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### The last trematosaurid amphibian *Hyperokynodon keuperinus* revisited

By Rainer R. Schoch, Berlin, Andrew R. Milner, London  
& Hanna Hellrung, Stuttgart

With 2 figures

#### Summary

A second trematosaurid specimen from the Schilfsandstein (Carnian) of the Heilbronn area (northern Baden-Württemberg, southwestern Germany), is described. It comprises a large portion of the postorbital skull region, which was extraordinarily slender and elongated. It is argued that the specimen is most plausibly attributed to *Hyperokynodon keuperinus*, which is based on the only other known trematosaurid find from the Schilfsandstein. The new specimen adds information on the size and morphology of *Hyperokynodon*, suggesting it to represent a highly derived lineage within the subfamily Tertreminae. It shows that by Carnian time, unexpectedly large, slender-snouted temnospondyl predators existed in Central European river systems, prior to the diversification of the Parasuchia.

#### Zusammenfassung

Aus dem Schilfsandstein der Heilbronner Gegend wird ein zweites Exemplar eines trematosauriden Amphibs beschrieben, das aus alten Beständen der Stuttgarter Sammlung stammt. Es handelt sich um den größten Teil eines ungewöhnlich langgestreckten und schlank gebauten Postorbitalschädels. Dieses Exemplar wird von uns dem tertreminen Trematosaurier *Hyperokynodon keuperinus* zugeordnet, dessen Holotypus ebenfalls aus dem Schilfsandstein von Heilbronn stammt. Der neu zugeordnete Fund erlaubt eine umfassendere Rekonstruktion des Schädels von *Hyperokynodon* und zeigt, daß es sich um eine hoch abgeleitete, außerordentlich großwüchsige Gattung innerhalb der Tertreminae handelt. Die neuen Befunde belegen, daß während des Karn ungeahnt große und langschädelige amphibische Räuber in mitteleuropäischen Flußsystemen lebten, und zwar vor der Diversifizierung der Parasuchier.

#### 1. Introduction

Trematosaurids are long-snouted to gavialiform temnospondyl amphibians known primarily from Lower Triassic horizons (WARREN & BLACK 1985; HELLRUNG 1987; HAMMER 1987; MILNER 1993). The family achieved early significance as a result of the detailed work of BURMEISTER (1849) on *Trematosaurus brauni*. As a

zoologist, BURMEISTER was able to take an unconventional perspective on these lower tetrapods, reconstructing the skulls rather than figuring the original specimens. His account of the Buntsandstein labyrinthodonts from Bernburg near Halle still stands among the most detailed descriptions of a trematosaur. As a consequence, relatives of *Trematosaurus* were clearly recognisable and the family has expanded considerably over the subsequent 150 years. Recently, however, it has been argued to be paraphyletic in relation to the Upper Triassic Almasauridae and Metoposauridae and has consequently been split into three families (SCHOCH & MILNER 2000). The majority of genera still form a substantial family Trematosauridae definable as a clade, but genera such as *Lyrocephaliscus*, *Inflectosaurus* and *Platystega* are now assigned elsewhere.

Trematosaurids sensu stricto make their first appearance with *Aphaneramma kokeni* in the Mittiwali Member of *Prionolobus* Beds (Induan: Griesbachian), Pakistan (HUENE 1920). By the Olenekian, they are widespread and abundant, occurring from Laurussia (Arizona, Greenland, Spitsbergen, Germany, and the Cis-Urals), over Northern Gondwana (India) to Southern Gondwana (Madagascar, South Africa, and Australia), see HELLRUNG (1987). More recently, it has become clear the lonchorhynchine trematosaurids survived widely into the early Mid-Triassic, with specimens now known from Nova Scotia, North Africa and India (WELLES 1993).

