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A NEW *SAURICHTHYS* (ACTINOPTERYGII) FROM THE SPATHIAN (EARLY TRIASSIC) OF CHAOHU (ANHUI PROVINCE, CHINA)

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Abstract. A new species of *Saurichthys*, *S. majiashanensis*, is described. It comes from a series of marine vertebrate-bearing beds of the upper member of the Nanlinghu Formation outcropping in the large quarry at the top of Majiashan (Majia Hill) near Chaohu (Hefei City, Anhui Province, China). Its age is Middle Spathian (Olenekian, Early Triassic). This new species deeply differs from the several pre-Spathian species of *Saurichthys* mainly for having only two longitudinal scale rows together with a reduced grid-like structure for the neural elements in the vertebral column. Further derived characters are in the endoskeleton of the dorsal and anal fin, where radials articulate only to anterior lepidotrichia, the posterior ones being supported by the first scale from the caudal pedicle mid-dorsal and mid-ventral rows, deeply imbedded in the body. In addition, the haemal spines of the caudal region are much enlarged and reversed, with their distal parts pointing forwards. Though the skull is lacking, postcranial characters are enough to justify the erection of a new species. This new *Saurichthys* species, together with other few actinopterygians, can be considered as the oldest assemblage of the Triassic Middle Fish Fauna, which bloomed probably in the early Anisian and widespread especially all over the Tethys for the Middle Triassic and at least the Carnian in the Late Triassic. This new fish assemblage, together with some of the oldest marine reptiles, is considered as the beginning of the actual Triassic recovery among marine vertebrates.

Introduction

The knowledge of biotic recovery, especially the biodiversity and evolution of marine vertebrates in the Early Triassic after the P/Tr mass extinction, is being deepened under new light owing to careful field-based collecting during the last few years, especially in southern China. Regarding the marine vertebrates, the Early Triassic has been split in two parts (Tintori et al. 2013), with the first part, Griensbachian to Smithian, being dominated by fishes and the second, Middle-Late Spathian, characterized by the oldest marine reptiles (McGowan & Motani 2003; Motani et al. 2014). So far, most of the Early Triassic fishes come from the classical sites in western Canada, Greenland, Spitsbergen and Madagascar and more recently from Anhui, Hubei and Jiangsu Provinces in Southern China. These faunas were considered as a whole the Triassic Early Fish Fauna (TEFF), based on their similar composition all over the world (Tintori et al. 2013). Above the fish bearing levels, marine reptiles appeared in the Spathian and they have been found in Japan, Spitsbergen and southern China (Shikama & Kamei 1978; Wiman 1929; Young and Dong 1972; Jiang et. al. 2012). Though in some cases also fishes, and particularly *Saurichthys*, have been cited together with the oldest marine reptiles (Chen 1985; Cox & Smith 1973), no detailed report has been given for them, or they have been described together with the older fauna (Stensiö 1925), as a part of the general 'Early Triassic' assemblage.

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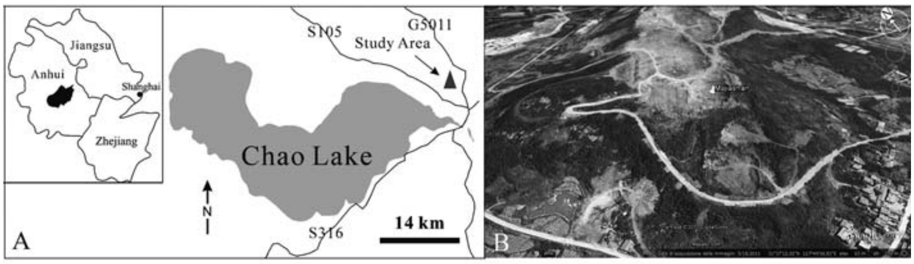

Fig. 1 - A, the localization of Majiashan quarry in Chaohu City, Anhui Province, South China, makes the position of Majiashan Quarry. B, the Majiashan Quarry seen from West toward East (after Sun et al. 2013, modified).

In southern China, two major Early Triassic localities are known to yield marine fishes of a typical TEFF, viz., Jurong in Jiangsu Province (Liu et al. 2002) and Chaohu in Anhui Province. The most interesting site appears to be Chaohu, where plenty of marine reptile skeletons (Jiang et al. 2012; Motani et al. 2014; Stone 2010), together with a few fishes, were excavated from the Upper Member of the Spathian Nanlinghu Formation at the Majiashan Quarry near downtown Chaohu City (Sun et al. 2013; Fig. 1). The locality also exposes the end-Smithian level (top of the Helongshan Formation) with nodules yielding abundant fishes, similar to those from Jurong (Tong et al. 2006), and considered as the youngest assemblage for TEFF (Tintori et al. 2013).

At Majiashan, the most common fish genus in the Upper Member of the Nanlinghu Formation appears to be *Chaohuperleidus* (Sun et al. 2013), which can be considered the oldest representative of the Perleidiformes, one of the two major orders of subholosteans, a specialized group of basal, non-neopterygian, actinopterygians. Few more fish specimens have since been collected from this fossiliferous level and they point to a still poor assemblage made of no more than four to five taxa. A few specimens unequivocally belong to *Saurichthys*, one of the most common fish across the Triassic (Beltan & Tintori 1980; Romano et al. 2012), even if apparently lacking in the end-Smithian assemblage of Jurong and Majiashan itself. Owing to the size of some skull fragments, we can assume that these saurichthyids, more likely belonging to different species, from the Spathian at Majiashan could reach well over 100 cm in length, thus comparable to other large species from Early and Middle Triassic (Tintori 2013). Their size is furthermore very close to the commonest Ichthyopterygia, *Chaohusaurus*, collected from the Upper Member of the Spathian Nanlinghu Formation at Majiashan. Unfortunately, only one specimen is suitable for a detailed description (Fig. 1) that allows us herein to erect the new species for this cosmopolitan genus.

