Journal of Paleontological Techniques

Book Reviews 3, March 2019

BOOK REVIEWS

PREFACE

The current volume of the Journal of Paleontological Techniques is the third number of our yearly series dedicated to the publication of book reviews. We publish a collection of reviews early every year, of books that were published the year before, and which cover any aspect related to paleontology or natural history in general.

Deadline for the submissions is generally at the end of the year, but proposals will have to be discussed with the editors beforehand, in order to avoid duplicate reviews on the same books. We also invite publishers to notify us about upcoming books, which we will be happy to advertise among our readers and followers on social media.

The current volume includes six book reviews by Alexandra E. Fernandes, Melanie A. D. During, Carl Mehling, Congyu Yu, Emanuel Tschopp, and Alexander Clark. The discussed books are about the pterosaur paleobiology, dinosaur evolution, dinosaur footprints, dinosaurs from Korea, fossils from the Swiss Alps, and land bridges.

PREFÁCIO [in Portuguese]

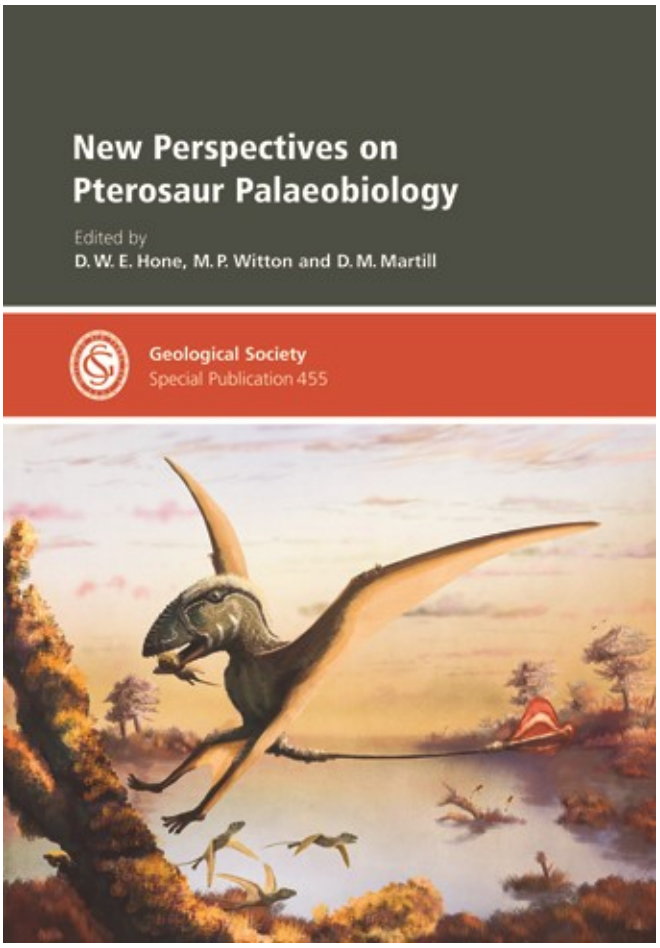
Este volume do Journal of Paleontological Techniques é o terceiro na nossa série anual dedicada à publicação de revisões de livros. Publicamos uma coleção de revisoes no início de cada ano, de livros que foram publicados no ano anterior e que abrangem qualquer aspecto relacionado à paleontologia ou à história natural em geral.

O prazo para as inscrições é geralmente até ao fim do ano, mas propostas terão que ser discutidas com os editores antes disso, para evitar revisões repetidas dos mesmos livros. Também encorajamos os editores a notificar-nos sobre os seus próximos livros, os quais ficaremos felizes em anunciar aos nossos leitores e seguidores nas redes sociais.

Este volume inclui seis revisões de livros da autoria de Alexandra E. Fernandes, Melanie A. D. Durante, Carl Mehling, Congyu Yu, Emanuel Tschopp e Alexander Clark. Os livros discutidos tratam de paleobiologia de pterossauros, evolução de dinossauros, pegadas de dinossauros, dinossauros da Coreia, fósseis dos Alpes Suíços e pontes terrestres.

NEW PERSPECTIVES ON PTEROSAUR PALAEOBIOLOGY

David W. E. Hone, Mark P. Witton and David M. Martill. 2018. The Geological Society. 238 pp. Hardcover. $176.78.
ISBN: 9781786203175.



Courtesy of The Geological Society.

New Perspectives on Pterosaur Palaeobiology is a bound compilation of scientific papers, the topics of which were first introduced by their various authors at the triennial pterosaur conference, Flugsaurier, in 2015 in Portsmouth, England. Most of the authors in this collection are recognizably-accomplished names in the pterosaur world, and the varied topics covered by their research range from descriptions of new pterosaur specimens to more controversial issues that are being currently developed within their fields of specialization. Truly, in this volume there is a little bit of everything. Pterosaurs are widely considered a challenging group to study for reasons such as a sparse fossil record, challenges in sampling due to their physical bone fragility, and a propensity for taphonomic duress. Bearing this in mind, these factors only enhance what already makes the current breakthroughs expounded upon throughout this volume to be such a compelling, though consequently dense, read.

In the introduction to the volume, the editors D. W. E. Hone, M. P. Witton, and D. M. Martill emphasize the rising popularity of pterosaurs in both scholarly avenues as well as in pop culture. They acknowledge this trend as being a valuable advantage in validating how compelling current works on pterosaurs can potentially be, but also how far the field has yet to cover. They also briefly introduce the works in the following chapters of this book as being pivotal contributions to the development of pterosaur fundamental knowledge, via descriptions of new species, collections documentation issues, systematics, paleobiology, functional anatomy, and reconstructions of ecological faunas. They make great points.

In M. P. Witton's *Pterosaurs in Mesozoic food webs: a review of fossil evidence*, an analysis of known preserved food remains, stomach regurgitations, coprolites, and feeding traces is made, pertaining to pterosaur predators as well as to pterosaurs themselves (including a standout example of one poor animal's ill-fated run-in with a palm frond), in order to better understand their ecological role. Many lagerstätten specimens, well-preserved enough to allow for species-level identifications of consumed taxa in their varying states of digestion, are used to illustrate a number of features regarding the pterosaur digestive tract and species feeding preferences. Witton's thorough compilation of findings, including an acknowledgment of some dubious examples, is gastronomically fascinating and reinforces the magnitude of how ecologically plastic pterosaur trophic interactions potentially could have been.

