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辽宁早白垩世义县组一原始鸟脚类恐龙 [1)]

徐 星[1] 汪筱林[1,2] 尤海鲁[1]

(1 中国科学院古脊椎动物与古人类研究所 北京 100044)

(2 中国地质大学地球科学与资源学院 北京 100083)

摘要 初步记述了采自辽西地区早白垩世义县组新的原始鸟脚类恐龙化石材料,并依此建立一新属新种上园热河龙(*Jeholosaurus shangyuanensis* gen. et sp. nov.)。化石产于北票市上园镇陆家屯义县组下部第一段灰白色凝灰质砂岩中,同一层位产出过大量鹦鹉嘴龙化石。

上园热河龙的主要鉴定特征包括6个前上颌齿,鼻骨背面发育小孔,前齿骨约为前上颌骨主体长度的1.5倍、未发育股骨前髁间沟、蹠骨不在一平面上,第三趾趾节中第四节最长。上园热河龙具有一些真鸟脚类恐龙的近裔性状,比如眶前孔小,方骨孔大,位于方颧骨侧面,外下颌孔缺失。另外,上园热河龙的股骨近端形态非常接近进步的鸟脚类恐龙。但是上园热河龙发育有6个前上颌齿,上下颌关节处与齿列位于同一水平线,前上颌齿列与上颌齿列位于同一水平线,这些原始特征未见于已知鸟脚类恐龙。上园热河龙确切系统分类位置需要进一步确定。

上园热河龙是义县组中发现的第二种鸟臀类恐龙,增加了这类恐龙在热河生物群中的分异度。

关键词 辽宁北票,早白垩世,鸟脚类恐龙

中图法分类号 Q915.864

A PRIMITIVE ORNITHOPOD FROM THE EARLY CRETACEOUS YIXIAN FORMATION OF LIAONING

XU Xing[1] WANG Xiao-Lin[1,2] YOU Hai-Lu[1]

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

(2 *College of Earth Science and Resources, China University of Geosciences* Beijing 100083)

Abstract A new ornithopod dinosaur is named and described on the basis of two specimens from the Early Cretaceous Yixian Formation at Lujiatun Locality, Liaoning Province, China. Diagnostic features of this new ornithopod include six premaxillary teeth, a few foramina on the dorsal surface of the nasal, a large quadrate foramen on the lateral

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side of the quadratojugal, lack of external mandibular fenestra, predentary about 1.5 times as long as the premaxillary main body, anterior intercondylar groove of the femur absent, metatarsals not in the same plane, pedal phalanx III-4 longer than other phalanges of pedal digit III. The discovery of a new ornithopod from the Yixian Formation increases the diversity of the Jehol fauna.

Key words Beipiao, Liaoning, Early Cretaceous, ornithopod

The lower Yixian Formation has recently produced many spectacular vertebrate fossils, which include some important dinosaur materials (Chen et al., 1998; Ji et al., 1998; Xu et al., 1999a, b). However, compared to the high diversity of non-avian theropod dinosaurs, only one ornithischian species has been reported (Xu and Wang, 1998). In 2000, two ornithopod specimens have been collected from the tuffaceous sandstone of the first member of the lower Yixian Formation (Wang et al., 1998). These two specimens represent a new ornithopod that might be the most primitive ornithischian from China. The purposes of this paper are to report this important discovery and to describe briefly the new taxon; detailed study, including discussion on the phylogenetic relationships of the new ornithopod, will be published later.

Order Ornithischia Seeley, 1887

Family Incertae sedis

Genus *Jeholosaurus* gen.nov.

Etymology Genus name refers to 'Jehol', old geographical name for western Liaoning and northern Hebei.

Type species *Jeholosaurus shangyuanensis* sp. nov.

Diagnosis As for the type and only known species.

Range Early Cretaceous, Western Liaoning, China.

Jeholosaurus shangyuanensis sp. nov.

(figs. 1～2; pls. I～II)

Etymology 'shangyuan' refers to the larger geographical area including the type locality.

Holotype IVPP V 12529, nearly complete skull, partial postcranial.

Referred specimen IVPP V 12530, nearly complete skull and some cervicals.