Material and methods

The specimen consists of an almost complete post-cranial skeleton. It lays on a light-grey marly slab, together with a fragmentary skeleton of a very interesting *Chaohusaurus* (Motani et al. 2014), though the two specimens are not yielded on the same lamina surface. The specimen (AGM I-2) was collected through a joint excavation led by AGM, Peking University, University of California, Davis, Università degli Studi di Milano and the Field Museum, Chicago, under concession of the Ministry of Land and Resources of the People's Republic of China. The specimen is stored at the Anhui Geological Museum in Hefei City, Anhui Province, China (Fig. 2).

Preparation of specimen has been roughly done by air chisels; some anatomical details have been cleared manually by very thin needles under the stereomicroscope, and were photographed with Nikon D200 and D3100 with micro lens Nikkor 60 mm, and Sony NEX 5N with micro lens 30 mm.

Abbreviations

Institutional Abbreviation. AGM, Anhui Geological Museum.

Anatomical Abbreviations. **af**, anal fin; **al**, anal loop; **dcs**, dorsal caudal scutes; **df**, dorsal fin; **dfr**, dorsal fin radials; **h**, haemal elements; **mds**, mid-dorsal scale row; **mvs**, mid-ventral scale row; **n**, neural elements; **pct**, pectoral fins; **pv**, pelvic fins; **rhs**, reversed haemal spines; **vcs**, ventral caudal scutes.

Systematic Paleontology

Subclass **Actinopterygii** Cope, 1887
Order **Saurichthyiformes** Aldinger, 1937
Family Saurichthyidae Owen, 1860 [sensu Stensiö 1925]
Genus *Saurichthys* Agassiz, 1834

Saurichthys majiashanensis sp. n.

Figs 2-5

Etymology: from Majiashan (Majia Hill) where the large quarry bearing the holotype and unique specimen is located.

Holotype: specimen AGM I-2, an almost complete specimen lacking most of the skull and the posterior tip of the caudal fin.

Age and Stratigraphical Distribution: bottom of the Subcolumbites zone, Middle Spathian, (Olenekian, Early Triassic), Middle Member of the Nanlinghu Formation.

Geographical Distribution: Majiashan of Chaohu City, Anhui Province (China).

Diagnosis (based on a single combination of characters and *apomorphies)**:** medium sized species of *Saurichthys*, possibly about 450/500 mm in total length. Two longitudinal scale rows (mid-dorsal and mid-ventral). Neural elements in vertebral column with short praezygapophisis, very low-angled in the caudal region, giving rise to a limited 'grid structure' (*sensu* Tintori 2013). Haemal elements ossified beginning from the region between pelvic and median fins, with half the number of the corresponding neural ones; at least 15 of them become very stout and pointing forward in tail region*. About 140 neural elements up to the caudal fin. Median fin rays with at least 8 segments