In D. M. Henderson's *Using three-dimensional, digital models of pterosaur skulls for the investigation of their relative bite forces and feeding styles*, twenty-two pterosaur species' crania and mandibles were digitized to calculate skull mechanical strength and jaw motion. Many pterosaur skulls were fragile and elongate, making them especially susceptible to different bending and torsional factors in their day-to-day alimentary routines. Henderson here nicely elucidates how bending is a variable skill, largely dependent on certain distinctive skull features, such as overall dimension, orbit size, tooth robustness, and posterior inclinations of certain skull parts. He, very respectably, also questions the

reliability of two-dimensional fossil preservation conditions for taking these speculative three-dimensional calculations, but nonetheless extrapolates what evolutionary trends he finds. His work is absorbing, so much so that it will give you pause the next time you take a bite out of something, yourself.

In R. A. Frigot's *Pelvic musculature of* Vectidraco daisymorrisonae *and consequences for pterosaur locomotion*, the morphology of this taxon is analyzed, based on reconstructed musculature of the existing phylogenetic bracket of pterosaurs. In comparison to older interpretations of how the pelvic region's muscle attachments, osteological ranges of motion, and gait estimates influenced pterosaur locomotion and posture, Frigot's reconstruction postulates that this taxon may have been capable of occupying arboreal niches. Using laser scans and comparative anatomy with extant groups, ten pelvic muscles are identified, placed, and assessed for their functionality, resulting in novel biomechanical hypotheses about locomotion and flight.

In C. Palmer's *Inferring the properties of the pterosaur wing membrane*, structural wing models were tested to determine likely pterosaur wing membrane tension, and deductions were made from the data collected to make inferences into their material composition. Using CT scans of wing bone cross-sections, structural cantilevered beam theory, existing fossil evidence on the arrangement of aktinofibrils, as well as the ingenious creation of a flutter threshold equation for aerodynamic drag (following an extremely creative appropriation of data from the newspaper printing industry), Palmer was able to deduce a relationship between wing thickness, air speed, air density and span, giving the potentials for flight and flutter resistance of different wing thicknesses and compositional materials. Equally to Palmer's credit, the engineering is all explained accessibly-enough that even the average layperson can grasp the more technical concepts.

In S. C. Bennett and P. Penkalski's *Waves of bone deposition on the rostrum of the pterosaur* Pteranodon, waves of alternating light and dark patterning on certain *Pteranodon* jaws were identified and analyzed from immature male individuals, and found to reflect waves of bone deposition as rostrums were reshaped during growth and the approach of sexual maturity. The authors use microscopic examination of thin sections, X-ray, and polarized light visualization techniques to also determine that this anterior growth wave would have provided for varying bone fiber orientations, giving more strength overall to the bone. Contrary to a droll collection note referenced by the authors, which cites a key specimen as being "'no value whatever'", at least one reviewer found this study to be of great value, for content as well as to exemplify the subtlety of characteristics that fossils sometimes exhibit, and the insights that a keen eye can subsequently unlock.

In L. Codorniú, L. Chiappe and D. Rivarola's *Neonate morphology and development in pterosaurs: evidence from a Ctenochasmatid embryo from the Early Cretaceous of Argentina*, a description is made of a near-hatching embryonic specimen found within an egg of *Pterodaustro guinazui*. This find marks only the fourth known pterosaur egg containing an embryo within, adding a great deal of knowledge and value to what had been previously inferred about embryonic morphology and characteristics.

In J. Lü, Q. Meng, B. Wang, D. Liu, C. Shen and Y. Zhang's *Short note on a new anurognathid pterosaur with evidence of perching behavior from Jianchang of Liaoning Province, China*, a description and taxonomic attribution is provided for a new genus and species, *Vesperopterylus lamadongensis*, adding nicely to the dizzying array of impressive new taxa coming out of this country. The occurrence of this species marks the youngest existence for anurognathids, thus expanding their known temporal range, and certain morphological characteristics of an apparent reversed first toe suggest that it had arboreal perching capabilities.

In M. A. McLain and R. T. Bakker's *Pterosaur material from the uppermost Jurassic of the uppermost Morrison Formation, Breakfast Bench Facies, Como Bluff, Wyoming, including a pterosaur with pneumatized femora*, a description of various pterosaur elements from the area is given, with taxonomic assignations made to a possible rhamphorhynchid, a possible dsungaripteroid, and a monofenestraten. An especially notable observation by the authors is the femoral pneumatization present on one of the specimens, which is a first occurrence of pneumatization on the hind limb bone of a Jurassic specimen, and for dsungaripteroids.

In S. U. Vidovic and D. M. Martill's *The taxonomy and phylogeny of* Diopecephalus kochi *(Wagner, 1837) and* 'Germanodactylus rhamphastinus' *(Wagner, 1851)*, taxonomic revisions are given to various Solnhofen specimens, following the authors' assertions that many taxa had been

falsely ascribed to *Pterodactylus*. Due to taphonomic flattening of the specimens, geometric morphometrics was here newly used to validate morphological observations, and corrective assertions were made to disentangle prior false attributions of the taxa. Of particular note are the article end points, which perfectly capture how taxa should be conceptualized and abstractly viewed, not as biologically distinct entities, but rather as evolutionary snapshots of organisms during evolution; it is a very enlightening discourse.

In D.W.E. Hone, S. Jiang and X. Xu's *A taxonomic revision of* Noripterus complicidens *and Asian members of the Dsungaripteridae*, the authors conduct taxonomic revisions after reappraising the holotype *Noripterus complicidens* and placing it into a separate genus. When originally collected, the specimens in question were inadequately numbered and described, and thus much confusion surrounded the attribution of actual specimens to their records. After attempting this reconciliation, and assessing similar taxa, the authors encourage further comparison between the holotypes of other already-attributed *Dsuniripteridae* in order to create a potential separate genus for them also. The article makes a great case for the need to take particular care with documentation, during both collection and accession.

