleoclimate data show that temperatures in the northern polar regions were significantly warmer during the Cretaceous compared to the modern data e. Studying ancient Beringia provides a unique opportunity to compare high latitude ecosystem dynamics under

contrasting greenhouse and icehouse conditions. Cretaceous sedimentary rocks representing ancient river channels and floodplains in Denali National Park and Preserve. Museum of Nature and Science Role 2: High sea levels facilitate exchanges of marine biota between the Pacific Ocean and Arctic Basin; lower sea levels enable terrestrial faunal and floral exchanges between Asia and North America. Recent advances in resolution of geochronologic methods show us that climate-driven sea level changes have been relatively recent and weak determinants of biogeographic patternsâ€"the final epilogue to a Beringia story spanning million years. Pre-Quaternary connection of Asia to North America was acknowledged with the broad acceptance of plate tectonic theory Hopkins a, Cox , Marincovich et al. Quaternary Beringia enjoys a year head start over the concept of Mesozoic Beringia. Cretaceous fossil fern from Wrangell-St. Elias National Park and Preserve. He conceived of Beringia as the major ice-free refugium for terrestrial northern vascular plants being excluded and extirpated elsewhere by glaciers and continental ice sheets during glacial maxima. Since the mid-twentieth century, biogeographers and paleontologists have credited Beringia with additional functions in the diversification of biota over increasing spans of geological time in the Northern Hemisphere cf. Collectively, these scientific efforts remain compartmentalized and under-recognized across boundaries separating disciplinary specialties. Evidence from dinosaur paleontology in Alaska, however, suggests that reaffirming the Cretaceous underpinnings of Beringia can lead to a timely synthesis of ideas between biogeographers and geologists. Viewing Beringia as rooted in the Cretaceous reminds us that details of current phenomena and of the more recent past blur into broader generalizations further back in time. Likewise, subtle taxonomic affinities and distinctions among extant biota are replaced by larger, more radical, taxonomic distinctions in the more distant past. The in-terdisciplinary challenge for paleontologists is nevertheless to remain conversant with the nuances that modern sciences bring to bear on understanding current biological systems. Geological Survey once carried out this facilitation e. History and evolution of the arctic flora: Evolution of the Cretaceous Ocean-Climate System. Geological Society of America Special Paper Vertebrate palaeodistributional patterns and continental drift. Review of the Dinosaur Record of Alaska with comments regarding Korean Dinosaurs as comparable high-latitude fossil faunas. Journal of Paleontological Society of Korea, 22 1: Cretaceous dinosaurs of Alaska: Implications for the origins of Beringia. Alaska Park Science 6: The first record of a Cretaceous dinosaur from western Alaska. The Cenozoic history of Beringia-A synthesis. The Bering Land Bridge. Outline of the history of Arctic and Boreal biota during the Quarternary period. Reprint of the Stockholm edition. Late Mesozoic and Cenozoic paleogeographic and paleoclimatic history of the Arctic Ocean Basin, based on shallow-water marine faunas and terrestrial vertebrates. L, edited by A. Geological Society of America. The last giant of Beringia: The mystery of the Bering land bridge. Geologic map of the Nabesna Quadrangle, Alaska. United States Geological Survey. Miscellaneous Investigations Map I, 1: Patterns of animal dispersal, vicariance and diversification in the Holarctic. Biological Journal of the Linnean Society

Chapter 2 : Cretaceous Fish

The Cretaceous-Paleogene (K-Pg) extinction event, also known as the Cretaceous-Tertiary (K-T) extinction, was a sudden mass extinction of some three-quarters of the plant and animal species on Earth, approximately 66 million years ago.