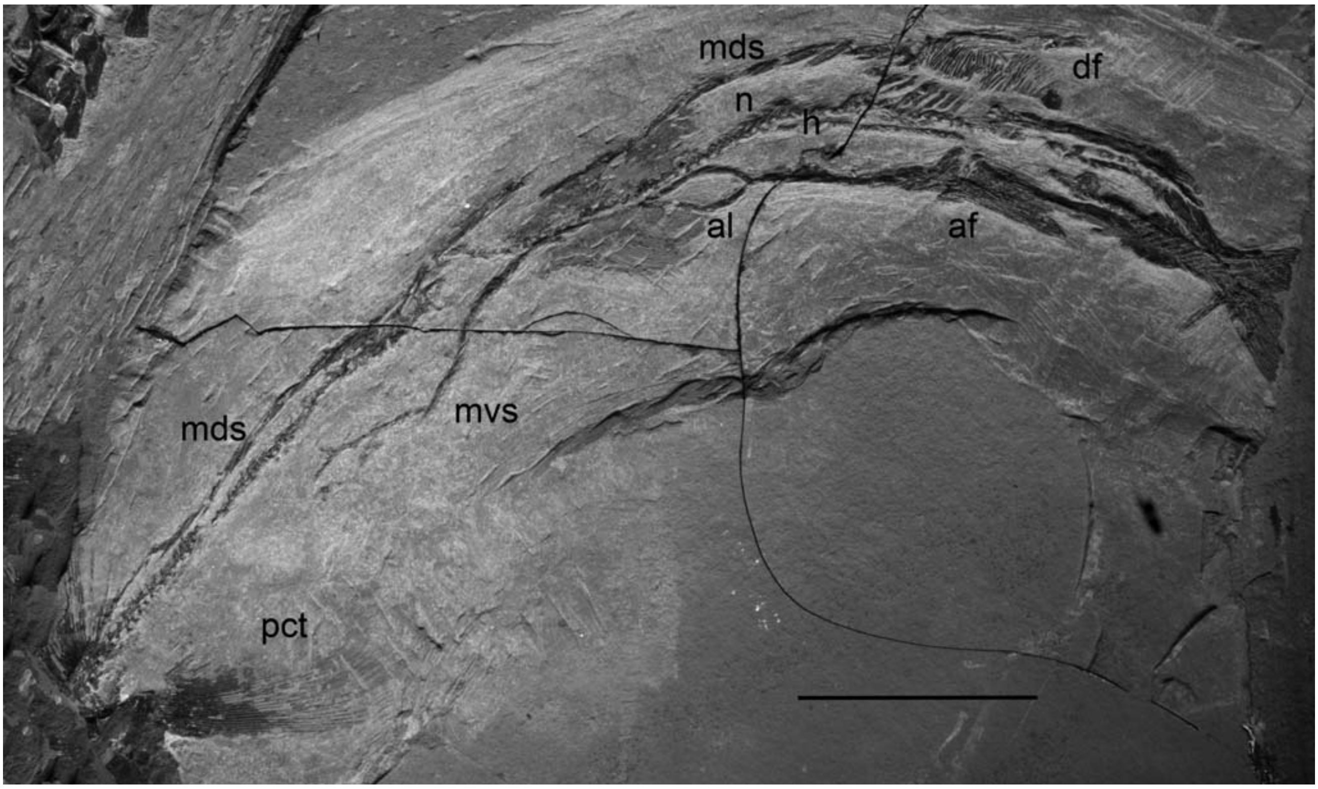

Fig. 2 - *Saurichthys majiashanensis* sp. n., the holotype, specimen AGM I-2. Scale bar equals 50 mm.

in anal and more than 7 in caudal fin. Fringing fulcra at least on median fins. Dorsal and anal fin radials present only in anterior part of the fins, the posteriormost rays articulating on deeply inserted first median scale of caudal pedicle*. Mid-dorsal and mid-ventral scales gradually enlarging to caudal scutes after the median fin.

Description

The length of the body is about 310 mm, which should correspond to a total length of about 450-500 mm; this estimate has been made considering that for middle-sized *Saurichthys* the skull usually represents about 30% of the total length (Tintori 2013).

Skull. As previously noted, little can be known of the skull because only the incomplete inner side of the left opercular bone is seen.

Vertebral Column. The vertebral column is preserved almost completely even if its small elements are not always well detectable (Figs 2, 3). The paired neural elements are made by a small arch region which is convex both on the anterior and posterior sides. Each hemiarch bears a rather short laterally flattened, backward directed, neural spine, not extending for more than one vertebral segment length. A thinner praezygapophysis (sensu Tintori 1990), roughly of the same length of the neural spine, is also present; it is medial to the neural spines and lays at lower angle relative to the notochord than the neural spines. The praezygapophysis and neural spine show a regular arrangement until the middle of the median fins, when they abruptly become almost parallel to the notochord. About 100 neural elements are present counting from the skull until the beginning of the dorsal and anal fins, and 40 more have been counted from there to the beginning of the caudal fin.

Haemal elements ossify starting immediately behind the anal loop: they are paired, very small, probably half the number of the corresponding neural elements, as in most of the earlier species of *Saurichthys* (summarized by Maxwell et al. 2013). Haemal elements are represented by the small arch region; when they approach the middle portion of the caudal pedicle they suddenly expand in a spine and extend in an unusual orientation: pointing anteroventrally instead of posteroventrally. Each spine abuts the adjacent ones giving rise to a very solid continuous 'wall': about 11 elements are involved. The length of the spines increases until the beginning of the caudal fin where they appear to be closer to the body axis: at least six-seven spines form this part and they are increasingly covered by the proximal end of the caudal lepidotrichia.

Scales. Only the two median scale rows are present: the mid-dorsal row starts immediately behind the skull; the mid-ventral one, as usual when squamation is not complete in the trunk region, is visible halfway between the pectoral and the pelvic fins (Fig. 2). The mid-dorsal scales are narrow and elongate at least until the insertion of the dorsal fin: their morphology seems to be the same except for the very first ones, which are very thin. The first mid-dorsal scale after the dorsal fin

