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On the Finding of Ornithomimid Dinosaurs (Saurischia, Ornithomimosauria) in the Upper Cretaceous Beds of Tajikistan

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Abstract—Fragmentary remains of ornithomimids (Ornithomimidae indet.) from the Lower Santonian (Upper Cretaceous) Kansai locality in northwestern Fergana (Tajikistan) are described, and the composition of its dinosaurian assemblage is updated.

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Key words: Dinosaurs, Ornithomimidae, Upper Cretaceous, Santonian, Tajikistan.

INTRODUCTION

In the 1940s, Vyalov (1945a, 1945b) discovered a burial of Late Cretaceous vertebrates in the red beds of the Yalovach Formation in northern Tajikistan near the village of Kansai, Leninabad (nowadays Khodzhent) Region, in the foothills of the Kuraminskii Mountain Range (northwestern Fergana). The locality was studied in detail by A.K. Rozhdestvensky in 1963 and 1964, with the participation of N.N. Verzilin and G.G. Martinson (Rozhdestvensky and Khozatsky, 1967; Rozhdestvensky, 1970, 1977). The expedition headed by Rozhdestvensky excavated bone beds over a large area using a bulldozer; as a result, extensive material of dinosaurs, turtles, and crocodiles was obtained. Additionally, L.A. Nessov in 1981 and 1984 and A.O. Averianov in 1991 collected vertebrates in the Kansai locality. Specimens were collected on the ground surface and also by screening, which provided the majority of small-sized vertebrate material.

The Kansai locality was formed in the deltaic deposits of a large river that flowed into the Fergana Gulf of the Tethys (Rozhdestvensky, 1977; Nessov and Verzilin, 1983). The vertebrate fauna from Kansai is represented by isolated bones of cartilaginous and bony fishes, caudate and anuran amphibians, turtles, lizards, crocodiles, pterosaurs, dinosaurs, birds, and mammals (Rozhdestvensky, 1970, 1977; Nessov and Verzilin, 1983; Nessov, 1988, 1995, 1997; Archibald and Averianov, 2003; Averianov, 2004).

Dinosaurs from Kansai belong to several groups. Rozhdestvensky (1977) indicated the presence of three families: Hadrosauridae (Lambeosaurinae), Tyrannosauridae, and Ornithomimidae. Nessov (1995) listed the following taxa: Dromaeosauridae, Ornithomimidae, cf. Oviraptoridae, large Carnosauria, the tyrannosaurids cf. *Alectrosaurus* sp. (with laterally flattened teeth) and Tyrannosauridae with relatively thick teeth, small theropods ("probable Coeluroidea": Nessov, 1988, p. 97), the sauropods Diplodocidae or Titanosauridae (long, narrow teeth), Ankylosauridae, medium-sized Lambeosaurinae, and cf. Hypsilophodontidae (this is possibly misidentification of small teeth of other young dinosaurs). The specimens identified as "cf. Oviraptoridae" most likely belong to therizinosaurids (the two groups are similar in a number of structural features of the skeleton). Among the specimens housed at the Paleontological Institute of the Russian Academy of Sciences (PIN), unquestionable therizinosaurids are represented by a femur, a sacral vertebra, and proximal and ungual phalanges of a forelimb.

Earlier, "Theropoda resembling Saurornithoididae" (= Troodontidae) and Ceratopsia were also included in the list of dinosaurs from Kansai (Nessov and Verzilin, 1983, p. 6). The teeth of troodontids from Kansai are actually present among the specimens examined by Nessov, whereas the presence of ceratopsians was not corroborated by the recent study of this collection.

The family Dromaeosauridae is probably represented by a corpus of a relatively short anterior thoracic vertebra with a stout hypapophysis (PIN, no. 3041/11). Thus, the Kansai Faunal Assemblage includes ten dinosaur families, eight of which are determined with confidence: Dromaeosauridae indet., Ornithomimidae indet., Therizinosauridae indet., Troodontidae indet., Tyrannosauridae indet., ?Oviraptoridae, Neosauropoda indet., Ankylosauridae indet., Hadrosauridae (Lambeosaurinae indet.), and ?Neoceratopsia.

