Proceedings
of the Eighth Annual Meeting
of the Chinese Society
of Vertebrate Paleontology

第八届
中国古脊椎动物学
学术年会论文集

邓 涛 王 原 主编

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内 容 简 介

本书收集了参加第八届中国古脊椎动物学学术年会的34篇学术论文。这些论文观点新颖，内容丰富，主要讨论了古脊椎动物学、古人类学、旧石器考古学、生物地层学和第四纪地质学等方面的热点问题。书中有关中生代两栖类和爬行类（尤其是恐龙）、晚新生代哺乳动物、中国旧石器、古人类行为以及第四纪环境等方面的论文，展示了中国古脊椎动物学的最新学术成果，具有十分重要的价值。本书可供古生物学、古人类学、地层学、第四纪地质学和考古学研究者、博物馆工作者以及高等院校有关学科教学人员参考。

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序

为了推动古脊椎动物学研究的发展，促进科研人员的学术交流，古脊椎动物学会在上次年会首次出版了学术年会论文集。本次年会的论文集收集了中外学者的论文30余篇，论文的主要内容涵盖了古脊椎动物学、古人类学及其相关的生物地层学、旧石器考古学和古环境学的部分最新研究成果，研究对象还包括了产自韩国和日本的脊椎动物化石。

承蒙所长和学会主席委托为本论文集作序，能为新世纪古脊椎动物学的第一个年会论文集作序实为我之大幸，但深感才疏学浅，难以胜任，唯有寄语同行继往开来，在开展学术交流的同时，总结过去，商议未来，使古脊椎动物学在我国得以进一步地健康发展。

古脊椎动物学是古生物学的一个分支，是通过对化石的发现和对脊椎动物起源、演化的研究，认识生命演变与地球历史的科学。我国幅员广阔，地史时期一直处于十分有利于脊椎动物繁衍的地理位置，在发育相当齐全的地层中保存了丰富而多彩的化石，是世界上探索地球5亿多年以来脊椎动物的演变历史，重建古环境、古地理和古气候最富有潜力的地区之一。尤其是不少脊椎动物的重要门类在我国出现的时代早、原始类型多，对探讨重大生命起源事件甚为重要。

由于我国具有得天独厚的化石资源，很久以前就吸引了国外古生物学者和国内一批有志于这一研究领域的年青人。如果以1927年我国古脊椎动物学的奠基人杨钟健先生的专著《中国北部啮齿动物化石》的出版为这门科学在中国诞生的标志，古脊椎动物学研究在中国已有 70 多年的历史。半个多世纪来，虽几经磨难，但在几代学者的艰苦奋斗和不懈努力下，中国的古脊椎动物学始终在向前发展，并在世界学术领域中占有了一席之地。

近年来，尤其是自上届年会以来，国家进一步加大了对古生物学研究的支持力度，使古脊椎动物学的研究又有了新的发展，并在国际研究前沿取得一个又一个的喜人成果。在著名的云南澄江生物群中发现了极为原始的脊椎动物——昆明鱼和海口鱼，其发现将脊椎动物的历史至少向前推进了2000万年。在云南曲靖泥盆系中发现了兼具辐鳍鱼类和肉鳍鱼类特征的斑鳞鱼，它的发现为硬骨鱼类起源的研究注入了活力，在寻找硬骨鱼类祖先的探索中迈出了重要的一步．贵州三叠纪水生爬行动物的大量发现，使东、西特提斯动物群和动物地理区系的对比成为可能。辽西“化石宝库”的新发现和研究更是高潮迭起，使人眼花缭乱，在鸟类起源及其早期辐射、中生代两栖类和兽类的演化等重大科学问题的研究方面取得的一系列重要成果，极大地吸引了中外学者的关注。在中南地区多处发现的古猿和灵长类化石令世人瞩目，特别是始新世地层中灵长类的发现，被认为是对高等灵长类“非洲起源说”提出的挑战。这些研究成果相继引起国际学术界的喝彩，并多已在世界最著名的科学杂志《Science》和《Nature》上发表。在不到10年的时间里，中外学者先后在这两份刊物上发表了与我国古脊椎动物学和古人类学研究有关的文章近50篇，这种情况恐怕在我国所开展的研究学科中是唯一的。