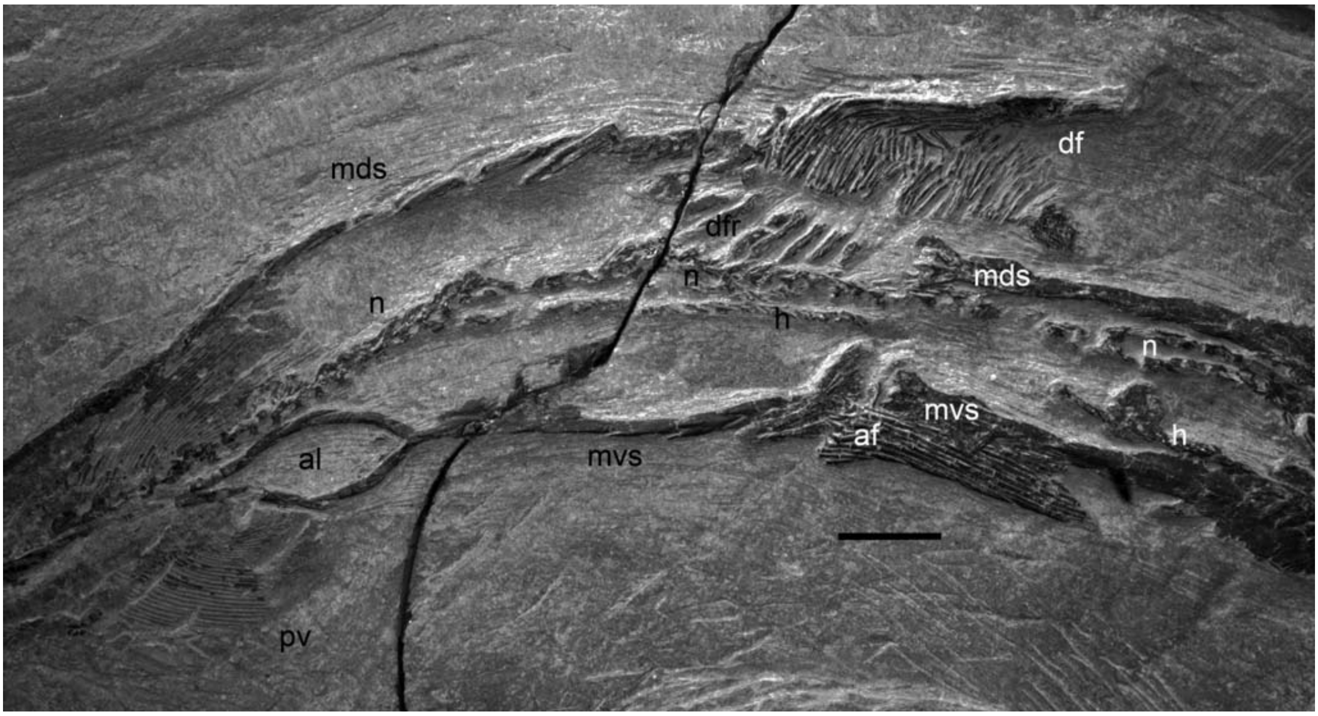

Fig. 3 - *Saurichthys majiashanensis* sp. n. The holotype, specimen AGM I-2. Detail of the region between the pelvic fins and the caudal pedicle. Scale bar equals 5 mm.

has the anterior edge well below the posterior part of the fin itself and it shows a specialized expanded anterior tip (Fig. 3). This tip has, on the dorsal side, two longitudinal, parallel ridges to articulate the posteriormost short lepidotrichia of the dorsal fin. Five-six scales, which show the usual lance-shape, follow this modified scale: proceeding posteriorly, the scales became larger and larger assuming the caudal scute-like shape (Fig. 4). At least 6-7 of such scutes are present; their external surface is smooth.

The mid-ventral scales follow the same general pattern as the mid-dorsal ones, but they start about mid-way between the pectoral and the pelvic fins and give rise to the anal loop just posterior to the pelvics. The anal loop is made of six scales on each side and does not show any specialized structure. The first scale after the anal fin is modified to give support to the posterior part of the fin itself. None of the mid-row scales shows any ornamentation.

Paired Fins. Both pectoral fins are preserved, probably in dorsal view, with the left one almost complete (Fig. 2). Each fin is made of about 40 unsegmented rays, most of which branch at least twice. Lepidotrichia are quite long, compared to most other saurichthyids, the longest one being up to 40 mm. The pelvic fins are made of 28-30 unsegmented lepidotrichia, the longest being at least 25 mm long. They are inserted at about mid-way between the pectorals and the caudal fin.

Median Fins. The median fins (Fig. 3) are inserted quite posteriorly and they are almost symmetrical as usual in *Saurichthys*: dorsal and anal fins are inserted at 2/3 of the body length, in correspondence of about the 100th neural element of the vertebral column. The dorsal fin is made of 50 rays, with posteriormost ones being very thin and short. In the anal fin, all rays are densely arranged as probably they were in life: at least eight segments are present in the longest rays, but their distal part is not preserved. A few fringing fulcra can be seen along the anterior margin of the fins. There are eight ossified endoskeletal elements at least in the dorsal fin: they are quite stout and their length decreases regularly backwards. As mentioned above, the posterior part of both anal and dorsal fin is supported by a modified scale of the mid ventral and mid-dorsal row respectively.

The caudal fin is preserved only in its proximal region (Fig. 4). It looks almost symmetrical, since the ventral lobe starts somewhat in front of the dorsal one, even if this can be due to the taphonomic process. The dorsal lobe shows lepidotrichia made of elongated proximal segments followed by very short ones. At least four more segment rows are present, each one becoming longer and longer distally. In the ventral lobe the structure of the lepidotrichia looks different as, following the long proximal segments, no regular segmentation pattern can be detected and each ray is further jointed at least up to six times (Fig. 4). In the preserved part no branching can be observed. Thin and elongate fringing fulcra are present on both the dorsal and the ventral edge of the fin.

