On the morphoplogy and taxonomic status of *Xinpusaurus kohi* Jiang et al., 2004 (Diapsida: Thalattosauria) from the Upper Triassic of China

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Abstract

Additional preparation has revealed new information on the cranium and the vertebral column of the type and only specimen of *Xinpusaurus kohi* Jiang et al., 2004, a thalattosaur from the Upper Triassic Xiaowa Formation of Guanling County (Guizhou, south-western China). The new data allow to supplement existing descriptions and to decide on some controversial points raised in recent discussions. Although the skeleton is almost complete, there is some reconstruction, which makes the low presacral vertebral number and the narrow proximal end of the femur, originally regarded as diagnostic characters, doubtful. All other diagnostic characters of the species are valid. Comparison to another thalattosaur species from the Xiaowa Formation, *Xinpusaurus bamaolinensis*, shows great similarities, but is limited due to its insufficient description. Hence, it cannot be excluded that *X. kohi* is a junior subjective synonym of *X. bamaolinensis*. However, the recent claim that *X. kohi* and *X. bamaolinensis* are synonyms of *X. suni*, the type species of the genus, is not supported by the new data. The description of *X. bamaolinensis* leaves many points unclear. Pending a re-description of that specimen that may allow for a more meaningful comparison, *X. kohi* should be allowed to stand.

Keywords: Thalattosauria, Guizhou, Xiaowa Formation, taxonomy, morphology

1. Introduction

The holotype and only known specimen of the derived thalattosaur, *Xinpusaurus kohi*, from the Upper Triassic (Carnian) Xiaowa Formation (formerly also known as the Wayao Member of the Falang Formation) of Guanling County, Guizhou Province, south-western China (Fig. 1) was described by Jiang et al. (2004). While this paper was submitted, Cheng (2003) independently described a skull of another, highly similar thalattosaur from the same formation as *Xinpusaurus bamaolinensis*. This skull is associated with a postcranial skeleton not described in Cheng's (2003) account. The authenticity of this postcranium is questionable (D.-Y. Jiang. pers. comm.; see also Liu 2013). Although Liu (2013) mentioned the postcranial skeleton of *X. bamaolinensis* in his discussion of the alphataxonomy of *Xinpusaurus*, he neither illustrated it nor did he provide any details on its anatomy, except for some general observations.

Liu & Rieppel (2005), in their restudy of *Anshunsaurus huangguoshuensis*, an askeptosaurid thalattosaur from the Xiaowa Formation, and Rieppel & Liu (2006) in their restudy of the skull of *Xinpusaurus suni*, commented on *X. kohi*. They suspected that the postcranial skeleton of the holotype was a composite (Liu & Rieppel 2005). They also commented on several alleged misinterpretations of the skull (Rieppel & Liu 2006) and regarded *X. kohi* as a junior subjective synonym of *X. bamaolinensis*. Based on this assessment, they supplemented the sparse information on the holotype of *X. bamaolinensis* available from Cheng's (2003) skull description by the holotype of *X. kohi* for their extensive re-analysis of the phylogenetic relationships of the Thalattosauria (Liu & Rieppel 2005). More recently, Liu (2013) revised the alphataxonomy of *Xinpusaurus*. He made some additional comments on *X. kohi*, again questioning the authenticity of the specimen (i.e., claiming that it was a composite). He concluded that all *Xinpusaurus* material from the Xiaowa Formation can be included in a single species, *Xinpusaurus suni* Yin in Yin et al., 2000.

Since its original description (Jiang et al. 2004), some re-preparation in crucial areas of the type specimen of *X. kohi* was done, exposing much of the other side of the skull and clarifying several details of the postcranial anatomy. The purpose of this paper is threefold. Firstly, I intend to supplement the original description of the specimen with respect to the newly available information. Secondly, I want to address some of the points concerning the specimen raised by Liu & Rieppel (2005), Rieppel & Liu (2006), and Liu (2013). Thirdly, the taxonomic status of this species is discussed.

Abbreviations: Gmr – Collections of the Geological Survey of Guizhou, Guiyang, PR China; GMPKU – Geological Museum of Peking University, Beijing, PR China; IVPP – Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica, PR China; SPC – Centre of Stratigraphy and Paleontology, Yichang, PR China; cor – coronoid; cor/sa – coronoid/surangular suture; hy – hyoid; j – jugal; fe – femur; fi – fibula; qaf – anterior flange of quadrate; qlc – lateral crest of quadrate; part – preatricular; pmx ppr – posterior process of premaxilla; sp – splenial; st – supratemporal; t –tibia.

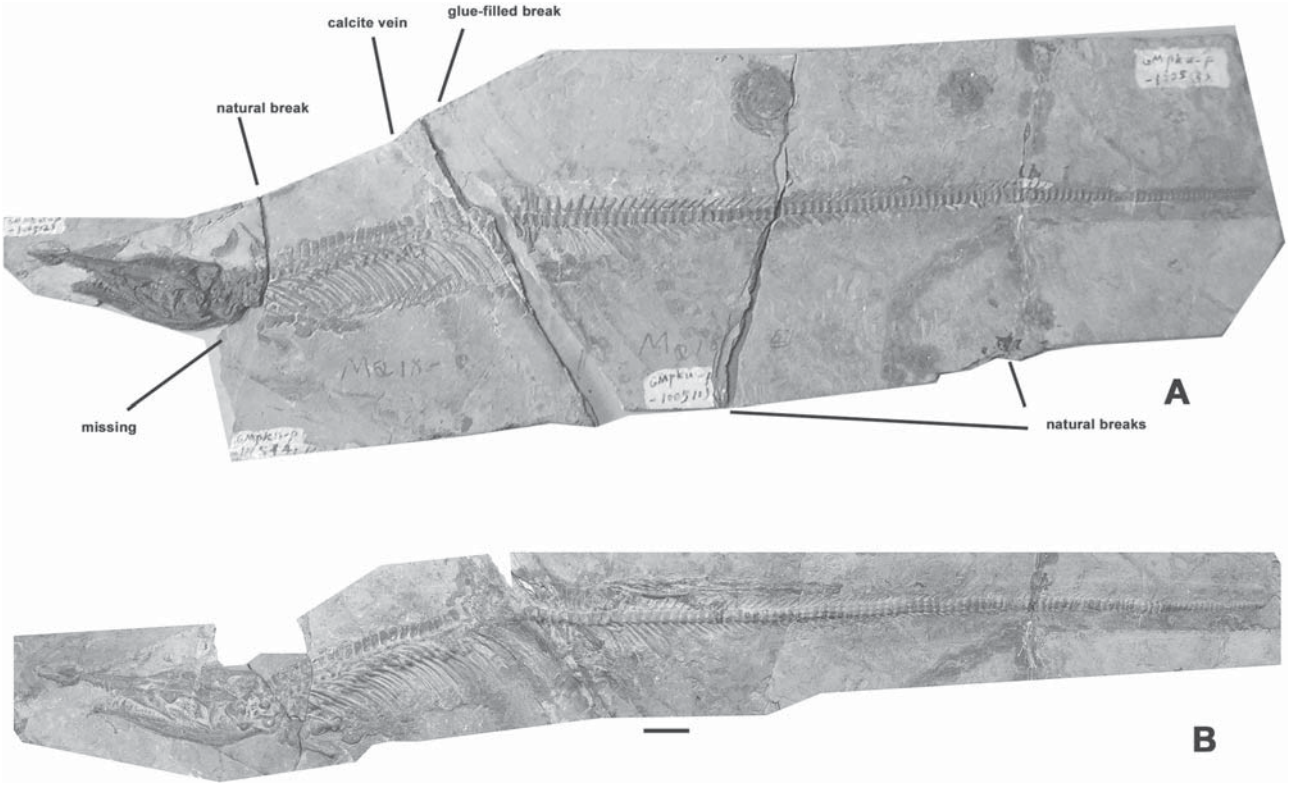

Fig. 1. *Xinpusaurus kohi* (Jiang et al., 2004), holotype (GMPKU 2000/005) from the Upper Triassic (Xiaowa Formation, Carnian) of Guanling, Guizhou, PR China. A: The skeleton as presently preserved, note that part of the scapular region is missing (see also Liu 2013). B: The skeleton in its original state (modified from Jiang et al. 2004). Scale bar 50 mm.