Type locality and horizon Lujiatun, Shangyuan, Beipiao City, Liaoning Province, China; Early Cretaceous, Yixian Formation.

Known distribution Known only from the type locality and horizon.

Diagnosis A small ornithopod differs from other ornithischians in a combination of the following primitive and derived characters: six premaxillary teeth, a few foramina on the dorsal surface of the nasal, a large quadrate foramen on the lateral side of quadratojugal, predentary about 1.5 times as long as the premaxillary main body, lack of external mandibular fenestra, the anterior intercondylar groove of the

femur absent, metatarsals not in the same plane, pedal phalanx III–4 longer than other phalanges of pedal digit III.

Description This description is based on both the holotype and referred specimens.

Jeholosaurus shangyuanensis is a small ornithopod with a skull that is about 6cm in length (from tip of snout to back of quadrate). It has a short preorbital skull segment (about 40% of the skull length) and large orbit (about 40% of the skull length). In this fearture, it is more similar to *Agilisaurus* (Peng, 1992) and hypsilophondontids (Sues and Norman, 1990). The premaxilla bears six teeth. The first premaxillary tooth is close to the midline of the snout, thus making a very limited edentulous anterior portion of the premaxilla. The ventral margin of the premaxilla is level with that of the maxilla and the diastema between the premaxillary and maxillary teeth is short (about one tooth length). A long posterolateral process of the premaxilla is present but seems not contacting the lacrimal. The external naris is large, and its long axis is nearly as long as that of the main body of the premaxilla. In this feature, it is more similar to heterodontosaurids (Weishampel and Witmer, 1990). Some advanced ornithopods also have an enlarged external naris (Sereno, 1986). A subnarial foramen is present along the suture of the premaxilla and the maxilla.

The maxilla is relatively tall and triangular in outline. The ventral margin of the maxilla is strongly emarginated dorsal to the tooth row. The outer surface of the tooth-bearing portion of the maxilla is pierced by a few foramina, one of which is large and probably communicates with the antorbital fossa. The antorbital fossa is moderate in size and well defined. A small antorbital fenestra is present in the posterior antorbital fossa.

The lacrimal is somewhat L-shaped. Its anterodorsal end seems to insert into a slot in the apex of the maxilla as in *Lesothosaurus* (Sereno, 1991) and *Agilisaurus* (Peng, 1997). Its ventral process contacts the maxilla, excluding the jugal from contributing to the formation of the antorbital fossa. In this character, it is similar to *Agilisaurus* (Peng, 1997) and *Hypsilophodon* (Sues and Norman, 1990).

The jugal is relatively shallow, with a slender under-orbital ramus, a long and slender dorsal process and a relatively deep under-temporal ramus. Relatively slender jugal is also present in *Lesothosaurus* (Weishampel and Witmer, 1990), *Agilisaurus* (Peng, 1992), and *Yandusaurus multidens* (He and Cai, 1984). Its posterior end is bifurcated, overlapping the quadratojugal laterally. The quadratojugal is comparably small in size, ventrally located and forms the ventral margin of the lower temporal fenestra. It is pierced by a prominent rounded foramen as in some hypsilophodontids (Sues and Norman, 1990).

The quadrate has a broad lateral process and its ventral end is relatively dorasIly positioned, almost level with the ventral margin of the maxilla. It forms the posterior border of the lower temporal fenestra. The lower temporal fenestra is long

dorsoventrally and very narrow anteroposteriorly, particularly in its middle portion, thus being somewhat dumbbell-shaped in lateral view.

In dorsal view, the nasal bears a few foramina along the anterolateral margin. An elliptic fossa is present along the sutural line of the nasals as in *Agilisaurus* (Peng, 1992) and *Yandusaurus multidens* (He and Cai, 1984). The frontals have a relatively narrow interorbital portion. The parietals are short anteroposteriorly and bear a sagittal crest. The upper temporal fenestra is small.