Published online Jan 8. This article has been cited by other articles in PMC. Abstract The Late Cretaceous was a time of tremendous global change, as the final stages of the Age of Dinosaurs were shaped by climate and sea level fluctuations and witness to marked paleogeographic and faunal changes, before the end-Cretaceous bolide impact. The terrestrial fossil record of Late Cretaceous Europe is becoming increasingly better understood, based largely on intensive fieldwork over the past two decades, promising new insights into latest Cretaceous faunal evolution. We review the terrestrial Late Cretaceous record from Europe and discuss its importance for understanding the paleogeography, ecology, evolution, and extinction of land-dwelling vertebrates. These faunas lived on an island archipelago, and we describe how this insular setting led to ecological peculiarities such as low diversity, a preponderance of primitive taxa, and marked changes in morphology particularly body size dwarfing. We conclude by discussing the importance of the European record in understanding the end-Cretaceous extinction and show that there is no clear evidence that dinosaurs or other groups were undergoing long-term declines in Europe prior to the bolide impact. Late Cretaceous, Europe, island, faunal evolution, paleobiogeography, extinction Introduction The most iconic picture of a Late Cretaceous terrestrial ecosystem is probably Tyrannosaurus attacking Triceratops on the vast, fertile floodplains of North America, as a suite of smaller dinosaurs, mammals, crocodyliforms, turtles, and pterosaurs look on. This vignette has been repeated often in movies and museum exhibits, and for good reason: For this reason, much of our understanding of how dinosaurs and other organisms were living, interacting, and evolving during the final few million years before the K-Pg extinction comes from careful study of the North American record. In recent years, however, the fossil record of the latest Cretaceous in Europe has improved tremendously. Large-scale fieldwork programs in France, Hungary, Portugal, Romania, and Spain have revealed a wealth of new taxa, ranging from carnivorous, duck-billed, and long-necked dinosaurs to mammals, crocodyliforms, turtles, pterosaurs, squamates, and numerous kinds of fishes. The phylogenetic relationships and paleobiology of many of these taxa have been studied in detail, leading to a better understanding of their evolution and behavior, and how they interacted with each other to form complex terrestrial ecosystems during the final stages of the Age of Dinosaurs. As we learn more about the European faunas, it is becoming increasingly clear that their evolution, paleogeographic composition, and ecologies were complex, and have an important story to tell in regards to how dinosaurs and other organisms were changing before the end-Cretaceous bolide impact. In this paper, we review the current state of the European Late Cretaceous terrestrial fossil record Fig. We begin with a paleogeographic overview of Europe during this time, which describes the island archipelago layout of Europe during the high sea levels of the terminal Cretaceous. We then outline the major faunas from Hungary, France, Iberia, and Romania, introduced by a brief overview of the lesser-known faunas from elsewhere in Europe. This is followed by a discussion about what the European faunas tell us about insular, island communities and evolution during the Mesozoic. Finally, we briefly review the relevance of the European faunas for understanding the end-Cretaceous extinction, and argue that although Europe had experienced some ecological reorganization during the waning years of the Cretaceous, there is no strong evidence that dinosaurs and other organisms gradually wasted away to extinction. In fact, there is now evidence that non-avian dinosaurs were present in Europe within , years of the K-Pg boundary, the finest resolution permitted by the current fossil record.

Chapter 3 : Cretaceousâ€“Paleogene extinction event - Wikipedia

Compared to invertebrates, vertebrates are rare in the fossil record. Fossil bones are occasionally found in Cretaceous deposits of southwestern Arkansas where several extinct marine reptiles such as mosasaurs and dinosaurs have been discovered.

