

**Preliminary note on some hadrosaurs from the Cretaceous of Jiayin County,
Heilongjiang Province (Manchuria)**

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Introduction

In the summer of 1977, the Heilongjiang Provincial Geologic Survey conducted a general reconnaissance along the south bank of the Heilongjiang River between navigation marker 619 and the town of Yuliangzi where they discovered dinosaurs. After a reexamination of the specimens at the Heilongjiang Provincial Museum, a joint excavation team was formed from members of the Museum, the Geologic Survey, the Provincial Office of Culture and Education, and the Cultural Center to conduct large-scale systematic excavations in the summers of 1978 and 1979.* There are two localities with three separate stratigraphic levels, over 1 km from the type locality that produced *Mandschurosaurus amurensis* excavated by A. N. Riabinin in 1925 to 1930.

Within the past two years, over 1,400 dinosaur bones have been excavated, weighing over 10 tons. Among these, hadrosaurian remains constitute the majority and as such three mounted skeletons have been erected. The largest is 6.48 m high and 11.24 m long. The small mount is 4.17 m high and 9.32 m long. In addition, the collection also contains elements of the Tyrannosauridae, other genera of Ornithischia, Ornithomimidae, and turtle fragments.

This collection provides new biogeographic, biostratigraphic, taxonomic, and quantitative data. The Jiayin Dinosaur Fauna of Heilongjiang is assigned to the larger Late Cretaceous Titanosaur-Hadrosaur Fauna defined by Dong (1980). Furthermore, this assemblage also represents one of the ideal locations for the study of North China Cretaceous biostratigraphy, and thus the Jiayin Local Fauna is erected within the Yuliangzi Fm. This text is a preliminary study of the two hadrosaurian skeletons mentioned above.

Locality and stratigraphic position

The fossil localities lie within a 500 m radius of each other between the town of Yuliangzi and the Heilongjiang River navigation marker 619, on the south bank of the river approximately 13 km west of Jiayin County seat, Heilongjiang Province. The two prolific localities are designated Longgushan (Dragon bone mountain) 1 and 2 (Fig.1). Locality 1 represents three stratigraphic levels on the side of a large erosional gully at the foot of the mountain in the vicinity of navigation marker 619. Fossiliferous sediments are predominantly gray-green mudstones and tan-yellow sandy conglomerates representing fluvial or lacustrine strand facies with a thickness of 6.95 m and dipping 4°-5° westward. Locality 2 is 500 m west of Locality 1 on the lower mountain slope as a single unit of gray-green 1.5 m thick conglomerate with a 5°-8° westward dip.

The range of the fossiliferous deposits in the Jiayin region is relatively extensive, extending from the east at Dongshan, Yongantun, and westward to Yuliangzi, representing over 12 km. Over ten fossiliferous horizons are documented, the most prolific of which lies between navigation marker 619 and Yuliangzi, representing a half kilometer circumference.

* Also contributing to this effort was Wenxi Liao, Xida Tong, and Fengge Yu from the Heilongjiang Provincial Museum; Yanbo Han, Guifan Xiao, Zhangyu Sun, and Zhai Liu from the Jiayin County Bureau of Culture and Education; and Jingbin Cui and Xingxian Yang from the Provincial Geologic Survey.

Material

After preparation and prior to the mounting of the skeletons, Professor Chengzhi Hu from the Central Geological Museum, who had undertaken a study of *Shantungosaurus*, provided a preliminary diagnosis to the level of Hadrosaurinae. The most common element is a collection of 18 tibiae (9 left, 9 right), thus reflecting a minimum of nine individuals. No other elements attain this quantity. Three skeletons were eventually mounted. The elements used in the reconstruction include left and right maxillae, left and right quadrates, left and right angulars, left and right dentaries, 8 cervicals, 20 dorsals, 9 sacrals, 66 caudals, 15 chevrons, and pairs of humeri, sterna, coracoids, ulnae, and radii. A total of 12 manus elements were used: 3 left metacarpals and 9 right metacarpals, but there was only a single left scapula. In addition, there is a humerus, ilium, ischium, pubis, tibia, fibula, 6 pairs of metatarsals, 14 tarsals, and 2 complete ribs; the remaining ribs are in varying degrees of fragmentation.

The large mounted skeletons are composed of 80% genuine bone with 12 cervicals, 20 dorsals, 9 sacrals, and 88 caudals.