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2. Systematic palaeontology

Thalattosauria Merriam, 1904
Thalattosauridae Merriam, 1904

Genus *Xinpusaurus* Yin in Yin et al., 2000

Type species: *Xinpusaurus suni* Yin in Yin et al., 2000.

Xinpusaurus kohi Jiang et al., 2004
Figs. 1–8

Holotype: GMPKU 2000/005, holotype of *Xinpusaurus kohi* Jiang et al., 2004, an almost complete articulated skeleton preserved largely in lateral view with the skull prepared from both sides.

Type horizon: Xiaowa Formation (Carnian).

Type locality: Xinpu village, Guanling County, Guizhou, PR China.

Diagnosis (emended from Jiang et al. 2004): Small species, skull length less than 250 mm, rostrum very narrow, slender, pointed and straight, lower jaw distinctly shorter than upper jaw, dorsal premaxillary process long, extends markedly beyond nasal, nasal extensive posterior to external naris, frontal and supratemporal meet in considerable suture, angular only very narrowly exposed on lateral surface of lower jaw, processus retroarticularis low and slender, neural spines of the cervical vertebrae wide, low and rectangular in outline, scapula much larger than humerus, radius with distinct anteroproximal notch, carpus well ossified, fibula slightly wider than long, tarsus completely ossified with two proximal and four distal tarsals, metatarsals 2–5 of subequal length, stylo-and zeugopodial elements of hind fin only 10% larger than those of the fore fin.

3. Additional information on the cranial osteology of *Xinpusaurus kohi* (Figs. 1-6)

The recently exposed right side of the skull (Figs. 2B, 3) shows most of the circum- and postorbital regions and

the posterior part of the snout, as well as much of the lower jaw. The right maxilla shows seven teeth, the anteriormost of which is clearly procumbent. Below the maxilla, part of the pterygoid is exposed. It shows a row of six blunt and robust teeth. Between the anterior four and posterior two of the series there is a gap, which probably accommodated an additional tooth. Another tooth definitely followed posterior to the last preserved one, so that there were probably eight pterygoid teeth in the lateral row. Only this lateral row of pterygoid teeth is exposed. Other palatal elements are not visible. Inside the orbit, several fragmentary and ill-preserved bones are present, which cannot be determined with confidence but may represent parts of pterygoid, parabasisphenoid and prootic.

The right jugal is more complete than the left one and clearly shows its triradiate structure (Fig. 3). The anterior suborbital ramus is broken. Its anterior portion is still attached to the maxilla dorsally and extends towards the prefrontal to exclude the maxilla from the orbital margin. The ventral orbital margin is thus entirely formed by the jugal. The postorbital process is almost straight and extends for about one half orbital height dorsally. It is rather wide at its base and continuously tapers to a pointed tip dorsally. The zygomatic ramus extends posteriorly below the infratemporal fenestra up to a point 8 mm anterior to the quadrate condyle.

The quadrate, as reported by Rieppel & Liu (2006) and Liu (2013), shows a large anterior flange that extends anteriorly and dorsally from the anteromedial surface of the condylar region and dorsal quadrate flange. It appears to be even larger than in the specimen of *X. suni* described by Rieppel & Liu (2006), extending, in the present state of the specimen, even anterior to the postorbital bar. This is similar to the situation described by Liu & Rieppel (2001) in another specimen of *X. suni*. The posterior quadrate margin is distinctly emarginated. The considerable bony flange present posteromedial to the lateral quadrate crest in *Xinpusaurus suni* (Rieppel & Liu 2006; Liu 2013) seems to be much reduced.

The quadrate remains in almost natural connection with the articular, which can be well delimitated against the other mandibular elements. It forms a slightly

