Brief report *Acta Palaeontologica Polonica* 51 (2): 377–380, 2006

New specimens of the multituberculate mammal *Uzbekbaatar* from the Late Cretaceous of Uzbekistan

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***Uzbekbaatar* Kielan-Jaworowska and Nessov, 1992 is among the rarest mammals and the only multituberculate in the diverse, eutherian dominated Bissekty (Turonian) and Aitym (?Coniacian) local faunas, Kyzylkum Desert, Uzbekistan. New material from the Bissekty local fauna, suggests that only one multituberculate species, *Uzbekbaatar kizylkumensis* Kielan-Jaworowska and Nessov, 1992 is present in the Bissekty fauna. A newly collected p4 is better preserved than the holotype and demonstrates presence of the posterolabial cusp in the p4 of *Uzbekbaatar*. New material of *Uzbekbaatar* is consistent with placement of this taxon within the basal cimolodontan "*Paracimexomys* group."**

Introduction

The multituberculate mammal *Uzbekbaatar kizylkumensis* Kielan-Jaworowska and Nessov, 1992 is one of the rarest mammals in the rich and diverse Bissekty local fauna from the Late Cretaceous (Turonian) of the central Kyzylkum Desert, Uzbekistan (Archibald and Averianov 2005). It is represented by only twelve of 1134 (1.06%) catalogued mammal specimens from this local fauna collected between 1977 and 2004. A similar, somewhat larger species *Uzbekbaatar wardi* Averianov, 1999 perhaps was more abundant in the slightly younger (Turonian–?Coniacian) and more poorly known Aitym local fauna at Dzharakuduk (Averianov 1999; Averianov and Archibald 2003; Archibald and Averianov 2005). *Uzbekbaatar* documents a poorly sampled early–middle Late Cretaceous interval of multituberculate evolution (Kielan-Jaworowska and Nessov 1992; Kielan-Jaworowska et al. 2004). It is the only Turonian multituberculate known from Asia. Otherwise, Turonian multituberculates have been reported only from the Smoky Hollow Member of the Straight Cliffs Formation, southern Utah, USA (Eaton 1995). In this brief report we describe some previously unpublished specimens of *U. kizylkumensis* from the Bissekty local fauna collected by URBAC expeditions between 1998 and 2004 that permit us to supplement the morphological characteristic of the species, and further clarify its phylogenetic position.

Institutional abbreviations.—CCMGE, Chernyshev's Central Museum of Geological Exploration, Saint Petersburg, Russia; URBAC, Uzbek / Russian / British / American / Canadian Paleontological expedition specimens currently held at San Diego State University, San Diego, USA; ZIN, Zoological Institute, Russian Academy of Sciences, Saint Petersburg, Russia.

Systematic paleontology

Multituberculata Cope, 1884

Cimolodonta McKenna, 1975

Cimolodonta *incertae sedis*

"*Paracimexomys* group" (although not formal, used *sensu*, Eaton and Cifelli, 2001)

Uzbekbaatar Kielan-Jaworowska and Nessov, 1992

Uzbekbaatar kizylkumensis Kielan-Jaworowska and Nessov, 1992

Fig. 1.

1992 *Uzbekbaatar kizylkumensis*; Kielan-Jaworowska and Nessov 1992: 14, figs. 1, 3C.
1992 Multituberculata? indet.: Kielan-Jaworowska and Nessov 1992: fig. 4A–C.
1992 Multituberculata indet.: Kielan-Jaworowska and Nessov 1992: fig. 4D–F.
1992 [Multituberculata indet.]: Kielan-Jaworowska and Nessov 1992: fig. 5.
1993 *Uzbekbaatar kizylkumensis*; Nessov 1993: figs. 1, *2*.
1995 *Uzbekbaatar kizylkumensis*; Nessov 1995: pl. 11: 5.
1997 *Uzbekbaatar kisylkumensis* [sic]; Nessov 1997: pl. 46: 7.
2000 *Uzbekbaatar kisylkumensis* [sic]; Averianov 2000: fig. 30.6A–D.
2004 *Uzbekbaatar kizylkumensis*; Kielan-Jaworowska et al. 2004: 332, fig. 8.42C.