The small hadrosaur skeleton is composed of a maxilla, dentary, angular, 20 dorsals, 65 caudals, a pair of sterna, scapulae, humeri, ulnae, radii, ischia, tibiae, fibulae, and a majority of the carpals and tarsals. Elements selected by the museum include 12 cervicals, 20 dorsals, 9 sacrals, and 65 caudals.

Description

Ornithischia Seeley

Ornithopoda Marsh

Hadrosauridae Cope

Hadrosaurinae Lambe

Mandschurosaurus Riabinin

Mandschurosaurus amurensis Riabinin

Appended genus diagnosis: The quadrate is straight. The maxilla is nearly triangular with the apex at its midpoint, and is 30.0 cm long with a tooth count of 25-44. Mandible length is 44.1 cm with a tooth count of 44-54. Teeth are prismatic with marginal denticles, replacement is overlapping, crown is higher laterally than medially, and the lateral side is smooth. Scapula is thick and straight with an expansive terminus, ischium terminus is expanded, and there are nine sacral vertebrae, the most posterior three of which have a faint ventral groove. Femur is large, robust, medially constricted, a fourth trochanter is well developed, and the distal end is flat and broad with spherical condyles and a circular foramen. It is a rather large species.

Appended species diagnosis: As for genus.

Description: Left quadrate is 35.0 cm and right quadrate is 35.6 cm, there is no curvature and the anterior margin is very slightly anteriorly oblique, resembling the morphology of *Mandschurosaurus amurensis*.

The majority of the maxilla is damaged, and there are only three relatively well preserved specimens. The large skeletal mount preserves two nearly complete maxillae that are 33.0 cm in length. The dentition length is 30.0 cm, the left maxilla preserves 44 teeth, the right maxilla is damaged and preserves only 25 teeth. The general morphology indicates that the dorsal apex of the *M. amurensis* maxilla should be at the midpoint. The apices on the current specimens are missing and probably resemble the condition of other hadrosaurines. The maxilla is triangular in outline with the base containing the dentition, it is very slightly dorsally projected, the posterior end of the apex is the shortest, and there is a distinct embayment. Several characters generally approach *Mandschurosaurus*.

Table 1. Maxilla measurements (cm)

	Left (78005)	Right (78006)
Total length	33.0	33.0
Dentition length	30.0	30.0
Anterior breadth	3.1	3.0
Posterior breadth	4.9	4.4
Height	8.5+	8.5
Tooth count	25+	44

The mandible is represented by the surangular, dentary, and premaxillary. The two dentaries differ in size and morphology. The left (79010) has minimal lateral curvature, is a thick element, and is also thick at the glenoid fossa but not very projected. The right (78291) has more lateral curvature, is relatively thin, and the glenoid is thin and projected.

Table 2. Mandible measurements (cm).

	Left 79010	Right 78291
Length	20.9	20.6
Medial width	7.8	6.8
Height at coronoid	5.0	6.0

Two dentaries were used in the skeletal mounts, the right being slightly larger than the left with a length of 67.4 cm, the latter being 53.0 cm. The anterior and posterior ends of the left dentary are damaged, and it contains 44 teeth. The right is complete with 54 teeth. The dentition is densely packed, crowns are foliate with marginal denticles, high, and anteriorly oblique with

the lateral side higher than the medial side, the lateral side is smooth, and the edentulous portion of the dentary is short.

Table 3. Dentary measurements (cm).

	Left 369	Right 411
Edentulous length	17.4	22.4
Height at coronoid process	22.5	24.2
Height at midsection	14.2	15.5

There are eight cervical vertebrae, among which only one is extremely well preserved. They belong to the midsection of the series, are tightly articulated, and are missing a small portion of the anterior section. Centra are elliptically opisthocoelous, short, broad, flat, and are conspicuously narrow dorsally and broadened ventrally. Length gradually increases anterior-to-posterior (8.0-9.8 cm).

Table 4. Cervical vertebrae measurements (cm).