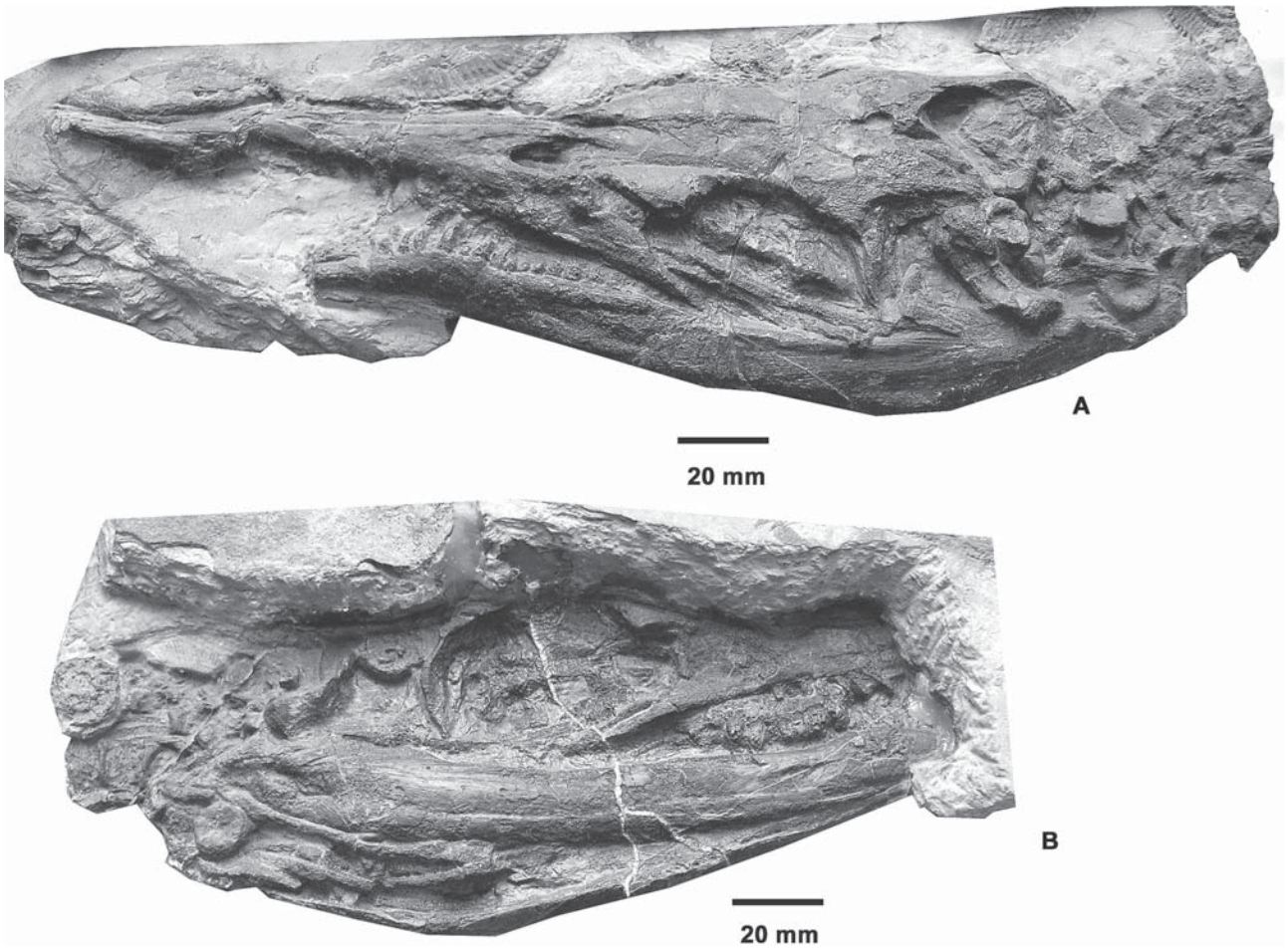

Fig. 2. *Xinpusaurus kohi* (Jiang et al., 2004). Skull of holotype in A: dorsal and B: ventral view.

sinusoidal suture with the surangular that extends anterodorsally-posteroventrally. It appears to reach the posteriormost termination of the retroarticular process, as in *X. suni* (Rieppel & Liu 2006, Fig. 3, where it is shown in medial aspect). The retroarticular process is slender and low, in contrast to *X. suni* (Fig. 2B).

Below the posterior end of the lower jaw and between the two jaw rami, two elongated elements are situated which are probably hyoid ossifications (Fig. 3). The right one, which is better preserved, is distinctly widened anteriorly. Otherwise the two elements are slightly and evenly curved and of slender, rod-like shape.

Part of the medial surface of the left lower jaw ramus is exposed (Fig. 3). An extensive splenial is seen to extend backwards from the symphyseal region and cover at least two thirds of the medial surface of the mandible. Further posteriorly, part of another, tongue-shaped and slender element is exposed which can only represent the prearticular (Fig. 3).

Other skull elements exposed confirm, as far as observable, to the description of Jiang et al. (2004), which needs not to be repeated here. Rieppel & Liu (2006) also commented on the cranial anatomy of *X. kohi*. They correctly stated that the anterior part of the rostrum has been secondarily set into the matrix that was attached, for aesthetic reasons, above the anterior head region. This has been done by the original preparator in an unsatisfactory way, so that there is a displacement between the anterior and posterior parts of the rostrum now (Fig. 4A). There is no doubt from preservation and proportions, however that the tip of the snout actually belongs to the same specimen (see Fig. 4). It is conceivable that it came off the main slab during careless preparation and was later glued back to it in a rather unsatisfactory way. The fact that the narrow, slender and pointed rostrum is an original feature of the specimen is further corroborated by the holotype of *Xinpusaurus bamaolinensis* (see discussion below), which is probably conspecific.

In addition, Rieppel & Liu (2006) claimed that the extent of the posterior process of the premaxilla was a misinterpretation, based on a displaced bone fragment. However, since this posterior premaxillary process is a symmetrical feature that occurs on both premaxillae, their assumption seems unlikely (Fig. 5). The left posterior premaxillary process has been slightly dislocated, whereas the one on the right side (not visible in the figure of the skull provided by Jiang et al. 2004, because it is hidden on the back side of the skull in lateral view) remains in place. An equally extensive posterior premaxillary process was also described for *X. bamaolinensis* (Cheng 2003), and, as Jiang et al. (2004) already had pointed out, it is also a constant feature of *X. suni* (as also shown by Rieppel & Liu

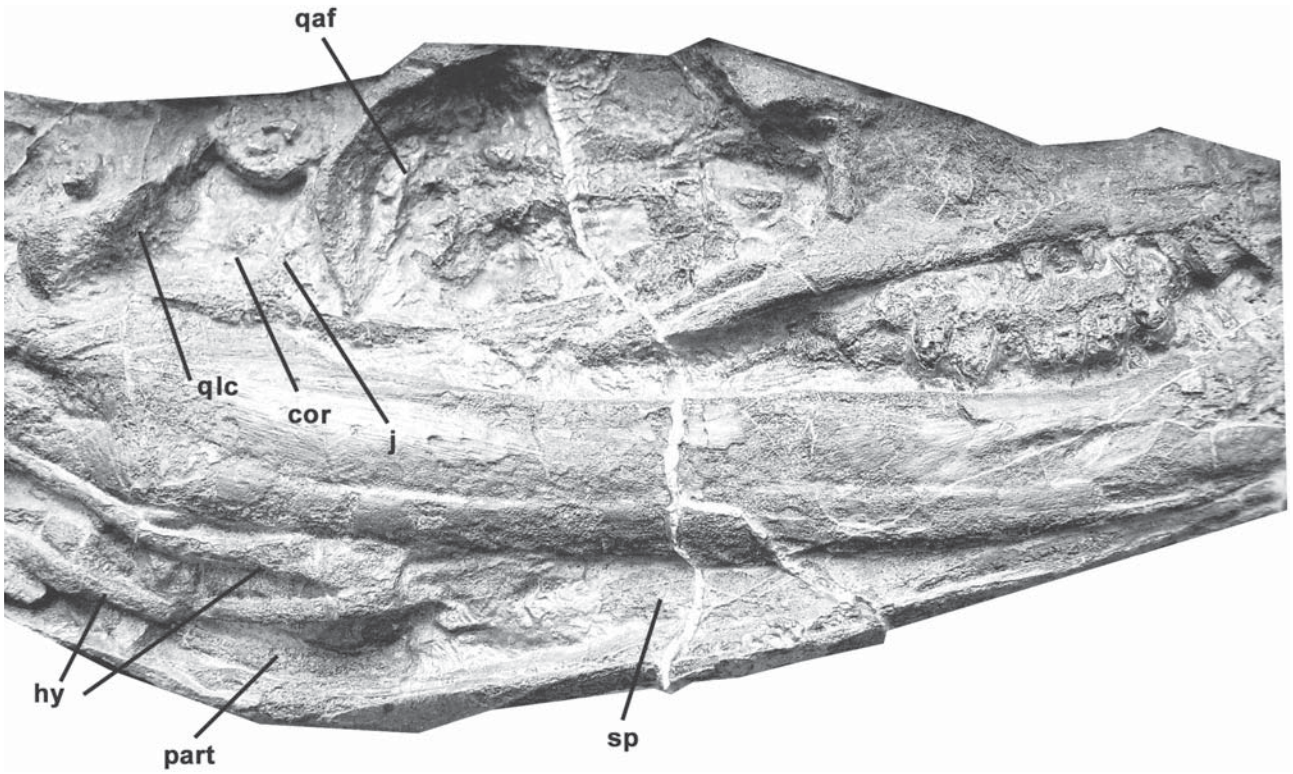

Fig. 3. *Xinpusaurus kohi* (Jiang et al., 2004). Details of the skull in ventral view.