In D. M. Martill and M. Moser's *Topotype specimens probably attributable to the giant azhdarchid pterosaur* Arambourgiana philadelphiae *(Arambourg 1959)*, a variety of additional bones are attributed to this taxon's original holotype, since they are from the same locality and stratigraphic horizon of Ruseifa, Jordan. Due to lack of documentation by the original collector, the prior relationship of the bones was uncertain and therefore had been left undescribed. Although no reliable autapomorphies are present in the undescribed material to make an azhdarchid attribution on their own, in this paper the authors acknowledge this likely topotype and give detailed descriptions and identifications for each bone, as well as give a fascinating historical recount of their findings.

In M. O'Sullivan's *The pterosaur assemblage of the Oxford Clay Formation (Jurassic, Callovian-Oxfordian) from the UK*, the seven known indeterminate pterosaur fossils in this unit are described, and doubts are also cast onto the one prior-named taxon from the formation. O'Sullivan points out that low preservation potentials make vertebrate remains scarce for this area, and thus pterosaur remains scarcer still due to their fragility, emphasizing the rarity of these particular surviving specimens.

In D. M. Unwin and D. M. Martill's *Systematic reassessment of the first Jurassic pterosaur from Thailand*, a taxon with a prior attribution to azhdarchoidea is redescribed by the authors as being a member of the more basal Rhamphorhynchidae, significantly extending this group's geographical range. The authors point out that morphological interpretations are always hampered by taphonomic uncertainties, so reconstructions often need reinterpretation. This revision is particularly significant because it marks the first occurrence of a Jurassic fossil pterosaur from the region and also from a non-coastal environment, suggesting that preservation biases in the fossil record are, and always have been, indeed, at play: the latter point being a valuable reminder to paleontology as a whole.

In S. C. Bennett's *A large pterodactyloid pterosaur from the Late Cretaceous Ferron Sandstone of Utah*, the author describes fragmentary new wing material from North America, marking an important addition to the pterosaur record during the Turonian. Additionally, Bennett provides thorough clarification between the conditions for the usages of the terms "ornithocheiroid" and "pteranodontoid". Based on his description, and other taxa available from the time period, the author concludes with a perspective that indicates that pteranodontoid diversity was low for the Western Interior Seaway.

In M. E. C. Leal, R. V. Pêgas, N. Bonde and A. W. A. Kellner's *Cervical vertebrae of an enigmatic pterosaur from the Crato Formation (Lower Cretaceous, Araripe Basin, NE Brazil)*, a description is given of four mysterious articulated mid-cervical vertebrae, which the authors find to be representative of Chaoyangopteridae. This proves significant considering that these pterosaurs have only ever indisputably come out of China, with the exception of one contentious taxon, *Lacusovagus magnificens*, from Brazil. Therefore, valiant reviews of the position of both taxa are made by the authors, as well as the general characters surrounding Chaoyangopteridae, with resulting taxon identifications being frustratingly-inconclusive: potential Chaoyangopteridae, in keeping with the only definite Chaoyangopteridae being the Chinese forms. But no one ever said paleontology was easy.

In F. M. Dalla Vecchia's *A wing metacarpal from Italy and its implications for latest Cretaceous pterosaur diversity*, the only known Italian

Cretaceous pterosaur is described, and found to be a basal pterodactyloid specimen from the Trieste province. Size estimates are also made, although the specimen's maturity at time of death is unknown, making the approximation uncertain. A specific assignation cannot be reached here, so the taxon is dubbed a new non-azhdharkid from the latest Cretaceous, making it the first record of such from the Adriatic Carbonate Platform.

In S. Rigal, D. M. Martill and S. C. Sweetman's *A new pterosaur specimen from the Upper Tunbridge Wells Sand Formation (Cretaceous, Valanginian) of southern England and a review of* Lonchodectes sagittirostris *(Owen 1874)*, a new pterodactyloid specimen is described, based on a partial fragment of a jaw with teeth, a partial vertebral column, and partial wing and limb bones. Clarification is also given to the description of *Lonchodectes sagittirostris*, which is re-examined and found to belong to the family Lonchodectidae (here validated), and found by the authors to constitute part of a new genus, here named *Serradraco*.

This book, taken as a whole, can be applauded for the sheer variety of individual methodologies and taxonomic revisions that paleontologists are currently applying to pterosaur fossils, apart from the dedication that each individual author applies to their topics alone. The scope of what they undertake to disentangle the chaos of past taxon attributions and false diagnoses is staggering, and those that forge ahead with new methodologies in new areas are also to be greatly lauded here. Though there may not be any obvious cohesiveness between articles' subject matters (nor was there ever professed to be), when taken paper-by-paper this volume is a very satisfying read. This book is highly recommended, if for no other reason than for having a timestamp on the current temperature of the pterosaur field, in light of how rapidly it is progressing. It also is more than worthwhile to have these papers accessible via a high-quality physical format. There is something to appeal to every serious researcher or paleontology fan, with even the slightest interest in these mysterious and compelling taxa.

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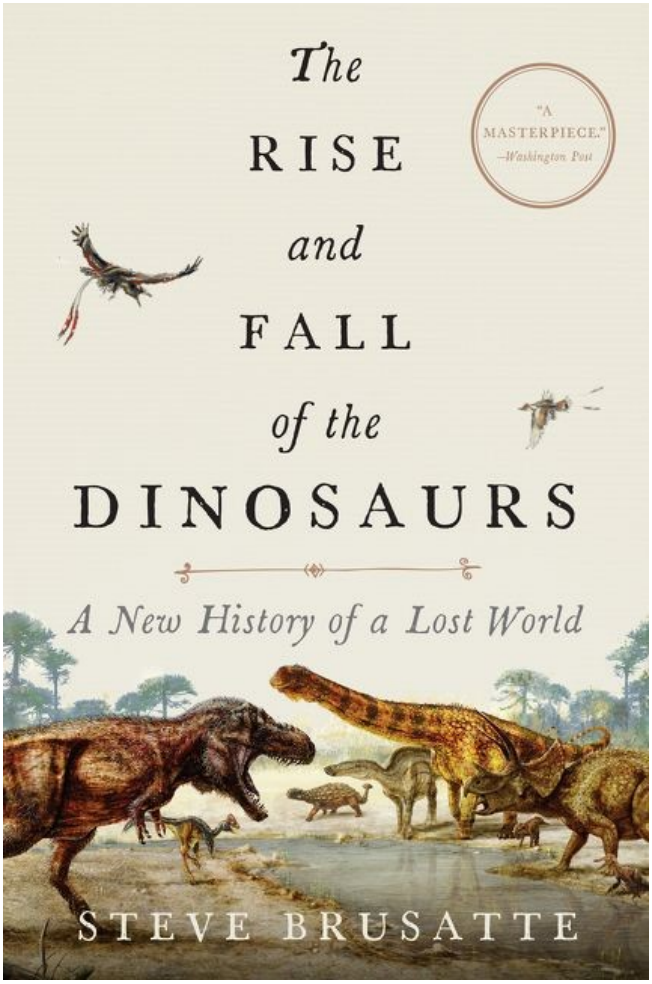
THE RISE AND FALL OF THE DINOSAURS: A NEW HISTORY OF A LOST WORLD