	1	2	3	4	5	6	7	8
Length	8.0	8.4	9.9	10.1	10.4	9.3	9.8	8.8
Anterior breadth	6.2	6.4	7.3	6.2	7.2	7.6	8.3	8.7
Posterior breadth	6.4	6.6	9.1	9.3	10.0	10.7	10.8	10.9
Neural canal breadth	3.5	4.2	4.1	4.3	4.6	5.1	5.6	5.7
Diapophyseal length	13.5	11.2	13.0	30.0	27.2	16.3	20.1	26.4
Postzygapophyses breadth	9.4	9.0	9.6	10.5	12.6	14.2	-	14.9

Studies were conducted upon 20 dorsal vertebrae from the small and large mounts. Those on the large mount are relatively well preserved, but those on the small mount were slightly deficient. The neural spine is rather high, being a thin flat plate. Sequence is unclear, but from what is at hand, the general range of variation and morphology indicates that the anterior series are opisthocoelous with intense anterior convexity, but posteriorly they become anteriorly flat and posteriorly gently concave. The centra become shortened (D1 is 13.8 cm and D20 is 7.6 cm). Breadth increases posteriorly (D1 is 10.3 cm and D20 is 14.1 cm). The posterior height increases very slightly (D1 is 9.1 cm and D20 is 15.8 cm). The neural canal modifies from being circular to elliptical (D1 circumference is 3.4 cm and D20 circumference is 4.3 cm). The diapophyses change from being oblique to horizontal and their length progressively increases (D1 is 24.1 cm and D20 is 26.9 cm). The neural spine progressively increases greatly in height (D1 is 16.1 cm and D20 is 26.9 cm). Adjacent to the sacral the neural spine becomes higher and thicker, but narrower.

Table 5. Dorsal vertebrae measurements (cm).

	Large mount			Small mount		
	Ant.	Med.	Post.	Ant.	Med.	Post
Centrum length	13.8	9.9	7.2	10.0	9.0	8.2
Posterior breadth	10.3	11.5	14.1	7.0	10.7	14.7
Posterior height	19.1	12.4	15.8	4.1	9.5	14.7
Neural spine height	16.1	19.0	28.9	15.1	17.2	23.4
Diapophyses length	23.4	20.1	26.9	22.2	24.3	20.2

There are nine fused sacral vertebrae. In left lateral view, the Sa1-Sa9 diapophyses are well preserved, the first three of which are anteriorly oblique and the second and third are unconnected. The posterior three diapophyses are extremely enlarged, particularly on Sa8 which is nearly twice the size as on the anterior five sacrals. The sacral diapophyses are incomplete but are anteriorly oblique. All neural spines are thin plates with the broadest at Sa3 and thickest at Sa9. From Sa6 posteriorly, spine height progressively increases and the spines again become narrow. There is a ventral keel on Sa6-Sa9 but a distinct groove associated with it is absent. Thus the following trends are noted: neural spine height increases posteriorly, anteroposterior breadth narrows and then broadens again, and thickness narrows and then expands again.

Table 6. Sacral vertebrae measurements (cm).

Series length	85.8
Breadth at rib #8	47.5
Sa1 anterior breadth	15.0
Sa1 anterior height	14.0
Sa9 posterior breadth	17.2
Sa9 posterior height	15.0
Left neural arch length	55.0
Complete height	62.0
Sa6 height, breadth, thickness	40.0x10.5x1.5
Sa7 height, breadth, thickness	31.5x9.7x1.3
Sa8 height, breadth, thickness	20.3x7.8x2.0
Sa9 height, breadth, thickness	24.0x8.4x2.5

Three caudal series were excavated. The centra are platycoelous and laterally compressed. The first two centra maintain “auricular-shaped” features which are not present posterior to these. There is a tight contact between the terminal sacral and the first caudal and as such a boundary line is not conspicuous.

There are 32 ribs selected from the mounts but only two are relatively well preserved. Six right ribs have a length of 127 cm and eight left ribs have a length of 130 cm, the remaining three are damaged in varying degrees.

Chevrons are present from Cd10 to Cd30 but only three are well preserved. Chevron 10 (Cv10) is 45 cm in length and its dorsal tuberosity bifurcation is 9.8 cm. Cv 28 is 19.5 cm long and its tuberosity bifurcation is 5.3 cm. Cv29 is 13.2 cm and its tuberosity bifurcation is 3.9 cm.

The large specimen preserves only a left scapula, its length being 99.2 cm, and its distal end being more expanded than the proximal end. The small specimen preserves a complete pair of scapulae that are thin with slight curvature, the anterior end is narrow, thin, and is not fused with the coracoid. It is distinct from the straight scapula on the holotype that is fused to the coracoid.

Table 7. Scapula measurements (cm).