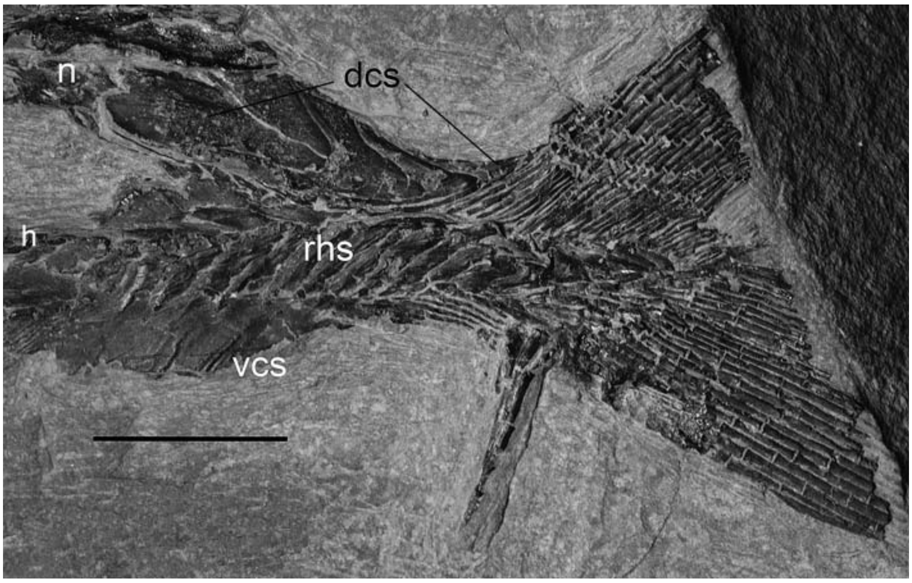

Fig. 4 - *Saurichthys majiashanensis* sp. n. The holotype, specimen AGM I-2. The posterior caudal region. Scale bar equals 5 mm.

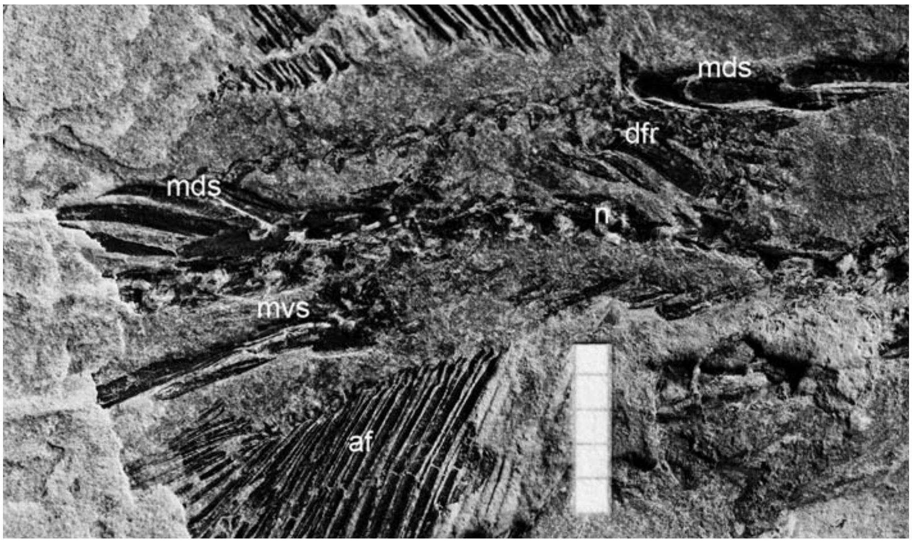

Fig. 5 - *Saurichthys* sp., from Carnian (Late Triassic) of Kozja dnina (Slovenia). Detail of the dorsal and anal fin region showing the anal fin endoskeleton with enlarged first mid ventral scale of the caudal pedicle. Courtesy by T. Itij. Scale bar in mm.

Discussion

As far as we know, the postcranial characters in *Saurichthys* can well support the subdivision in subgenera and species (Rieppel 1985, 1992; Tintori 1990, 2013; Mutter et al. 2008; Romano et al. 2012) even in absence of the skull. The most obvious character of *S. majiashanensis* sp. n. is the greatly reduced scale covering with the presence of the only mid-dorsal and the mid-ventral scale rows. So far, only *S. grignae* (Tintori, 2013) from the early Ladinian of northern Italy, other than *S. deperditus* and *S.* sp. B (Tintori, 1990) from the Norian of the Alps, has this same character. However, these latter species have a well-developed grid structure in the neural part of the vertebral column (Tintori 1990, 2013), as both neural spines and praezygapophyses are as long as a few vertebral segments, up to six, thus much longer than in *S. majiashanensis* sp. n.

All the other species from the end Permian/Early Triassic [*S.* (*Eosaurichthys*) *chaoi, S. (E.) madagascariensis, S.* (*Lepidosaurichthys*) *ornatus, S.* (*L.*) *wimani, S.* (*L.*) *dayi, S.*aff. *dayi, S.*(*L.*) *toxolepis*], all from pre-Spathian levels, have at least six scale-rows, with the anterior part of the body almost totally covered by well ornamented scales (Mutter et al. 2008; Kogan 2011; Romano et al. 2012; but see Tintori 2013 for the subgeneric assignation). All other Middle Triassic species such as *S.* (*Sinosaurichthys*) spp., *S. curionii, S. macrocephalus, S.* (*Costasaurichthys*) *costasquamosus, S.* (*C.*) *paucitrichus,* have six scale rows but *S. dawaziensis* has probably four (Rieppel 1985, 1992; Wu et al. 2009, 2011). Species from the early Late Triassic have usually four or six scale-rows, too (Kogan et al 2009; Tintori 2013). Though the preservation of the new specimen is not perfect, there are no doubts that there are no other scale rows than the two median ones. Nothing can be said about the relationships with *Yelangichthys*, a supposed saurichthyiform recently erected only on skull elements (Wu et al. 2013). Also, it must be pointed out that the phylogenetical analyses of Wu et al. (2013) is quite poor, as very few species of *Saurichthys* have been accounted for. Moreover, it is mostly based on dermal skull and neurocranial characters, which are not usually known in most species of *Saurichthys*.