Holotype: CCMGE 100/12455, right p4 (CBI-14, 1987).

Type locality and horizon: Dzharakuduk, Central Kyzylkum Desert, Uzbekistan; Bissekty Formation, middle–upper Turonian, Upper Cretaceous.

Material.—URBAC 98-11, left maxilla fragment with alveoli for P1–4 (CBI-14, CCMGE 102/12455, right(?) lower incisor (CBI-14, 1989); URBAC 04-105, left p4 (CBI-14); CCMGE 101/12455, right dentary fragment with alveoli for i, p3–4, m1–2 (CBI-14, 1991); URBAC 03-175, right dentary fragment with alveoli for i, p3–4, m1–2 (CBI-14); ZIN 89005, right dentary fragment with alveoli for i, p4, m1–2 (CBI-14, 1987); ZIN 89004, left dentary fragment with alveoli for i, p4, m1–2 (CBI-14, 1989); URBAC 04-46, left dentary fragment with alveoli for p4, m1–2 (CBI-17); CCMGE 103/12455, proximal part of right humerus (CBI-14, 1987); CCMGE 104/12455, proximal part of left femur (CBI-14, 1987); CCMGE 104a/12455, proximal part of juvenile right femur (CBI-14, 1989).

Description.—The maxilla fragment URBAC 98-11 (Fig. 1A) preserves alveoli for P1–4. There is no maxillary-premaxillary suture preserved. Judging from the alveoli, P1 was larger than P2

