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Editorial: 25 years of 'Fossil Record, an International Journal of Palaeontology'

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In his editorial accompanying the first issue of 'Mitteilungen aus dem Museum für Naturkunde, geowissenschaftliche Reihe' on 19 November 1998, Prof. Hans Peter Schultze – the journal's founder and director of the former Institute of Palaeontology at the Museum für Naturkunde Berlin – wrote: 'I wish for the journal a good start and a successful commencement, with high recognition from the scientific community'. In 2006 the journal was renamed 'Fossil Record, an International Journal of Palaeontology' and in 2023 it celebrated its 25th anniversary. Fulfilling Prof. Schultze's vision and expectations, 'Fossil Record' has steadily gained a solid reputation as a well-established, modern scientific outlet, currently ranked within the top quartile of palaeontological journals. The journal attracts a broad international readership and features research in all fields of palaeontology. Paving the way for its success were the tireless efforts of the early editors, Professor Gloria Arratia and Dr. Dieter Korn, who put exacting rules firmly in place in terms of article quality and impact, ultimately leading to the 'Fossil Record' being SCIE-listed in 2014. The journal has adhered to its tradition of publishing articles in English, with two volumes released every year, and with a minimum of two international reviewers selected for each article. In a continuous effort of the journal to stay modern, it has now become an international open access journal, a success that has been greatly supported by the Coordination Office for Scientific Publishing as part of the Library. As a key driver of the museum's Open Access strategy, the Coordination Office plays a crucial role in ensuring that the museum's Open Access journals, including 'Fossil Record', achieve wide visibility and make a meaningful impact within the global scientific community. We extend our heartfelt thanks to our colleagues, as well as the numerous contributors and referees, whose dedication and expertise have significantly contributed to the rapid growth and success of 'Fossil Record'. Our gratitude also goes to the Museum für Naturkunde and its Directorate General for generously covering the author page charges, and to the Library for their steadfast commitment to promoting Open Access at the museum.

This special issue celebrates the 25th anniversary of 'Fossil Record'. We chose 'The fish-to-tetrapod transition and the conquest of land by vertebrates' as its overarching topic. This research topic has a long tradition at the Museum für Naturkunde, starting with contributions by the eminent palaeoichthyologist and histologist, Walter Gross (1903–1974), to whom we owe the discovery and first description of the Devonian tetrapod-like fish *Panderichthys rhombolepis*, the holotype of which is kept at the Museum für Naturkunde. Hans-Peter Schultze and his working group continued Gross' work and amplified its scope. Schultze published important new findings on *Elpistostege*, a relative of *Panderichthys* that is even closer to tetrapods than the latter and conducted research on the phylogenetic status of tetrapods as a monophyletic group and the environmental conditions accompanying the transition from fishes to tetrapods. For short intervals, distinguished early tetrapod-researchers, including Michel Laurin (from 1997 to 1998) and Rainer Schoch (from 2001 to 2002) worked at the Museum für Naturkunde. Today, the long tradition of early tetrapod research at the Museum continues with the activities of the research groups led by Nadia Fröbisch and Florian Witzmann, with primary focus on temnospondyl amphibians.

Vertebrate terrestrialization is a major chapter in animal evolution. Following the conquest of the land, vertebrates evolved a remarkable diversity of body proportions and a wide array of feeding, locomotory, and sensory adaptations. Early tetrapods are of great interest to the scientific community because they illuminate the rise of modern terrestrial ecosystems and the deep roots of much of today's terrestrial vertebrate diversity. Last but not least, this topic is of great interest for the public at large, because it is one of the major evolutionary transitions and research on early tetrapods is also the study of our own remote ancestry.

We are delighted to present this special volume to mark the achievements of 'Fossil Record' and the increasing importance and reach of early tetrapod studies. The volume features a welcoming address by Prof. Johannes Vogel, the Director General of the MfN, followed by a contribution by Prof. Hans-Peter Schultze, who provides an account of the founding of the journal in 1998 and the difficulties it faced in the beginning. The centerpiece of the volume consists of eight original research articles written by 18 international authors, both established scientists and young researchers. The articles cover a wide range of topics such as the palaeoecology of the fish-tetrapod transition, morphology and phylogeny of stem tetrapods, phylogeny and morphology of temnospondyls, the convergent evolutionary simplification of the tetrapod skull, and biomechanics of the skull in semi-aquatic and terrestrial tetrapods.

The first article, by Michel Laurin, examines the extent to which the habitats of the early tetrapods revealed a marine influence, a question that has long been controversial. Originally it was assumed, by analogy with modern amphibians, that early tetrapods inhabited freshwater environments, where they had originated from fish-like ancestors. Accordingly, most early tetrapods were thought to be unable to tolerate brackish or marine environments. Based on a vast compendium of data and a literature survey, Michel Laurin builds upon his earlier study on this topic that he undertook with Rodrigo Soler-Gijón in 2010. Following different lines of evidence, he shows that many early tetrapods were euryhaline and lived in brackish waters or even marine settings and concludes that tetrapods originated in marine environments.