Steve Brusatte. 2018. HarperCollinsPublishers. 416 pp. Hardcover. $29.99.
ISBN: 9780062490421.



Courtesy of HarperCollinsPublishers.

As a vertebrate paleontologist, you've likely already read Bakker's "Dinosaur Heresies" or Alvarez' "Crater of Doom" and by now expect that a popular science book is no longer required reading for your career in vertebrate paleontology, or personal enjoyment. And by all means, "The Rise and Fall of the Dinosaurs" turned out to be popular indeed.

On first hand I would agree with this, seeing how we keep up to date with the published literature. In the last decades a multitude of new dinosaur species have been uncovered and the paleontological methods have expanded perhaps even more. Dinosaur paleontologists all are a part of these developments, yet we are all specialized in relatively small portions of the about 150-million-year history of the dinosaurs. As for the many paleontologists with other specialties, this book provides a compelling tale with up-to-date information of the current understanding of dinosaurs, including field-work anecdotes, which certainly will feel familiar. Mammals and their ancestors, as well as amphibians and invertebrates all have a relevant role in the history of the dinosaurs and are not left untouched.

The Rise and Fall of the Dinosaurs provides an elaborate chronological view on the rise and demise of the various dinosaurian clades, which, as Pangaea slowly came apart, were part of notably different ecosystems on different regions of the globe. It is an updated overview of the history of the processes that occurred on Earth as these dinosaurs came and went and the various other animals they shared their habitat with. This history of dinosaurs is weaved together with personal anecdotes of Brusatte's career. Stories of fieldwork in various countries under various weather-conditions with a multitude of other well-known and lesser-known paleontologists and geologists, which summed up sound like a best-case scenario. I admit I sometimes read these anecdotes with minor envy, as it all sounds so problem-free, yet at the same time I can imagine that the general audience is not wanting of anecdotes that include the 6 months in which one applies for jobs without success. On the other hand, all of us, given the chance, would focus on the tales of our field campaigns and successfully completed research projects, rather than our job insecurity and endless quests for funding.

As a paleontologist, it is nearly impossible to read this book without a sense of recognition. We've experienced the weather in either its (Midwestern USA) summer heat, or wet (European) springs and autumns. As I came across this weather remark in the first chapter "The Dawn of the Dinosaurs": "After a few minutes of hacking through the weeds, we were soaked, my field notebook warping as ink started to run off the pages." I couldn't help but hear my undergrad geology professors chanting: "And that is why we write with pencil in the field!"

As the Permian Mass Extinction had cleared the stage for the beasts of the main story, Brusatte had already taken the time to explain the difference between the Permian Dimetrodon and dinosaurs; toy-manufacturers, please take note. Entering the Mesozoic in chapter 2 ("The Dinosaurs Rise Up"), the empty stage was rapidly populated by various life-forms, including giant, salamander-like temnospondyls and new

upright-walking archosaurs. These new archosaurs split into two major lineages, the pseudosuchians (the clade including today's crocodiles) and avemetatarsalians, which later developed into pterosaurs and dinosaurs.

Brusatte found a very good analogy for explaining when the first species are recognized as being dinosaurs, which is similarly artificial to boundaries on maps: "The same way that nothing really changes as you cross the border from Illinois to Indiana, there was no profound evolutionary leap as one of these dog-sized dinosauromorphs changed into another dog-sized dinosauromorph that was just over that dividing line on the family tree that denotes dinosaurs."

As the supercontinent of Pangaea slowly disintegrated, the various ecosystems on the different continents all developed quite differently. Much attention is of course given to the North American continent, yet South America, Asia, and the European "islands" are tentatively compared and Brusatte makes it easy to understand how these ecosystems evolved. Development of flight and massive body size are described clearly and all well-known dinosaur "superstars" are discussed in great detail, and the origin and diversity of their feathers cannot possibly be questioned anymore by anyone who's read this book.

Finally, the brutal ending of the dinosaur era is described. To my personal great pleasure Brusatte did not only name the wonderful father-son Alvarez-team, but even mentioned my supervisor Prof. Jan Smit in light of the mountain of evidence that a bolide struck Earth and killed the dinosaurs. In vivid detail Brusatte describes what it was like for the last dinosaurs who may have unknowingly seen their demise coming: "For the last several weeks, the more perceptive of the Rexes may have noticed a glowing orb in the sky –a hazy ball with a fiery rim, like a duller and smaller version of the sun."

In Summary, Brusatte did a wonderful job writing a dinosaur best-seller, many well-known and lesser known dinosaurs are described in detail and in the light of the evolutionary trends they underwent. Various researchers are described not only for their skills, but also their passion and interests in life, and as we know, these researchers are extremely diverse; male, female, straight, gay and naturally, from all corners of the world. For professionals it is a book full of recognition and a grand overview at the same time. I would recommend this book to everyone.