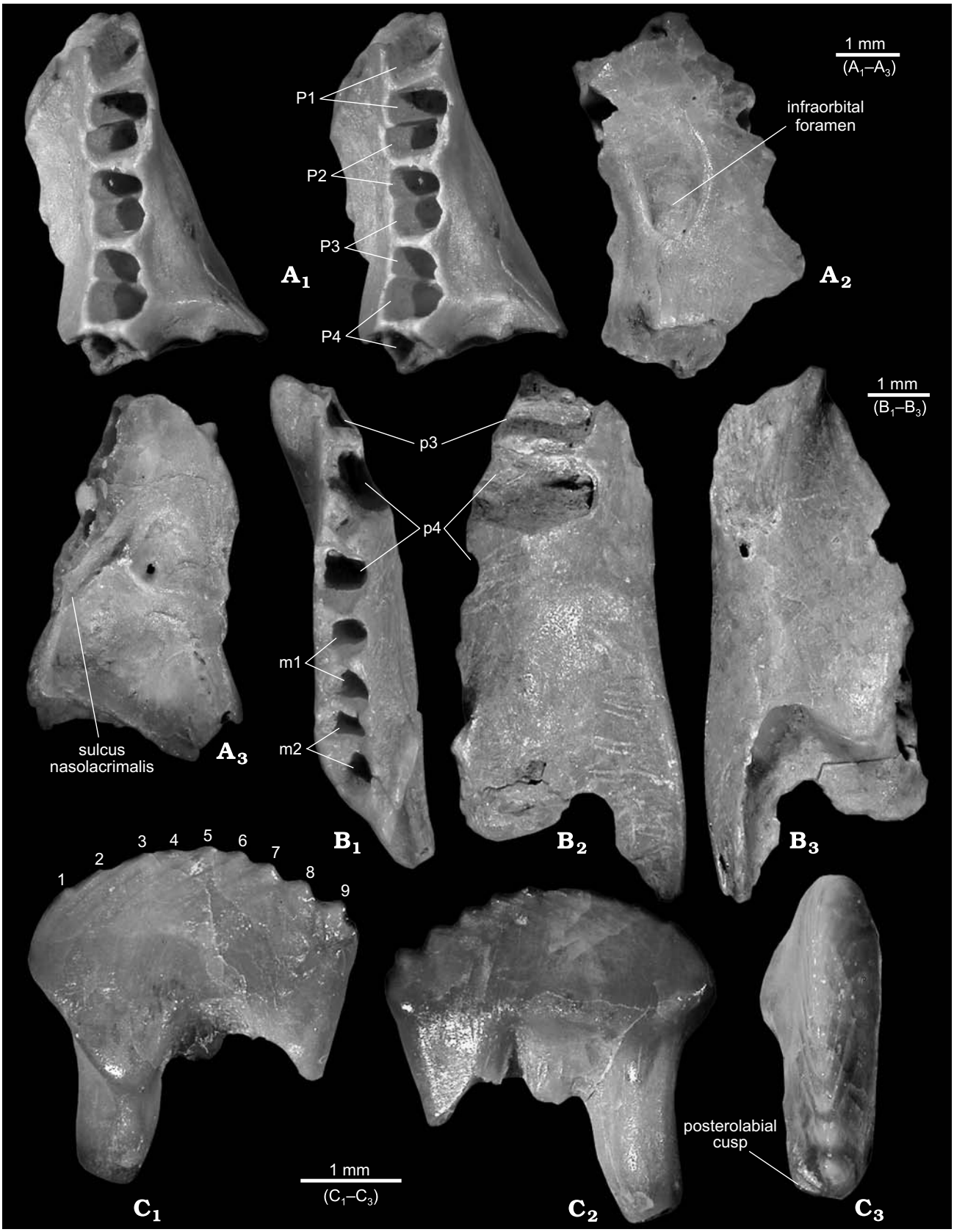

Fig. 1. *Uzbekbaatar kizylkumensis*. Dzharakuduk, Kyzylkum Desert, Uzbekistan; Bissekty Formation, Upper Cretaceous (Turonian). **A**. URBAC 98-11, left maxilla fragment with alveoli for P1–4, in occlusal (A_1, stereopair), lateral (A_2), and medial (A_3) views. **B**. URBAC 03-175, right dentary fragment with alveoli for lower incisor, p3–4, m1–2, in occlusal (B_1), labial (B_2), and lingual (B_3) views. **C**. URBAC 04-105, left p4, in labial (C_1), lingual (C_2), and occlusal (C_3) views.

and P3, but smaller than P4. The alveolar border is arcuate in lateral profile (Fig. $1A_2$). The alveoli for P2–3 are more or less vertical, while the alveoli of P1 are inclined anteriorly and those for P4 are inclined posteriorly. On the lateral side there is a single large infraorbital foramen at the level between P3–4. It opens into a large depression reaching anteriorly to the anterior alveolus of P2. The depression is delimited by a strong, straight ventral ridge and an arcuate, dorsal ridge. The medial wall of the infraorbital canal, concealed laterally by the zygomatic process of the maxilla, is perforated by two small foramina opening into the maxillary sinus. The anterior edge of the root of the zygomatic process gently slopes anteriorly to the level between P1–2. Its posterior edge is almost transverse and originates opposite the posterior alveolus for P4. On the ventral side of zygomatic process there is a small, triangular, horizontal shelf-like area posterior to the infraorbital foramen and opposite to the posterior root of P3 and anterior root of P4. This area is bordered posteriorly by a poorly differentiated, transverse, anterior zygomatic ridge. The palatal process of the maxilla is broken close to the alveolar border and thus presence of palatal vacuities cannot be established. The majority of medial side, forming the lateral wall of the nasal cavity, is occupied by two depressions, small anterior and large posterior, separated by an almost vertical ridge. Within the floor of anterior depression, close to the crista maxilloturbinalis, there is an opening into the maxillary sinus. Along the anterodorsal edge of these depressions there is a distinct groove, likely for the nasolacrimal canal (sulcus nasolacrimalis in Fig. $1A_3$).

The dentary of *U. kizylkumensis* was described in detail by Kielan-Jaworowska and Nessov (1992: 8–10; as "Multituberculata indet. sp. A", see discussion). Additional dentary specimens from Dzharakuduk fully agree with this description. The masseteric fossa starts at the posterior root of p4 in all specimens. The coronoid process starts at the posterior root of m1 in URBAC 04-46, 03-175, and ZIN 89005, but between m1–2 in CCMGE 101/12455. In URBAC 03-175 (Fig. $1B_3$), ZIN 89004, and CCMGE 101/12455 (Kielan-Jaworowska and Nessov 1992: fig. 4F) there is a small foramen or depression just posterior to the alveolus for the lower incisor, while this foramen is lacking in ZIN 89005. It cannot be excluded that this foramen is an artefact.