In the 1980's, a vertebrate specimen known for over a century, namely *Hyperokynodon keuperinus* PLIENINGER, 1852 from the Schilfsandstein (Middle Carnian) of Heilbronn in northern Baden-Württemberg, was recognised as the first Upper Triassic trematosaurid (HELLRUNG 1987). This find, a giant snout of a moderately long-snouted trematosaurid, is not only the largest, but also the stratigraphically youngest representative of the Trematosauridae, and its peculiar morphology had long puzzled palaeontologists.

Recently, another trematosaurid specimen – SMNS 55910 – has been recognised from the same horizon, and a locality very close to that of *Hyperokynodon*. It merits description as only the second specimen of an Upper Triassic trematosaurid containing new morphological information about the latest members of this group. It was recognised by RRS and ARM independently during examination of the SMNS metoposaurid collection, and the unusual morphology of the find was clearly in conflict with the original label. Subsequent collaborative study confirmed that the specimen is a fragmentary posterior skull table, preserved as a skulptursteinkern (i.e. an internal cast with imprinted sculpture), with traces of the cultriform process in the palate and marginal teeth of the maxilla and ectopterygoid. It can be unambiguously characterized as the posterior skull of an extremely large trematosaurid amphibian.

## 2. Specimen history

The holotype of *Hyperokynodon keuperinus* was found to the northeast of Heilbronn (topographical map 1:25.000, sheet 6821), at the northwestern rim of the Löwensteiner Berge. The exact location of the type locality is uncertain (HELLRUNG 1987: 2), although KEHRER (1848) indicated the Wartberg (formerly: Warthberg) by adding a map of the area north of Heilbronn, in which two quarries were figured. This area bore numerous quarries during the eighteenth and nineteenth century (pers. comm. R. WILD and M. URLICHS to RRS).

The second specimen (SMNS 55910) was apparently found nearly in the same area: east of the city of Heilbronn at the large sandstone quarry north of the Jägerhaus. The label of the specimen reads as follows: “*Metopias diagnosticus* H. v. M., Schädelstück; Schilfsandstein; Heilbronn, Jägerhaus; Dr. BRUCKMANN.” FRAAS (1889: 140) referred to this specimen only as *Metopias* “from Heilbronn”, and it has subsequently received only brief mention by MILNER (1994: 10) and SCHOCH & MILNER (2000: 111). The specimen is not as spectacular as the famous finds of *Metoposaurus diagnosticus* from Hanweiler and the Feuerbacher Heide, and it appears that no previous author paid particular attention to it. The catalogue of the museum’s trade activities contains a note that Dr. BRUCKMANN (from Cannstatt - now Stuttgart-Bad Cannstatt according to FRAAS’ notes in SMNS files, see also MAYER 1973) had donated several fossils to the Königlich-Württembergisches Naturalienkabinet, the forerunner of the SMNS.

### 3. Description of SMNS 55910

Extrapolation from the known dimensions, scaled against the large trematosaurine trematosaurid *Trematosuchus sobeyi* (HAUGHTON 1915), suggests a total skull length of approximately 80 cm. The specimen represents about one-third of the postorbital skull table with some traces of palate visible on the ventral side of the block. It appears to be a skulptursteinkern of the postorbital skull: the natural mould of the internal surface of the skull table combined with traces of dermal sculpture and lateral-line sulci suggest that the bone had been highly compressed before solution, so that dorsal and ventral dermal features are now visible together on the mould. The sutures of the skull roofing elements are largely preserved as positive, serrated lines. Cranial elements represented include both frontals, postfrontals and parietals, the left postorbital, jugal and supratemporal, and traces of the parasphenoid, left maxilla, ectopterygoid and squamosal. The posteromedial margin of the right orbit margin is visible, and from this, and the preserved internal cast of the left jaw margin, it is clear that the orbits were situated very close to the jaw margin and separated by about two orbit widths. The distance from the medial margin of the right orbit to the medial axis is 42 mm. The posterolateral margin of the right orbit is preserved on the ventral side of the core, so that the width of the orbit can be measured to be 35 mm and the height to be 26 mm. The preserved internal side of the left cheek is shallowly concave when seen from above, indicating that the skull was narrow-snouted anteriorly but flared out substantially posteriorly from the level of the anterior parietal edge backwards. Possibly this could be an effect of preservation as a steinkern, because the jugal is normally more massive in the area of the posterior end of the ectopterygoid and the contact with the pterygoid, than anteriorly and posteriorly, so that the inner side of the jugal is concave in this region.