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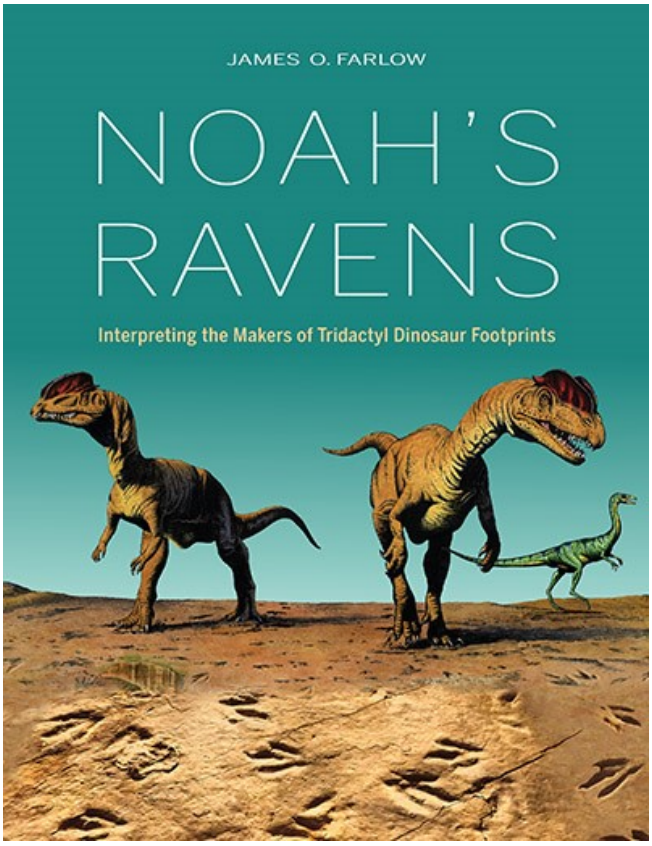
NOAH'S RAVENS: INTERPRETING THE MAKERS OF TRIDACTYL DINOSAUR FOOTPRINTS

James O. Farlow. 2018. Indiana University Press. 750 pp. With illustrations. Hardcover. $85.
ISBN: 9780253027252.



Courtesy of Indiana University Press.

The first fossil dinosaur tracks to be studied scientifically were the 3-toed Early Jurassic biped footprints of the Connecticut River Valley of Connecticut and Massachusetts. Around the turn of the 19th Century, people started noticing what looked like bird tracks embedded in the solid rock and it wasn't long before scientists sought to explain them. The first, in the 1830s, was Reverend Edward Hitchcock who launched the discipline of ichnology and amassed what is considered the largest collection of dinosaur footprints in the world, housed and partly displayed at the Beneski Museum of Natural History in Amherst, Massachusetts.

Hitchcock devoted 3 decades to collecting and studying these tracks but maintained throughout his career that the tridactyl tracks were those of birds – not a bad guess and oddly close to the truth. But he can't be blamed for missing the target: he began his investigations before the word Dinosauria was coined, and it was a very long time before there was enough good fossil skeletal material of dinosaurs to prove the dinosaurian nature of all of the Connecticut River Valley tridactyl footprints.

But the current volume certainly proves that even with over 180 years of dinosaur ichnology to stand on, there is still an incredible amount of work to do. Farlow endeavors to tackle only the 3-toed tracks of the Newark Supergroup, of which the Connecticut River Valley is a part, and manages to pump out 750 pages that he admits is just a start. Early in his career he was tantalized by some of the unknowns surrounding these tracks and was dissuaded from studying them by his advisor, the eminent John Ostrom of Yale, who considered dinosaur ichnology an academic dead end. But Farlow had an itch that could only be scratched with 3 toes.

The deceptively simple questions that led him into this line of inquiry turned out to be a Pandora's box: Can one determine how many kinds of dinosaurs are responsible for the fossil footprints found in the Newark Supergroup? And can the groups to which they belong, broadly speaking, be identified? Another 3 decades of work by one person obsessed with following these long-extinct creatures wherever they might lead gets us *Noah's Ravens: Interpreting the Makers of Tridactyl Dinosaur Footprints*.

Uniformitarianism, coincidentally also coming of age in the 1830s, is the simple but powerful idea that 'the present is the key to the past.' And it is this principle that guides Farlow to his conclusions. By using the foot bones, fleshed-out feet, footmarks, and hindlimb proportions of the closest living relatives of the animals in question he addresses the following questions in great detail:

How do bone measurements vary within and between species of bipedal non-avian dinosaurs, and extant species of birds and crocodilians, their closest modern relatives? Is pedal shape in extant species of birds and crocodilians a trustworthy criterion on which to identify species? Can the amount of taper in fleshy toes be used to separate birds from other bipedal non-avian dinosaurs as well theropods from bipedal ornithischians? What do the ontogenetic and across-species foot and hindlimb proportions of extant species of birds and crocodilians tell us about bipedal non-avian dinosaurs? How much variation is there in the pedal details of a single extant species close to dinosaurs (*Alligator*

mississippiensis)? And how much variability is there in the footmarks of the emu and other ground birds?

And finally, atop this mountain of data from which to see the view, Farlow tackles the Newark Supergroup tridactyl tracks themselves. Using a wealth of such tracks, he concludes that the ichnofauna includes at least 3 tridactyl dinosaurian bipeds: one kind of theropod represented by *Grallator* and most *Anchisauripus* tracks, another theropod represented by other *Anchisauripus* tracks plus *Eubrontes* tracks, and an ornithischian represented by *Anomoepus* tracks. This is much the same as what has been assumed for most of the time these fossils have been studied, but nowhere has it been so exhaustively backed up with data as opposed to gut feelings.

In essence, this entire volume is one grand scientific paper, separated into sections, offering a gargantuan amount of data dealing with certain aspects of the final inquiry. The reading can be rough going because of the depth of the specialization of the topic – it is a bit more of a reference book than a fireside read. But Farlow is well aware of this, apologizing at points and congratulating the audience for pushing on. The text is remarkably readable if arcane and is frequently written in the first person with a nice amount of humor tossed in to reward the diligent reader. It is, of course, thorough. In fact, the entire second half of the book is solid tables, but there is also no shortage of tables in the first half. And there are also a huge number of graphs and figures of all the types of specimens covered. The author is very clear about the reasoning behind his methods, fully disclosing how data was obtained, and carefully and lucidly explains the pitfalls of each investigation and how they were dealt with. In his own words, he has "…used lots of statistics, and tried very hard not to lie."