The lower premolar p4 (URBAC 04-105; Fig. 1C) agrees well in morphology and size with the holotype (see description in Kielan-Jaworowska and Nessov 1992: 4–6). The crown is arcuate and relatively low (lingual crown height/crown length ratio is 0.49), overhanging the anterior and posterior roots. There are nine serrations; the anterior eight bear ridges on both labial and lingual sides. The fifth and sixth ridges extend onto the anterior triangular lobe. There is a distinct shelf-like posterolabial cusp at the level of the eighth and ninth serrations approximately at the middle of the crown height (Fig. $1C_1$, C_3; on the holotype this area is not adequately preserved). A short, stout, vertical ridge extending ventrally from the eighth serration borders the posterolateral cusp anteriorly, and a similar but smaller ridge extends ventrally from the ninth serration onto this cusp. There is a distinct groove on anterior surface of the anterior root for reception of p3.

Measurements.—The p4 (CCMGE 100/12455, holotype, after Kielan-Jaworowska and Nessov 1992, and URBAC 04-105, respectively, in mm): crown length 3.1 [tooth is not complete anteriorly], 3.3; crown width across the middle of the anterior triangular lobe 1.2, 1.3; crown height along the middle of anterior triangular lobe 2.4, 2.4; crown height above the interradicular crest on labial side 1.5, 1.5; maximum crown height on lingual side 1.6, 1.6.

Discussion

Kielan-Jaworowska and Nessov (1992) established *Uzbekbaatar kizylkumensis* based on the single specimen, isolated p4, while an edentulous dentary fragment, a lower incisor, and humeral and femoral fragments were referred to Multituberculata indet. Although it was found that all specimens "roughly fit each other in size" (Kielan-Jaworowska and Nessov 1992: 13), the dentary was not considered conspecific with the premolar because "the length of isolated p4 is 3.1 mm, while the estimated length of p4 in the edentulous dentary is 2.8 mm" (p. 13, or 2.7 mm on p. 10). In *Uzbekbaatar*, as in many other cimolodontans, however, the crown is overhanging the root anteriorly and posteriorly (perhaps the crown of p4 completely overhangs p3) and thus is not equal to the length of its alveoli. The length of the roots at the alveolar border in the holotype is 2.6 mm (2.5 mm in URBAC 04-105), while our measurements of the p4 alveoli is 2.5 mm for CCMGE 101/12455 and 2.5 mm for URBAC 03-175. In other dentary fragments, alveoli for p4 are not complete, but they have virtually the same size. Two only known multituberculate teeth from the Bissekty local fauna at Dzharakuduk, p4s CCMGE 100/12455 and URBAC 04-105, are almost identical in size and morphology. According to measurements of Kielan-Jaworowska and Nessov (1992), humerus/femur ratio for fragments from Dzharakuduk would be different from that in one articulated specimen of *Nemegtbaatar gobiensis* Kielan-Jaworowska, 1974 from the Campanian of Gobi Desert, Mongolia. The limits of individual, sexual, and interspecific variation of this ratio, however, are not known and this single comparison could not unequivocally demonstrate the presence of more than one multituberculate taxon in Dzharakuduk fauna. The five multituberculate dentary fragments from this fauna show no dimensional or morphological variation and are compatible in size with known p4's. Moreover, when anteriorly complete, these dentary fragments demonstrated the presence of a single-rooted p3. Presence of a small p3 may be deduced from a groove on the anterior surface of the anterior root in both p4's. The maxillary fragment URBAC 98-11 cannot be directly compared with dentaries but likely also matches them in size (Fig. 1). Thus, we here refer available multituberculate specimens from the Bissekty local fauna to the single taxon *Uzbekbaatar kizylkumensis*.