The frontals are extremely slender bones with highly elongate dermal sculpture. The anterior region is not present but the preserved region is three times as long as it is wide and they extend posteriorly one orbit length behind the level of the orbit. The postfrontals extend anteriorly, medial to the orbit and must have contributed to the exclusion of the frontals from the orbit margin. They are extremely elongate posterior to the level of the orbits and extend for three orbit lengths behind the orbits. The right postfrontal bears a pronounced rim where it forms the orbit margin, a fea-



Fig. 1. SMNS 55910, the second trematosaurid specimen of the Schilfsandstein here assigned to *Hyperokynodon keuperinus*. The specimen is an internal mould of the skull roof and thus the outline of the skull originally was somewhat wider than the preservation suggests. Photograph of original in dorsal view.

ture which is characteristic of internal casts and shows the thickness of the dissolved bone. COSGRIFF & GARBUTT (1972) describe a similar everted rim at the orbit from the holotype of *Erythrobatrachus noonkanbahensis*, a matrix core from the pre-orbital skull. A specimen of *Stoschiosaurus nielseni* from Greenland, stored in the collection of the Geological Museum in Copenhagen, likewise a steinkern, shows at the right orbit a similar rim, while at the left orbit, where a piece of bone is preserved, the surface of the skull is flat. Only the anterior region of the parietals is preserved in SMNS 55910 but it is clear from the ornament pattern that the centres of ossification of the parietals were situated posteriorly and hence, that the pineal foramen was