This book comes about as close to answering Farlow's initial questions as one can imagine in a historical science. And even with the inevitable holes - more a problem of the shortcomings of the fossil record and the amount of effort needed to tease out the answers rather than any fault of Farlow's – this book will certainly become the indispensable reference for anyone working on fossil tridactyl tracks, indeed any fossil footprints at all.

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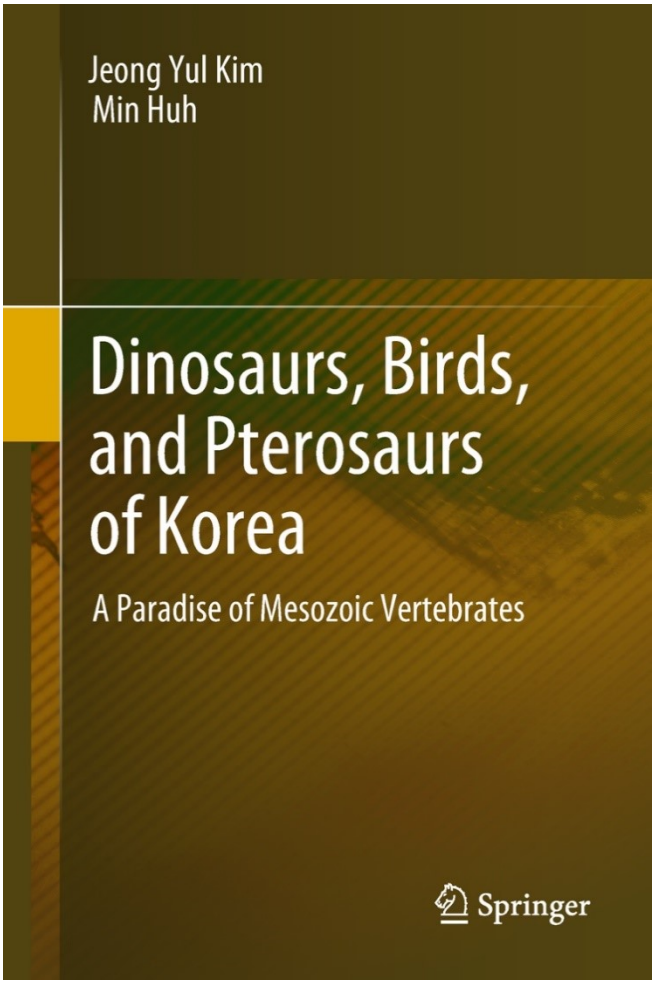
DINOSAURS, BIRDS, AND PTEROSAURS OF KOREA – A PARADISE OF MESOZOIC VERTEBRATES

Jeong Y. Kim and Min Huh. 2018. Springer. 320 pp. Hardcover. €155.99.
ISBN: 9789811069970.



Courtesy of Springer.

Though not large in land area, Korea has several remarkable trackways of Mesozoic vertebrates including the densest Cretaceous avian tracks. The new Springer book "Dinosaurs, Birds, and Pterosaurs of Korean: A Paradise of Mesozoic Vertebrates", by Jeong Yul Kim from Korea National University of Education and Min Huh from Chonnam National University, provides a systematic view of Mesozoic vertebrates from the Korean Peninsula.

When talking about Mesozoic vertebrate fossils from Asia, most would think of the famous Mongolian Gobi Desert or the Jehol Lagerstätte in Northeast China with feathered dinosaurs. Dinosaurs and other Mesozoic vertebrates have been widely reported from many other sites in Central Asia, China, and Southeast Asia. New taxa have been reported from these places every year and frequent expeditions keep adding new information to our knowledge of the Asian Mesozoic ecosystem.

The Korea Peninsula, however, has hardly been recognized for its fossils. Most Mesozoic vertebrate remains in Korea are ichnofossils including three major groups of dinosaurs (Sauropoda, Theropoda, and Ornithopoda), birds, pterosaurs, other reptiles and mammaliaforms. Besides trackways, fragmentary remains including eggs, bones, and teeth were reported but were not easy to be identified further than to major clades. Only two ornithischian dinosaur taxa (*Koreanosaurus* and *Koreaceratops*) were reported very recently, but based on partial skeletons.

Before this book, the special issue "Tracking on the Korean Cretaceous Dinosaur Coast: 40 years of vertebrate Ichnology in Korea" was published in the journal *Ichnos* in 2012, which is an overview focusing solely on track fossils in Korea. However, there has not been a comprehensive publication, neither regarding taxa nor fossil types, on the Mesozoic fossils from Korea. The new book "Dinosaurs, Birds and Pterosaurs of Korean: A Paradise of Mesozoic Vertebrates" provides a very detailed illustration on these three major vertebrate groups as well as other Mesozoic organisms.

The book is arranged in a very straightforward order; chapter 1 briefly introduces the background and research timeline, chapters 2 to 4 deal with dinosaurs, birds, and pterosaurs, respectively, including both track fossils and reported bone, tooth, and egg remains. Chapter 5 introduces other Cretaceous fossils of Korea, including fishes, arthropods, insects, plants, stromatolites, and invertebrate trace fossils. Chapter 6 is a summary listing all major fossil sites with their location, age, geological settings, and fossils from there. The final chapter 7 gives a short summary and prospects of vertebrate paleontology in Korea.

The book is written in a relatively formal style with many descriptions of fossils as well as related figures and tables. Thanks to the very detailed references, readers can easily find the original publication and the research history of Korean vertebrate paleontology. On the other hand, most of the references were written by Korean researchers, which is explicit but indicates the potential of future international collaborations.

