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Skeletal remains of Tyrannosauroidea (Dinosauria: Theropoda) from the Bissekty Formation (Upper Cretaceous: Turonian) of Uzbekistan

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ABSTRACT

There exists a major gap in the fossil record of tyrannosauroid theropod dinosaurs spanning the early part of the Late Cretaceous. We report on skeletal remains referable to Tyrannosauroidea indet. from the Turonian Bissekty Formation at Dzharakuduk in the central Kyzylkum Desert of Uzbekistan. Phylogenetic analysis of the hypodigm places the Bissekty tyrannosauroid as a non-tyrannosaurid tyrannosauroid more basal than the Campanian tyrannosauroids *Appalachiosaurus* and *Bistahieversor* from North America.

1. Introduction

Some 60 localities yielding dinosaurian skeletal remains in the Late Cretaceous continental deposits of the Kyzylkum Desert in Uzbekistan have been recorded to date (Nessov, 1995, 1997; AA, unpublished data). The most common fossils found at almost all of these localities are isolated teeth of tyrannosauroid theropods. Other skeletal elements, including a variety of cranial and post-cranial bones or fragments of such bones, are found only in strata of the Turonian Bissekty Formation at Dzharakuduk, about 80 km west of Uchkuduk in the Navoi Viloyat (district) of Uzbekistan (Fig. 1). Sosedko (1937) referred the earliest finds of tyrannosauroid remains from Dzharakuduk to *Allosaurus* sp. Later Efremov (1944) attributed these materials to "Deinodontidae" (an old name for Tyrannosauridae). In 1958 Anatoly K. Rozhdestvensky (Paleontological Institute of the Soviet Academy of Sciences, Moscow) collected an excellently preserved theropod braincase from Dzharakuduk that Kurzanov (1976) later described in detail and designated as the holotype of a new taxon *Itemirus medullaris*. *Itemirus* has sometimes been classified as a tyrannosauroid (e.g., Holtz, 2004), but newly collected material indicates that it is, in fact, referable to Dromaeosauridae (Sues and Averianov, in preparation).

Nessov (1995) identified the Bissekty tyrannosauroid as *Alectrosaurus* sp. and referred to it numerous labiolingually compressed tyrannosauroid teeth from other Late Cretaceous localities in the Kyzylkum Desert. He also noted the similarities of certain femora, a tibia, metatarsals, and astragali recovered from Dzharakuduk to those of the holotype of *Alectrosaurus olseni* from the Iren Dabasu Formation of Inner Mongolia, China (Gilmore, 1933; Perle, 1977; Mader and Bradley, 1989). Most of these bones, however, are referable to Ornithomimosauria, and a fragment of a maxilla (CCMGE 600/12457) has been re-identified as belonging to a dromaeosaurid (Sues and Averianov, in preparation). Nessov (1995) also identified some isolated teeth from Dzharakuduk as cf. *Aublysodon* sp. and noted that certain high-crowned, mesiodistally short teeth with transversely wide bases (e.g., Nessov, 1995, pl. 1, figs 3, 7, 10, 11) differ from those he had attributed to *Alectrosaurus* sp.; thus, he classified them as Theropoda indet. The latter possibly represent anterior maxillary or anterior dentary teeth of the same taxon, which had short anterior alveoli at least in the maxilla. Finally, Nessov identified premaxillary teeth without denticles as cf. *Aublysodon* sp.; we here assign these teeth to Tyrannosauroidea indet.

Between 1997 and 2006 the joint Uzbek-Russian-British-American-Canadian expeditions (URBAC) to the Kyzylkum Desert greatly increased the known fossil record of dinosaurs from the Bissekty Formation at Dzharakuduk (Archibald et al., 1998). The aim of this paper is to describe all skeletal remains referable to Tyrannosauroidea from Dzharakuduk and elucidate the phylogenetic position of the Bissekty tyrannosauroid.

Institutional abbreviations. CCMGE, Chernyshev's Central Museum of Geological Exploration, Saint Petersburg, Russia; PIN, Paleontological Institute, Russian Academy of Sciences, Moscow, Russia; USNM,