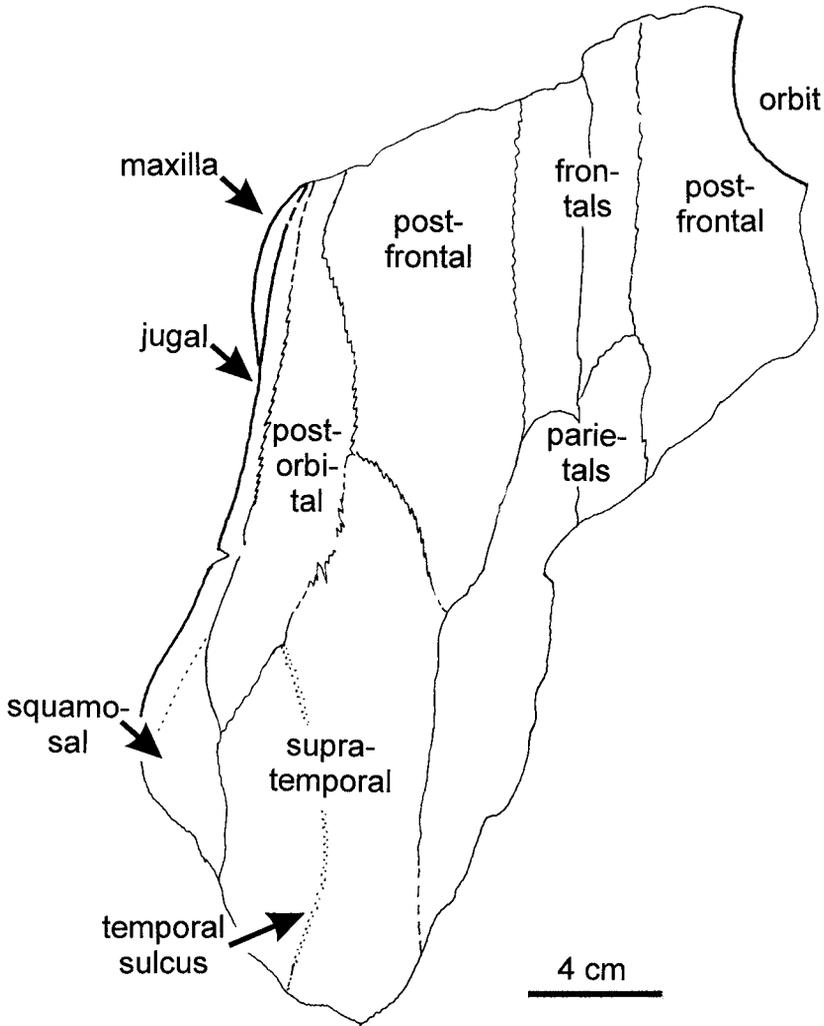


Fig.2. SMNS 55910, same view and scale as Fig.1. Interpretation of sutures and lateral line sulci.

also situated posteriorly within the parietals. On the left cheek, the mould of the posterior end of the maxilla is preserved and the sandstone below bears a row of moulds of small marginal teeth. Further back, part of the ectopterygoid is present as a mould and ventrally, the steinkern bears the casts of a few larger teeth. Medial to the maxilla is the left postorbital, which is about three times as long as it is wide. Behind this is a large and elongate supratemporal, about twice as long as wide. Finally on the left margin is a long slender jugal extending back to at least halfway down the length of the supratemporal. A small wedge of left squamosal is visible behind the common suture of the jugal and supratemporal.

Although much of the dermal bone is lost, the course of some lateral line sulci is clearly visible. The supraorbital sulcus extends around the posteromedial orbit margin on the left postfrontal and onto the left postorbital at the mid-point of their common suture. From the mid-postorbital, a temporal sulcus extends posteriorly, being exceptionally prominent as it passes across the supratemporal.

On the reverse aspect of the slab, only a few traces of the palate are visible but they are highly significant. The posterior region of the cultriform process appears as a very slender vertical strip of bone, a characteristic feature of trematosaurids *sensu lato*. At the posterior end of the preserved bone, the cultriform process shows sudden widening at the point where the basal plate should be. A small piece of the left ectopterygoid is preserved and shows where the posterior end of the bone expands medially at the point where it meets the palatine ramus of the pterygoid.

#### 4. Taxonomic assignment of SMNS 55910

Although the specimen was identified as a metoposaur, this identity can be refuted readily. Comparison with material of *Metoposaurus diagnosticus* (MEYER 1842) reveals the following, most conspicuous differences. (1) The skull is very narrow, with nearly straight or concave lateral margins; (2) the proportions of the preserved roofing bones (frontal, postorbital, postfrontal, parietal, and supratemporal) differ from those of all non-trematosaurid Triassic temnospondyls in their extreme length and narrowness; (3) the cultriform process of the parasphenoid is keeled and thin, forming a vertical sheet of bone characteristic of trematosaurids and almasaurids instead of a wide, horizontal bone as in metoposaurids.

The find can be attributed to the Trematosauroida *sensu* SCHOCH & MILNER (2000) (including the Metoposauridae) on the basis of the following, apomorphic characters:

1. Cultriform process forms vertical sheet.
2. Parietal much elongated anterior to pineal foramen.
3. Postfrontal and postorbital extremely elongated and posterolaterally orientated.

SMNS 55910 belongs to the Trematosauridae *sensu stricto* because of the following autapomorphies:

4. Postorbital skull table extremely elongated and narrow.
5. Postorbital very narrow, and not extended beyond the level of postfrontal.

More specific features of SMNS 55910 are:

6. Lateral margin of postorbital skull distinctly concave (Tertremiinae and some Lonchorhynchinae)
7. Jugal very narrow and squamosal inferred to be narrow (Trematosaurinae, Tertremiinae and some Lonchorhynchinae).
8. Frontals much narrower than parietals, postfrontals wide (Lonchorhynchinae and Tertremiinae).
9. Frontals extend behind level of orbits by a full orbit length (large trematosaurids of all subfamilies).