The most exciting part of this book is Chapter 4 about Pterosaurs. Currently, there are 3 ichnogenera and 4 species named from Korea. Many of them co-occurred with either many kinds of footprints of dinosaurs or birds, which suggests a diversified, but barely known paleoecosystem in the Cretaceous of Korea. The authors wrote a lot on the amazing Pterosaur footprints *Haenamichnus gainensis*, "enigmatic tracks vaguely resembling modern human footprints associated with sauropod, ornithopod, and theropod tracks on the same bedding surface." Although other pterosaurs trackways around the world suggest a quadrupedal locomotion during walking, the Gain and Adu trackway, where only pes tracks were discovered, probably indicates a novel walking locomotion for some pterosaurs. However, another possible explanation is that those footprints were formed in shallow water when forelimbs did not touch the ground. The co-occurrence with many dinosaur footprints recorded a diversified ecosystem and gives important information on the ecological relationship between these two groups. But the most interesting part of the giant pterosaur footprints is that they look like human footprints, and were indeed previously taken by some cranks as the evidence for creationism. Therefore, authors give a very convincing explanation and strongly refute against creationism: "However, for the general public, students, and children, it seems necessary to point out that the supposed human footprints are not, in fact, human footprints; rather, they are the pes tracks of pterosaurs. […] The following reasons detail the argument against the footprints being human but, rather, being pterosaur tracks: 1. Age differs tremendously […]; 2. Morphology differs […]; 3. Size and locomotion pattern differ".

Including the weird pes-only pterosaur trackway and other interesting dinosaur trackways like the ones with internal ridges, authors provide and refer some interpretations, but these hypotheses still need more evidence and analysis to be validated, especially since track fossils only provide limited information and the lack of skeletal remains in the whole peninsula makes the story even more mysterious.

In total, 34 vertebrate and ichnotaxa have been established in Korea. The authors claim, "Eight avian ichnotaxa and three pterosaur ichnotaxa have been named and described in Korea's Cretaceous deposits […] the most diverse and the highest density of bird and pterosaur ichnospecies have been described in the Cretaceous in Korea", thus explaining the subtitle "A Paradise of Mesozoic Vertebrates".

Paleontology did not start very early in Korea. The first named bird track *Koreanaornis hamanensis* was not reported until 1969. The first dinosaur trackway was reported in 1982. And the two remarkable ornithischian dinosaurs *Koreanosaurus boseongensis* and *Koreaceratops hwaseongensis* were reported in 2010 and 2011. There are not numerous vertebrate fossils in Korea compared to the geologically close Gobi Desert and Jehol biota in Northeast China, however, Kim and Huh, as well as other Korean paleontologists show their enthusiasm to introduce Korean discoveries to the world. They mentioned the Gyengnam Goseong Dinosaur International Symposium and the Gyeongnam Goseong Dinosaur World Expo, which should be a great chance for both scientific communication and popular science. The fossil sites in Korea are not visited as often as other well-known sites, I believe the Mesozoic Korean needs and will have more exploration and validation.

Generally, this book is a good reference and guide to Korean dinosaurs, birds, pterosaurs, as well as other Mesozoic fossils. However, the word "Mesozoic" in the title sounds a little bit boasting because most fossils come from Cretaceous strata. Most space of the book is dedicated to ichnofossils as they represent the majority of Mesozoic vertebrate fossils from Korea. The compilation of geological information of reported fossil sites makes this book the first comprehensive publication regarding all Mesozoic, mostly Cretaceous, Korean fossils. It is a good summary, and a good start also.

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FOSSILIEN IM ALPSTEIN

Peter Kürsteiner and Christian Klug (eds). 2018. Appenzeller Verlag. 372 pp. With 744 illustrations. Hardcover. CHF 89.
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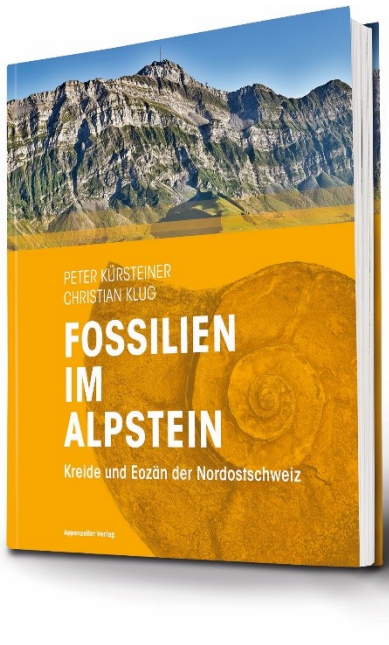

Courtesy of Appenzeller Verlag.

Fossilien im Alpstein – Kreide und Eozän der Nordostschweiz is a German book about Cretaceous and Eocene fossils of the Alpstein mountain range in the Swiss cantons of Appenzell and St. Gallen. It is heavily illustrated with 744 high quality photos and illustrations (exactly two per page!), not counting the beautiful aerial view of the region on the front and back endpapers. The book provides a very complete and detailed guide on where which kind of fossils can be found and how they can be identified. It is aimed at paleontologists and fossil enthusiasts alike, and every chapter has been written by local experts in the field, be it academic and/or non-academic paleontologists. It is thus also a great example of how a good collaboration between "professional" and "amateur" paleontologists can produce great outcomes.

The book is divided in eight main chapters, with the one describing the fossils being divided into several subsections that represent the main clades of which fossils have been found in the Alpstein. This part contributes about 75% to the book. The single sections are marked with a specific color band that extends to the margin of nearly all pages, so that they are visible also when the book is closed. The book starts with an introduction that puts the Alpstein into the context of Swiss paleontology, both geographically and historically, and is illustrated with a number of beautiful photographs from the different localities where fossils were found. The second chapter describes the geology of the Alpstein, how the mountain range formed through tectonic processes, and which formations occur here. This chapter is followed by a description of what fossils are, how they form, get preserved, and where they can be found. It also describes how to excavate and prepare the fossils from the Alpstein, and in which museums they can be seen (most importantly the St. Galler Naturmuseum in northeastern Switzerland). Chapter four is a summary of the research that has been done on the fossils from here, from 1740 to today. It also includes figures of some of the earliest scientific papers published on the material in the 1820s. A summary of the paleoecology and paleogeography of the place follows. It shows the changing taxonomic composition throughout the Cretaceous as well as the development of the Tethys ocean, in which the fossilized organisms of the Alpstein lived. As an introduction to the main chapter on the actual fossils, a small chapter explains the general evolutionary history of animals, and the basics of systematics and taxonomy. This chapter is necessary to be able to use the following guide to the Alpstein fossils in the best way. This guide is divided into several subsections, each describing a group of organisms, its evolution and ecological significance, preservation, where to find and how to identify them, followed by an impressively complete, illustrated account of the currently known species. It was surprising to me (I grew up close to the Alpstein), how extremely diverse the Alpstein ecosystem was, and am still wondering why I never went fossil collecting there as a kid, nor as a grown-up kid. I guess the main issue was that I was a vertebrate paleontologist at heart from early on, and there's not too much to be found concerning bones… Anyway, fossils that can be found (and are thus described in specific subsections) are from the single-celled organisms forming stromatolites, and rhodolites. A single subsection treats the few fossil plants found at the Alpstein. Invertebrates are divided into foraminifera, sponges, corals, bryozoans, sabellid and serpulid worms, gastropods, scaphopods, bivalves (which I discovered can grow more than 500 years old!), nautiloids, a huge variety of ammonoids, belemnites, brachiopods, decapods, crinoids, and echinoids. Vertebrates are represented by numerous teeth of chondrichthyans, some remains of