	Large left	Small left	Small right
Length	99.0	60.0	60.0
Anterior breadth	23.2	14.8	14.8
Distal breadth	17.2	14.9	14.9
Maximum constriction	15.2	9.1	9.1

The sterna are relatively well preserved on both the large and small specimens. On the large specimen the length is 47.0 cm and on the small it is 43.5 cm. Morphologies on both specimens are generally equivalent, being anteriorly broad and posteriorly reduced into a manubrium.

Table 8. Sternum measurements (cm).

	Large left	Large right	Small left	Small right
Length	47.0	47.0	43.5	43.5
Median breadth	81.1	18.1	15.6	15.6
Distal breadth	10.6	10.6	8.5	8.5

Relatively well preserved humeri are present in both sizes. The large specimen left humerus is 64.0 cm in length and right is 61.0 cm. With the exception of the size discrepancy, the morphologies are completely consistent. The shaft has distinct curvature, the deltopectoral crest is relatively well developed, located proximally on the shaft, and terminates at the midline of the shaft. The medial curvature is extremely distinct.

A pair of ulnae and radii were studied from both the large and small mounts. Large ulnae are both ~78 cm, but the left small ulna is 50.2 cm and right is 51.2 cm. The left large radius is 63.0 cm and right large radius is 64.3 cm. The dorsal end of the ulna is thick, its midshaft is slender, and the distal end is expanded. The radius is slender and elongate.

Table 9. Humerus measurements (cm).

	Large left	Large right	Small left	Small right
Length	64.0	61.0	45.0	47.5
Deltopectoral crest length	36.0	35.0	25.0	27.0
Deltopectoral crest breadth	16.1	15.1	12.5	12.8
Proximal breadth	20.9	20.0	13.6	14.2
Distal Breadth	17.6	16.9	11.8	12.6
Minimum circumference	29.6	28.5	21.2	22.1

Numerous metacarpals are preserved in both the large and small mounts, and only a small portion is missing.

A pair of ilia from the large mount was studied, the left of which is relatively well preserved but the right is poorly preserved. Left ilium length is 118.0 cm and right is 115.0 cm but the anterior end is missing. Both represent the same individual. The ilium is dorsally inflated, unlike the linear blade on *M. mongoliensis*. The pre- and postacetabular processes are moderate, unlike the posteriorly elongated fashion on *M. mongoliensis* and *Anatosaurus*. The dorsal margin of the antitrochanter is rather ventrally embayed, and there is a slight depression on the top of the postacetabular process at the dorsal margin of the antitrochanter. The ventral margin is rather strongly curved. In dorsal view it is relatively straight, as only the anterior section has slight curvature.

A pair of relatively complete pubes were studied on the large mount. The left pubis is 53.3 cm and right is 53.2 cm. They are short and broad and there is no appreciable dorsoventral compression at the midsection.

A pair of ischia was studied from both large and small mounts. On the large mount the ischium is robust with a fan-shaped dorsal end. The midsection of the ischial body is thick and straight, there is slight curvature at the distal end, and the terminus expands into a footplate. On the small mount this element is straight and long. Breadth along the medial and posterior sections, or three-quarters the length of the element, is consistent, differing from the slight narrowing on *Anatosaurus*. The terminus is slightly expanded.

Table 10. Ischium measurements (cm).

	Large left	Large right	Small left	Small right
Length	126.2	127.0	93.0	94.0
Dorsal breadth	37.2	37.0	27.5	27.5
Medial breadth	8.9	9.0	11.0	11.0
Ventral breadth	16.5	17.0	5.6	5.6

The femur is the largest element on the skeleton. The shaft is robust and straight, and the femur head is low, semispherical, and lies slightly higher than the greater trochanter. The midshaft is rather slender, and there is a well developed fourth trochanter. The distal end is broad and flat with a small lateral condyle that is laterally convex and a large medial condyle that is medially concave. Distally there is a large deep circular foramen that is 8.0 cm in diameter. These characters are quite distinct from other hadrosaurs. Characters on the large and small specimens are nearly equivalent, but the distal foramen on the small femur is not as deep.

Table 11. Femur measurements (cm).