Considered in isolation, SMNS 55910 can be recognised to be part of either a large tertremine or a large lonchorhynchine trematosaurid. Because the tertremine *Hyperokynodon* is known from the same locality, the simplest conclusion is that this specimen should be referred to *Hyperokynodon*, but the possibility that it is a frag-

ment of a lonchorhynchine must be noted. Lower Triassic trematosaurid assemblages sometimes contain several taxa together (Spitzbergen, Madagascar, Panchet Formation) and it is possible that there are two relict trematosaurids together in the Heilbronn assemblage. Given that both specimens are of usually large size and that the morphology of SMNS 55910 is compatible with the Tertreminae, albeit with a rather narrow skull table, we feel that the simplest resolution is to assign this specimen to *Hyperokynodon keuperinus*. The formal synonymy and diagnosis is now as follows.

*Hyperokynodon keuperinus* PLIENINGER 1852

- 1848 "Kopfteile eines großen Reptils aus der Abtheilung der Saurier". – KEHRER, p. 7, pl. 2.  
 \*1852 *Hyperokynodon keuperinus*. – PLIENINGER, p. 470.  
 1857 *Hyperotrema keuperianum*. – JÄGER, p. 26.  
 1861 *Hyperokynodon*. – MEYER, p. 257.  
 1889 *Metopias diagnosticus*. – FRAAS, p. 140.  
 1933 *Hyperokynodon*. – KUHN, p. 77.  
 1935 *Hyperokynodon*. – SÄVE-SÖDERBERGH, p. 22, 86.  
 1938 *Hyperokynodon keuperinum*. – SCHMIDT, p. 58, fig. 1070d.  
 1956 *Hyperokynodon*. – HUENE, p. 97.  
 1964 *Metoposaurus diagnosticus* [partim]. – SHISHKIN, p. 117.  
 1966 *Hyperokynodon*. – ROMER, p. 363.  
 1968 *Hyperokynodon keuperinum*. – LINCK, p. 53.  
 1969 *Hyperokynodon*. – ROMER, p. 82.  
 1971 *Hyperokynodon*. – KUHN, p. 8, fig. 9a/2.  
 1985 *Hyperokynodon keuperinum*. – WARREN & BLACK, p. 308.  
 1987 *Hyperokynodon keuperinus*. – HELLRUNG, p. 3, fig. 1–4, 6A, 10A  
 2000 *Hyperokynodon keuperinus*. – SCHOCH & MILNER, p. 111.

Holotype: SMNS 16670. Impression of anterior tip of snout in palatal view, encompassing openings in the anterior palate for the accommodation of symphyseal tusks (aperturæ præmaxillares), choanae, and the large tusks of the vomer and palatine.

Type locality: Wartberg near Heilbronn, Baden-Württemberg, Southwestern Germany.

Type horizon: Schilfsandstein, Mittlerer Keuper (km<sub>2</sub>), Middle Carnian, Upper Triassic.

Diagnosis. – Snout tip wide, anterior palatal openings medially well separated; keeled, laterally compressed vomerine and palatal fangs; choanae proportionately smaller and fangs somewhat larger than in *Tertrema*, which may be a scaling effect.

Extended diagnosis (based on SMNS 55910). – Lateral margin of postorbital skull strongly concave, squamosal and especially jugal very narrow.

Characters shared with *Tertrema*. – No parachoanal tooth row; palatal fangs sagittally elongated; fangs disproportionately large (HELLRUNG 1987).

## 5. Conclusions

SMNS 55910 clearly belongs to a very large representative of the Trematosauridae. The posterior skull table of the present specimen is extraordinarily slender, approximating to the morphology of the highly derived lonchorhynchine *Cosgriffius campi* (WELLES 1993). The co-occurrence of a tertremin snout fragment belonging to a very slender-headed trematosaurid of similar size is unlikely to be a coincidence. The most plausible assumption is that both specimens belong to the same taxon, *Hyperokynodon keuperinus* PLIENINGER 1852.