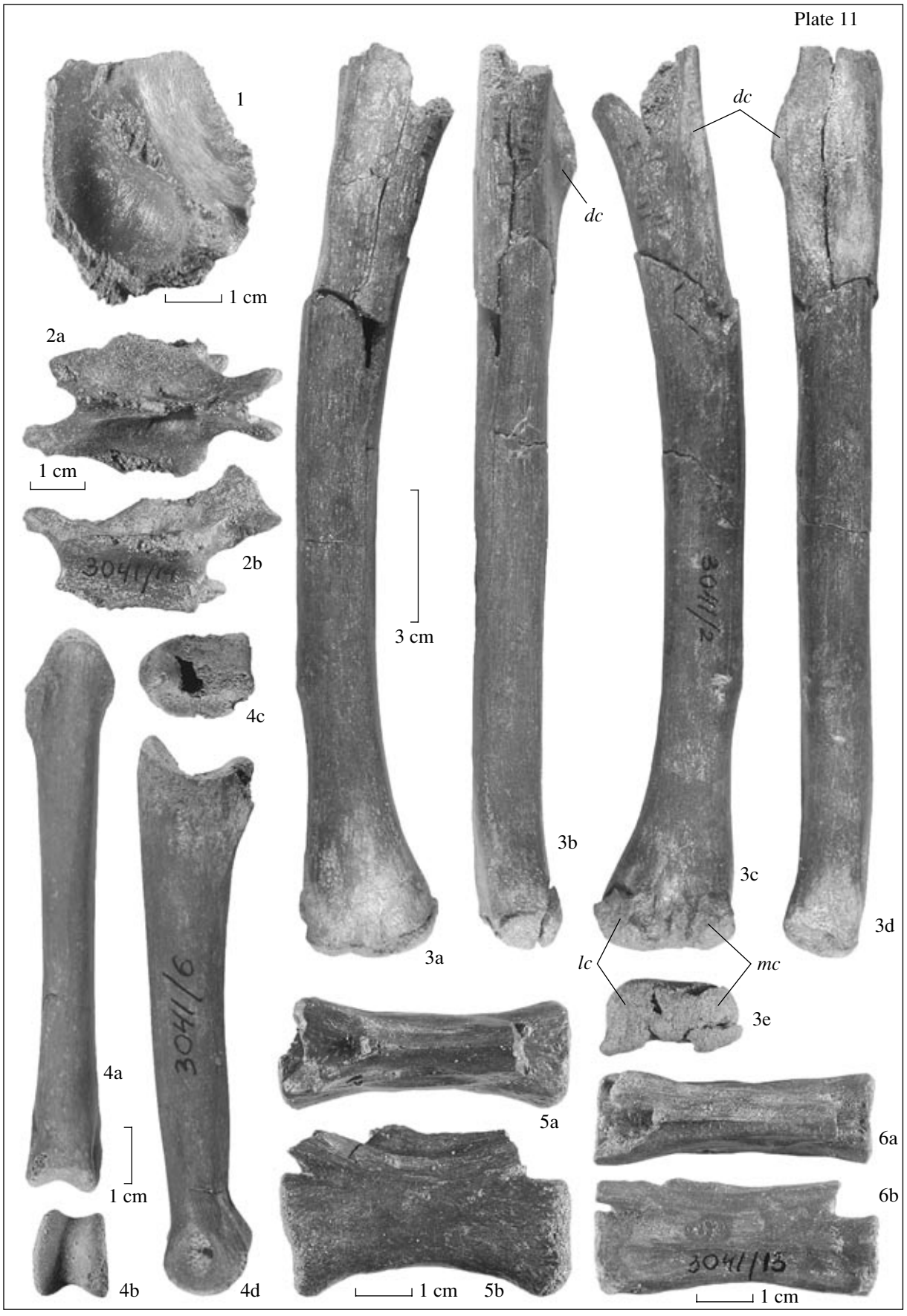
Plate 11
1
1 cm
2a
1 cm
2b
3041/14
3 cm
3a
dc
3b
dc
3041/2
3c
3d
lc
mc
3e
4c
4a
1 cm
3041/6
4b
4d
5a
1 cm
5b
6a
6b
3041/13
1 cm

Rozhdestvensky (1977) determined the age of the Kansai locality as Coniacian–Lower Santonian; Nessov (1997) believed it should be dated Lower Santonian. This interval of the Cretaceous is poorly represented by vertebrate remains throughout the world, which gives the Kansai Vertebrate Assemblage an important role in the understanding of the evolution of dinosaur faunas during the Late Cretaceous and in the determination of relative age and correlation of the Upper Cretaceous continental beds with dinosaur remains in Asia. It should be noted that, at present, it is difficult to compare Late Cretaceous vertebrate assemblages from different regions of Asia because of the incompleteness of the fossil record, insufficient knowledge of many extinct vertebrates, and differences of opinion regarding the relative age of fossiliferous rocks.