Following Rieppel (1992), also the segmentation in the median fin may be of some taxonomic interest. *S. majiashanensis* sp. n. has a comparably high number of segments, seven-eight or possibly more, in the lepidotrichia of the median fins. Other species with comparable high ray segmentation are *S.* (*E.*) *madagascariensis* (Dienerian-Smithian), *S. dawaziensis* (Pelsonian), *S.* (*C.*) *costasquamosus* (around Anisian-Ladinian boundary) and *S. deperditus* (Norian) (Rieppel 1985, 1992; Wu et al. 2009; Tintori 2013). However, all these species can be easily distinguished from *S. majiashanensis* at least by the scale covering. Two apomorphic characters, the support of the posterior end of both dorsal and anal fins by a deeply inserted mid-row scale, and the reversed direction of the enlarged haemal spines in the tail, further support the erection of the new taxon *S. majiashanensis* sp. n. Regarding the former, the same structure of the dorsal and anal fins endoskeletric support seems to be present also in an undescribed specimen of *Saurichthys* (Fig. 5) from the late Carnian of NW Slovenia (T. Itij pers. com. 2014). On the other hand, also in *Saurichthys grignae* the posterior part of the endoskeleton of the dorsal and anal fins is quite peculiar (Tintori 2013) and very different from the most common pattern, which shows the radials regularly decreasing in size from the anteriormost to the posteriormost one, supporting the last rays (Rieppel 1985, 1992; Wu et al. 2011; A.T. pers. obs.). Regarding the paired haemal spines in the posterior caudal region, though this character could appear unusual, we do not see any other congruent interpretation. Bürgin (1990, fig. 5) showed similar structures in *Saurichthys curionii* at the pelvic fins level: they were correctly ascribed to the ventro-lateral scale row. These paired rows, when present, are well developed both anterior and posterior to the pelvic fins, as in *Saurichthys orientalis* (Kogan et al. 2009), but they never reach the posteriormost caudal region, after the dorsal and anal fins. In this part of the body, the posteriormost scales of the lateral scale row can be of similar shape respect to the posteriormost haemal spines in *S. majiashanensis* sp. n. However, when present, the paired lateral scale rows cover all the fish body. Thus, we think it is not correct to interpret these bones as a scale row, in the light of the fact that only the mid-dorsal and mid-ventral scales rows are present in *S. majiashanensis* sp. n.

The haemal elements in the different species of *Saurichthys* can vary greatly, and in some cases, they can become very strong, such as in the caudal pedicle of *S. grignae* (Tintori 2013), even if they do not reach the same size visible on *S. majiashanensis* sp. n.

Maxwell & Wilson (2013) conclusions about *Saurichthys* are to be considered at best as provisional, as they are based on very few species of *Saurichthys*, possibly only one or two from a similar age (Middle Triassic). Furthermore, Maxwell & Wilson (2013) did not considered that *Saurichthys* had paired haemal arches and spines, in contrast to the median haemal spines in neopterygian taxa. This latter character, together with the presence of the notochord in *Saurichthys* and vertebral centra in teleosts, must be taken into consideration when discussing the anatomy and the functional morphology of the vertebral column. It is highly probable that also the haemal structures in the caudal (post-pelvic fins) region in *Saurichthys* actively contributed to stiff that region, together with the neural structures and the unpaired fins endoskeletons (Tintori 2013), in order to achieve a better thrust during the ambush ram chase (Gozzi 2006). Thus, the interpretation given by Maxwell & Wilson (2013, fig. 1C) is clearly wrong, as the body cavity cannot end after the anal fin endoskeleton and, furthermore, in the notochordal space.

Conclusions

Though this new fish assemblage from the Upper Member of the Spathian Nanlinghu Formation is still poorly known, it highlights a very important evolutionary step in the actinopterygian fishes, marking the onset of the Triassic Middle Fish Fauna (TMFF) that later radiated in the Anisian (Tintori et al. 2013). So far, typical TMFF is not known in Anhui or Jiangsu Provinces. However, well-known TMFF localities do exist further southwest in China, in Guizhou and Yunnan Provinces, where two very rich Anisian actinopterygian assemblages, comprising both basal Neopterygii and subholosteans, are known as the Panxian and Luoping Faunas (Lombardo et al. 2011; Sun et al. 2012; Tintori et al. 2010). The new species of *Saurichthys* described herein, being so different from all other Early Triassic species of *Saurichthys*, suggests that the important ichthyofaunal change was already started during the middle Spathian (Sun et al. 2013; Tintori et al. 2013), when also several marine reptile clades suddenly bloomed (Jiang et al. 2012; Motani et al. 2014). After the Spathian, marine fishes and reptiles became suddenly very common and diversified at least by the middle Anisian, as recorded by the Panxian and Luoping Faunas in South China (Motani et al. 2008; Lombardo et al. 2011; Sun et al. 2008, 2012; Tintori et al. 2010).

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REFERENCES

Agassiz L. (1834) - Abgerissene Bemerkungen über fossile Fische. *N. Jb. Mineral, Geogn. Geol. Petref.,* 1834: 379-390.

Aldinger H. (1937) - Permische Ganoidfische aus Ostgrönland. *Medd. Grønl.,* 102(3): 1-392.

Beltan L. & Tintori A. (1980) - The genus *Saurichthys* (Pisces, Actinopterygii) during the Gondwana period. In: Cresswell M. M. & Vella P. (Eds) - *Gondwana Five: Proceedings Fifth International Gondwana Symposium*: 53-59, A.A. Balkema, Rotterdam.

