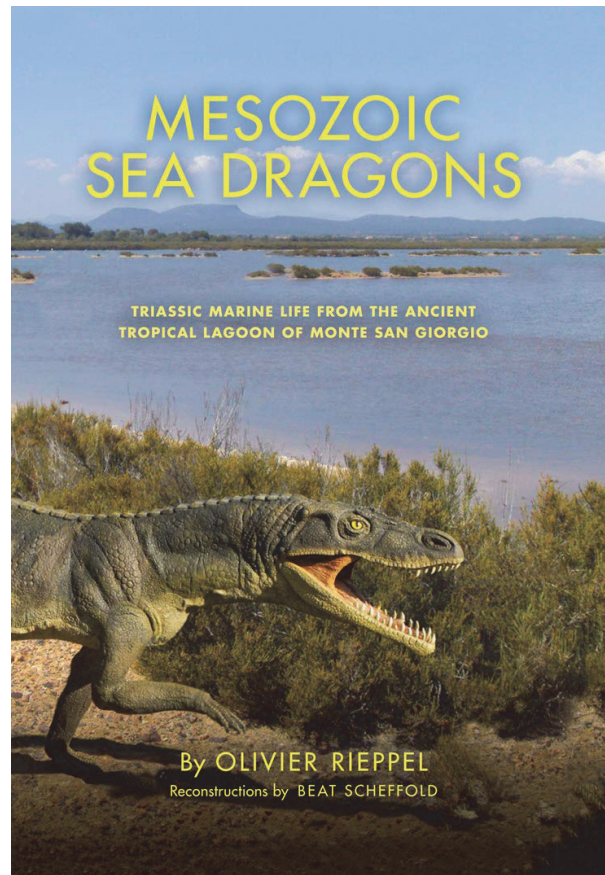


## **Mesozoic Sea Dragons: Triassic Marine Life from the Ancient Tropical Lagoon of Monte San Giorgio**

Review by Andrzej Wolniewicz

*Mesozoic Sea Dragons: Triassic Marine Life from the Ancient Tropical Lagoon of Monte San Giorgio*, by Olivier Rieppel. 2019. Indiana University Press. 256 pages. \$75.00 (hardcover). ISBN: 978-0-253-04011-4.

Monte San Giorgio, located at the border of Switzerland and Italy in the Lugano Prealps, is a UNESCO World Heritage Site famous for its rich fossil record of Middle Triassic marine life. The fossil-bearing horizons of Monte San Giorgio were deposited when today's mountain was a shallow, tropical lagoon inhabited by a great variety of fishes and marine reptiles. The marine reptiles of Monte San Giorgio – including ichthyosaurs, thalattosaurs and a remarkable diversity of sauropterygians – are particularly well-known, thanks to numerous, well-preserved and mostly complete fossil skeletons. Historically, the fossils of Monte San Giorgio were of great importance for understanding the anatomy and palaeobiology of Middle Triassic marine reptiles. They also played a pivotal role in the formulation of early ideas regarding the evolution and phylogenetic relationships of diapsids. More recently, the fossils of Monte San Giorgio have been crucial for placing the great diversity of Triassic marine reptiles discovered in southern China in the last 20 years into a phylogenetic and palaeobiogeographic context. In *Mesozoic Sea Dragons*, Olivier Rieppel, a world-renowned expert on Triassic marine reptiles and author of numerous studies focusing on the marine faunas of Monte San Giorgio, reviews the history of fossil discoveries at this exceptional locality. He also summarizes the current state of knowledge on



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the taxonomy, evolution and palaeobiology of its extinct residents.

The book is organised into eleven chapters, followed by a short epilogue and a comprehensive list of references. The first chapter provides an excellent review of the history of palaeontological excavations at Monte San Giorgio and other nearby Middle Triassic localities (e.g. those in the vicinity of the Italian town of Besano), which date back to the 1850s. Particular attention is given to the portrayal of the prominent 20<sup>th</sup> century Swiss palaeontologists Bernhard Peyer and his student – and eventual successor – Emil Kuhn-Schnyder, who both played a central role in the excavation and description of the extensive collection of Monte San Giorgio fossils housed at the Paleontological Institute and Museum of the University of Zürich (PIMUZ). In addition to providing a chronological account of their field campaigns, highlighting their most important findings and key publications, Rieppel also discusses the professional and personal relationship between Peyer and Kuhn-Schnyder, drawing from the non-technical literature and unpublished documents to provide curious anecdotes. At the end of the chapter, Rieppel gives a summary of the geology and stratigraphy of Monte San Giorgio and reviews the taphonomic and palaeoenvironmental studies of the ancient lagoon. Chapter 1 is accompanied by numerous archival photographs which show the fieldwork organised by Peyer in the late 1920s and early 1930s and by Kuhn-Schnyder in the 1960s.