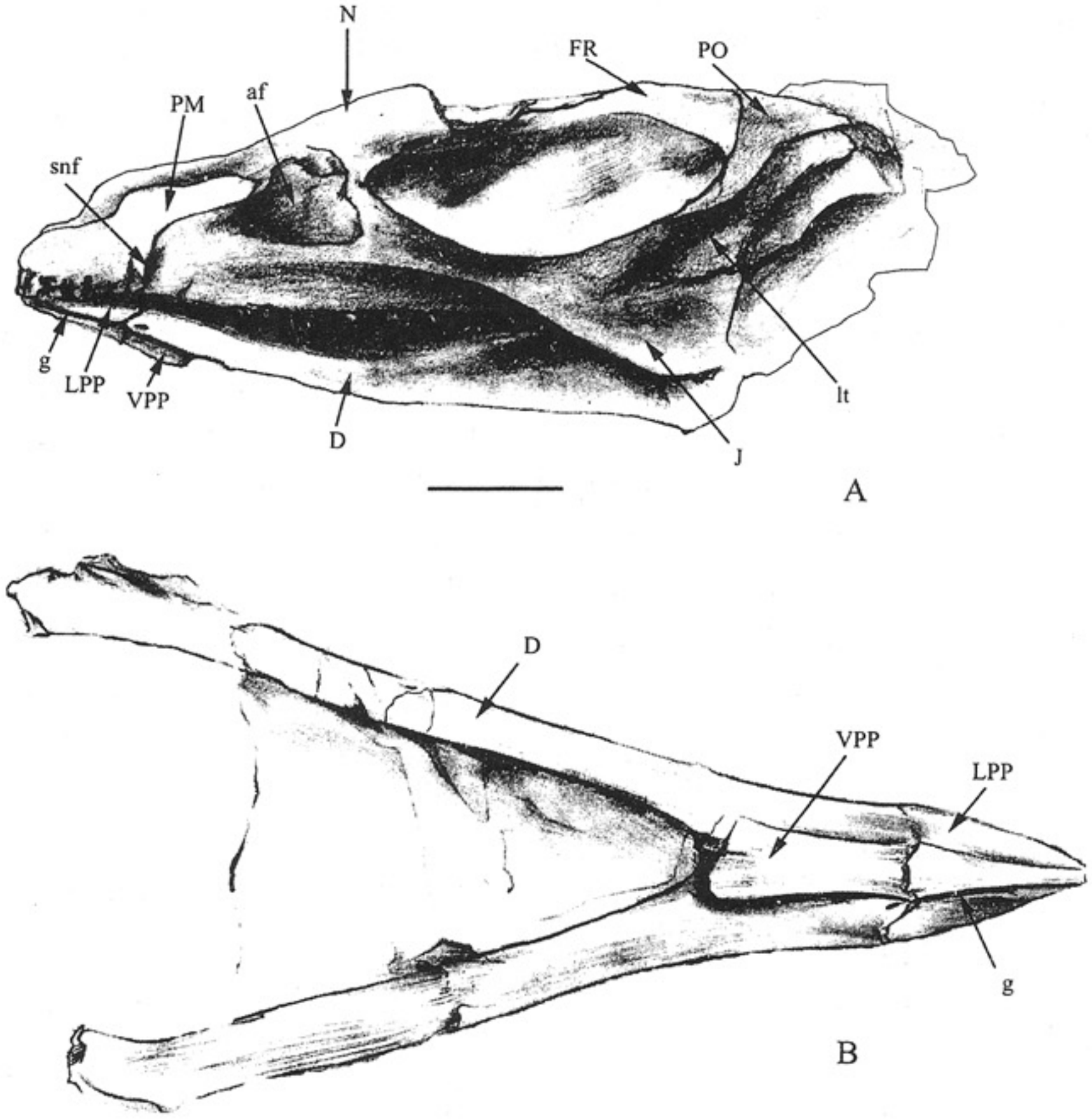

Fig.1　Skull and mandible of the holotype *Jeholosaurus shangyuanensis* (V 12529)
A. 头骨和下颌侧视(skull and mandible in lateral view)；B. 下颌腹视(mandible in ventral view)
af, antorbital fossa 眶前窝；D, dentary 齿骨；FR, frontal 额骨；g, groove 沟；J, jugal 颧骨；LPP, lateral process of predentary 前齿骨侧支；lt, lower temporal fenestra 下颞颧孔；N, nasal 鼻骨；PM, premaxilla 前上颌骨；PO, postorbital 眶后骨；snf, subnarial foramen 下鼻孔；VPP, ventral process of predentary 前齿骨腹支；scale bar = 10mm