Bürgin T. (1990) - Reproduction in Middle Triassic actinopterygians; complex fin structures and evidence of viviparity in fossil fishes. *Zool. J. Linn. Soc.*, 100: 379-391.

Chen L. Z. (1985) - Ichthyosaurs from Early Triassic of Chaoxian County, Anhui Province, China. *Reg. Geol. China,* 15: 139-146. [in Chinese]

Cope E. D. (1887) - Geology and Palæontology. Zittel's manual on Palæontology. *Am. Nat.*, 22: 1014-1019.

Cox C. B. & Smith D. G. (1973) - A review of the Triassic vertebrate faunas of Svalbard. *Geol. Mag.*, 110: 405-418.

Gozzi E. (2006) - Analisi tassonomica e morfo-funzionale di *Saurichthys* e *Birgeria* (Osteichthyes, Actinopterygii). Unpublished Ph. D. Thesis, Università degli Studi di Milano.

Jiang D. Y., Motani R., Tintori A., Rieppel O. & Sun Z. Y. (2012) - Two new Early Triassic marine reptiles from Chaohu, Anhui Province, South China. *J. Vert. Paleontol.*, Program and Abstracts, 2012: 117.

Kogan I., Schönberger K., Fischer J. & Voigt S. (2009) - A nearly complete skeleton of *Saurichthys orientalis* (Pisces, Actinopterygii) from the Madygen Formation (Middle to Late Triassic, Kyrgyzstan, Central Asia) - preliminary results. *Freiberger Forschung.*, C 532: 139-152.

Kogan I. (2011) - Remains of *Saurichthys* (Pisces, Actinopterygii) from the Early Triassic Wordie Creek Formation of East Greenland. *Bull. Geol. Soc. Denmark*, 59: 93-100.

Liu G. B., Feng H. Z., Wang J. X., Wu T. M. & Zhai Z. H. (2002) - Early Triassic fishes from Jurong, Jiangsu. *Acta Paleontol. Sin.*, 41(1): 27-52. [Chinese 27-40; English 41-52]

Lombardo, C., Sun Z. Y., Tintori A., Jiang D. Y. & Hao W. C. (2011) - A new species of the genus *Perleidus* (Actinopterygii: Perleidiformes) from the Middle Triassic of Southern China. *Boll. Soc. Paleontol. It.*, 50: 75-83.

Maxwell E. E., Furrer H. & Sanchez-Villagra M. R. (2013) - Exceptional fossil preservation demonstrates a new mode of axial skeleton elongation in early ray-finned fishes. *Nature Communications*, 4: 2570, DOI: 10.1038/ncomms3570.

Maxwell E. E. & Wilson L. A. B. (2013) - Regionalization of the axial skeleton in the 'ambush predator' guild - are there developmental rules underlying body shape evolution in ray-finned fishes? *B. M. C. Evol. Biol.,* 2013, 13: 265.

McGowan C. & Motani R. (2003) - Ichthyopterygia. In: Sues H.-D. (Ed.) - Handbook of Paleoherpetology, Vol. 8, Verlag Dr. Friedrich Pfeil, München, 175 pp.

Motani R, Jiang D.Y., Tintori A., Rieppel O. & Chen G.B. (2014) - Terrestrial origin of viviparity in Mesozoic Marine Reptiles indicated by Early Triassic embryonic fossils. *PLoS ONE,* 9(2): e88640. doi:10.1371/journal.pone.0088640

Motani R., Jiang D. Y., Tintori A., Sun Y. L., Hao W. C., Boyd A., Hinic-Frlog S., Schmitz L., Shin J. Y. & Sun Z. Y. (2008) - Horizons and assemblages of Middle Triassic Marine reptiles from Panxian, Guizhou, China. *J. Vert. Paleontol.,* 28: 900-903.

Mutter R. J, Cartanyà J. & Basaraba S. A. U. (2008) - New evidence of *Saurichthys* from the Lower Triassic with an evaluation of early saurichthyid diversity. In: Arratia G., Schultze H. P. & Wilson M. V. H. (Eds) - Mesozoic Fishes 4–Homology and Phylogeny: 103-127, Verlag Dr. Friedrich Pfeil, München.

Owen R. (1860) - Palaeontology or a systematic summary of extinct animals and their geological relations. A. and C. Black, Edinburgh, 420 pp.

Rieppel O. (1985) - Die Triasfauna der Tessiner Kalkalpen. XXV. Die Gattung *Saurichthys* (Pisces, Actinopterygii) aus der mittleren Trias des Monte San Giorgio, Kanton Tessin. *Schweiz. Paläontol. Ab.*, 108: 1-103.

Rieppel O. (1992) - A new species of the genus *Saurichthys* (Pisces: Actinopterygii) from the Middle Triassic of Monte San Giorgio (Switzerland), with comments on the phylogenetic interrelationships of the genus. *Palaeontographica*, Abt. A 221: 63-94.

Romano C., Kogan I., Jenks J., Jerien I. & Brinkmann W. (2012) - *Saurichthys* and other fossil fishes from the late Smithian (Early Triassic) of Bear Lake County

(Idaho, USA), with a discussion of saurichthyid palaeogeography and evolution. *Bull. Geosci.*, 87: 543-570.

Shikama T. & Kamei T. (1978) - Early Triassic ichthyosaurus, *Utatsusaurus hataii* gen. et sp. n., from the Kitakami Massif, northeast Japan. *Tohoku Un. Sc. Rep.,* 2nd series, 48: 77-97.