	Large left	Large right	Small left	Small right
Length	130.0	128.0	87.0	87.0
Proximal breadth	35.0	34.0	23.5	21.0
Distal breadth	28.5	28.0	19.0	18.5
Ventral breadth	18.0	18.5	12.5	11.6

There are a total of 18 tibiae collected and a pair was studied each from the large and small mount. A total of 15 fibulae were collected and one pair was studied. The morphologies resemble previously published descriptions. Over 30 metatarsals were collected, sufficient to reconstruct two feet. Three left metatarsals were selected from the large mount: MtII is 34.0 cm long, MtIII is 43.0 cm, and MtIV is 33.5 cm. On the right side MtII is 30.0 cm, MtIII is 43.6 cm, and Mt IV is 33.0 cm. Morphologies are rather similar with no major distinctions. The left pes preserves digit II phalanx 1, digit II phalanx 2, digit III phalanx 3, and digit IV phalanges 1 and 4. The right pes preserves digit II phalanges 1 and 2, digit III phalanges 1-4, and digit IV phalanges 1 and 5.

The small mount has left MtII that is 33.5 cm long, MtIII is 36.5 cm, and MtIV is 32.0. Right MtII is 27.9 cm, MtIII is 32.0 cm and MtIV is 28.0 cm. The left pes preserves digit II phalanx 1- 9.3 cm; digit II phalanx 3- 8.8 cm; digit III phalanx 1- 11.2 cm; digit III phalanx 4- 8.4 cm, digit IV phalanx 1- 8.3 cm; digit IV phalanx 2- 3.4 cm; digit IV phalanx 4- 1.8 cm. On the right side there is digit II, phalanx 1- 8.0 cm, digit II phalanx 2- 3.5 cm; digit II phalanx 3- 8.1 cm; digit III phalanx 1- 9.7 cm, digit III phalanx 2- 3.9 cm; digit III phalanx 4- 8.5; digit IV phalanx 1- 9.9 cm; digit IV phalanx 2- 3.7 cm; digit IV phalanx 3- 3.9 cm; digit IV phalanx 4- 1.9 cm; and digit IV phalanx 5- 9.9 cm.

Diagnosis and discussion

The type locality for *Mandschurosaurus amurensis* is at the foot of Mt. Baishilizishan in the lower reaches of the Anyang river, Wuyuan Co. (currently within the jurisdiction of Jiayin Co.), Heilongjiang Province. Riabinin (1925) erected *Trachodon amurense* sp. nov., after which he published a more formal description (1930) erecting *Mandschurosaurus amurensis* gen. nov., recognizing its age as Late Cretaceous and correlating it to the Lancian Stage of North America.

The large quantity of specimens from the current localities of Longgushan 1 and 2 provides sufficient material to mount three skeletons. These specimens do not represent a single complete individual but a combination of at least nine individuals and thus it is not possible to state that the reconstructions are completely unadulterated. Nevertheless, the vast majority of the specimens are hadrosaurian and are thus comparable to the Russian specimens.

The holotype is small, approximately 4.5 m high and approximately 8 m long. The hadrosaurs excavated in this study are large, attaining 11.24 m in length and 6.48 m in height. The quadrate on the holotype resembles those in this study, being rather straight, with only minor curvature, and lies very slightly anteriorly oblique. The maxilla on the holotype is triangular with its apex at its midsection but the complete morphology of the maxillae in this study is unclear due to lacking the apex, although it is still recognized as triangular. The mandibles on both are prismatic with an anteriorly oblique coronoid process.

The scapula on the holotype is thick, linear, and well sutured to the coracoid but the text plates in the type literature indicate they were not fused. Each scapula in this study is also thick and linear with an expanded terminus and it is not fused with the coracoid. On the former the distal ischium is unexpanded but again, the text plates illustrate that the element is damaged, and thus the unexpanded distal end is conjecture. Ischia are complete in the current study and there are differential degrees of distal expansion.

The femur on the holotype is robust, and although its proximal end is missing, its distal end is broadly expanded, spherical, and there is a circular perforating foramina. In this study the femora are also robust, the femoral condyle is a low semispherical body, the midshaft is slender, fourth trochanter is well developed, distal end is broadly expanded and spherical, and there is a circular perforating foramen. Both have a humerus, ulna, radius, tibia, and fibula with nearly identical morphology and they only differ in size. The holotype has eight sacral vertebrae with a linear ventral groove. In this study the sacral count is nine and a ventral groove is not very distinct.