The mandible is relatively slender, lacking an external mandibular fenestra as in most ornithopods more derived than heterodontosaurids (Weishampel, 1990). The predentary is anteriorly pointed, with two relatively short lateral processes and a long,

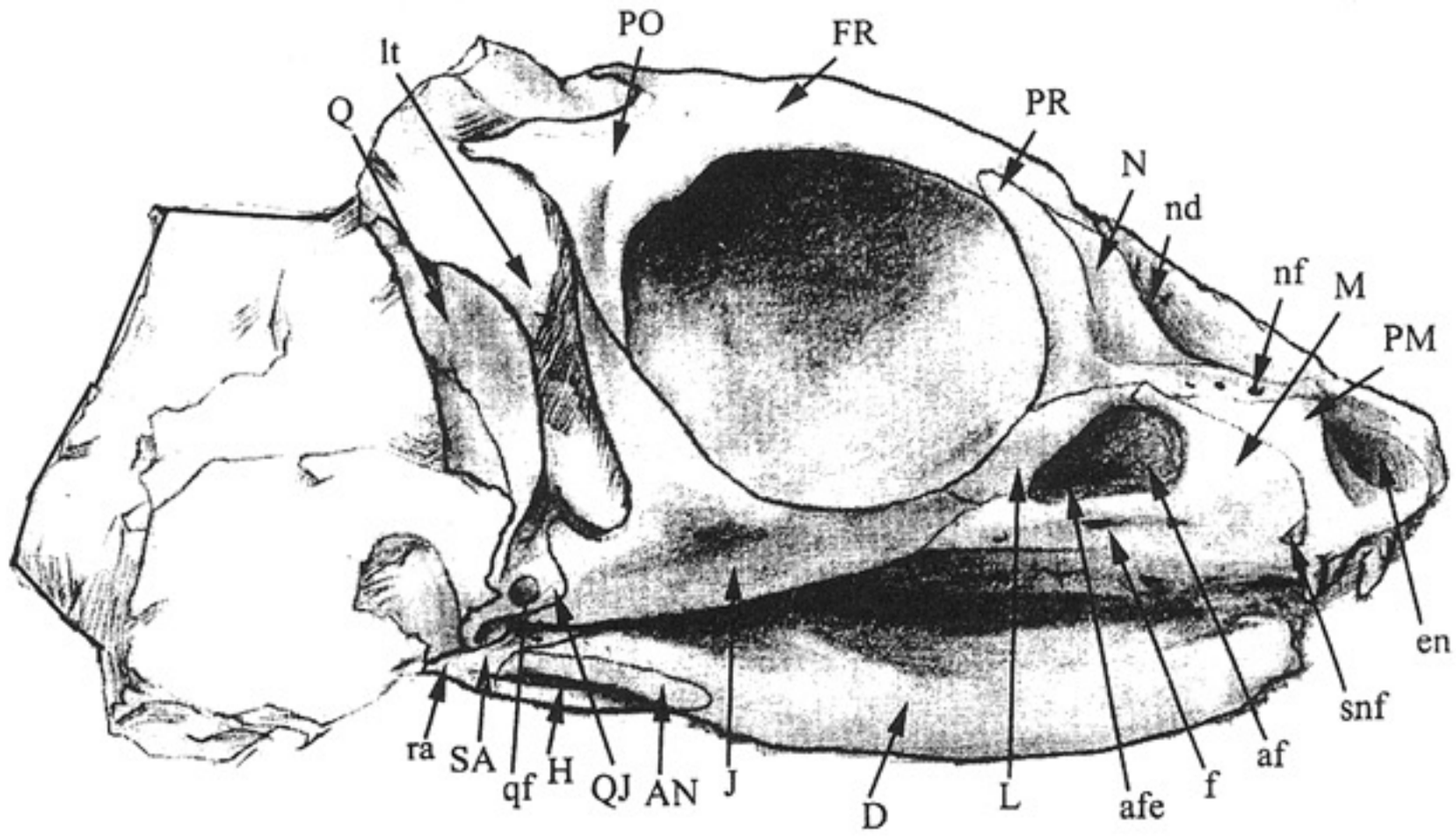

Fig. 2 Skull and mandible of the referred specimen of *Jeholosaurus shangyuanensis* (V 12530) in lateral view

