

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



海洋出版社

责任编辑：彭 慧  
封面设计：郭子芳



ISBN 7-5027-5370-2



9 787502 753702 >

ISBN 7-5027-5370-2/Q · 166

定价：59.00 元

深圳市仙湖植物园资助出版

# 第八届中国古脊椎动物学 学术年会论文集

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

邓涛 王原 主编

海洋出版社

2001年·北京

## 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。

### 图书在版编目（CIP）数据

第八届中国古脊椎动物学学术年会论文集 / 邓 涛, 王 原主编. —北京: 海洋出版社, 2001. 10

ISBN 7-5027-5307-2

I. 第... II. ①邓... ②王... III. 古生物学-脊椎动物-学术会议-中国-文集 IV. Q915.86-53

中国版本图书馆 CIP 数据核字（2001）第 064114 号

责任编辑: 彭 慧

海洋出版社 出版发行

<http://www.oceanpress.com.cn>

（100081 北京市海淀区大慧寺路 8 号）

北京市燕山印刷厂印刷 新华书店发行所经销

2001 年 10 月第 1 版 2001 年 10 月北京第 1 次印刷

开本: 787×1092 1/16 印张: 19.5

字数: 475 千字 印数: 1~800 册

定价: 59.00 元

海洋版图书印、装错误可随时退换

## 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,是通过化石的发现和脊椎动物起源、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，但仍然存在着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！

邱寿鼎

2001年9月5日

# 目 次

序.....	邱铸鼎 (i)
新铺龙的头后骨骼.....	刘俊 (1)
中国中生代滑体两栖类研究新进展.....	王原 (9)
云南禄丰原蜥脚类和蜥脚类恐龙食性研究.....	魏明瑞 胡书生 张雁 (21)
辽宁朝阳地区土城子组的蜥脚类恐龙化石.....	董枝明 (29)
井研马门溪龙 ( <i>Mamenchisaurus jingyanensis</i> ) 新材料的补充研究.....	张玉光 李建军 (35)
记韩国白垩纪一新的蜥脚类恐龙.....	董枝明 白仁成 金贤珠 (41)
日本的第一个多瘤齿兽化石.....	高田大考 松冈广繁 濑户口烈司 (55)
广东河源盆地的恐龙化石.....	邱立诚 黄东 (59)
黑龙江省上白垩统嘉荫群研究进展.....	李蔚荣 金基东 (65)
山西天镇—河北平原一带晚白垩世的恐龙动物群及地层.....	庞其清 程政武 (75)
苏尼特左旗通古尔组下段及其下伏地层的时代.....	董明星 艾立志 (83)
云南开远小龙潭盆地上新生界地层及古环境.....	董为 (91)
维氏大唇犀(奇蹄目,犀科)头骨的个体发育.....	邓涛 (101)
牙齿尺寸比例及形态特征与食物结构的关系——元谋古猿的食性分析.....	郑良 高峰 刘武 (113)
元谋古猿牙齿釉质生长线与生长发育研究.....	赵凌霄 郑良 姜础 (127)
中国第四纪猿类的来源与系统演化问题.....	同号文 徐繁 (133)
若干大熊猫—剑齿象动物群年代新考及其意义.....	沈冠军 房迎三 (143)
中国鬣狗 <i>Pachycrocuta sinensis</i> 的研究综述——与现生两属 <i>Hyaena</i> 和 <i>Crocuta</i> 的系 统发育关系浅析.....	刘金毅 (149)
岭南地区第四纪动物群的组合和时代的划分.....	张镇洪 (159)
东北地区第四纪哺乳动物群的时代及其特征.....	傅仁义 (167)
苏皖北部新发现的淮河象化石及其生存环境.....	房迎三 (177)
解析周口店第 15 地点古人类的技术与行为.....	高星 (183)
三峡地区旧石器考古新进展.....	裴树文 冯兴无 陈福友 高星 (197)
石制品观察格式探讨.....	卫奇 (209)
甘肃庄浪双堡子旧石器地点.....	谢骏义 刘玉林 丁广学 (219)
浙江洞穴遗址的考古学观察与思考.....	王海明 (229)
“操作链”与旧石器研究范例的变革.....	陈淳 (235)
百色旧石器的发现与研究.....	谢光茂 林强 (245)
安徽旧石器时代.....	郑龙亭 徐繁 (255)
试论汉水流域旧石器时代文化.....	冯小波 (263)
中国与西亚旧石器时代早、中期文化关系.....	王幼平 (271)