此外，地层古生物学者还在我国广大地区开展了与古脊椎动物学有关的课题研究，默默地作着大量不甚显眼，但十分有意义的地质学基础性工作，这些研究也取得不少重要的成果。如对新生代哺乳动物的研究，不断在华北、西北和西南填补我国化石和地层的空白，

有力地推动了生物地层学研究的发展，为地层高精度划分、新生代地层表的完善以及使我国这一研究领域与国际接轨方面做出了重要的贡献。本集论文，很大一部分也属于这类有意义的基础研究工作。

近几年来，我国的古脊椎动物学研究虽然进步显著，但仍然存在一些值得注意的问题。这些问题主要表现在：素材积累式的传统研究较多，理论综合性的研究较少；跟踪他人研究较多，自我创新的研究较少；热点研究的短平快较多，大规模的基础性研究较少。古生物学是一门基础性、描述性和积累性的学科，只有做大量扎实的基础工作，才有可能从中找出规律，上升为理论。只有简单的描述而无综合总结，不可能提高；学科的交叉和现代技术的应用无疑是十分重要的，但不重视描述和扎实的基础工作，只追求“高、精、尖”是不切实际，也不可能把研究工作做好；如果只追求“热点”，忽视了基础研究，必然会成为无源之水，基础不稳对学科的长远和持续发展极为不利！

二十一世纪古脊椎动物学也会和其他学科一样，必将有更大的发展。对脊椎动物重要门类在起源和演化方面的认识会大大提高；牵涉到脊椎动物登陆、鸟类的起源、恐龙绝灭和哺乳动物大爆发等重大生物事件的研究必有重大的突破；在探索古生代陆地生态系统的出现、中生代生态系统的转变、现代人类赖以生存的现代生态系统的形成、以及对这些生态系统的演变模式和机制的研究将取得进展；本世纪人类还会孜孜不倦地追踪与研究自身的演化历史，人类的起源和中华民族的由来将是我们探索的重要课题。继续发现更多新地点、新层位和新材料，努力地去攻克古脊椎动物学这些悬而未决的重大问题，是我国古生物学者责无旁贷的历史使命。中国的学者只要立足于自我的人才和化石资源优势，既扎扎实实做好基础性的工作，又勇于创新，完全有可能在古脊椎动物学研究的国际学术舞台上做出更大的贡献！

邱铸鼎

2001 年 9 月 5 日

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新铺龙的头后骨骼 1)

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摘 要 详细记述了产于贵州关岭新铺的一个海龙新材料。此标本可定为孙氏新铺龙相似种（*Xinpusaurus* cf. *suni*）。其头后骨骼有以下特征：颈部短，颈椎数量少于7节；肩胛骨窄高；肱骨近端比远端宽；桡骨肾形；股骨比肱骨长；桡骨与腓骨基本等长。讨论了新铺龙四肢比例，并推测其在水中主要靠尾部侧向摆动前进，四肢起舵的作用。

关键词 海龙目 贵州关岭 晚三叠世 法郎组瓦窑段

POSTCRANIAL SKELETON OF *XINPUSAURUS*

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Abstract A new specimen is described and referred to *Xinpusaurus* cf. *suni*. The postcranial skeleton is characterized by the number of cervical vertebrae that is less than 7, i.e., having a short neck; by high and narrow *Thalattosaurus*-type scapula, the proximal end of the humerus being wider than the distal end, the kidney-shaped radius, the femur being longer than the humerus, the length of the radius being equal to that of the fibula. Based on the analysis of the limb proportions and the tail, it is inferred that the lateral undulation of the tail of *Xinpusaurus* would have provided the necessary force to propel the body through the water, and the limbs are reduced to a steering function.

Key words Thalattosauria, Guizhou, Late Triassic, Wayao Member of the Falang Formation

1 Introduction

Xinpusaurus was named on the basis of specimens from Xinpu, Guanling, Guizhou Province by Yin [1]. A skull from this area was described and referred to this taxon as *Xinpusaurus* cf. *suni*[2]. Another specimen (Institute of Vertebrate Paleontology and Paleoanthropology, IVPP V 12673) was prepared recently, which comprises the posterior part of a skull with the lower jaw and part of the postcranial skeleton (including about 18 presacral vertebrae with ribs, and part of the appendicular skeleton) (Plate I). This specimen also came from the Wayao Member of the

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Falang Formation (Carnian) of Xinpu, Guanling, Guizhou Province, and can be referred to *Xinpusaurus* cf. *suni*. It offers some new information about the postcranial skeleton as is described in this paper.