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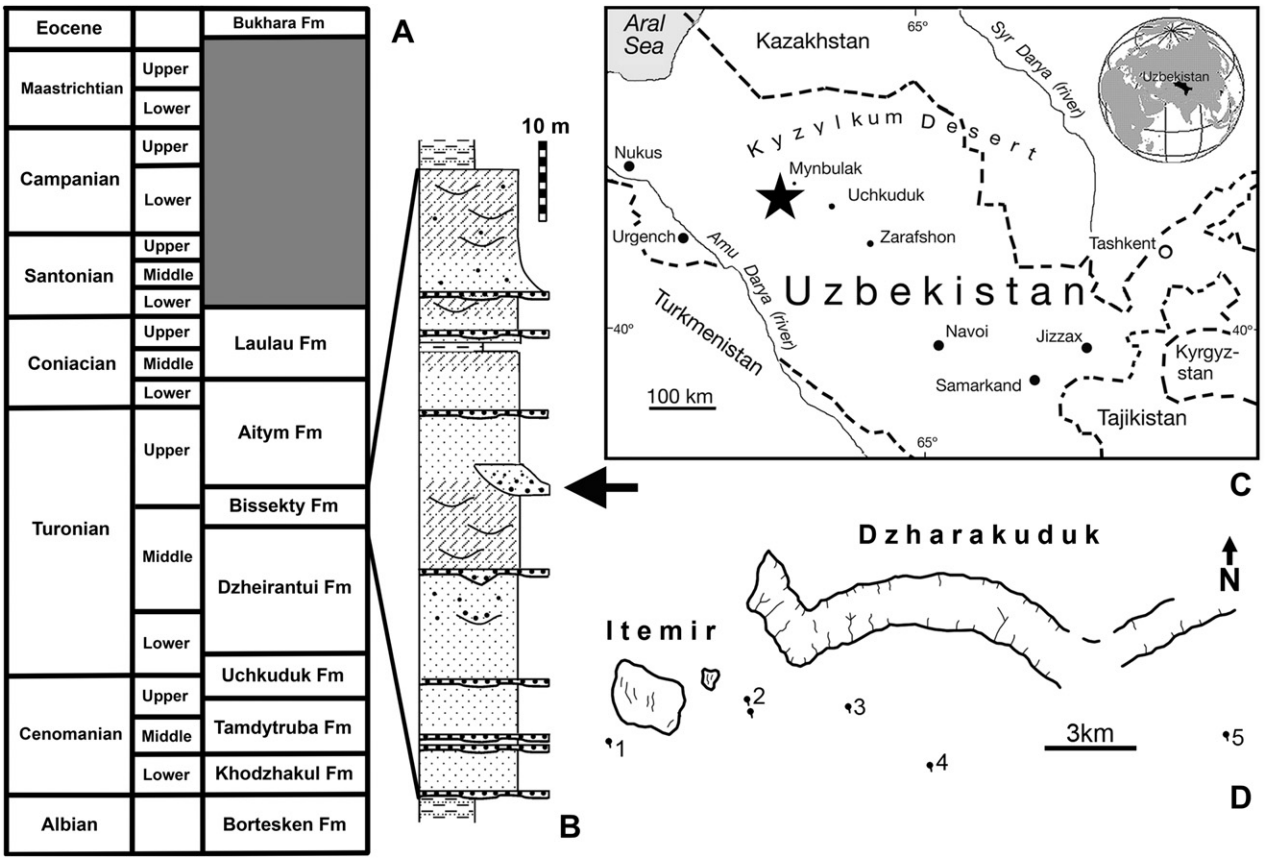

Fig. 1. Stratigraphic and geographic setting for the Dzharakuduk locality complex, Kyzylkum Desert, Uzbekistan. Stratigraphic succession of the Cretaceous formations (A) and section of the Bissekty Formation (B) at Itemir-Dzharakuduk depression are modified from unpublished work by C. King and colleagues. Arrow in B denotes position of the CBI-14 site, one of the most productive localities for microvertebrate remains. The outline map of Uzbekistan (C), with the position of the Itemir-Dzharakuduk depression marked by a star, and sketch of the Itemir-Dzharakuduk escarpments (D) are modified from Averianov and Sues (2007). 1, Itemir well; 2, Dzharakuduk wells; 3, Kul'beke well; 4, Bissekty well; 5, Khodzhakhmet well.

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Locality abbreviations. CBI, Central [Kyzylkum] Bissekty; CDZH, Central [Kyzylkum] Dzharakuduk. This prefixes were used by Nessov for the localities within upper-middle and lower parts of the Bissekty Formation, respectively.

Measurements. Tooth crowns: BW, basal width; FABL, fore-aft basal length; TCH, tooth crown height. Vertebrae: ACH, anterior height of centrum (without hypapophysis); ACW, anterior width of centrum; ANW, anterior width of neural arch (between lateral margins of prezygapophyses); CL, centrum length (ventral); NAL, neural arch length (between anterior and posterior margins of dorsal roof of neural canal); NSL, neural spine length (maximum); PCH, posterior height of centrum; PCW, posterior centrum width; PNW, posterior width of neural arch (between lateral margins of postzygapophyses). All measurements are in millimeters.

2. Systematic paleontology

Dinosauria Owen, 1842
Saurischia Seeley, 1887
Theropoda Marsh, 1881
Tyrannosauroidea Osborn, 1905
Tyrannosauroidea indet.
Figs. 2–12

1995 *Alectrosaurus* sp. [partim]: Nessov, p. 38, pl. 1, figs 2, 5, 6, 8, 9, 12, 15 [not fig. 1, (ornithomimosaur ungual) and figs 19, 20 (ornithomimosaur astragali)]
1995 Theropoda [indet.]: Nessov, pl. 1, figs 3, 7, 10, 11
1995 Dinosauria [indet.]: Nessov, pl. 3, fig. 4.

Material examined. Almost complete right maxilla, fragment of left maxilla, isolated frontals, distal end of left quadrate, fragment of right dentary, posterior fragments of mandibular rami with fused articular and surangular, isolated premaxillary and lateral teeth; cervical, dorsal and caudal vertebrae, ungual phalanges of manus and pes; possible fragment of astragalus.

Description

Skull

Frontal: There are several isolated unfused frontals from younger specimens of Tyrannosauroidea. The most complete of these frontals (ZIN PH 2330/16; Fig. 2) is triangular with an anteroposterior length 1.5 times greater than its transverse width. Its anterior end bears three facets for the overlapping nasal prongs, as in other