Oâ€”S The blue graph shows the apparent percentage not the absolute number of marine animal genera becoming extinct during any given time interval. It does not represent all marine species, just those that are readily fossilized. The labels of the traditional "Big Five" extinction events and the more recently recognised End-Capitanian extinction event are clickable hyperlinks; see Extinction event for more details. Non-avian dinosaurs, for example, are known from the Maastrichtian of North America, Europe, Asia, Africa, South America, and Antarctica, [30] but are unknown from the Cenozoic anywhere in the world. Similarly, fossil pollen shows devastation of the plant communities in areas as far apart as New Mexico, Alaska, China, and New Zealand. Species that depended on photosynthesis declined or became extinct as atmospheric particles blocked sunlight and reduced the solar energy reaching the ground. This plant extinction caused a major reshuffling of the dominant plant groups. No purely herbivorous or carnivorous mammals seem to have survived. Rather, the surviving mammals and birds fed on insects , worms , and snails, which in turn fed on detritus dead plant and animal matter. Extinction was more severe among animals living in the water column than among animals living on or in the sea floor. Animals in the water column are almost entirely dependent on primary production from living phytoplankton, while animals on the ocean floor always or sometimes feed on detritus. For example, it is thought that ammonites were the principal food of mosasaurs , a group of giant marine reptiles that became extinct at the boundary. Modern crocodilians can live as scavengers and survive for months without food, and their young are small, grow slowly, and feed largely on invertebrates and dead organisms for their first few years. These characteristics have been linked to crocodilian survival at the end of the Cretaceous. There is no evidence of mass extinction of these organisms, and there is support for high productivity of these species in southern high latitudes as a result of cooling temperatures in the early Paleocene. As the marine microbiota recovered, however, it is thought that increased speciation of benthic foraminifera resulted from the increase in food sources. Ultimate recovery of the benthic populations occurred over several stages lasting several hundred thousand years into the early Paleocene. The apparent rate is influenced by a lack of fossil records, rather than extinctions. A review of these fossils shows that ostracod diversity was lower in the Paleocene than any other time in the Cenozoic. Current research cannot ascertain, however, whether the extinctions occurred prior to, or during, the boundary interval. The solitary corals, which generally do not form reefs and inhabit colder and deeper below the photic zone areas of the ocean were less impacted by the Kâ€”Pg boundary. Colonial coral species rely upon symbiosis with photosynthetic algae , which collapsed due to the events surrounding the Kâ€”Pg boundary, [45] [46] however, the use of data from coral fossils to support Kâ€”Pg extinction and subsequent Paleocene recovery, must be weighed against the changes that occurred in coral ecosystems through the Kâ€”Pg boundary. These included the ecologically significant belemnoids , as well as the ammonoids , a group of highly diverse, numerous, and widely distributed shelled cephalopods. Researchers have pointed out that the reproductive strategy of the surviving nautiloids, which rely upon few and larger eggs, played a role in outsurviving their ammonoid counterparts through the extinction event. The ammonoids utilized a planktonic strategy of reproduction numerous eggs and planktonic larvae , which would have been devastated by the Kâ€”Pg extinction event. Additional research has shown that subsequent to this elimination of ammonoids from the global biota, nautiloids began an evolutionary radiation into shell shapes and complexities theretofore known only from ammonoids. Mid-latitude, deep-water echinoderms were much less affected at the Kâ€”Pg boundary. The pattern of extinction points to habitat loss, specifically the drowning of carbonate platforms , the shallow-water reefs in existence at that time, by the extinction event. The specific problem is: The paragraph on sharks and survival through the K-T event simply does not make sense. It contradicts the article on sharks, and self-contradicts. It also requires some language cleanup. March There are substantial fossil records of jawed fishes across the