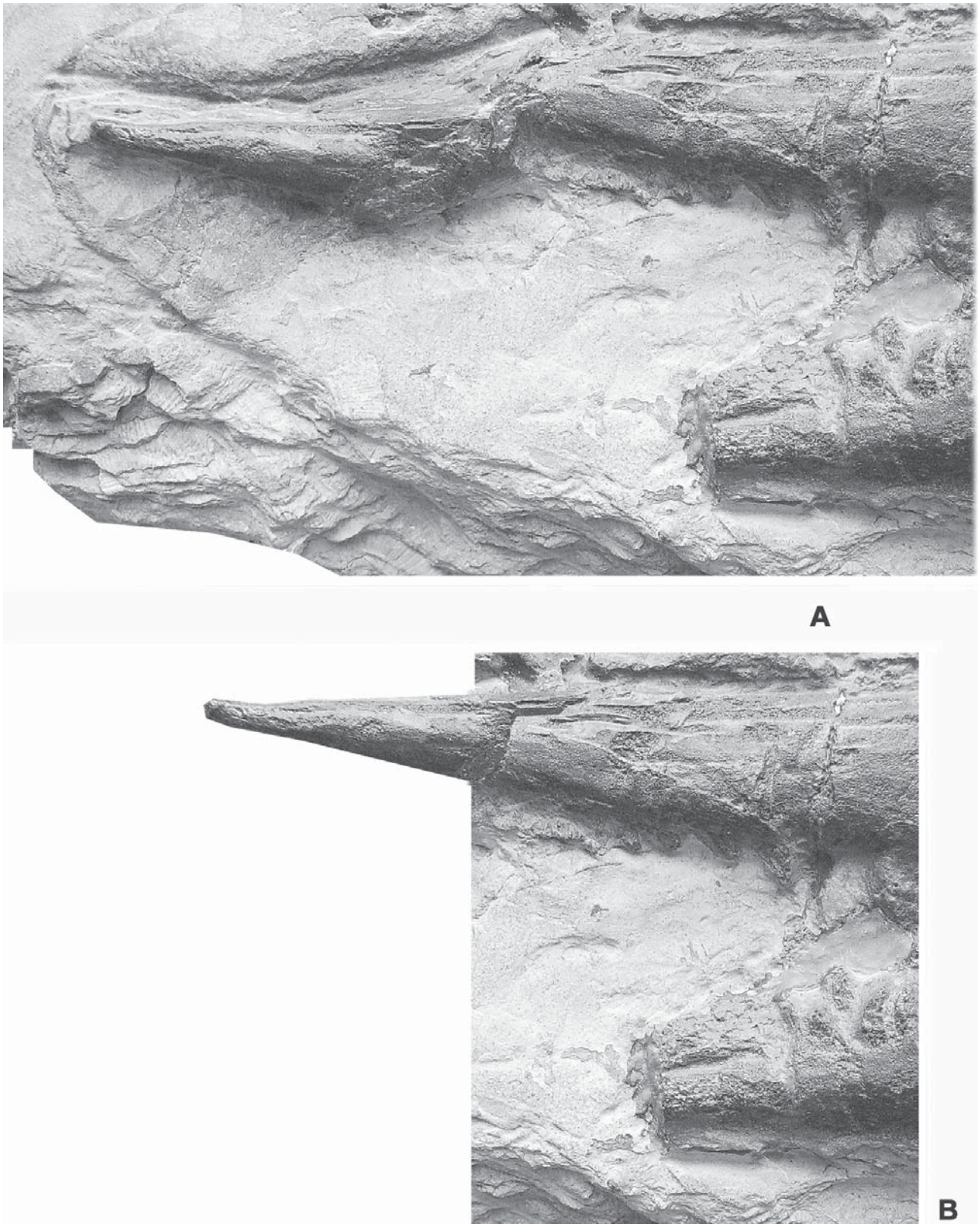

Fig. 4. *Xinpusaurus kohi* (JIANG et al., 2004). The rostrum. A: as preserved. B: reconstructed.

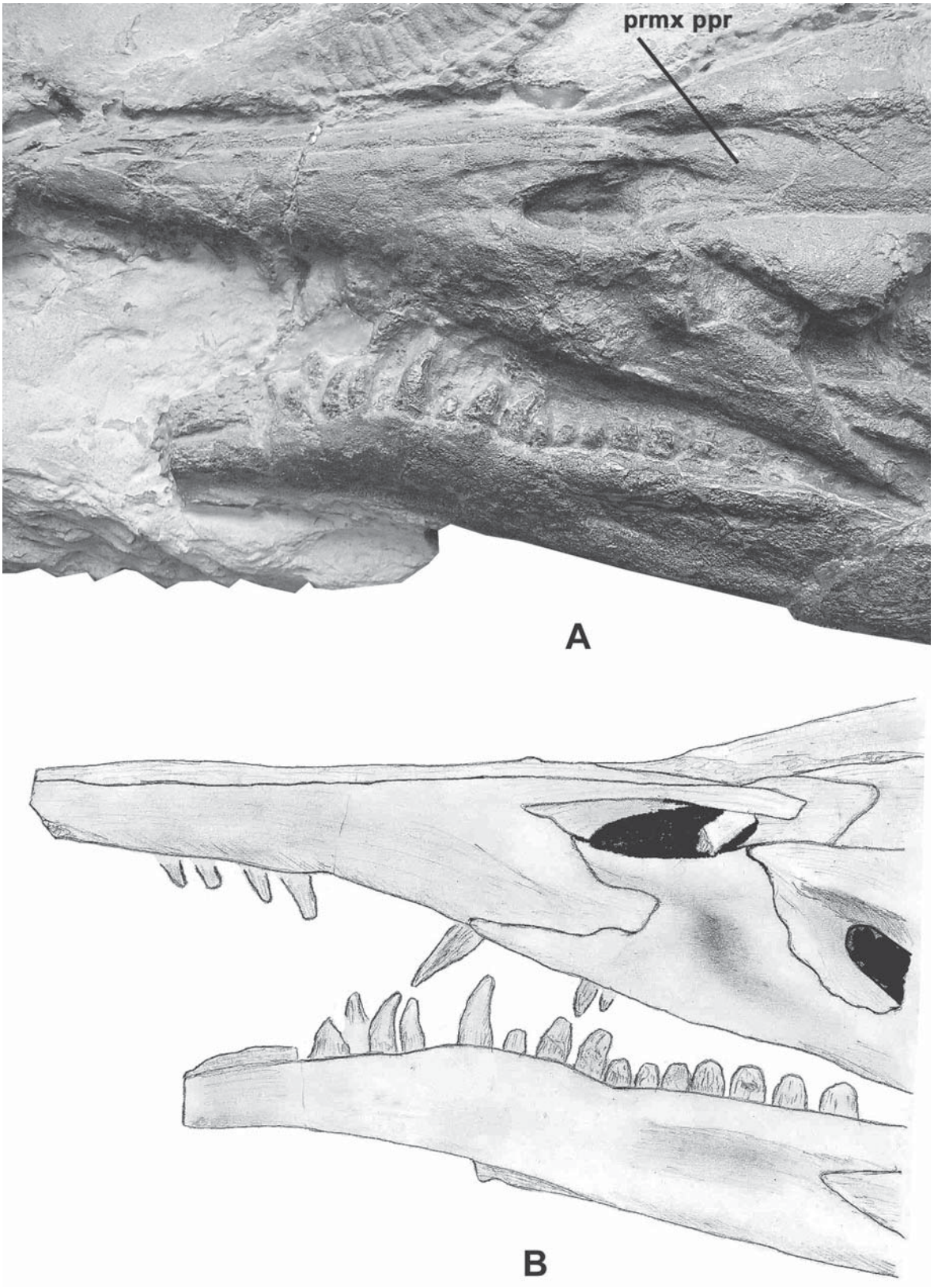

Fig. 5. *Xinpusaurus kohi* (Jiang et al., 2004). The posterior snout region to show the extent of the posterior premaxillary process. A: photograph. B: interpretative line drawing.