A better preserved p4, URBAC 04-105, confirms for *U. kizylkumensis* the lack of a triangular plate with crenulated margins for reception of p3 on the anterior surface (incomplete on the holotype), characteristic for plagiaulacoid multituberculates. The new specimen confirms the presence of a posterolabial cusp that was presumed absent in the damaged holotype. Presence of a posterolabial cusp further supports the attribution of *Uzbekbaatar* to the basal cimolodontan "*Paracimexomys* group," first proposed after study of isolated teeth of *U. wardi* from the Aitym local fauna at Dzharakuduk (Averianov and Archibald 2003). The posterolabial cusp in *Uzbekbaatar* is almost identical in structure to that in a de-

rived plagiaulacoid *Eobaatar magnus* Kielan-Jaworowska, Dashzeveg, and Trofimov, 1987 from the Early Cretaceous of Mongolia (Kielan-Jaworowska et al. 1987: fig. 1A, B, pl. 1: 1a, 3a), or in some ptilodontids from the Late Cretaceous of North America (e.g., Clemens 1963: fig. 13; Archibald 1982: fig. 11a, c). *Uzbekbaatar* is similar to *Eobaatar* in having nine serrations on p4, but clearly differs in having a more arcuate, rather than having parallel anterior and posterior sides of the crown of p4, and in having only two lower premolars with a reduced, single-rooted p3. *Uzbekbaatar* differs from North American genera of the "*Paracimexomys* group" (*Paracimexomys* Archibald, 1982, *Bryceomys* Eaton, 1995; *Cedaromys* Eaton and Cifelli, 2001, and *Dakotamys* Eaton, 1995, see Eaton 1995; Eaton and Cifelli 2001; Kielan-Jaworowska et al. 2004) in having a lower, arcuate p4 crown, compared to most other North American genera that have an arcuate, but taller p4 crown.

Eaton and Cifelli (2001: 459, fig. 3A, B) noted a similarity "in overall outline" of an isolated p4 of an indeterminate plagiaulacoid from the mid-Cretaceous Cedar Mountain Formation in Utah, USA with the p4 in *Uzbekbaatar*. The tooth from Utah, however, is clearly a plagiaulacoid, parallel-sided p4, while in *Uzbekbaatar* the p4 crown is more arcuate with a crown overhanging the anterior and posterior roots, which is typical for Cimolodonta.

Averianov and Archibald (2003) suggested that *Uzbekbaatar* was probably derived from an American immigrant, because basal cimolodontan multituberculates of the "*Paracimexomys* group" are known only from the Cretaceous of North America. Inasmuch as taxa of "*Paracimexomys* group" were derived from the Asiatic Eobaataridae (Eaton and Cifelli 2001), persistence of this lineage in Asia until the Turonian cannot be excluded. Nevertheless, an immigration of *Uzbekbaatar* ancestor from North America seems more likely at the current state of our knowledge, because of extensive intercontinental exchange occurred at this time, involving, in particular, dispersal of spalacotheriid "symmetrodont" *Shalbaatar* Nessov, 1997 from North America to Asia and eutherian *Paranyctoides* Fox, 1979 and possible zhelestids from Asia to North America (Archibald and Averianov 2001; Averianov and Archibald 2003).

Acknowledgements.—The continued cooperation of the Zoological Institute, National Academy of Sciences of Uzbekistan, Tashkent, notably Djaloliddin Azimov is much appreciated. We thank the URBAC expedition members Alexei Abramov, Igor Danilov (both Zoological Institute, Saint Petersburg), Christopher King, David Ward (both University of Greenwich, Chatham Maritime), Noel Morris (Natural History Museum, London), Anton Rezvyi, Pavel Skutschas (both Saint Petersburg State University, Saint Petersburg), Catherine Skrabec (Royal Ontario Museum, Toronto), and Hans-Dieter Sues (Smithsonian Institute, Washington) for their myriad field help and scientific expertise. We thank reviewers Jeffrey Eaton (Weber State University, Ogden) and Anne Weil (Duke University, Durham) for reading the paper and comments. The financial support of the National Geographic Society (grants nos. 5901-97 and 6281-98), the National Science Foundation (grants EAR-9804771 and 0207004), and the Civilian Research and Development Foundation (grant RU-G1-2571-ST-04) are gratefully acknowledged. The work of AA was supported by the President's of Russia grant MD-255.2003.04 and by the Russian Fund of Basic Research grants 04-04-49113 and 04-04-49637.

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