2 Description

2.1 Skull

The skull of IVPP V 12673 is 150 mm long as preserved (the corresponding length in IVPP V 11860 is about 90 mm). The preserved length of the whole specimen is about 400 mm, no longer than the length of the skull of *Anshunsaurus*[3, 4].

The head of IVPP V 12673 is closely similar to that of IVPP V 11860 in shape. There is no need to describe it in more detail because the bones are not as well preserved as in the latter specimen. The left jugal is preserved *in situ*, but the right one is dislocated towards the ventral side of the lower jaw. The posterior process of the jugal is elongated, which approaches but does not contact the quadrate. Therefore, the inferior temporal arcade remains incomplete posteriorly. The squamosal is a nail-shaped bone located along the posteroventral side of the postorbitofrontal. Its base is expanded to form a ventral process, and it articulates with the quadrate along the posterior surface. The left quadrate is complete and preserved *in situ*. It articulates with the supratemporal dorsally, and with the squamosal along the dorsal part of its anterior surface. No quadratojugal can be identified. There is a pair of ossified hyoid element below the skull; they are slender, and the length of the more complete one is 93 mm.

2.2 Vertebral column and ribs

There are 18 vertebrae preserved. Most of the vertebrae are in articulation with its adjacent ones each other, so the nature of the intervertebral articulation cannot be determined. But it is clear that the posterior part of the centrum of the axis and the anterior part of the centrum of the 3rd vertebra are concave.

The anterior two vertebrae are partly covered by the skull, but it is still possible to analyze the atlas-axis complex. The posterior end of the atlas shows a morphology typical for reptiles. The centrum of the atlas is beveled posteroventrally for the articulation with the intercentrum of the axis. Its neural arch retains a slender postzygapophysis. The intercentrum of the axis is a triangular element in lateral view. The axis resembles the more posterior vertebrae except that the shape of the neural spine is not so wide as in other reptiles. The length of the axis is 14 mm.

The cervical vertebrae cannot be distinguished unequivocally because the sternum is not preserved and other elements of the pectoral girdle also are not in their original position. But there are undoubted long ribs from the 7th vertebra on backwards.

The centra do not vary very much from front to back. All the centra from the 3rd one are about 12 mm (11~14 mm) in length. The ventral edges of the centra are distinctly concave dorsally. Intercentra could not be identified.

The neural arches are well preserved. They are completely fused with the centra. The neural spines slightly slant posteriorly, and they gradually increase in height from front to back (from 25 mm of the 3rd to 30 mm of the 18th).

The base of the neural arch forms prezygapophyses that one anterodorsally directed, which enclose an angle of 40°~ 50° with the vertical line perpendicular to the long axis of the centra; the postzygopophyse have a posterodorsal orientation. Below the zygopophysis of the succeeding vertebrae, there lies a distinct intervertebral forman of a nearly oval outline.

The transverse processes (diapophyse) are distinct on the upper surface of the centrum from the axis. Whether the ribs are holocephalous or dichocephalus is uncertain due to the poor preservation of the proximal ends of the ribs and the overlapping of the rib head. However, a separate parapophysis perhaps exists as shown in the 3rd and the 6th vertebra, in which anterior ribs are articulating with the centra at a position below the diapophysis, suggesting that the ribs be dichocephalus in the anterior part. Some ribs on the posterior position articulate with the diapophysis directly.

The ribs are present from the axis at least. The length of the ribs articulated with the second (atlas), 5th, 6th vertebra is 40 mm, 75 mm, 80 mm respectively as preserved. The length of ribs from 7th to 18th is about 110 mm.