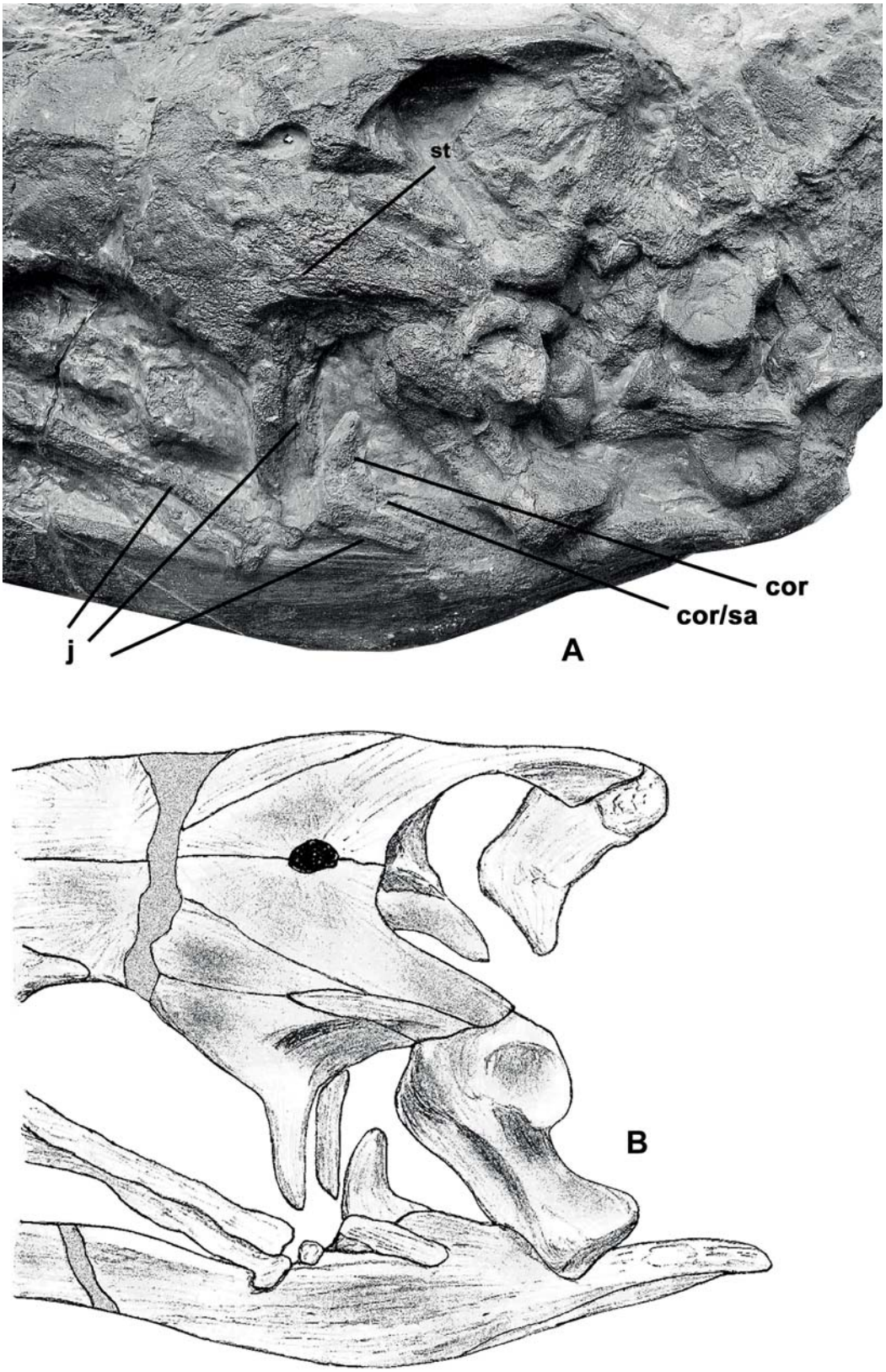

Fig. 6. *Xinpusaurus kohi* (JIANG et al., 2004). The skull roof to show the arrangement of jugal, coronoid and supratemporal. A: photograph. B: interpretative line drawing.

2006: fig. 2). We therefore consider our original interpretation as correct.

Rieppel & Liu (2006) further claimed that we identified the postorbital process of the jugal as the coronoid. This is not true. Part of the zygomatic process of the jugal is clearly overlying the coronoid region of the lower jaw on the left side of the skull (Fig. 6). The coronoid, the lateral surface of which is badly eroded, comes to light dorsal to this portion of the jugal. Its suture with the surangular can be clearly followed for several millimetres (Fig. 6). Part of the postorbital process of the jugal may instead be represented by a narrow splint of badly eroded bone adjacent to the postorbital process of the postorbitofrontal. A similar morphology of the coronoid is also indicated on the newly prepared right side of the skull (Figs. 2B, 3), where the jugal remains completely intact, and where the outlines and part of the surface of the coronoid can be seen adjacent and below the anterior quadrate flange. We therefore see no reason to deviate from our original interpretation. The relatively high coronoid process of *X. kohi* is a genuine feature.

Rieppel & Liu (2006) also stated that they were unable to delineate the supratemporal. Admittedly the ventral suture of the bone, as depicted by Jiang et al. (2004), is not very clear and subject to interpretation. The dorsal suture towards the parietal can be clearly followed, though, especially when moistening the specimen (a process that is generally helpful in identifying the sutures in this material). In fact the supratemporal is even more extensive than figured by Jiang et al. (2004) and makes not only a point-contact but forms a distinct suture with the frontal (Fig. 6).

In consequence, most of the claims of Liu & Rieppel (2005) and Rieppel & Liu (2006) regarding the preservation and morphology of the *X. kohi* type are either in themselves without substance or based on their own misinterpretations.

Liu (2013) commented on the usefulness of the snout length as a distinguishing feature for the several species of *Xinpusaurus*. He concluded that there was variation and that smaller specimens tend to have longer snouts. He therefore regarded the snout length as a taxonomically not very useful feature in *Xinpusaurus*, a conclusion with which I concur. As Jiang et al. (2004) did not consider the snout length in their diagnosis of *X. kohi*, this is of no relevance to the taxonomic status of the species.

4. New information on the postcranial skeleton of *Xinpusaurus kohi* (Figs. 1, 7–8)

The count of presacral vertebrae, which is distinctly lower than in *X. suni*, has been overestimated in the original description of *X. kohi* by Jiang et al (2004). Preparation of the right side of the skull slab has exposed some more of the cervical vertebral column. The atlas and axis can not be definitely identified, but it appears plausible that the anteriormost preserved neural arch, which is situated behind the right half of the skull and partially hidden below skull elements, represents that of the axis. Then follow five clearly identifiable neural arches on the skull slab, all retaining their natural articulation. The centrum associated with the sixth cervical neural arch is already situated on the second slab. On the skull slab, five vertebral centra are clearly identifiable, corresponding with the number of neural arches. Whether the six anteriormost preserved vertebrae can all be counted as cervicals remains unsure, due to a lack of sufficient information on the rib articulation.