Nevertheless, Rozhdestvensky (1977) indicated a probable similarity between vertebrate assemblages from Kansai and the Syuk-Syuk locality (Syuk-Syuk Formation, Santonian) in Kazakhstan. According to Nessov (1997), the Kansai Vertebrate Assemblage is intermediate between the Bissekty (central Kyzylkum Desert) and Baibishie (northeastern Aral Region) assemblages.

The Bissekty Vertebrate Assemblage of the Kyzylkum Desert has much in common with vertebrate assemblages from the Iren-Dabasu Formation (Inner Mongolia, China) and the upper part of the Bain-Shire Formation in Mongolia (Nessov, 1995). The next stage in the development of vertebrates in Mongolia and China is characterized by the Dzhadokhta and Barun Goyot assemblages, which differ from the Kansai Assemblage in the composition of dinosaurs, i.e., they are dominated by horned dinosaurs of the families Protoceratopidae and Bagaceratopidae (Alifanov, 2003). Thus, no analogues of the Kansai Vertebrate Assemblage have been found in Central Asia.

The material collected by Rozhdestvensky in Kansai has not been described in detail. Some specimens were probably lost. For example, Rozhdestvensky (1977, p. 239) mentioned that, in 1967, excavation in Kansai yielded an almost complete lower jaw belonging to "an earlier unknown, primitive species from the family Ornithomimidae." Unfortunately, we failed to find this specimen in the collection of PIN; thus, it was impossible to check this identification. At the same time, it should be noted that Rozhdestvensky did not mention the presence of jaw dentition, which is characteristic of Early Cretaceous ornithomimosaurs, such as *Pelecanimimus polyodon* from Spain (Pérez-Moreno *et al.*, 1994), *Shenzhousaurus orientalis* from the Neocomian of China (Ji *et al.*, 2003), or *Harpymimus okladnikovi* from the ?Aptian–Albian of Mongolia (Barsbold and Perle, 1984). Available isolated specimens are impossible to identify more accurately than as Ornithomimidae indet., because the bones of ornithomimids from Kansai do not differ from the bones of other Late Cretaceous Asian representatives of this family. At the same time, the postcranial skeletons of known ornithomimid species are rather conservative, such that taxa belonging to this family are usually distinguished by the relative proportions of limb regions (Osmólska *et al.*, 1972; Russell, 1972; Barsbold and Osmólska, 1990; Osmólska, 1997; Kobayashi and Lü, 2003).

Ornithomimid remains from Kansai which compose the majority of dinosaur specimens from this locality are described and figured below; all bones are housed at the Paleontological Institute of the Russian Academy of Sciences (Moscow).

DESCRIPTION

The skull is only represented by a posterior fragment of the left frontal (PIN, no. 3041/20, Pl. 11, fig. 1). The bone is dome-shaped, which suggests relatively large cerebral hemispheres. The carina cranii extends close to the midwidth of the bone.

The neural arch of the anterior caudal vertebra (PIN, no. 3041/14, Pl. 11, fig. 2) has well-developed transverse processes. The prezygapophyses are relatively widely spaced and are separated by a deep oval notch, with oval articular facets facing dorsomedially. The prezygapophyses are on a level with the transverse process, while the postzygapophyses are somewhat higher (in *Gallimimus bullatus*, they are at the same level, see Osmólska *et al.*, 1972, pl. 53, fig. 3b). The neural spine was high, displaced to the posterior half of the vertebra.

The posterior caudal vertebrae (PIN, nos. 3041/12 and 3041/13, Pl. 11, figs. 5, 6) are elongated, with a reduced neural arch lacking transverse processes and a relatively low, longitudinally extended crestlike neural

Explanation of Plate 11

Ornithomimidae indet., Kansai locality, Khodzhent Region, Tajikistan; Yalovach Formation, Lower Santonian, Upper Cretaceous.

Fig. 1. Specimen PIN, no. 3041/20, left frontal, ventral view.

Fig. 2. Specimen PIN, no. 3041/14, neural arch of the anterior caudal vertebra, (a) dorsal and (b) lateral views.