af, antorbital fossa 眶前窝; afe, antorbital fenestra 眶前孔; AN, angular 隅骨; D, dentary 齿骨; en, external naris 外鼻孔; f, foramen 小孔; FR, frontal 额骨; H, hyoid 舌骨; J, jugal 颧骨; L, lacrimal 泪骨; lt, lower temporal fenestra 下颞颥孔; M, maxilla 上颌骨; N, nasal 鼻骨; nd, elliptic depression on nasal 鼻骨椭圆形凹陷; nf, foramina on dorsal surface of nasal 鼻骨小孔; PF, prefrontal 前额骨; PM, premaxilla 前上颌骨; PO, postorbital 眶后骨; Q, quadrate 方骨; qf, quadrate foramen 方骨孔; QJ, quadratojugal 方颧骨; ra, retroarticular process 反关节突; SA, surangular 上隅骨; snf, subnarial foramen 下鼻孔; scale bar = 10mm

uni-lobate ventral process. The total length of the predentary is almost 1.5 times of that of the premaxillary main body. A prominent groove is present on the lateral surface of the predentary and extends onto the dentary, which represents the attaching site of a horny beak. Anteroventral to the glenoid fossa is a relatively large surangular foramen. The retroarticular process seems to be long. The jaw articulation is level with the occlusal plane of the teeth. A rod-like hyoid is preserved.

The heterodont dentition of *Jeholosaurus* consists of six premaxillary teeth and at least 13 maxillary teeth, the number of dentary teeth is unknown. The crowns of premaxillary teeth are relatively slender, slightly recurved and bear no denticles. The maxillary tooth crowns are somewhat fan-shaped, bearing about six to nine denticles. Some vertical ridges corresponding to the denticles are present on the lateral side of the maxillary tooth crowns. Wear facets are well developed on the maxillary tooth crowns except the anterior ones. The anterior maxillary tooth crowns are much smaller, and proportionately shorter in dorsoventral depth than the posterior ones. Posteriorly the lateral surfaces of the maxillary tooth crowns are flatter and their maginal ridges are better developed. The dentary tooth crowns bear about eight denticles and weak vertical ridges. The anterior ones seem much smaller than the posterior ones.

The numbers of cervicals, dorsals, sacrals, and caudals are unknown in *Jeholosaurus*. The cervicals are ventrally keeled and have a weak ventral process. The caudals are elongated and their centra are cylindrical, with both articular ends enlarged. No ossified tendons have been observed.

Table 1 Measurements of the skeleton of the holotype of *Jeholosaurus shangyuanensis* V 12529(mm)

	Skull	mandible	Femur(L)	Tibia(L)	Metatarsal I(L)	Metatarsal III(L)
Length	63	59	90	107	24	55

The femur is bowed anteriorly. The greater trochanter is wide anteroposteriorly and the finger-like lesser trochanter is slightly lower than the greater trochanter. The latter is about three times as wide as the former and they are separated by a shallow cleft. A probably pendent fourth trochanter is relatively proximally positioned. This is different from the situation in *Xiaosaurus* in that its fourth trochanter is positioned near the mid-shaft (Dong and Tang, 1983). Distally the posterior intercondylar groove is deep but the anterior intercondylar groove is absent. The distal femur is mediolaterally convex. In most other ornithischians an anterior intercondylar groove is present, though it is very weak in some primitive ones. The tibia is about 120% the length of the femur. The fibula is much slender than the tibia. The pes is interesting as the metatarsals are not in the same plane, instead metatarsal III is more anteriorly positioned and metatarsal I is more posteriorly positioned. Metatarsal I is proximally splint-like and only 44% as long as metatarsal III as in *Lesothosaurus* (Sereno, 1991). The latter is about 60% as long as the femur. The pedal phalangeal formula is 2–3–4–5–0. Pedal phalanx III–4 is longer than the other phalanges of pedal digit III as in *Xiaosaurus* (Dong and Tang, 1983).