On the second slab, there follow 23 presacrals that are all in natural articulation with only some slight displacement anterior to the sacral region. This gives a count of atlas, axis plus 28 presacrals, i.e. 30 presacral vertebrae, as compared to more than 33 assumed by Jiang et al. (2004). The difference to *X. suni* seems thus even more considerable than originally proposed.

However, as pointed out by Liu & Rieppel (2005) and Liu (2013) there is a glue-filled gap between the presacrals 29 and 30 and crossing through presacral 29 (Fig. 1A). The two last presacral ribs, as well as the proximal ends of both femora and another large element, that may represent the ilium, do not cross this gap but end at a thin vein of calcite. The last presacral ribs are much stouter and wider than the elongate rib of the 27th presacral, which is the last one preserved anterior to the glue-filled crack. They also point in another direction, i.e. anteriorly rather than posteriorly, as the more anteriorly situated presacral ribs do. The calcitic vein along which this change takes place is again found above the neural spine of presacral 28, but runs in a slightly different direction. Much of the centrum of presacral 29 is lost and replaced by what appears to be a mixture of matrix and glue. The neural arch associated with this vertebra seems to be composed of the remains of two neural arches distributed anterior and posterior to the glue-filled gap.

All this evidence strongly suggests that the specimen has been tampered with, but not that the specimen is a composite, because in all other respects –size, preservation, sediment colour, texture and degree of weathering as well as associated fauna – numerous specimen of *Trachyceras* and *Daonella* – there is perfect agreement. As both the anterior and posterior part of the skeleton show osteological differences to *X. suni*, it is furthermore clear that both are derived from a much rarer taxon, which makes the possibility of the specimen being a composite even more unlikely. Instead the peculiar preservation suggests that part of the presacral vertebral column, a small portion of the hind limbs (proximal ends of both femora, rendering their narrowness useless as a diagnostic character, as

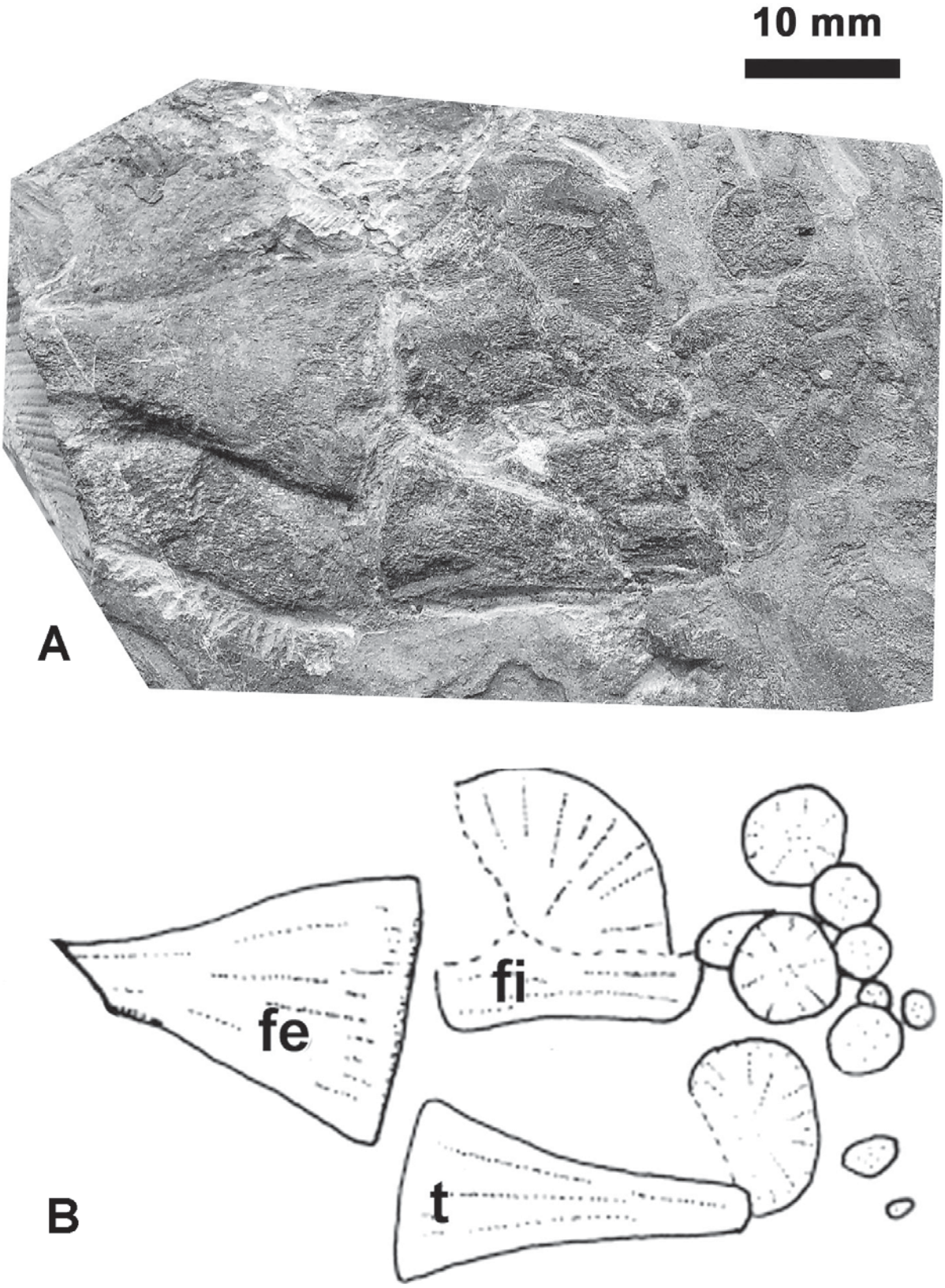

Fig. 7. *Xinpusaurus kohi* (JIANG et al., 2004). The stylo- and zeugopodial elements and the elements of the tarsus A: as preserved, B: as reconstructed (modified from JIANG et al. 2004).

correctly pointed out by Rieppel & Liu 2005 and Liu 2013) and possibly much of the pelvic girdle as well, was lost during the excavation of the specimen or before, and that the two remaining pieces were glued directly together. It is impossible to estimate how many presacral vertebrae fell victim to this procedure, but from the differences seen in rib morphology, it could be at least 5, possibly many more. It is therefore conceivable that the presacral number of *X. kohi* was very similar to that of *X. suni*. It is even possible that it actually exceeded that of *X. suni*. Without further specimens, a decision is impossible.

Nevertheless, this alteration of the specimen is a harmless one, compared to other notorious procedures that are encountered among a large number of vertebrate and invertebrate fossils from the Triassic of Guizhou which are commercially traded. Such procedures include the combination of several specimens of the same species, of several species or even of several genera, the artificial carving and sculpturing of skulls, fins, vertebral columns or even entire skeletons, and, worst of all, the deliberate destruction of original bone in order to produce shapes that are reminiscent of certain skull or limb structures that the fossil trader expected to find or wants the customer to believe to be present in the specimen. With regard to these notorious phenomena, the type of *X. kohi* is still a relatively harmless specimen, and certainly still one of the best and most complete thalattosaur skeletons available worldwide. I do not see any convincing evidence that it is a composite specimen.