osteichthyans, and very few vertebrae as well as a single tooth of an ichthyosaur among reptiles. A subsection on trace fossils concludes this chapter. In the appendix, the abbreviations of the various collections (mentioned in the figure captions) are explained, and most importantly, an extensive index lists all the discussed species and other taxa.

Some of the subsections on the fossils have a very extensive introduction on the taxa they treat, and because most of the fossils that can be found at the Alpstein are invertebrates, I learned quite a bit while reading. It is a very extensive compilation of taxa and illustrations, and can thus be considered the reference work summarizing the geology and paleontology of the Alpstein, as well as a guide for the identification of its fossils for the academic and non-academic paleontologist alike. Unfortunately, given the large dimensions of the book itself, it will be heavy to actually bring into the field, but will definitely help to identify the collected fossils once back home. Throughout the entire book, the authors of the various chapters also provide lots of references for further reading for interested readers. The only thing I could possibly find to criticize could be that additional life reconstructions of some of the animals would have been nice – but with its already 744 figures, of which about 50 are reconstructions, I can't really ask for much more. I highly recommend this book to anybody interested in invertebrate paleontology, the ecology of the Tethys ocean, the geology and paleontology of the alps, or just in beautiful fossils. Now, please, translate it into English!

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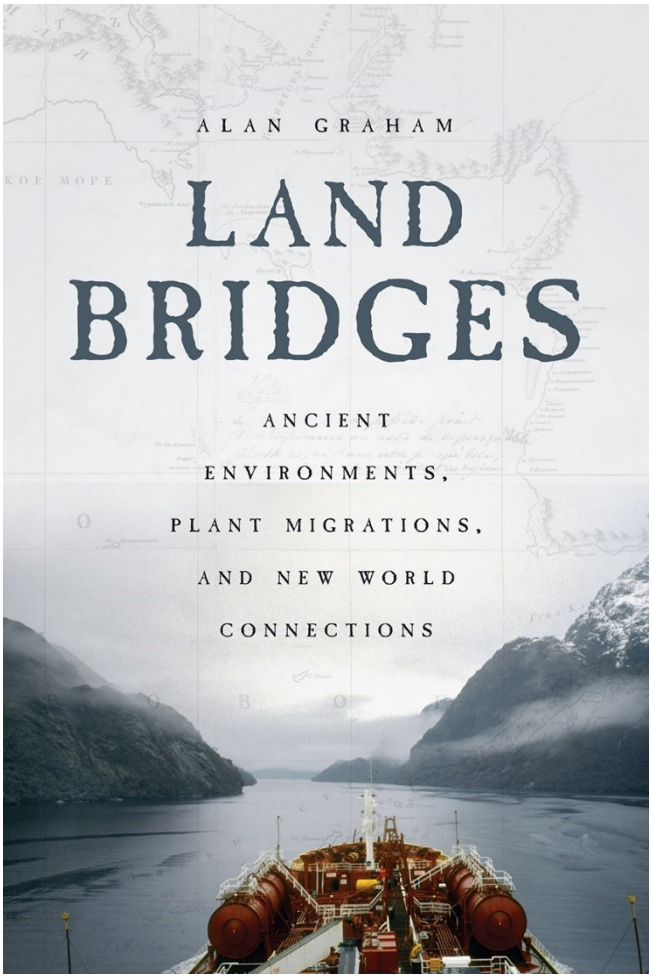
LAND BRIDGES: ANCIENT ENVIRONMENTS, PLANT MIGRATION AND NEW WORLD CONNECTIONS

Alan Graham. 2018. University of Chicago Press. 334 pp. Hardcover. $148.00.
ISBN: 9780226544298.



Courtesy of University of Chicago Press.

The complexity and interwoven nature of the biogeographical history of the New World makes biogeography a difficult topic to study. With *Land Bridges*, Graham has compiled a vast amount of information spanning hundreds of millions of years and four continents into a concise book. Close examinations of the five different land bridges between the New World and the Old World are made.

The use of the term 'New World' throughout the book is fitting. Historical accounts of the discoveries and feats of endurance are used to introduce each of the land bridges. Besides giving a human element and showing the extreme conditions of these areas, they are an inviting introduction. Further interesting personal anecdotes, such as a conference in Soviet-era Russia, show the personal interest and global developments in the area.

The context is immediately provided through the introduction and allows the reader to fully comprehend the scope in which the author has examined the subject. The many difficulties facing modern scientists in reconstructing ancient migrations is a constant thread throughout the book, showing the scientific approach with which the author has examined the vast source material. Differing climates, plant diversity and geology on each side of the land bridge are explained through a multitude of sources.

Part One deals with the two Boreal Land Bridges in the far Northern reaches of the New World, the Beringia and North American Land Bridges. The main components are systematically discussed, despite the lack of a current land bridge and fragmentary fossil record present in Beringia. Part Two consists of the two Equatorial Land Bridges in the connection between North and South America. Part Three describes the Magellan Land Bridge in the very tip of South America. The different mechanisms and effects that dominated each land bridge are summarized with this last land bridge. It shows the well-chosen and logical structure that runs through the entire book, making it easy to follow and read.

The passion and vast knowledge Graham has of the biogeography of the New World, past and present, is shown on every page. The broad descriptions of the physiography, climate, age and paleo vegetation of land bridges make this book an excellent reference work for any future climate scientist, student or amateur.

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