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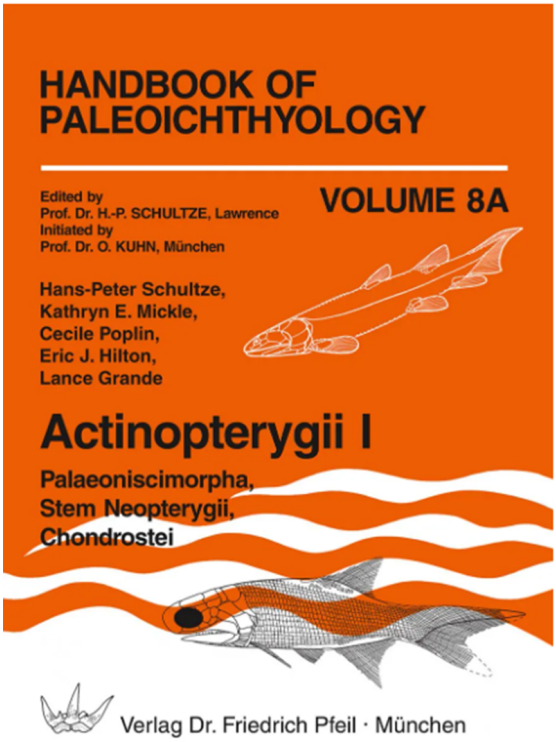
A Review of *Handbook of Paleoichthyology Volume 8a: Actinopterygii I, Palaeoniscimorpha, Stem Neopterygii, Chondrostei*

Reviewed by Russell K. Engelman, Nicholas Gardner, and John-Paul M. Hodnett

by Hans-Peter Schultze, Kathryn E. Mickle, Cecile Poplin, Eric J. Hilton, and Lance Grande, 2021. Verlag Dr. Friedrich Pfeil, München, 299 pp. US$293.50, hardcover, ISBN: 978-3-89937-272-4.

Palaeoniscoids, an informal term referring to a paraphyletic group of largely Paleozoic stem-neopterygian fishes, have generally gotten the short end of the stick in paleoichthyology. These fishes are typically overshadowed by Paleozoic placoderms, sarcopterygians, and chondrichthyans, as well as their geologically younger neopterygian (especially teleost) descendants. As a result, it is a pleasant surprise to see *Handbook of Paleoichthyology Volume 8a: Actinopterygii I, Palaeoniscimorpha, Stem Neopterygii, Chondrostei*, a volume wholly devoted to these underappreciated taxa, as well as the few Meso-Cenozoic lineages of non-neopterygian ray-finned fishes (i.e., bichir, sturgeons, and paddlefishes).



The book itself is very high quality. The binding is nice; the pages are crisp. This is typical and expected of most books in this series, and it is delightful to see adherence to the same quality standards of the prior decades when many other printing houses are cutting corners in physical publishing.

The first 42 pages of the book are a review of ray-finned fish anatomy. This section focuses on

Russell K. Engelman. Department of Biology, Case Western Reserve University, 10900 Euclid Ave., Cleveland, Ohio 44106, USA. neovenatoridae@gmail.com
Nicholas Gardner. Mary F. Shipper Library, WVU Potomac State College, Keyser, West Virginia 26726, USA. nick.gardner@gmail.com
John-Paul M. Hodnett. Archaeology Office, Natural and Historic Resource Division, Maryland-National Capitol Park and Planning Commission, Upper Marlboro, Maryland 28608, USA. jp.hodnett@pgparks.com

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the various bones of the skull, the different body shapes and morphologies exhibited by palaeoniscoids, and associated terminology, which is illuminating as the significant body shape disparity seen in palaeniscoids is underappreciated compared to teleosts. Although Paleozoic actinopterygians are often characterized as morphologically homogeneous *Cheirolepis*- or *Kentuckia*-like taxa, a mere glance at Figures 1 and 3 of this volume will dispel that notion. The section on paleobiology ("Habitat and Adaptations", pp. 45–49) is brief, focusing on whether certain palaeoniscoid taxa occur in freshwater or marine environments, but which can be forgiven due to the general dearth of research on their life habits. For more in-depth discussions of palaeoniscoid paleobiology, readers will want to refer to Williams (1990) and Chevrinais et al. (2017) for their role in trophic structures, Pearson and Westoll (1979), Poplin and Lund (2000), and Friedman et al. (2018) on feeding behavior, and Williams and Lucas (2013) and Fletcher et al. (2014) on locomotory behavior and habitat.