Kâ€”Pg boundary, which provide good evidence of extinction patterns of these classes of marine vertebrates. While the deep sea realm was able to remain seemingly unaffected, there was an equal loss between the open marine apex predators and the durophagous demersal feeders on the continental shelf. Researchers found that Cretaceous sites, prior to the extinction event, had rich plant and insect-feeding diversity. During the early Paleocene, however, flora were relatively diverse with little predation from insects, even 1. In high southern hemisphere latitudes, such as New Zealand and Antarctica, the mass die-off of flora caused no significant turnover in species, but dramatic and short-term changes in the relative abundance of plant groups. The dominance of fungal species lasted only a few years while the atmosphere cleared and plenty of organic matter to feed on was present. Once the atmosphere cleared, photosynthetic organisms, initially ferns and other ground-level plants, returned. A study of fossil vertebrates across the Kâ€”Pg boundary in Montana concluded that no species of amphibian became extinct. These include the frog Theatonius lancensis [68] and the albanerpetontid Albanerpeton galaktion; [69] therefore, some amphibians do seem to have become extinct at the boundary. The relatively low levels of extinction seen among amphibians probably reflect the low extinction rates seen in freshwater animals. Choristodere[edit] The choristoderes semi-aquatic archosauromorphs survived across the Kâ€”Pg boundary [28] but would die out in the early Miocene. Additionally, all six turtle families in existence at the end of the Cretaceous survived into the Paleogene and are represented by living species. The rhynchocephalians were a widespread and relatively successful group of lepidosaurians during the early Mesozoic, but began to decline by the mid-Cretaceous, although they were very successful in the Late Cretaceous of South America. Many families of terrestrial squamates became extinct at the boundary, such as monstersaurians and polyglyphanodonts , and fossil evidence indicates they suffered very heavy losses in the KT event, only recovering 10 million years after it. Archosaurs[edit] The archosaur clade includes two surviving groups, crocodilians and birds , along with the various extinct groups of non-avian dinosaurs and pterosaurs. All of the surviving families of crocodyliforms inhabited freshwater and terrestrial environmentsâ€”except for the Dyrosauridae , which lived in freshwater and marine locations. These large pterosaurs were the last representatives of a declining group that contained ten families during the mid-Cretaceous. Several other pterosaur lineages may have been present during the Maastrichtian, such as the ornithocheirids , pteranodontids , nyctosaurids , as well as, a possible tapejarid , though they are represented by fragmentary remains that are difficult to assign to any given group. It is thought that all non- avian theropods became extinct, including then-flourishing groups such as enantiornithines and hesperornithiforms. The absence of these birds in the Paleogene is evidence that a mass extinction of archaic birds took place there. Many species of avians can build burrows, or nest in tree holes or termite nests, all of which provided shelter from the environmental effects at the Kâ€”Pg boundary. Long-term survival past the boundary was assured as a result of filling ecological niches left empty by extinction of non-avian dinosaurs. Excluding a few controversial claims , scientists agree that all non-avian dinosaurs became extinct at the Kâ€”Pg boundary. The dinosaur fossil record has been interpreted to show both a decline in diversity and no decline in diversity during the last few million years of the Cretaceous, and it may be that the quality of the dinosaur fossil record is simply not good enough to permit researchers to distinguish between the options. It is possible that small dinosaurs other than birds did survive, but they would have been deprived of food, as herbivorous dinosaurs would have found plant material scarce and carnivores would have quickly found prey in short supply. Ectothermic "cold-blooded" crocodiles have very limited needs for food they can survive several months without eating while endothermic "warm-blooded" animals of similar size need much more food to sustain their faster metabolism. Thus, under the circumstances of food chain disruption previously mentioned, non-avian dinosaurs died, [31] while some crocodiles survived. In this context, the survival of other endothermic animals, such as some birds and mammals, could be due, among other reasons, to their smaller needs for food, related to their small size at the extinction epoch. Other scientists have made the same assessment following their research. Evidence of this existence is based on the discovery of dinosaur remains in the Hell Creek Formation up to 1. If their existence past the Kâ€”Pg boundary can be confirmed, these hadrosaurids would be considered a dead clade walking. In particular, metatherians largely disappeared from North America, and the Asian deltatheroidans became extinct aside from the lineage leadng to Gurbanodelta.

Diversification of mammals stalled across the boundary. In addition, it is postulated that some early monotremes, marsupials, and placentals were semiaquatic or burrowing, as there are multiple mammalian lineages with such habits today. Any burrowing or semiaquatic mammal would have had additional protection from Kâ€”Pg boundary environmental stresses. However, these fossil beds are geographically limited, covering only part of one continent. The late Maastrichtian rocks contain the largest members of several major clades: Tyrannosaurus , Ankylosaurus , Pachycephalosaurus , Triceratops , and Torosaurus , [] which suggests food was plentiful immediately prior to the extinction. In addition to rich dinosaur fossils, there are also plant fossils that illustrate the reduction in plant species across the Kâ€”Pg boundary. In the sediments below the Kâ€”Pg boundary the dominant plant remains are angiosperm pollen grains, but the boundary layer contains little pollen and is dominated by fern spores. This is reminiscent of areas blighted by modern volcanic eruptions, where the recovery is led by ferns, which are later replaced by larger angiosperm plants. The gradual extinction of most inoceramid bivalves began well before the Kâ€”Pg boundary, and a small, gradual reduction in ammonite diversity occurred throughout the very late Cretaceous. The temperature increased about three to four degrees very rapidly between Not only did the climate temperature increase, but the water temperature decreased, causing a drastic decrease in marine diversity. The issue is difficult to resolve because of the Signorâ€”Lipps effect ; that is, the fossil record is so incomplete that most extinct species probably died out long after the most recent fossil that has been found.

Chapter 4 : Fossilized feces reveal Early Cretaceous aquatic vertebrate diversity

4, entitled "A Guide to the Frankstown Vertebrate Fossil Locality (Upper Cretaceous), Prentiss County, Mississippi," by Earl M. Manning and David T. Dockery III.