The following chapters (2–10) focus on reviewing the diversity of vertebrate life represented in the fossil record of Monte San Giorgio. Chapter two covers the diversity of fossil fishes, discussed as a grade comprising sharks, actinopterygians and coelacanths. Chapter three is aimed largely at the general reader and serves as a primer in reptile phylogeny and evolution. Chapters 4–8 are dedicated to each of the major marine reptile clades – ichthyosaurs, placodonts, pachypleurosaur, nothosaurs and thalattosaurs, respectively (marine reptiles of uncertain phylogenetic affinity – *Helveticosaurus zollingeri* and *Eusaurosphargis dalsassoi* – are covered together with placodonts in a single chapter). The protorosaurs, represented by the terrestrial *Macrocnemus* and the likely semi-aquatic, long-necked *Tanystropheus*, are discussed in chapter 9. The terrestrial, crocodile-line archosaur *Ticinosuchus ferox* is featured in chapter 10, alongside a historical review of the discovery and interpretation of the *Chirotherium* trace fossils, attributed to *Ticinosuchus* by

some authors. Chapter 2 and chapters 4–10 follow approximately the same organisational pattern – they begin with a historical review of the early discoveries of the featured clade (or grade), often followed by an account of the history of ideas regarding its phylogenetic position. Afterwards, Rieppel reviews the representatives of each of the vertebrate groups, focussing on their taxonomy, anatomy, life history and palaeobiology. In addition, each chapter also contains a dedicated box, which summarises the most important information on selected fossil taxa and includes a scientifically accurate life reconstruction created by the talented Beat Scheffold (PIMUZ). The content of the chapters is further enhanced by the inclusion of excellent photographs of important fossil specimens from the collections of the PIMUZ and the Museo Civico di Storia Naturale in Milan – the second major repository of Monte San Giorgio fossils.

The paragraphs devoted to the historical and taxonomic reviews comprise a large part of each chapter. They will be important references for professional palaeontologists, as Rieppel succinctly summarises information gathered from an extensive body of literature, including many important, historical works which are often difficult to access or unavailable in English. Rieppel frequently uses his taxonomic discussions to demonstrate how the discovery of new fossils from Monte San Giorgio allowed palaeontologists to revise previous ideas regarding the identity of extinct animals, such as the heterodont shark *Acronemus tuberculatus* (chapter 2) and the protorosaur *Tanystropheus* (chapter 9). Another theme which recurs throughout the book is the key role of fossils from Monte San Giorgio in the formulation of early ideas on the evolution and phylogenetic relationships of diapsid reptiles, as demonstrated in chapters dedicated to placodonts (chapter 5), thalattosaurs (chapter 8) and protorosaurs (chapter 9). The paragraphs outlining the anatomy of the fossil taxa are concisely written and informative. However, the technical nomenclature used throughout might be difficult to comprehend especially by the general reader, because the text is not accompanied even by simple, anatomical diagrams and no glossary of key terms is available as an appendix at the end of the book. The discussions of life history, palaeobiology and evolution are covered to a greater extent for some groups (e.g. the actinopterygian *Saurichthys*, pachypleurosaur, protorosaurs) than for others (e.g. ichthyosaurs, nothosaurs), but this reflects the lack of palaeobiological studies of the latter groups rather than any taxonomic bias of the author.

The final chapter – chapter 11 – briefly reviews the abundant marine faunas spanning the entire Triassic of south and southwestern China discovered in the last 20 years. In addition, it also discusses how fossils from Monte San Giorgio and China complement each other in providing a broad picture of marine reptile evolution and biogeography in the Triassic. The short epilogue gives a summary of the historical importance of the Middle Triassic marine faunas of Monte San Giorgio and emphasises their relevance for current studies of Triassic marine ecosystems, especially of those from southern China. At the end of the epilogue, Rieppel states that “it is unquestionable that the Middle Triassic marine biota from Besano–Monte San Giorgio will forever retain their historical significance (...). But it is equally unquestionable that the highest metabolic rate in research on Middle Triassic marine fishes and reptiles conducted today is seen in southern and southwestern China” (p. 217). However, Rieppel fails to acknowledge the increasing role of new technologies, such as CT-scanning, 3D-modelling and biomechanical analyses in studies of fossils in general, and the fossil vertebrates of Monte San Giorgio in particular. In fact, recent research utilising CT-scanning

has allowed palaeontologists to provide new details on the evolution of tooth replacement in placodonts (Neenan et al. 2015) and the anatomy and phylogenetic position of the actinopterygian *Saurichthys* (Argyriou et al. 2018). It is a shame that these new studies, as well as the potential of new technologies for advancing our knowledge of the extinct vertebrates of Monte San Giorgio, were not discussed in the book.

In summary, *Mesozoic Sea Dragons* by Olivier Rieppel is the most comprehensive review of the Middle Triassic marine faunas of Monte San Giorgio published to date. It synthesises a vast body of literature in an accessible way and provides an informative, beautifully illustrated review of the vertebrate life that once thrived in the ancient lagoon. It also delivers a fascinating account of the history of fossil discoveries of this remarkable site. The book will undoubtedly be an important reference for students and professionals specialising in Mesozoic marine reptiles, Triassic marine ecosystems and the phylogenetic relationships within Diapsida. It will also be an accessible and informative read for the non-specialists with an interest in reptile evolution, the Triassic period and the history of palaeontology.

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