山东新石器时代人类眶顶筛孔样病变.....	尚 虹 韩康信(281)
黄河源区的地质及生态环境特征 .....	
.....程 捷 张绪教 田明中 唐德翔 岳建伟 于文洋 占车生	(289)
古脊椎动物标本的计算机管理.....	郑 芳(299)
编后记.....	(301)



# CONTENTS

Postcranial skeleton of <i>Xinpusaurus</i> .....	LIU Jun (1)
Advance in the study of Mesozoic lissamphibians from China.....	WANG Yuan (9)
The diet of prosauropods and sauropods from Lufeng, Yunnan Province, China.....	WEI Mingrui HU Shusheng ZHANG Yan (21)
A forefoot of sauropod from the Tuchengzi Formation of Chaoyang area in Liaoning, China.....	DONG Zhiming (29)
A study on new materials of <i>Mamenchisaurus jingyanensis</i> ...	ZHANG Yuguang LI Jianjun (35)
A preliminary report on a sauropod from the Hasandong Formation (Lower Cretaceous), Korea.....	DONG Zhiming PAIK In Sung KIM Hyun Joo (41)
The first multituberculate from Japan.....	TAKADA Takahiro MATSUOKA Hiroshige SETOGUCHI Takeshi (55)
Dinosaur fossils from the Heyuan Basin in Guangdong Province, China.....	QIU Licheng HUANG Dong (59)
On the Upper Cretaceous Jiayin Group of Heilongjiang Province, China.....	LI Weirong JIN Jidong (65)
The Late Cretaceous dinosaur fauna and strata from Tianzhen, Shanxi And Yangyuan, Hebei, China.....	PANG Qiqing CHENG Zhengwu (75)
The lower part of Tunggur Formation and the age of its underlying stratum.....	DONG Mingxing AI Lizhi (83)
Upper Cenozoic stratigraphy and paleoenvironment of Xiaolongtan Basin, Kaiyuan, Yunnan Province.....	DONG Wei (91)
Cranial ontogenesis of <i>Chilotherium wimani</i> (Perissodactyla, Rhinocerotidae) ...	DENG Tao (101)
The relation between diet and tooth size and morphology: application to the diet analysis for Yuanmou Hominoid.....	ZHENG Liang GAO Feng LIU Wu (113)
Incremental markings and dental development of Yuanmou Hominoid.....	ZHAO Lingxia ZHENG Liang JIANG Chu (127)
On the origin and evolution of Quaternary tapirs in China.....	TONG Haowen XU Fan (133)
Re-dating Late Pleistocene <i>Ailuropoda-Stegodon</i> Fauna and its implications.....	SHEN Guanjun FANG Yingsan (143)
A review of <i>Pachycrocuta sinensis</i> and analysis of its relationship with the two extant genera <i>Hyaena</i> and <i>Crocuta</i> .....	LIU Jinyi (149)
Assemblage and age of the Quaternary mammalian faunas from Lingnan region.....	ZHANG Zhenhong (159)
The age and characteristics of Quaternary mammalian faunas from northeastern China.....	

