



## SUMMARY OF PAPERS INCLUDED WITHIN THIS COMMEMORATIVE ISSUE

### **The fossil record of tadpoles** by James D. Gardner

The fossil record of frogs is unique, because it sometimes involves premetamorphic and metamorphic larval stages documented not only by ossified skeletal elements, but also by soft tissue parts. This makes it possible to investigate development of some organ systems and their transformations in the course of metamorphosis, which is seemingly restricted to extant amphibians. Attempts to classify anuran developmental stages were made as early as in 1860, when Meyer described tadpoles from various European localities. However, Špinar was the first researcher who was able to distinguish palaeobatrachid and pelobatoid tadpoles. In this paper, Jim Gardner undertook the first comprehensive, global review of the fossil tadpole record, beginning from Bronn's (1828) first note on “puzzling, scorpion-like animal” from Geistingen Busch in Siebengebirge.

### **“Lost” and rediscovered: Holotype of *Palaeobatrachus diluvianus* (GOLDFUSS, 1831)** by Zbyněk Roček

*Palaeobatrachus* is one of the earliest fossil frogs ever reported and, at the same time, the most common fossil frog in Europe. The great number of specimens recovered from the oil shale mines and other Tertiary deposits in central Europe resulted in descriptions of many new taxa, often without true descriptions or diagnoses. This is why the first revision of palaeobatrachid frogs was made in 1860 and shortly afterwards again, in 1886. Špinar collected several hundred superbly preserved specimens, including tadpoles of various developmental stages from the locality Bechlejovice in the Czech Republic, but before he was able to make taxonomic assessments, he was told that the type specimen was lost during World War 2. Only much later, in 2014, the holotype was rediscovered. Thus, this paper is the first redescription of the holotype and the type genus since 1886.

### **Frogs (Amphibia, Anura) from the Eocene and Oligocene of the Phosphorites du Quercy (France). An overview** by Jean-Claude Rage

Evolution of anuran assemblages from the Eocene to Oligocene, including the “Grande Coupure”, a major European turnover that profoundly influenced amphibians, is relatively well documented in the Quercy Phosphorites in France. This review was written by one of the leading French palaeoherpetologists, who belonged to younger generation of Špinar's colleagues. The review brings important information: for instance, it confirms the presence of a pelodytid in the Eocene of Europe. Disjunct areas of anuran distribution with pelodytid affinities in the Eocene of Europe and North America, combined with recently discovered fossils in the Paleocene and Eocene of east Eurasia that

display combination of pelodytid and megophryid anatomical features, are the crucial facts which provide a possible scenario of early pelobatoid frog history.

### **Revision of the skeletal morphology of *Eodiscoglossus santonjae*, an early Cretaceous frog from northeastern Spain, with comments on its phylogenetic placement** by Ana Maria Báez and Raúl O. Gómez

Mesozoic history of anurans is mainly reconstructed from disarticulated skeletal elements. Articulated skeletons are rare, which is why they are thoroughly and repeatedly analyzed, sometimes with contradictory results. Although they are mostly crushed due to dorsoventral compression, so that morphology of single bones is distorted, they provide valuable information on sizes and ages of individuals. One of such important fossils is the early Cretaceous *Eodiscoglossus santonjae* from Spain. A revised description of the holotype and of some additional material from the same locality revealed that this assemblage consists of several individuals, some of them probably taxonomically different from the *E. santonjae* holotype. It is therefore better to adhere to only the diagnostic features displayed by the holotype, rather than use the former diagnoses, which included characters of additional taxa.

### **The hopping dead: Late Cretaceous frogs from the middle – late Campanian (Judithian) of western North America** by James D. Gardner, Cory M. Redman, and Richard L. Cifelli

During recent decades, anuran paleontology has made great progress, not only in the number of described taxa, but thanks to better understanding of osteology of both extinct and extant frogs and toads, also in refining their taxonomic assignments. Špinar, who was deeply interested in the history of science often cited Georges Cuvier, who claimed that he was able to identify a whole animal from a single, isolated bone. The fossil record of the anurans in North America is exceptional in many respects; one of them is that it is mostly represented by isolated, fragmentary bones. In spite of this handicap, many new taxa were diagnosed from various formations of North America, essentially by methods used by Cuvier. This report by Gardner and colleagues is one of those, which presents a complex history of anurans on the North American continent during the Mesozoic.

**Frog origins: inferences based on ancestral reconstructions of locomotor performance and anatomy** by Anthony Herrel, Cécile Moureaux, Michel Laurin, Gheyleen Daghfous, Kristen Crandell, Krystal A. Tolley, G. John Measey, Bieke Vanhooydonck, and Renaud Boistel

Anatomical transformations in course of origin of frogs may be inferred from comparisons of ancestral, probably paedomorphic temnospondyls with the earliest frogs from the Early Jurassic, almost 200 million years ago. Some of these transformations, such as elongation of hindlimbs, reduction of presacral vertebral column, and loss of the tail, were undoubtedly associated with acquiring saltatory locomotion. Efficiency of jumping was also increased by simultaneous use of both hindlimbs which, however, cannot be inferred from fossils. This, as well as degree of jumping performance, can be learned exclusively from extant taxa. Low performance jumping can be then associated with precisely defined anatomical conditions present in early, Mesozoic anurans. Conversely, good jumpers with proportionally long hindlimbs combined with other anatomical traits evolved much later.

**A new find of discosauriscid seymouriamorph from the Lower Permian of Boskovice basin in Moravia (the Czech Republic)** by Jozef Klembara

This paper is an interim report on a new specimen of the Discosauriscidae from the Boskovice Basin. Špinar's focus on these Early Permian amphibians was initiated by Josef Augusta, who became professor of vertebrate paleontology at Charles University and, at the same time, Špinar's supervisor. He published several short descriptive papers on discosauriscids from the region of Boskovice, but soon realized that this material needed a thorough revision. Thus, "Revision of some Moravian Discosauriscidae" that appeared

in 1952 was Špinar's PhD thesis, and it appeared that he would pursue this field. However, superbly preserved Tertiary frogs from the locality Bechlejovice in north Bohemia were discovered at that time, and Špinar switched from discosauriscids to fossil frogs. In spite of this, several of Špinar's students continued in this field, which makes it possible to assess progress during the past six decades.

**Cartilago teniformis and its derivatives: addition information on the basic composition and evolution of the skull** by Hans C. Bjerring

The concluding paper is a theoretical essay aiming to elucidate homologies of some basic components of the vertebrate skull. Špinar was always interested in a broader evolutionary context of anurans but, as a geologist by training, he had to seek information on embryology, development, functional anatomy and ecology of frogs among a wide range of his colleagues who were specialized in these fields. Hans Bjerring is known for his deep knowledge of old literature in vertebrate embryology and comparative anatomy (sometimes overlooked by modern specialists), and his ideas – although they may sometimes appear peculiar – may attract interest among young evo-devo people to the astonishing richness and preciseness of the old literature, and may thus trigger new research projects with new analytic and investigational techniques.

Zbyněk Roček