In summary, the type locality and specimens for the current study are only over 1 km apart, being relatively close, and as such may be considered from the same region and same general stratigraphic horizon or age. Thus it is concluded that with the exception of size and slight discrepancy in sacral count, the remaining characters are not very distinct and instead are extremely similar. Consequently, the current specimens are assigned to *M. amurensis*. Although the hadrosaurs excavated from the Jiayin region of Heilongjiang are not taxonomically significant, they are still important in the following respects:

Firstly, they supplement characters previously unknown on the holotype. Secondly, they are the only mounted hadrosaur skeletons in Northeast China. Thirdly, they represent a leading role among the exhibits in the Heilongjiang Provincial Museum for the propagation of science and the dispelling of superstitious beliefs.

In conclusion, the discovery of this set of dinosaurs supplements the previous data quantitatively, taxonomically, stratigraphically, and geographically. The correction of a Late Cretaceous age of the sediments from the previous misconception of a Paleogene age is further substantiated. Furthermore, the excavations uncovered abundant fossil plants and thus these localities represents a relatively complete Late Cretaceous taphocoenosis.

Stratigraphic age

Previous work on the regional stratigraphy of this area is not extensive and discussions are even more deficient, with only individual citations available. Furthermore, geochronological interpretations are inconsistent.

Riabinin (1925) correlated the dinosaur-bearing sediments here to the Lancian Stage of North America. And in his formal description of the species (1930) he again reiterated this correlation. The Chinese 1975 Northeast Regional Stratigraphic Table included a portion of the dinosaur-bearing sediments in the Tertiary, and was published as such in the 1979 Northeast Regional Stratigraphic Table by the Chinese Geological Publishing House. In 1977 the Heilongjiang Regional Geologic Survey conducted 1/20,000 regional mapping of this area in which they discovered several units that contained dinosaurs. In 1978 and 1979 the Heilongjiang Provincial Cooperative Excavation Team conducted a preliminary analysis of the range of the regional dinosaur-bearing sediments, recognizing the eastern border at Dongshan, Antun, and extending westwards to Yuliangzi, encompassing over 20 km, within which there are over ten sedimentary units bearing dinosaurs. Moreover, within this broad range of exposure lies the most productive localities of Longgushan Loc. 1 and Loc. 2 at navigation marker 619, on the south bank of the Heilongjiang River. Measured cross-sections are provided in Figures 2 and 3.

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Explanation of figures on page 123

Top left: Fossil locality map of Jiayin Co.

Top right: Stratigraphic cross-section at Locality 1, Longgushan (Dragon bone Mt.), Jiayin Col.

Bottom left: Stratigraphic cross-section at Locality 2, Longgushan (Dragon bone Mt.), Jiayin Co.

Explanation of Plates

Page 123 plate:

1. Medial view of right quadrate (1/5).
2. Lateral view of left mandible (1/5).
3. Lateral view of right quadrate (1/5).
4. Lateral view of left maxilla (1/5).
5. Medial view of left mandible (1/5).
6. Lateral view of right maxilla (1/5).
7. Medial view of left dentary (1/10).
8. Medial view of right dentary (1/10).
9. Lateral view of left dentary (1/10).

Page 124 left plate (all 1/10)

1. Anterior view of left humerus
2. Anterior view of haemal arch.
3. Posterior view of right humerus
4. Mediолateral view of left scapula.
5. Mediолateral view of right scapula.
6. Dorsal view of left manus.
7. Lateral view of left and right coracoid.
8. Dorsal view of right manus.

Page 124 right plate (all 1/5)

1. Posterior view of anterior dorsal.
2. Anteroposterior view of anterior cervical.
3. Anterior view of anterior dorsal.
4. Lateral view of most posterior dorsal.
5. Lateral view of medial dorsal.
6. Posterior view of most posterior dorsal.
7. Lateral view of caudal.

Page 125 left plate

1. Lateral view of left femur.
2. Lateral view of right femur.
3. Medial view of left femur.
4. Lateral view of left tibia.
5. Lateral view of left and right tibiae.
6. Lateral view of left and right fibulae.
7. Anterior view of left and right ulnae.

Page 126 left plate (all 1/10)

1. Lateral view of sacral vertebrae.
2. Ventral view of sacral vertebrae.
3. Dorsal view of sacral vertebrae.
4. Medial view of left and right sterna.
5. Lateral view of left and right sterna.
6. Medial view of left and right radii.

Page 125 right plate

View of *Mandschurosaurus amurensis* mounted skeleton.

Page 126 right plate (all 1/10)

1. Lateral view of right and left ilia.
2. Medial view of left and right ischia.
3. Lateral view of left and right ischia.
4. Medial view of right pubis.
5. Lateral view of left and right pubes.
6. Medial view of left pubis.