.....	FU Renyi (167)
New materials of <i>Palaeoloxodon huaihoensis</i> in northern Jiangsu and Anhui Provinces and their paleoenvironment.....	FANG Yingsan (177)
An interpretation of lithic technology and hominid behavior at Zhoukoudian Locality 15 .....	GAO Xing (183)
New advances in Paleolithic archeological investigations in the Three Gorges region, China .....	PEI Shuwen FENG Xingwu CHEN Fuyou GAO Xing (197)
On the pattern of observing stone artifacts.....	WEI Qi (209)
The Paleolithic localities at Shuangpuzi in Zhuanglang County, Gansu Province..... .....	XIE Junyi LIU Yulin DING Guangxue (219)
Observation and reflection on the archaeology of cave sites in Zhejiang.....	WANG Haiming (229)
“Chaine operatoire” and the shift of Paleolithic paradigms.....	CHEN Chun (235)
Discoveries and studies of the Bose Paleolithic industry.....	XIE Guangmao LIN Qiang (245)
The Paleolithic age of Anhui.....	ZHENG Longting XU Fan (255)
Discussion on the Paleolithic culture of Hanshui River valley.....	FENG Xiaobo (263)
The lower and middle Paleolithic in China and West Asia.....	WANG Youping (271)
Cribræ orbitalia on Neolithic skulls of Shandong.....	SHANG Hong HAN Kangxin (281)
The geological and ecological environmental characteristics in the source area of the Yellow River.....	CHENG Jie ZHANG Xujiao TIAN Mingzhong TANG Dexiang YUE Jianwei YU Wenyang ZHAN Chesheng (289)

# 新铺龙的头后骨骼<sup>1)</sup>

刘俊

(中国科学院古脊椎动物与古人类研究所 北京 100044)

**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. *sunii*)。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*

LIU Jun

(Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences Beijing 100044)

**Abstract** A new specimen is described and referred to *Xinpusaurus* cf. *sunii*. 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<sup>[1]</sup>. A skull from this area was described and referred to this taxon as *Xinpusaurus* cf. *sunii*<sup>[2]</sup>. 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

---

1)国家自然科学基金(编号:40072010)和中国科学院创新基金(编号:KZCX3-J-02)资助项目。  
刘俊,男,27岁,助理研究员,从事早期四足动物研究。

Falang Formation (Carnian) of Xinpu, Guanling, Guizhou Province, and can be referred to *Xinpusaurus* cf. *sunii*. 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*<sup>[3, 4]</sup>.

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  $40^{\circ}$ ~ $50^{\circ}$  with the vertical line perpendicular to the long axis of the centra; the postzygapophyse have a posterodorsal orientation. Below the zygapophysis of the succeeding vertebrae, there lies a distinct intervertebral foramen 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 dichoccephalus 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 dichoccephalus 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)

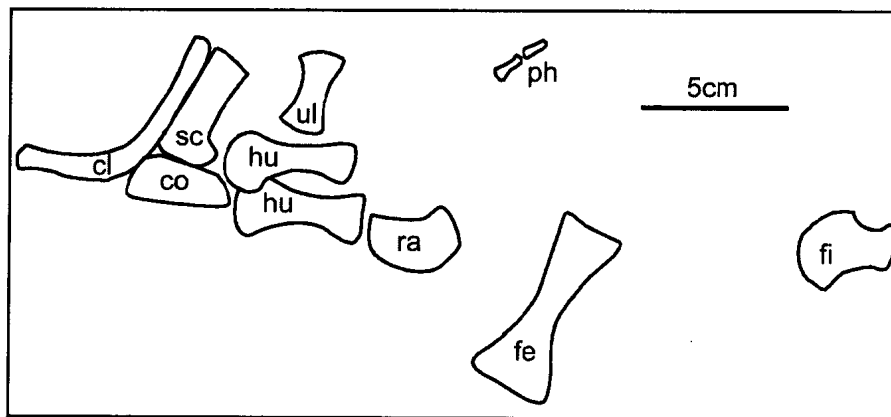


Fig. 1 Outline drawing of the appendicular skeleton of *Xinpusaurus cf. suni* (IVPP V 12673) in later view  
cl, clavicle; co, coracoid; fe, femur; fi, fibula; hu, humerus; ph, phalange; ra, radius; sc, scapula; ul, ulna

#### 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  $130^{\circ}$ . The curvature of the bone is less pronounced than that in *Clarazia* and *Hescheleria*<sup>[5]</sup>.

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<sup>[6]</sup>, pl. VIII and fig. 2, 3; Nicholls<sup>[7]</sup>,

fig. 10), but not like that of *Askeptosaurus*<sup>[8]</sup>, *Clarazia* (Peyer<sup>[9]</sup>, fig. 7 and taf. 47; Rieppel<sup>[5]</sup>, fig. 1) and *Hescheleria* (Peyer<sup>[10]</sup>, fig. 18 and taf. 51, 53; Rieppel<sup>[5]</sup>, 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 *Californosaurus* or *Shastasaurus*<sup>[11]</sup>.