The first body fossils of stem-tetrapods with limbs are known from the Late Devonian. In the first 15 million years of the subsequent Carboniferous Period (the Tournaisian and parts of the Viséan), only very few remains of tetrapods have been found worldwide, a circumstance to which this time interval owes its name, "Romer's Gap". In recent years, however, new finds from the Early Carboniferous, particularly from Scotland and Canada, have begun to close this gap. In the second article, Tim Smithson and Marcello Ruta – along with the late Jenny Clack – redescribe one of the recently discovered Tournaisian tetrapods, *Ossirarus kierani* from Scotland, which shows a mosaic of plesiomorphic and derived characters. Their phylogenetic results strengthen the hypothesis that the morphological and taxonomic diversity of early tetrapods in the lowermost Carboniferous were greater than previously assumed.

Different groups of tetrapods independently showed a reduction and loss of skull roof bones, attaining a simpler skull morphology relative to tetrapodomorph fishes and various Devonian and later Paleozoic groups. In the third article, Kim Kean, Marylène Danto, Celeste Pérez-Ben and Nadia Fröbisch provide an overview of the groups of tetrapods in which a reduction of the cranial bones took place and how this occurred. Interestingly, the loss of individual bones was very variable and cannot be correlated with a particular lifestyle or body size, suggesting complex and as yet poorly understood morphogenetic patterns.

The eryopids are a diverse group of Permo-Carboniferous temnospondyls that had transitioned from the strictly aquatic existence of their ancestors to a more amphibious mode of life. While the phylogenetic position of eryopids within temnospondyls is well established, the relationships within the group are controversial. The affinities of three taxa from the Middle Permian of Russia, *Clamorosaurus borealis*, *C. nocturnus* and *Syndyodosuchus*, have remained elusive so far. In the fourth article, Ralf Werneburg and Florian Witzmann undertake a detailed redescription of their anatomy and lifestyle, and present a comprehensive phylogenetic analysis of eryopids. They retrieve no support for the previously held hypothesis that the Russian eryopids were terrestrial animals and argue that a semi-aquatic lifestyle is more probable.

In the fifth article, Raphael Moreno, Sanjukta Chakravorti, Samuel Cooper and Rainer Schoch address the taxonomic diversity and palaeobiogeographic and stratigraphic distribution of temnospondyls in the partially marine Grabfeld Formation (Gipskeuper) of southwestern Germany, straddling the Ladinian-Carnian boundary. Although the frequent occurrences of sabkha and playa deposits suggest arid environmental conditions, the authors demonstrate a surprising diversity of temnospondyls belonging to at least three families, including the oldest occurrence of a metoposaurid. This work presents important palaeobiogeogaphic data on temnospondyls in the Ladinian and Carnian and provides evidence that many members of this group were euryhaline.

The ontogeny of Palaeozoic temnospondyls included a larval phase similar to that of modern salamanders and has been studied for more than 150 years. In contrast, the ontogeny of the predominantly Mesozoic stereospondyls remains poorly understood. In the sixth article of this volume, Rainer Schoch, Florian Witzmann, Raphael Moreno, Ralf Werneburg and Eudald Mujal describe for the first time the ontogeny of the largest known temnospondyl, the capitosaurian stereospondyl *Mastodonsaurus giganteus* from the Middle Triassic of Germany, with preserved skulls ranging between 12–15 mm and 1200 mm. In contrast to the larval ontogenies of Palaeozoic forms, *Mastodonsaurus* attained adult morphological characteristics of its skull and postcranium early in ontogeny, with juvenile and adult skulls differing mainly

in overall proportions. The findings broaden our knowledge of stereospondyl ontogeny and indicate a major shift in the developmental mode of stereospondyls relative to their Palaeozoic relatives.

The seventh article, by Pummy Roy, Sanjukta Chakravorti and Dhurjati Prasad Sengupta, expands our knowledge of Gondwanan tetrapod assemblages throughout the Triassic. Based on newly found and hitherto undescribed material, the authors address the taxonomy and morphology of an apex predator, the giant capitosaur *Cherninia denwai* from the middle Triassic Denwa Formation of central India. In addition to cranial material, they also document several postcranial bones for the first time.

The eighth article, by Ingmar Werneburg, discusses the biomechanical basis for the formation of cranial openings in tetrapods, including temporal fenestrae, palatal vacuities and squamosal embayments, during the evolutionary transition from water to land. The author documents differences in the mode of feeding and body posture in two semi-aquatic early tetrapods (a stereospondyl amphibian and a stem-amniote) and two terrestrial amniotes (an early archosaur and a dinosaur), and concludes that the formation or closure of skull openings is tightly correlated with the bite force exerted by the jaw adductors as well as with the presence of cranial weapons (e.g., horns, frills, protuberances). Additionally, the author shows how the stress induced by the neck musculature may have an impact on the skull architecture. Finally, he provides a new hypothesis for the evolution of skull openings, especially in the temporal region, based on biomechanical considerations.

We hope that this special issue will stimulate further discussions and scientific work in the field of early tetrapods. Special thanks go to go to the Department Service Development and Impact whose generous financial support made this special issue possible. We would also like to express our sincere thanks to Pensoft Publishers for the excellent cooperation. Last but not least, we wish to thank all the authors of this special issue for their contributions, and the numerous reviewers whose expertise greatly enhanced the quality of the articles.