Even cautious extrapolation of its dimensions suggests that the animal represented by SMNS 55910 exceeded the size of *Trematosuchus sobeyi*, formerly held as the largest trematosaurid species. The skull roof of *Hyperokynodon* reached at least 80 cm. Judging from recently discovered complete skeletons of trematosaurids in the Lower Keuper, the calculated skull length would indicate a total body length of 2.8 to 3.2 m.

The second specimen of *Hyperokynodon* does not provide substantial information on the relationships of the genus, because the morphology of the preserved region is largely unique. However, the autapomorphic state of the posterior skull table demonstrates that *Hyperokynodon* had a considerably more derived morphology than *Tertrema*. The differences in the snout, such as the smaller choanae, more laterally positioned palatal openings, and proportionately larger fangs, may be attributed to the much larger size of *Hyperokynodon* rather than to phylogenetically significant differences.

The last appearance of a slender-skulled trematosaurid in the Carnian record of Europe corresponds to the appearance and diversification of the crocodile-like Parasuchia (phytosaur). It appears that the niche for an amphibious slender-snouted piscivore was filled sequentially by temnospondyls and parasuchians, and that the latter replaced the former during the Carnian. As mentioned above, many of the trematosaurids from Greenland, Spitsbergen, Europe, Madagascar and Australia are preserved as casts in sandstones. This could mean that they lived in flowing water and this would correlate with the postulated ecology of the different fossiliferous layers: trematosaurians lived in rivers and were often swept in deltaic or marine deposits.

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#### 6. References

- BURMEISTER, H. (1849): Die Labyrinthodenten aus dem Bunten Sandstein von Bernburg. Zoologisch geschildert. Erste Abhandlung. *Trematosaurus*. 71 pp.; Berlin (Reimer).
- COSGRIFF, J. W. & GARBUTT, N. K. (1972): *Erythrobatrachus noonkanbahensis*, a Trematosaurid species from the Blina Shale. – J. Roy. Soc. Western Australia **55**: 5–18; Perth.
- FRAAS, E. (1889): Die Labyrinthodenten der schwäbischen Trias. – Palaeontogr., **36**: 1–158; Stuttgart.
- HAMMER, W. R. (1987). Paleogeology and phylogeny of the Trematosauridae. – In: MCKENZIE, G. D. (ed.), Gondwana Six: Stratigraphy, Sedimentology and Paleontology. – Geophys. Monogr. Amer. Geophys. Union, **41**: 73–83; Washington, DC.
- HAUGHTON, S. H. (1915): On a new species of *Trematosaurus* (*T. sobeyi*). – Ann. S. Afr. Mus., **12**: 47–51; Cape Town.
- HELLRUNG, H. (1987): Revision von *Hyperokynodon keuperinus* PLIENINGER (Amphibia: Temnospondyli) aus dem Schilfsandstein von Heilbronn (Baden-Württemberg). – Stuttgarter Beitr. Naturkde., **136**: 1–28; Stuttgart.
- HUENE, F. V. (1920): *Gonioglyptus*, ein alttriassischer Stegocephale aus Indien. – Acta Zool., **1**: 433–464; Stockholm.
- (1956): Paläontologie und Phylogenie der Niederen Tetrapoden. 716 pp.; Jena (Gustav Fischer).
- JAEGER, G. F. (1857): [short notice over a talk] – Tageblatt der 33. Versammlung deutscher Naturforscher und Ärzte in Bonn im Jahre 1857, Nr. 4, p. 26; and: Amtlicher Bericht, p. 99.