Prehistory[edit] The fossil record of North Carolina spans from Eocambrian remains million years old to the Pleistocene 10, years ago. These are the oldest known lifeforms in the state and among the oldest large fossils in the world. A few Edicarian biota have been found in the state. The disk-shaped Aspidella is also known from the state, as well as the strange Sekwia. There are no sedimentary rocks from this interval of time in which fossils could have been preserved. The only known fossils from this time period is the tube-shaped trace fossil Skolithos. Triassic[edit] Restoration of R. Powerful geologic forces formed rifts in North Carolina during the Triassic period. Clams , crustaceans , and fishes lived in local lakes and rivers. On land, the local flora included conifers and cycads. North Carolinan Mesozoic plant life left behind abundant remains of cycads and conifers. At least 9 kinds of Mesozoic plants are endemic to North Carolina. Ferns and horsetails that grew in what is now Chatham County have been the source of exquisitely preserved fossils. Pekin Formation reptiles include Pekinosaurus olseni , early relatives of modern crocodiles like the phytosaur Rutiodon , and several species of aetosaur. The vertebrate fauna it preserved included crocodilians, phytosaurs, and lizard -like animals. These left behind fragmentary skeletal remains like teeth and a few bones, as well as trace fossils like footprints. Dinosaur footprints were also laid down here during the Triassic. This is the only place on earth where complete well-preserved Triassic insects are known from. The oldest known examples of many living groups have been preserved here. Insects of the Solite Quarry include staphylinid beetles , caddis-flies , belostomatids , and thrips. Fossil insects are common at other places in Virginia and North Carolina as well. Small specimens were often preserved in association with unusually rich concentrations of conchostracans. However, due to this high depth, it would be extremely difficult to collect fossils from there, and currently the only known fossils from this strata are ostracods collected from deep well cores. Local oysters left behind remains that would later fossilize. Areas of the state not submerged by the sea were home to dinosaurs. Some of the local Cretaceous trees were preserved as petrified wood. Cretaceous mollusks are known in a variety of locations across the state. Inhabitants of the sea would sometimes fossilize in the state. There are two Paleocene formations from North Carolina: The Beaufort Formation is exposed in a few areas around the coastal plain, though it usually is combined with the Eocene Castle Hayne formation. The Bald Head Shoals Formation, on the other hand, has an even more limited exposure; it is only located around the mouth of the Cape Fear River , and its only exposures are on some of the islands created from the dredging of the river. Army Corps of Engineers. Eocene[edit] During the Eocene , between 38 and 54 million years ago, North Carolina was home to marine life. Some of their remains are preserved in what are now the marl pits in Pender County. Among the invertebrates were nautiloids , sand dollars , and sea urchins. The vertebrates included bony fish , sharks , and whales. These deposits are relatively well known. Sharks found in the state include early Tiger and Mako sharks. Other invertebrates of this epoch included at least two species of gastropod , eleven pelecypods , two brachiopods , four echinoderms , and a great diversity of bryozoans. This single fossils site preserves a Neogene fauna that included coral, sand dollars , sea shells, sea urchins , fish remains, seals , sharks with huge teeth, and fossils from whales. Fossil vertebrates from this fauna included whales and sharks. Tooth fossils indicate the presence of sharks in the region. During the ensuing Pliocene epoch, North Carolina was home to invertebrate faunas including at least 25 species of gastropods and 46 pelecypods.

Chapter 5 : Paleontology in North Carolina - Wikipedia

These findings uncover some of the feeding behaviors of Early Cretaceous aquatic vertebrates and support previous fossil evidence suggesting that Las Hoyas was a rich and diverse wetland ecosystem.

Chapter 6 : Wholesale Flat: Cretaceous Marine Vertebrate Fossils - 14 Pieces For Sale (#) - www.nxgvisio

Fossil vertebrates from the Cabao Formation discovered in the area of Nalut in northwestern Libya include the hybodont shark Priohybodus, the crocodilian Sarcosuchus, an abelisaurid, a baryonichine spinosaurid and a large sauropod with spatulate teeth.

Chapter 7 : Cretaceous Fossil Vertebrates pdf | www.nxgvision.com

rocks and the fossils found within them are from the latest Cretaceous, approximately 67 to 65 million years ago, when Montana and other western states were situated along the coast of a vast seaway.

Chapter 8 : Beringia from a Cretaceous Perspective (U.S. National Park Service)

Only two groups of arthropods are common as fossils in the Cretaceous of the C&D Canal area, and both are types of crustaceans: the Malacostraca (crabs, lobsters, and shrimp) and the microscopic Ostracoda.