2.3 Appendicular skeleton (Fig. 1)

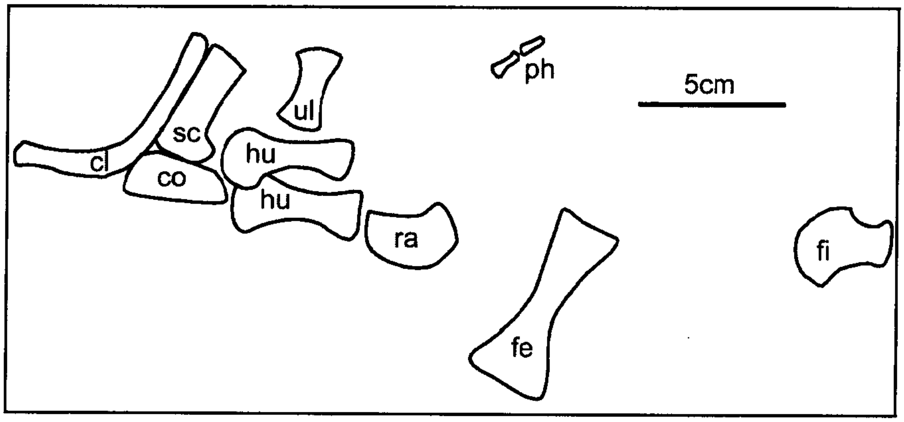

Fig. 1 Outline drawing of the appendicular skeleton of *Xinpusaurus* cf. *suni* (IVPP V 12673) in later view
cl, clavicle; co, coracoid; fe, femur; fi, fibula; hu, humerus; ph, phalange; ra, radius; sc, scapula; ul, ulna

2.3.1 Pectoral girdle

Only the left elements of the pectoral girdle are partly preserved, including the clavicle, the scapular and the coracoid. No interclavicle and sternum can be observed.

The clavicle is well exposed, lying beside the scapular and the coracoid. It is a slender and curved bone of 9 cm in length, and the proximal and distal shanks enclose an angle of about 130°. The curvature of the bone is less pronounced than that in *Clarazia* and *Hescheleria*[5].

The anterior margin of the scapula is overlapped by the clavicle. The scapula is a high and narrow bone with a height of 4.2 cm and a distal width of 2 cm, as is the case in *Thalattosaurus* and *Nectosaurus* sp. (= *Thalattosaurus shastensis*) (Merriam[6], pl. VIII and fig. 2, 3; Nicholls[7], fig. 10), but not like that of *Askeptosaurus*[8], *Clarazia* (Peyer[9], fig. 7 and taf. 47; Rieppel[5], fig. 1) and *Hescheleria* (Peyer[10], fig. 18 and taf. 51, 53; Rieppel[5], fig. 8). The posteroventral part of the scapula that contributes to the glenoid cavity is 10 mm wide.

It is interesting that there are two different types of scapulae in Thalattosauria: one type that is seen in *Thalattosaurus*, *Nectosaurus* and *Xinpusaurus*, and another type characteristic of *Askeptosaurus*, *Clarazia*, *Hescheleria*. These two types can also be found in the Ichthyopterygia: the first type is similar to the scapula of *Shonisaurus*, and the second one similar to that of *Californosarus* or *Shastasarus*[11].

The coracoid is an arch-shaped element with a basal width of 37 mm. The ventral margin is nearly straight with no emargination that would indicate the presence of a coracoid fenestra. The posterodorsal part of the coracoid that takes part in the formation of the glenoid cavity is about 10 mm wide. Unlike in *Thalattosaurus alexandrae* (Nicholls[7], fig. 10), the postoventral part of the coracoid extends posteriorly to the glenoid cavity.

2.3.2 The limb

Two humeri, the left ulna, the left radius, the left femur, the left fibula, and two phalanges are preserved. The humerus measures 45 mm in length, 24 mm in proximal width, 18 mm in distal width, and 11mm in distal thickness. The humerus is greatly expanded at its proximal end, which is wider than the distal end. This is a peculiar character of all thalattosaurs. The humerus may be upside-down, but this is not the case in the preservation of this specimen, and the humeri of the specimens described by Yin[1] are also like this one, so this is the natural case. The distal end of the humerus forms a prominent concave socket, indicting that the articular surface has not been preserved. The humerus is similar to the one in *Nectosaurus* sp. (Merriam[6], pl. VIII and fig. 8), but the latter one perhaps is upside-down. There are no foramina found on the humerus.