- KEHRER, A. (1848): Die geognostischen Verhältnisse der nächsten Umgebung von Heilbronn.- Einladungsschrift zu der Feier des Geburtsfestes SEINER MAJESTÄT DES KÖNIGS WILHELM VON WÜRTTEMBERG. 10 pp.; Heilbronn (Schell'sche Buchhandlung).
- KUHN, O. (1933): Labyrinthodontia. – Fossilium Catalogus, I. Animalia, Pars 61, 114 pp.; Berlin (Junk).
- LINCK, O. (1968): Fossilinhalt des Schilfsandsteins. – *In*: Erläuterungen zur Geologischen Karte von Baden-Württemberg, GK 25, Bl. 6821, Heilbronn, pp. 50–53; Freiburg.
- MAYER, G. (1973): August Eduard Bruckmann (1810–1884), ein schwäbischer Architekt, Ingenieur und Geologe. – *Jh. Ges. Naturkde. Württ.*, 128: 77–82; Stuttgart.
- MEYER, H. v. (1842): [Letter on Mesozoic amphibians and reptiles] – *N. Jb. Min. Geol. Paläont.* 1842: 301–304; Stuttgart.
- MILNER, A. R. (1993): Chapter 38. Amphibian-grade Tetrapoda. – *In*: BENTON, M.J. (ed.). *The Fossil Record 2*: 663–677; London (Palaeontological Association / Chapman and Hall).
- (1994): Late Triassic and Jurassic amphibians: fossil record and phylogeny. – *In*: FRASER, N. C. & SUES, H.-D. (eds.): *In the Shadow of the Dinosaurs, Early Mesozoic Tetrapods*, pp. 5–22; Cambridge/Mass. (Cambridge University Press).
- PLIENINGER, T. (1852): *Belodon Plieningeri* H. v. MEYER. Ein Saurier der Keuperformation. – *Jh. Ver. Vaterl. Naturkde Württ.*, 8: 389–524; Stuttgart.
- ROMER, A. S. (1966): *Vertebrate Paleontology*; 3rd edn. 468 pp.; Chicago (Chicago Univ. Press).
- (1968): *Notes and comments on Vertebrate Paleontology*. 304 pp.; Chicago (Chicago Univ. Press).
- SÄVE-SÖDERBERGH, G. (1935): On the dermal bones of the head in labyrinthodont stegocephalians and primitive Reptilia with special reference to Eotriassic stegocephalians from East Greenland. – *Medd. Grønland*, 98/3: 1–211; Copenhagen.
- SCHMIDT, M. (1938): Die Lebewelt unserer Trias, Nachtrag. 144 pp.; Öhringen (Rau).
- SCHOCH, R. R. & MILNER, A. R. (2000): Stereospondyli. – *In*: WELLNHOFER, P. (ed.): *Handbuch der Paläoherpetologie*, Band 3B. 203 pp; München (Pfeil).
- SHISHKIN, M. A. (1964): Podotryad Stereospondyli. – *In*: ORLOV, Y.A. (ed.): *Osnovy Paleontologij*, pp. 83–122; Moscow (Nauka).
- WARREN, A. A. & BLACK, T. (1985): A new rhytidosteid (Amphibia, Labyrinthodontia) from the Early Triassic Arcadia Formation of Queensland, Australia, and the relationships of Triassic temnospondyls. – *J. Vert. Paleont.*, 5: 303–327; Norman/Oklah.
- WELLES, S. P. (1993): A review of the lonchorhynchine trematosaur (Labyrinthodontia), and a description of a new genus and species from the Lower Moenkopi Formation of Arizona. – *PaleoBios*, 14: 1–24; Berkeley/Calif.

Addresses of the authors:

Dr. R. Schoch, Humboldt-Universität Berlin, Museum für Naturkunde und Institut für Paläontologie, Invalidenstr. 43, D-10115, Germany.  
E-mail: Rainer.Schoch@MUSEUM.HU-Berlin.de

Prof. Dr. A. R. Milner, School of Biological and Chemical Sciences, Birkbeck College, Malet Street, London WC1E 7HX, UK.  
E-mail: a.milner@bbk.ac.uk

Dipl.-Geol. H. Hellrung, Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart, Germany.  
E-mail: hellrung.smns@naturkundemuseum-bw.de





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