Stensiö E. A. (1925) - Triassic fishes from Spitzbergen - Part 2. *Kung. Svenska Vetensk. Hand.* Serie 3(2/1): 1-261.

Stone R. (2010) - Paleontology Excavation Yields Tantalizing Hints Of Earliest Marine Reptiles. *Science*, 330: 1164.

Sun Z. Y., Lombardo C., Tintori A., Jiang D. Y., Hao W. C., Sun Y. L. &. Lin H. Q. (2012) - *Fuyuangperleidus dengi* Geng et al., 2012 (Osteichthyes, Actinopterygii) from the Middle Triassic of Yunnan Province, South China. *Riv. It. Paleont. Strat.*, 118: 359-373.

Sun Z.Y., Tintori A., Lombardo C., Jiang D. Y., Hao W. C., Sun Y. L., Wu F. X. & Rusconi M. (2008) - A new species of the Genus *Colobodus* Agassiz 1844 (Osteichthyes, Actinopterygii) from the Pelsonian (Anisian, Middle Triassic) of Guizhou (South China). *Riv. It. Paleontol. Strat.*, 114: 363-376.

Sun Z.Y., Tintori A., Jiang D.Y. & Motani R. (2013) - A new Perleididae from the Spathian (Olenekian, Early Triassic) of Chaohu, Anhui Province, China. *Riv. It. Paleont. Strat.*, 119: 275-285.

Tintori A. (1990) - The vertebral column of the Triassic fish *Saurichthys* (Actinopterygii) and its stratigraphical significance. *Riv. It. Paleont. Strat.*, 96: 93-102.

Tintori A. (2013) - A new species of *Saurichthys* (Actinopterygii) from the Middle Triassic (Early Ladinian) of the Northern Grigna Mountain (Lombardy, Italy). *Riv. It. Paleont. Strat.*, 119: 287-302.

Tintori A., Hitij T., Jiang D.Y., Lombardo C. & Sun Z. Y. (2013) - Triassic actinopterygian fishes: the recovery after the end-Permian crisis. *Integr. Zool.* On-line October 2013, doi:10.1111/1749-4877.12077.

Tintori A., Sun Z. Y., Lombardo C., Jiang D. Y., Sun Y. L. &. Hao W. C. (2010) - A new basal Neopterygian from the Middle Triassic of Luoping County (South China). *Riv. It. Paleont. Strat.*, 116: 161-172.

Tong J. N., Zhou X. G., Erwin D. H., Zuo J. X. & Zhao L. S. (2006) - Fossil fishes from the Lower Triassic of Majiashan, Chaohu, Anhui Province, China. *J. Paleontol.*, 80: 146-161.

Wiman C. (1929) - Eine neue Reptilien-Ordnung aus der Trias Spitzbergens. *Bull. Geol. Institut. Univ. Uppsala*, 22: 183-196.

Wu F., Chang M. M., Sun Y. L. & Xu G.H. (2013) - A New Saurichthyiform (Actinopterygii) with a Crushing Feeding Mechanism from the Middle Triassic of Guizhou (China). *PLoS ONE*, 8(12): e81010. doi:10.1371/journal.pone.0081010.

Wu F. X., Sun Y. L., Xu G. H., Hao W. C., Jiang D. Y. & Sun Z. Y. (2011) - New saurichthyid actinopterygian fishes from the Anisian (Middle Triassic) of southwestern China. *Acta Palaeont. Pol.*, 56: 581-614.

Wu F. X., Sun Y.L., Hao W. C., Jiang D. Y., Xu G. H., Sun Z. Y. & Tintori A. (2009) - New species of *Saurichthys* (Actinopterygii: Saurichthydae) from Middle Triassic (Anisian) of Yunnan Province, China. *Acta Geol. Sin.*, 83: 440-450.

Young C. C. & Dong Z. M. (1972) - *Chaohusaurus geishanensis* from Anhui Province. In: Young C. C. and Dong Z. M. (Eds) - Aquatic reptiles from the Triassic of China. *Mem. I.V.P. P., Ac. Sin.*, 9: 11-14. [In Chinese].

摘要—本文描述了龙鱼属一新种,马家山龙鱼 *S. majiashanensis*. 此标本采自安徽省合肥市巢湖马家山顶部南陵湖组上段海生脊椎动物化石富集层，地层时代为早三叠世奥伦尼克期斯帕斯亚期。此新种与出现在斯帕斯亚期之前的龙鱼属种的重大区别在于其仅有两列纵向鳞列、脊柱神经弓上呈现为退化的栅格状结构。其他重要的进化特征出现在背鳍和臀鳍等的内骨骼上，如支鳍骨仅与前端鳍条相连接而后端的鳍条则由尾区的第一个鳞片支撑、中背鳞和中腹鳞支撑深埋于体表、尾区的脉棘比较大、反转而且远端指向前方。尽管缺失头骨，此标本头后骨骼的特征已足以支持建立新种。本龙鱼属新种与同时发现的其他一些辐鳍鱼类是三叠纪中鱼群序列的最早组合，而之后三叠纪中鱼群序列在安尼期早期开始繁盛并在中三叠世至晚三叠世卡尼期扩散到整个特提斯区域。这些早三叠世鱼类组合及最早的海生爬行动物，很可能指示三叠纪生物圈复苏已在海生脊椎动物中真正开始。