The sacral vertebrae are well identifiable by their short and distally strongly widened sacral ribs, both of which are reasonably well preserved in close association with the respective centra. The large costal facet of the second sacral vertebra is partially exposed, making misidentification impossible. The two following anterior caudals bear remarkably long, slender and straight caudal ribs. Ribs from both sides are exposed below the vertebral centra. The first caudal rib is distinctly widened distally, whereas the second one is slender distally. There is no sign of free or even rudimentary caudal ribs further posteriorly in the caudal vertebral column. Instead, haemapophyses are well developed from between caudals 3 and 4 onwards. The lateral surfaces of caudals 1–15 are rather smooth. From the 16th caudal onward, each centrum bears a distinct

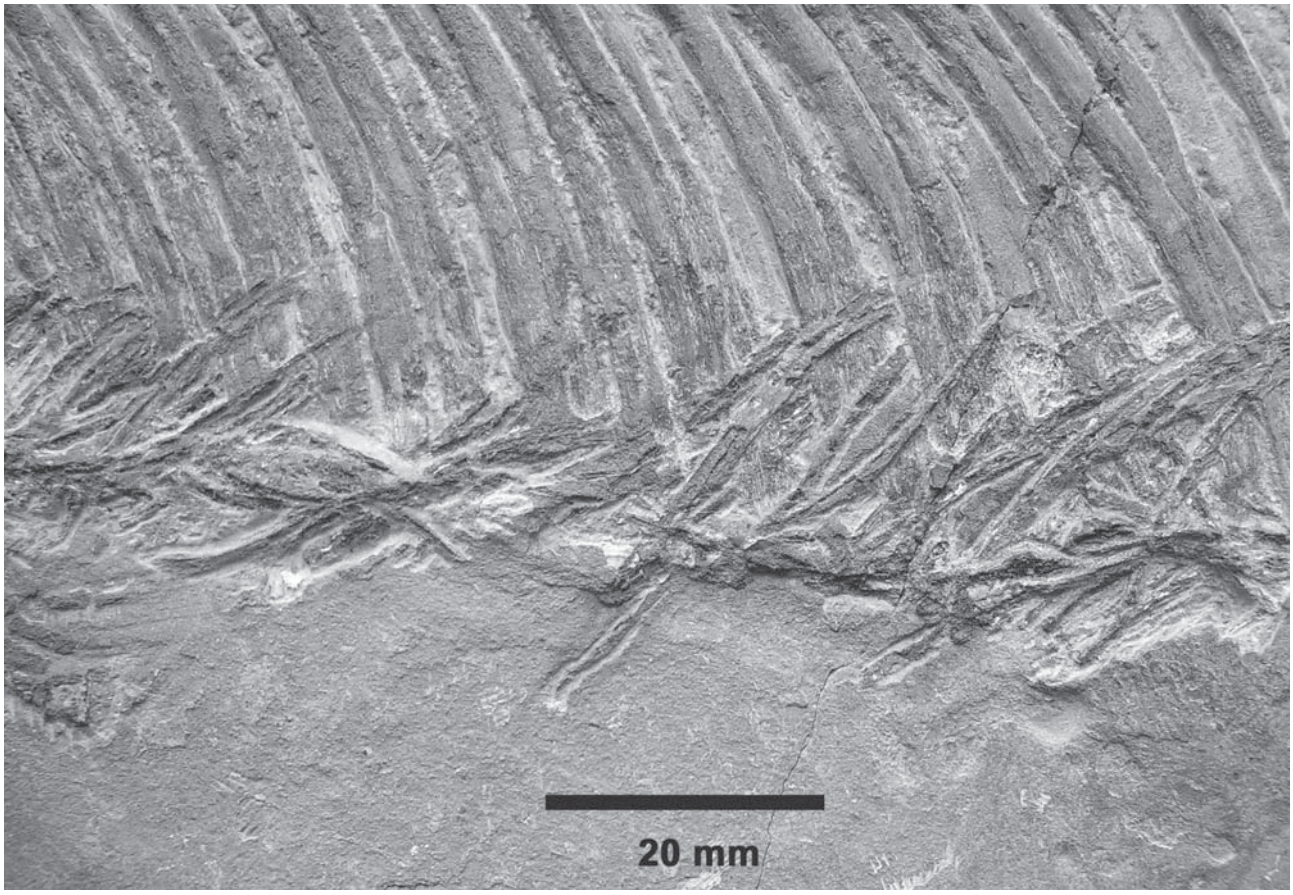

Fig. 8. *Xinpusaurus kohi* (Jiang et al., 2004). The gastral armour in the anterior trunk region.

anteroposteriorly running lateral keel, which can be followed up to the last preserved vertebrae. There are 96 caudal vertebrae preserved in the specimen. Some of the smallest terminal vertebrae are certainly absent (Fig. 1), making a number of at least 100 caudal vertebrae a realistic assumption.

The fins of *X. kohi* have already been described and illustrated in some detail by JIANG et al. (2004) and no new information emerged after restudy, except that the proximal ends of both femora are, as re-preparation has shown, incompletely preserved, and thus their narrowness cannot be considered as a diagnostic character, contra JIANG et al. (2004). However, part of a large plate-like bone was exposed above the zeugopodial elements of the hind fin, which almost certainly represents the ischium. Its posterior margin, as preserved, seems to be almost semicircular in outline. The tarsal elements are refigured here (Fig. 7), since LIU (2013) recently claimed that they were hard to identify in the specimen. Numerous gastral ribs have also been further exposed (Fig. 8). They extend for the entire length of the body, as far as preserved, bearing the probable loss of several presacral vertebrae in mind. They are simple, very narrow, slightly curved rods of bone. Their large number suggests that at least two or three gastralia were present per vertebral segment.

5. Taxonomic status of *Xinpusaurus kohi*

The fact that *X. kohi* represents a taxon different from *X. suni*, the type species of the genus, has been accepted by all subsequent authors, except LIU (2013). However, LIU & RIEPPEL (2005) and RIEPPEL & LIU (2006) claimed that *X. kohi* was a junior subjective synonym of *X. bamaolinensis*. As *X. bamaolinensis* was still undescribed when JIANG et al. (2004) submitted their paper to an international review journal (2 May 2002) and was published much faster (April 2003) in a Chinese non-review-journal; it is certainly necessary to discuss the relationships between these two taxa, which were introduced more or less in parallel.

For unknown reasons, RIEPPEL & LIU (2006) stated that *X. bamaolinensis* was "nearly twice as large" as *X. suni*. In fact CHENG's (2003) account shows a relatively small skull with a length of about 22–23 cm. This is very similar to the size of the type skull of *X. kohi* and lies well within the range of *X. suni*, which, in contrast to RIEPPEL & LIU's (2006) claim, reached considerably larger sizes, with a maximum skull length of almost 40 cm (pers. observ.).

A striking feature of *X. bamaolinensis* is its narrow rostrum as noted by CHENG (2003). In fact it is not much longer than in other specimens of *Xinpusaurus* (see also LIU 2013), but it is strikingly slender and narrow, as in *X. kohi*. Further features considered as diagnostic for the new species *X. bamaolinensis* by CHENG (2003) include the following: a posterior process of the premaxilla which reaches posterior to the nasal (also found in *X. kohi*), a mandible that is distinctly shorter than the skull (also found in *X. kohi* and, to a lesser extent, in *X. suni*), an external naris formed by the maxilla and nasal (found in all specimens of *Xinpusaurus*), an anteromedial process of the frontal extending further anteriorly than the anterolateral process (as is the case also in *X. suni*, the condition in *X. kohi* is somewhat unclear but may have been similar), parietal foramen small and displaced posteriorly (a feature also shown ubiquitously in *Xinpusaurus*).