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<sup>[7]</sup>, fig. 10), the postventral 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 11 mm 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<sup>[1]</sup> are also like this one, so this is the natural case. The distal end of the humerus forms a prominent concave socket, indicating that the articular surface has not been preserved. The humerus is similar to the one in *Nectosaurus* sp. (Merriam<sup>[6]</sup>, 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<sup>[6]</sup> (pl. VIII, fig. 6, 7) as the ulna. However Nicholls<sup>[7]</sup> 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<sup>[7]</sup>, 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<sup>[7]</sup>, 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*<sup>[12]</sup>.

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

Specimen	Humerus		Femur		Radius			Fibula			Tibia		L <sub>ra</sub>		L <sub>di</sub>	
	L	L	L <sub>hu</sub>	L	W	W/L	L	W	W/L	L	L <sub>h</sub>	L <sub>fe</sub>				
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<sup>[5]</sup>, Table 1), but approximates that in *Nectosaurus* (0.65) (Nicholls<sup>[7]</sup>, 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<sup>[5]</sup>. 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. <sup>[1]</sup>, Plate VII). Its epipodials are shortened and widened. In analogy of the analysis of *Hovasaurus* by Currie<sup>[12]</sup>. 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.<sup>[1]</sup>, the phalangeal formula was primitively indicated as 2, 3, 4, 5, 3 in the manus and 2, 3, 4, 5, 4 in the pes.

**Acknowledgements** The author thanks Professor Li Jinling and Li Chun for collecting the fossil. I am especially indebted to Dr. Olivier Rieppel and Wang Yuan for kindly revising the manuscript. The specimen was prepared by Ding Jinzhao, and photoed by Zhang Jie.

## REFERENCES

- [1] 尹恭正, 周修高, 曹泽田等. 贵州关岭晚三叠世早期海生爬行动物的初步研究. 地质地球化学, 2000, 28(3): 1~23
- [2] Liu Jun, Rieppel O. The second thalattosaur from the Triassic of Guizhou, China. *Vert Palasiat*, 2001, 39(2): 77~87
- [3] Liu Jun. New discovery of sauropterygian from Triassic of Guizhou, China. *Chin Sci Bull*, 1999, 13: 1312~1315
- [4] Rieppel O, Liu J, Bucher H. The first record of a thalattosaur reptile from the Late Triassic of Southern China (Guizhou Province, P R China). *J Vert Paleont*, 2000, 20(3): 507~514
- [5] Rieppel O. *Clarazia* and *Hescheleria*, a re-investigation of two problematical reptiles from the Middle Triassic of Monte San Giorgio, Switzerland. *Palaeontographica A*, 1987, 195: 101~129
- [6] Merriam J C. The Thalattosauria, a group of marine reptiles from the Triassic of California. *Mem California Acad Sci*, 1905, 5: 1~38
- [7] Nicholls E L. A reexamination of *Thalattosaurus* and *Nectosaurus* and the relationships of the Thalattosauria (Reptilia: Diapsida). *PaleoBios*, 1999, 19: 1~29
- [8] Kuhn-Schnyder E. Die Triasfauna der Tessiner Kalkalpen. XVII. *Askeptosaurus italicus* Nopcsa. *Schw Paläont Abhand*, 1952, 69: 1~52
- [9] Peyer B. Die Triasfauna der Tessiner Kalkalpen. X. *Clarazia schinzi* nov. gen. nov. spec. *Abhand Schw Palaeont Gesell*, 1936, 57: 1~61
- [10] Peyer B. Die Triasfauna der Tessiner Kalkalpen. XI. *Hescheleria rübeli* nov. gen. nov. spec. *Abhand Schw Palaeont Gesell*, 1936, 58: 1~48
- [11] Motani R. Phylogeny of the Ichthyopterygia. *J Vert Paleont*, 1999, 19(3): 473~496
- [12] Currie P J. *Hovasaurus boulei*, an aquatic eosuchian from the Upper Permian of Madagascar. *Palaeont Afr*, 1981, 24: 99~168

## Explanation of Plate I

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