Discussion A number of primitive ornithischians have been named and described (Simmons, 1965; Young, 1982a, b; Dong and Tang, 1983; He and Cai, 1984; Dong, 1989; Peng, 1992) from the Jurassic of China. *Jeholosaurus* represents the first primitive ornithischian taxon from the Cretaceous deposits in China.

Jeholosaurus is an interesting ornithopod in having a combination of primitive and derived characters. It shares with euornithopods the following synapomorphies: antorbital fenestra small, quadrate foramen located on the lateral aspect of quadratojugal, quadrate foramen large, external mandibular fenestra absent (Sereno, 1999). Its femur is also similar to derived ornithopods in the morphology of the proximal portion, such as finger-like lesser trochanter and anteroposteriorly wide greater trochanter. *Jeholosaurus* has a long predentary, which suggests it might have an immobile mandibular symphysis as in ceratopsians (Sereno, 1986). However it lacks some ornithopod autopomorphies: the presence of premaxilla-lacrimal, the jaw articulation offset ventral to the maxillary tooth row and premaxillary tooth row ventral to the maxillary tooth row (Sereno, 1999). It is also more primitive than other ornithopods and marginocephalians in having six premaxillary teeth (Sereno, 1986; Weishampel, 1990). a short edentulous anterior portion of the premaxilla, and a short

diastema between premaxillary and maxillary teeth.

It is notable that *Jeholosaurus* bears some similarities to some primitive ornithischians from China. A longitudinal fossa is present along the midline of the nasals in *Jeholosaurus shangyuanensis, Agilisaurus louderbacki* (Peng, 1997), and *Yandusaurus mutildentus* (He and Cai, 1984). These three taxa also share a somewhat dumbbell-shaped lower temporal fenestra (this feature may turn out a pleisomorphy as *Lesothosaurus* also has a dorsoventrally deep lower temporal fenestra). *Jeholosaurus* and *Xiaosaurus* also share a long pedal phalanx III–4. The above similarities suggest that these Chinese ornithischian taxa may form a monophyletic group, yet it needs to be confirmed by more evidence. The precise phylogenetic relationships of the new ornithopod needs further work.

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Explanations of plates

Plate I

Jeholosaurus shangyuanensis gen. et sp. nov., skull and mandible of holotype, IVPP V 12529

A. left lateral view, B. dorsal view, C. ventral view, scale bar = 10mm

Plate II

A. skull and mandible of *Jeholosaurus shanyuanensis* gen. et sp. nov. (IVPP V 12530) in lateral view, B. left femur of *Jeholosaurus shangyuanensis* gen. et sp. nov. (IVPP V 12529) in lateral view, C. left tibia and fibula of *Jeholosaurus shangyuanensis* gen. et sp. nov. (IVPP V 12529) in anterior view, D. left pes of *Jeholosaurus shangyuanensis* gen. et sp. nov. (IVPP V 12529) in medial view, scale bar = 10mm