In summary, *X. bamaolinensis* is diagnosed by an array of characters, which is either found in all species of *Xinpusaurus* or which is shared with *X. kohi*. Apparently there are no features, by which the latter two species could be distinguished, except that the supratemporal and frontal do not meet each other, according to CHENG's (2003) skull drawing and description. For unknown reasons, there is a contact of the two bones shown in his skull reconstruction, hence there remains considerable uncertainty concerning this feature. As the supratemporal and frontal are clearly in extensive contact in *X. kohi*, the lack of such a contact in *X. bamaolinensis* – if true – would constitute a valid difference.

CHENG (2003) also mentioned the presence of a quadratojugal in *X. bamaolinensis*. This is a feature unknown from other thalattosaurids and clearly needs a re-investigation. There are other discrepancies between the skull description, skull drawings and reconstruction, which indicate that the description of CHENG (2003) can hardly be accepted at face value. It is thus certainly necessary that a detailed re-description of *X. bamaolinensis* is provided before any meaningful comparison to the other nominal species of *Xinpusaurus* is possible. Unfortunately, LIU (2013), when revising the taxonomy of *Xinpusaurus*, did not address any of these points, nor did he provide a re-description of the specimen. As long as such a description is unavailable, and since according to the published data there are significant differences between *X. bamaolinensis* and *X. kohi*, the latter species must be considered valid, as also noted by JIANG et al. (2005).

At any rate, the available evidence nevertheless suggests, that the proposal of LIU & RIEPPEL (2005) to regard *X. kohi* as a junior subjective synonym of *X. bamaolinensis* is not implausible. Such a synonymy would have several advantages. First, it reduces the already existing plethora of thalattosaur taxa from the Xiaowa Formation. Second, it supports the decision of LIU & RIEPPEL (2005) to supplement the scarce information on the skull of *X. bamaolinensis* by the type specimen of *X. kohi*, which includes an almost complete postcranium. Nevertheless, with the data presently at hand, such a definite decision is premature and must await further information on *X. bamaolinensis*. The more recent claim to consider both *X. bamaolinensis*

and *X. kohi* as junior subjective synonyms of *X. suni* cannot be supported with the available data, as discussed above. I therefore follow JIANG et al. (2005) in regarding *Xinpusaurus kohi* as a valid species and *X. bamaolinensis* as a species inquirendae.

6. References

CHENG, L. (2003): A new species of Triassic Thalattosauria from Guanling, Guizhou. – Geological Bulletin of China, **22**: 274–277.

JIANG, D.-Y., MAISCH, M. W., SUN, Y.-L., MATZKE, A. T. & HAO, W.-C. (2004): A new species of *Xinpusaurus* (Thalattosauria) from the Upper Triassic of China. – Journal of Vertebrate Paleontology, **24**: 80–88.

JIANG, D.-Y., MOTANI, R., CHUN, L., HAO, W.-C., SUN, Y.-L., SUN, Z.-Y. & SCHMITZ, L. (2005): Guanling Biota: a marker of Triassic biotic recovery from the end-Permian extinction in ancient Guizhou sea. – Acta Geologica Sinica, **79**: 729-738.

LIU, J. & RIEPPEL, O. (2001): A second thalattosaur from the Triassic of Guizhou, China. – Vertebrata Palasiatica, **39**: 77–87.

LIU, J. & RIEPPEL, O. (2005): Restudy of *Anshunsaurus huangguoshuensis* (Reptilia: Thalattosauria) from the Middle Triassic of Guizhou, China. – American Museum Novitates, **3488**: 1–34.

LIU, J. (2013): On the taxonomy of Xinpusaurus (Reptilia: Thalattosauria). – Vertebrata Palasiatica, **51**: 17–23.

LUO, Y. & YU, Y. (2002): The restudy on the skull and mandible of *Xinpusaurus suni*. – Guizhou Geology, **19**: 71–75.

MERRIAM, J. C. (1904): A new marine reptile from the Triassic of California. – University of California Publications in Geological Sciences, **3**: 419–421.

RIEPPEL, O. & LIU, J. (2006): On *Xinpusaurus* (Reptilia: Thalattosauria). – Journal of Vertebrate Paleontology, **26**: 200–204.

YIN, G.-Z., ZHUO, X.-G., CAO, C.-T., YU, Y.-Y. & LUO, Y.-M. (2000): A preliminary study on the early Late Triassic marine reptiles from Guanling, Guizhou, China. – Geology, Geochemistry, **28** (3): 1–22.

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Appendix:

Measurements of the specimen (in mm):

Estimated total length 1400–1500
Height of body measured at the level of the fore fin 95
Measured anterior to hind fin 105
Height of tail at 7th caudal 54
At 15th caudal 41
At 24th caudal 37.5
At 50th caudal 29
At 60th caudal 22.5

Skull length midline 179
Lower jaw as preserved 171.5
Rostrum (preorbital length) 125
Prenarial length 96
Length of naris 11
Orbital length 45
Orbit maximum height 28
Width across posterior skull table 32
Distance of foramen parietale to posterior margin 5
Length of foramen parietale 5.5
Width of foramen parietale 3.5
Height of quadrate sin. 28.5

Length of fore fin ca. 107
Humerus length 29.5
Humerus proximal width 16
Humerus minimum width 6
Humerus distal width 9
Radius proximal width 5.5
Radius distal width 21
Ulna proximal width 10
Ulna minimal width 5
Ulna distal width 8

Length of hind fin ca. 150
Femur distal width 17
Femur minimal width 6
Tibia proximal width 9
Tibia distal width 4.5
Fibula proximal width 9
Fibula distal width 16.5

Presacral 7 neural spine height 10
Distal width 8
Presacral 8 neural spine height 11.5
Distal width 8
Presacral 9 neural spine height 14.5
Distal width 10
Presacral 10 neural spine height 15
Distal width 7
Presacral 11 neural spine height 14
Distal width 7
Presacral 16 neural spine height 14
Distal width 9.5
Presacral 21 neural spine height 15
Distal width 9
Sacral 1 neural spine height ca. 17
Distal width 4.5
Sacral rib 1 distal width 11
Sacral rib 2 length 23
Sacral rib 2 proximal width 5
Sacral rib 2 distal width 10
Caudal rib 1 length 25
Caudal rib 1 minimal width 2
Caudal rib 1 distal width 4.5
Caudal rib 2 length 18 + x
Caudal rib 2 minimal width 1
Caudal rib 2 distal width 1.5
Caudal 3 centrum length 11
Caudal 3 centrum height (ant.) 13
Caudal 15 centrum length 10
Caudal 15 centrum height 14.5
Caudal 25 centrum length 10
Caudal 25 centrum height 13.5
Caudal centrum 30 height/length 10.5/12
Caudal centrum 40 height/length 9.5/12
Caudal centrum 50 height/length 8.5/11
Neural spine caudal 6 height 18.5
Distal width 1.5
Neural spine caudal 15 height 15
Distal width 2
Neural spine caudal 25 height 14
Distal width 2
Haemapophysis 7 length along 29
Haemapophysis 20 length 14/24