The book contains copious life reconstructions, with almost every page containing at least one whole body reconstruction or skull illustration. These reconstructions are mostly high quality, and literature figures have been redrawn to give them all a very consistent feel. A very nice touch are the additions of "scale windows" on most of these reconstructions. Readers will have a good idea of the overall scalation pattern of each taxon, while not being overwhelmed by the intricate and often complicated patterning of palaeoniscoid scales.

While the book has large numbers of life reconstructions of palaeoniscoids, it has perhaps 3-5 photographs of actual fish fossils outside of the section on chondrosteans, which conceals how many of the reconstructions have been retro-assembled from the preserved fossils and what palaeoniscoid fossils look like in their original state. For example, the figured image of *Bluefieldius mercerensis* Mickle, 2018, is spectacular. However, palaeoniscoid fossils are quite often "splattered" (e.g., '*Fubarichthys'*; Lowney, 1980; Lowney in Frickhinger, 1991) and require a significant amount of expertise to put back together. However, we acknowledge that additional photography would likely add significant reproduction costs to an already expensive book, and could represent an opportunity for future researchers.

The poorly resolved nature of stem-actinopterygian taxonomy (Henderson et al., 2023) challenges this book's organization. The authors fully acknowledge this limitation (p. 64). This makes it challenging to use this text for identifying fossils, as the taxa are organized alphabetically for a significant portion of this text (pp. 73–225), with almost 89 pages (pp. 136–225) of 'Palaeoniscimorpha incertae sedis'. Readers must flip through the book and hope to see a recognizable taxon. Until palaeoniscoid taxonomy can be better resolved, this was organized as well as it could be.

Most of the diagnoses in the book focus entirely on cranial characters (which is unsurprising: Mickle, 2015). However, the vast majority of palaeoniscoid fossils encountered in the field and lab are scale patches or isolated scales. The actual section on scale anatomy (pp. 39–41) is very brief. Obviously, the use of "scale taxa" is best approached cautiously, but a table showing what scale features occur in what taxa would have been beneficial. There is also no key to help refer fossils at the genus- or species-level or even higher-level groups. This greatly limits the utility of the book in identifying palaeoniscoid material, making it mostly useful for palaeoniscoid specialists, rather than Paleozoic fish researchers more broadly. As researchers that had hoped to use this volume to identify palaeoniscoid material, we were left wanting more. Future work could explore the interspecific, intraspecific, and intra-individual variation of palaeoniscoid scale morphology, as a standalone volume.

This book still fills a gap as palaeoniscoids have lacked a general review, which is what will draw most readers to this text. The sections on stem-neopterygians and chondrosteans are worthy of reading as well as a resource for those interested in delving into this topic. It is appreciable that despite chondrostean anatomy and evolution already being extensively published elsewhere (e.g., Findeis, 1997; Hilton and Grande, 2006; Hilton et al., 2011), that the section on chondrosteans is lavishly documented, providing detailed illustrations and photographs of the skeletal anatomy of these fishes. The quality of the treatment of sturgeons, paddlefishes, and their extinct relatives is comparable to what has already been published for other living non-teleost actinopterygians: bowfins (Grande and Bemis, 1998) and gars (Grande, 2010).

In summary, this book is a must-have for any researcher working on Paleozoic actinopterygians. It will primarily benefit workers who need a reference for palaeoniscimorphs, as well as a general review of chondrosteans and stem-neopterygians. The book and its illustrations are high quality mak-

ing it a worthwhile consideration for any paleoichthyologist's bookshelf.

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