“辽宁古盗鸟”标本回归中国

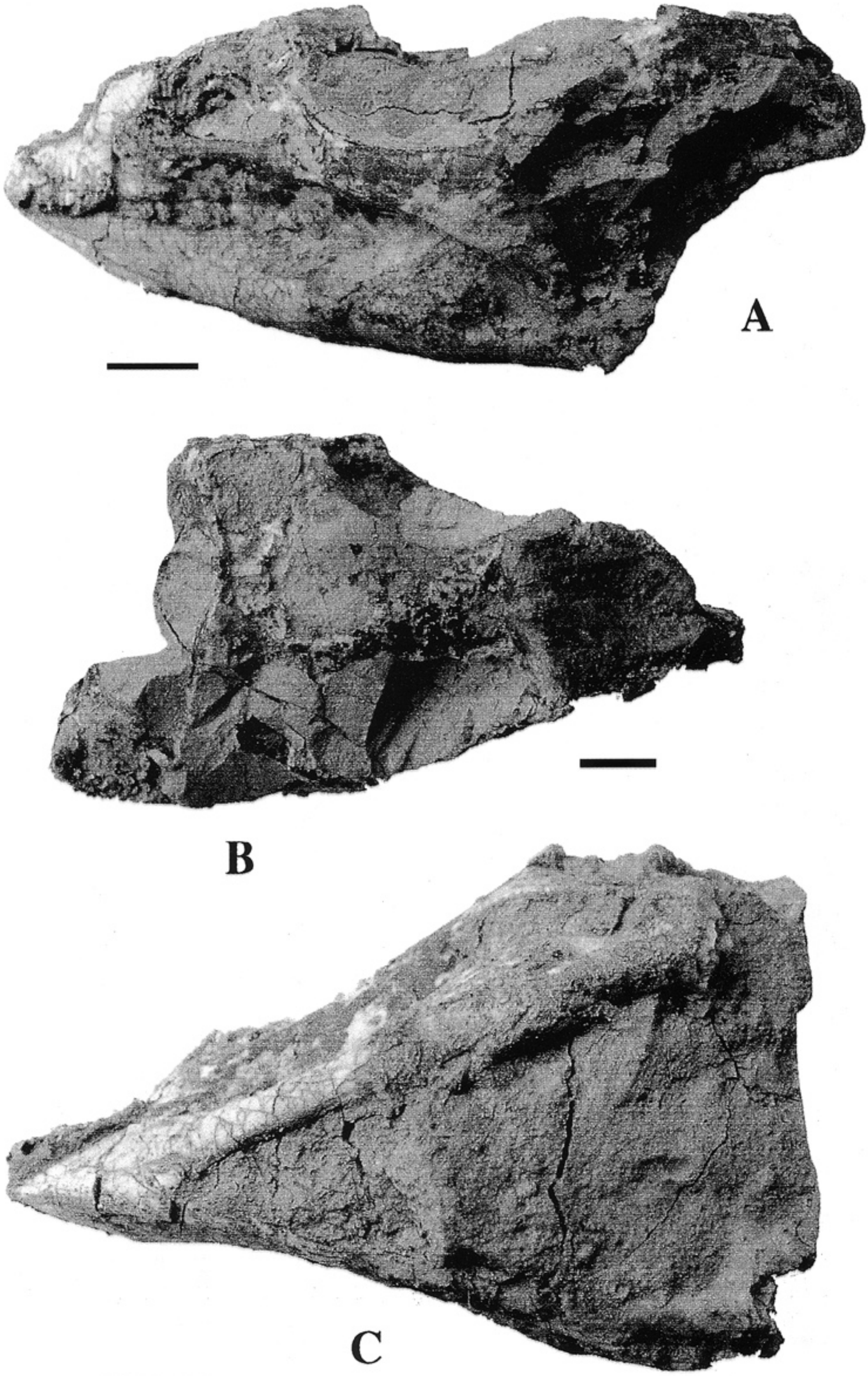
2000 年 5 月 28 日,经过多方努力,在国内外一度引起轰动的“辽宁古盗鸟”标本终于从美国回到产地中国,现被收藏于中国科学院古脊椎动物与古人类研究所标本馆中。

“辽宁古盗鸟”标本出自我国辽西早白垩世九佛堂组,后被走私至美国,为美国犹它布兰丁恐龙博物馆收藏。1999 年 11 月出版的美国《国家地理杂志》首次向公众介绍了“辽宁古盗鸟”,称其为连接恐龙和鸟类的缺失环节,引起了媒体的广泛注意。

1999 年 12 月中科院古脊椎所的学者在研究采自辽西的兽脚类恐龙化石时,发现确凿科学证据表明“辽宁古盗鸟”标本是由不同动物骨骼拼凑而成,是一个人为的“物种”。它的头部和身体部分代表一种新的中生代鸟类,对于研究原始鸟类向进步鸟类的演化具有重要意义;其尾部则属于驰龙类,并保存有皮肤衍生物,这可能为鸟类羽毛起源的研究提供更多证据。尽管“辽宁古盗鸟”标本系人为拼凑而成,但这一标本的不同部分分别包含着重要的科研信息,有关的研究工作正在进行。

近年来我国大量脊椎动物化石被走私国外,给我国古生物学研究带来很大损失。国内外同仁一致呼吁制止这一现象的泛滥,呼吁学术刊物或者有良知的个人不介入走私标本的发表或研究。“辽宁古盗鸟”标本是外国博物馆或者个人第一次无偿向我国归还流失到国外的具有重要科研价值的古脊椎动物标本,这对于鼓励其他外国博物馆或者个人归还从中国走私出境的珍贵标本具有积极作用。