Fig. 3. Specimen PIN, no. 3041/2, left humerus: (a) dorsal, (b) posterior, (c) ventral, (d) anterior views, and (e) distal end.

Fig. 4. Specimen PIN, no. 3041/6, left preungual phalanx of the forelimb, II-2: (a) frontal, (b) distal, (c) proximal views, and (d) lateral views.

Fig. 5. Specimen PIN, no. 3041/12, posterior caudal vertebra: (a) dorsal and (b) lateral views.

Fig. 6. Specimen PIN, no. 3041/13, posterior caudal vertebra: (a) dorsal and (b) lateral views.

Designations: (*dc*) deltopectoral crest, (*lc*) lateral condyle, and (*mc*) medial condyle.

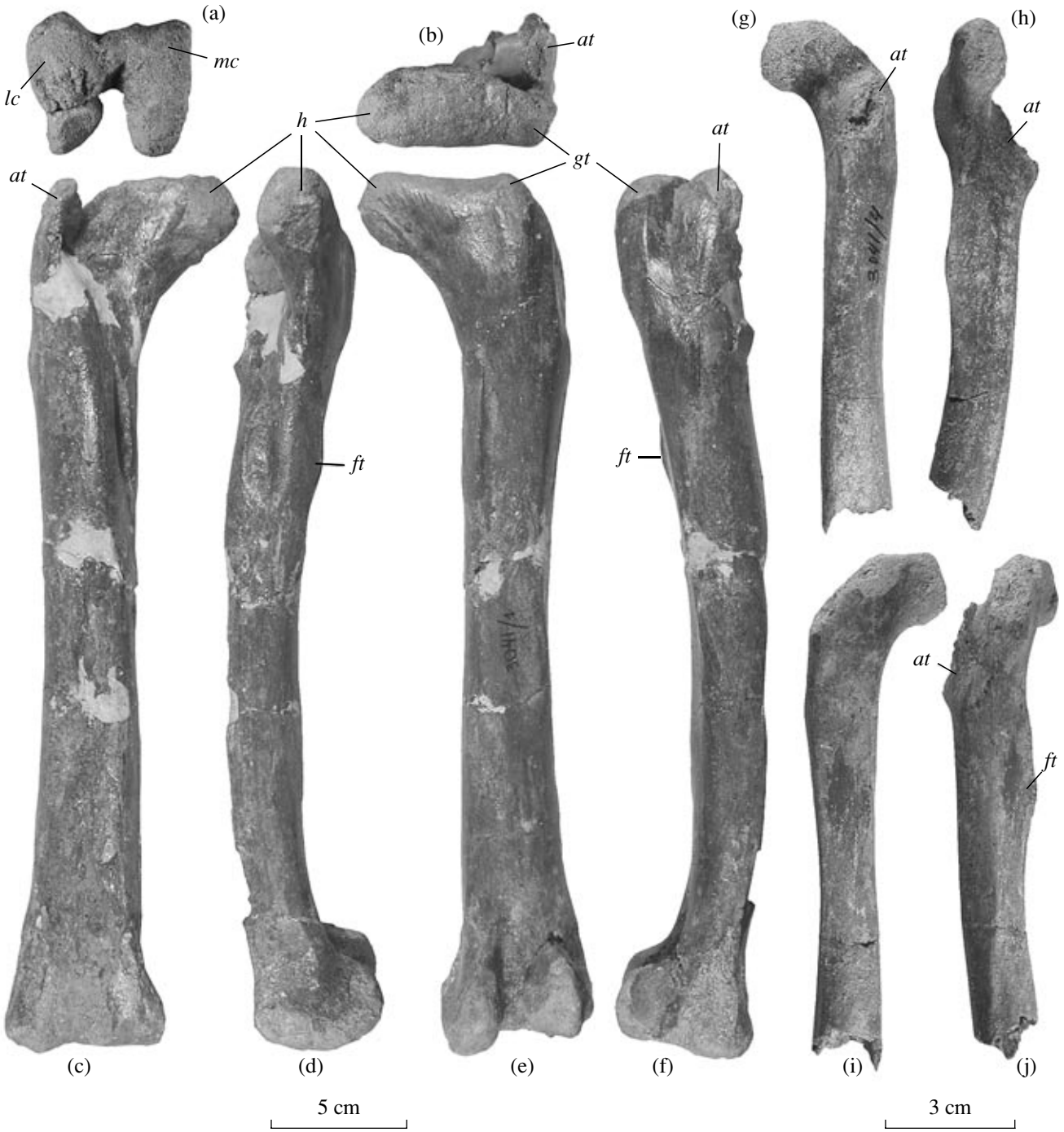

Fig. 1. Femora of Ornithomimidae indet., Kansai locality, Khodzhent Region, Tajikistan; Yalovach Formation, Lower Santonian, Upper Cretaceous: (a–f) specimen PIN, no. 3041/1, right femur of an adult individual: (a) distal, (b) proximal, (c) anterior, (d) medial, (e) posterior, and (f) lateral views; (g–j) specimen PIN, no. 3041/4, left femur of a young individual, (a) anterior, (b) medial, (c) posterior, and (d) lateral views. Designations: (*at*) anterior trochanter, (*ft*) fourth trochanter, (*gt*) greater trochanter, (*h*) head of the femur, (*lc*) lateral condyle, and (*mc*) medial condyle.

spine. The prezygapophyses were massive and, probably, long (broken off in the specimens), directed anterodorsally. The postzygapophyses are reduced, connected to the prezygapophyses by a distinct crest. The vertebral center is slightly expanded at the anterior and posterior ends. The ventral surface of the center is flattened, with a superficial longitudinal groove bordered by lateral crests. On the ventral side, the vertebral center is 49.3 mm in PIN, no. 3041/12 and 50.8 mm long in PIN, no. 3041/13.

The left humerus (PIN, no. 3041/2, Pl. 11, fig. 3) lacks a proximal epiphysis. The bone is relatively long, narrow, and slightly curved, with a reduced deltopectoral crest, which is characteristic of ornithomimids (Barsbold and Osmólska, 1990; Osmólska, 1997; Kobayashi and Lü, 2003). The bone is almost identical in structure and proportions to that of *Gallimimus bullatus* (Osmólska *et al.*, 1972, pl. 35). The distal epiphysis is dorsoventrally flattened, the lateral (radial) condyle is somewhat smaller than the medial (ulnar) condyle (synapomorphy of the Ornithomimidae, see Kobayashi and Lü, 2003). The lateral epicondyle is clearly detached. The distal epiphysis is 33.2 mm wide.