A kidney-shaped element is present, similar to the one figured by Merriam[6] (pl. VIII, fig. 6, 7) as the ulna. However Nicholls [7] suspected that it belongs to ichthyosaurs rather than thalattosaurs. The element is identified as the radius in this specimen. Its inner margin is slightly concave while the outer margin is convex. The radius measures 31 mm in length, and 19 mm in width. It closely resembles the distal part of the radius of *Clarazia* in shape, so it had been thought to be only partially preserved, but its length is greater than that of the ulna and thus it seems to be a complete bone. The radius also is similar to that of *Nectosaurus halius* (Nicholls[7], fig. 23).

The ulna is shifted from its original position. It measures 29 mm in length, 15 mm in proximal width and 16 mm in distal width. The proximal articular head forms a concave socket. The distal head is convex. It resembles the ulna of *Thalattosaurus alexandrae* (Nicholls[7], fig. 10).

The femur is slender, and longer than the humerus. It measures 61 mm in length, 21 mm in proximal width, and 29 mm in distal width. The articular surface of the proximal head is weakly convex. No fossa can be observed.

The fibula is a fan-shaped bone, with a length of 31 mm, a distal width of 29 mm, and a proximal width of 15 mm in proximal width. The shaft is markedly concave on both sides. It is shorter than that of *Clarazia* and *Hescheleria*. The distal head shows a strongly convex articular surface.

There are two small club-shaped bones, 12 mm and 9 mm in length respectively. They are identified as the phalanges.

3 Limb proportions

Table 1 lists the measurements of some of the limb elements in *Xinpusaurus* and calculated some proportional values calculated to illustrate changes during growth. The humerus grows faster relative to femur, just as it is in *Hovasaurus* [12].

Table 1 Measurements (in mm) and proportion of limb bones in *Xinpusaurus*

Specimen	Humerus	Femur	L_{hu}	Radius			Fibula			Tibia	L_{ra}	L_{ti}
	L	L	L_{fe}	L	W	W/L	L	W	W/L	L	L_h	L_{fe}
Gmr013	40	60	0.67	27	20	0.74	27	25	0.93	32	0.68	0.53
Gmr011	43	56	0.77	27	20	0.74				36	0.63	0.64
IVPP V 12673	45	61	0.74	31	19	0.61	31	29	0.94		0.69	
Gmr010	62	79	0.78	39	25	0.64	39	35	0.90	35	0.63	0.44
Gmr012	74	83	0.89							40		0.48

The data on Gmr-numbered specimens are from Reference [1]. L = length; W = width.

The epipodials are shortened and widened in *Xinpusaurus*. The length of the radius of *Xinpusaurus* is about 2/3 of the length of the humerus. The length ratio of the radius to humerus (0.63~0.69) are higher than those in the specimens of *Clarazia* (0.42), *Hescheleria* (0.61), *Askeptosaurus* (0.53, 0.57) and *Thalattosaurus* (0.53) (Rieppel[5], Table 1), but approximates that in *Nectosaurus* (0.65) (Nicholls [7], Table 2). The length of the tibia in large specimen is less than half the length of the femur. The relative length of the tibia is the shortest in possibly related diapsids selected by Rieppel[5]. The radius and the fibula are widened as plate-like bones. The width of the fibula is close to its length. But the relative widths of the radius and the fibula reduce during the growth, which is not so distinct. It is interesting to note that the length of the radius is equal to that of the fibula this same specimen.

Xinpusaurus was adapted for swimming. It has a long tail with laterally compressed appearance due to the fairly long neural spines and chevrons. Its limb is small relative to the body (Yin et al. [1], Plate VII). Its epipodials are shortened and widened. In analogy of the analysis of *Hovasaurus* by Currie [12]. The lateral undulation of the tail of *Xinpusaurus* would have provided the necessary force to propel the body through the water, while the limbs are reduced to a steering function.

4 Remarks

Although this specimen of *Xinpusaurus* is not complete, it offers important information on the postcranial skeleton. It is characterized by the number of cervical vertebrae that is less than 7, i.e., having a short neck, and by high and narrow *Thalattosaurus*-type scapula, the proximal end of the humerus being wider than the distal end, the kidney-shaped radius, the femur being longer than the humerus, the length of the radius being equal to that of the fibula. According to the description of Yin et al. [1], the phalangeal formula was primitively indicated as 2, 3, 4, 5, 3 in the manus and 2, 3, 4, 5, 4 in the pes.

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Explanation of Plate I

Xinpusaurus cf. *suni* (IVPP V 12673) in lateral view