(徐　星)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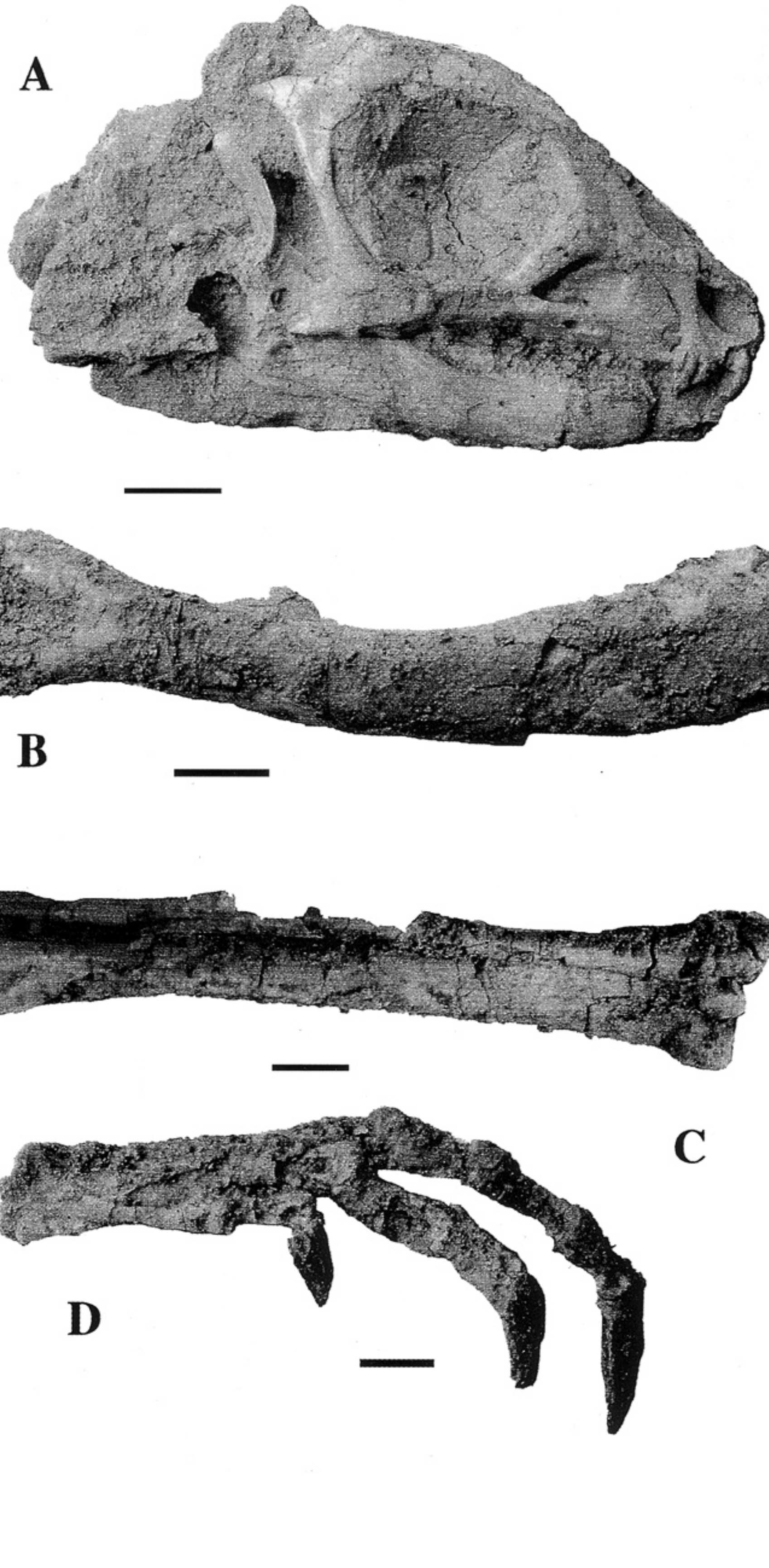
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