The left distal preungual phalanx of the second manual digit (phalanx II-2; PIN no. 3401/6, Pl. 11, fig. 4) is relatively long (95.7 mm in length), with a stout dorsal proximal process and a ginglymoid proximal articular surface divided by a high crest into two parts. The medial and lateral distal condyles are approximately equal in size. A fossa for the colateral ligament is well-developed on either side.

The right femur of an adult (PIN, no. 3041/1, Figs. 1a–1f) is characterized by a relatively slender, sigmoidal diaphysis. The head of the bone is directed strictly medially and has a flattened dorsal surface. On the posteromedial side, its articular surface has a small tubercle bordered posteriorly by a groove. The greater trochanter is only slightly differentiated from the head of the bone to form together an articular surface, which is inclined somewhat posteriorly. The anterior (lesser) trochanter adjoins the greater trochanter; the trochanters are separated from each other by a deep groove, and their proximal edges are positioned at the same level. The fourth trochanter is crestlike, located on the posteromedial margin of the diaphysis, proximal to its midlength. A relatively deep elliptical fossa providing an attachment area for a tendon of the caudifemoralis longus muscle is located anterior to the fourth trochanter. The diaphysis of the bone clearly curves in the anteroposterior and mediolateral planes. The distal epiphysis of the bone is relatively narrow mediolaterally, with flattened condyles approximately equal in size, separated posteriorly from one another by a deep groove. On the anterior side, proximal to the medial condyle, the distal part of the bone has a distinct longitudinal crest bordering medially a depression for a tendon of the femorotibialis muscle. The greatest length of the bone is 329.5 mm, the distal epiphysis is 59.1 mm wide.

The femur of a young animal (PIN, no. 3041/4, Figs. 1g–1j) differs from the adult bone described above and from the holotype of *"Archaeornithomimus" bissektensis* from the Turonian of Uzbekistan, which also belongs to a young animal (Nessov, 1995, pl. 3, fig. 7), in the more distal positions of its anterior and fourth trochanters and fossa for the caudifemoralis longus muscle.

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