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Discovery of *Yuomys* from Altun Shan, Xinjiang, China

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Abstract Specimens reported in this note represent the first discovery of *Yuomys* in Altun Shan. A new species, *Yuomys altunensis*, is established based on the following features: molars large and wide in proportion; metaconule distinctly separated from metacone, metaloph long, but incomplete; hypocone smaller than protocone; sinus extending to base of crown on lingual side; postcingulum connectting lingual side of metacone; metacone crescent and postcingulum short in M3. *Yuomys altunensis* is similar to *Y. cavioides*, *Y. eleganes* and *Y. huangzhuangensis* of late Middle Eocene in molar morphlogy. According to its evolutionary level, *Y. altunensis* is supposed as of late Middle Eocene in age, or slightly later.

Key words Altun Shan, Xinjiang, Middle Eocene, Xishuigou Formation, *Yuomys*

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The genus *Yuomys* has so far been considered as an extinct endemic genus of rodents lived in Middle–Late Eocene of China. Their fossils have been found only from eastern and southern parts of China (east to 100°E). In 2011 some specimens of *Yuomys* were collected from Altun Shan in Xinjiang Uygur Autonomous Region, in a site located near 91°E. This proves clearly that the distribution of *Yuomys* can be extended far to the western part of China. Furthermore, the Altun Shan specimens represent a new species of *Yuomys* worthy of a special note.

Ctenodactyloidea Simpson, 1945

Yuomys Li, 1975

Yuomys altunensis sp. nov.

(Fig. 1)

Holotype Right maxilla with M1–3 and roots of P4 (IVPP V 16295.1).

Paratypes Left maxilla with M1–2 (IVPP V 16295.2), left maxilla with M2–3 (V 16295.3), and right maxilla with M2 (V 16295.4).

Locality and horizon East to Caihong Gou (91°30′57.21″E, 38°55′30.65″N), Altun

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Shan in Ruoqiang County of Bayingolin Mongol Autonomous Prefecture of Xinjiang Uygur Autonomous Region, China; lower part of the Xishuigou Formation, late Middle Eocene.

Diagnosis Larger-sized *Yuomys*; upper molars higher-crowned, much wider than long, with mesostyle, metaconule distinctly separated from metacone by a longer, lower and incomplete metaloph, hypocone smaller than the protocone, postcingulum connecting lingual side of metacone, sinus extending to base of the crown on the lingual side; M3 having more lingually situated and crescent metacone, short postcingulum and distinct hypocone.

Description Technical terms used in this paper follow Li and Meng (2015).

The holotype and three paratypes all preserve only parts of maxillae. The zygomatic process of the maxilla is opposite to P3 and P4 and its lateral part bends posteriorly to form the anterior root of the zygomatic arch. The anteriormost point of emarginated posterior border of zygomatic arch is opposite to middle of P4.

The specimens described here have 2 premolars (P3 and P4). V 16295.1 and V 16295.3 preserve alveoli of P3, showing that P3 has one root. V 16295.1 preserves roots of P4, and V 16295.2 and V 16295.3 preserve only alveoli of P4, showing that P4 is composed of three roots. The lingual root is the largest and the postero-buccal one is the smallest.

The molars are buno-lophodont and lingually hypsodont, much wider than long. The M1 and M2 are rectangular in outline, wider than long (see Table 1). The M1 of V 16295.1 is heavily worn and that of V 16295.2 is only partly preserved. The M2 are preserved well. The protocone is the largest cusp on the occlusal view. The paracone is slightly larger and higher than the metacone. The protoloph is complete and slightly lower in its middle part. No protoconule is visible. The metaconule is smaller than the metacone and separated from the latter distinctly. Thus, the metaloph connecting the metacone with metaconule is relatively longer, but lower than the protoloph in height. The incomplete metaloph extends toward the protocone, not reaching the latter. The hypocone is located posterior to the protocone and distinctly smaller than the latter in size. On the lingual side the sinus extends to the base of the crown. The parastyle is distinct, but smaller and lower than the metacone. At the joint point of the precingulum and the protoloph there is a distinct groove on the lingual side. The postcingulum, which connects the lingual side of the metacone, and precingulum are subequal to each other in length and nearly parallel to each other. The mesostyle is present, but small.

M3 is trapezoid in outline, with anterior side wider than posterior one, and buccal side longer than lingual side. The anterior part of M3 is similar to M2 in basic features, but the anterosinus between the precingulum and protoloph is longer than that of M2 antero-posteriorly, and more widely opens buccally. The metacone is crescent in occlusal view and situated slightly more lingually than the paracone in position. The metaconule situates slightly more anteriorly than the metacone than in M2. The metaloph is low and incomplete, and no ridge is seen between the metaconule and the protocone. The mesostyle is more developed than in M1–2. The hypocone is distinct. The postcigulum is much shorter than the precingulum and connects the lingual end of the metacone.

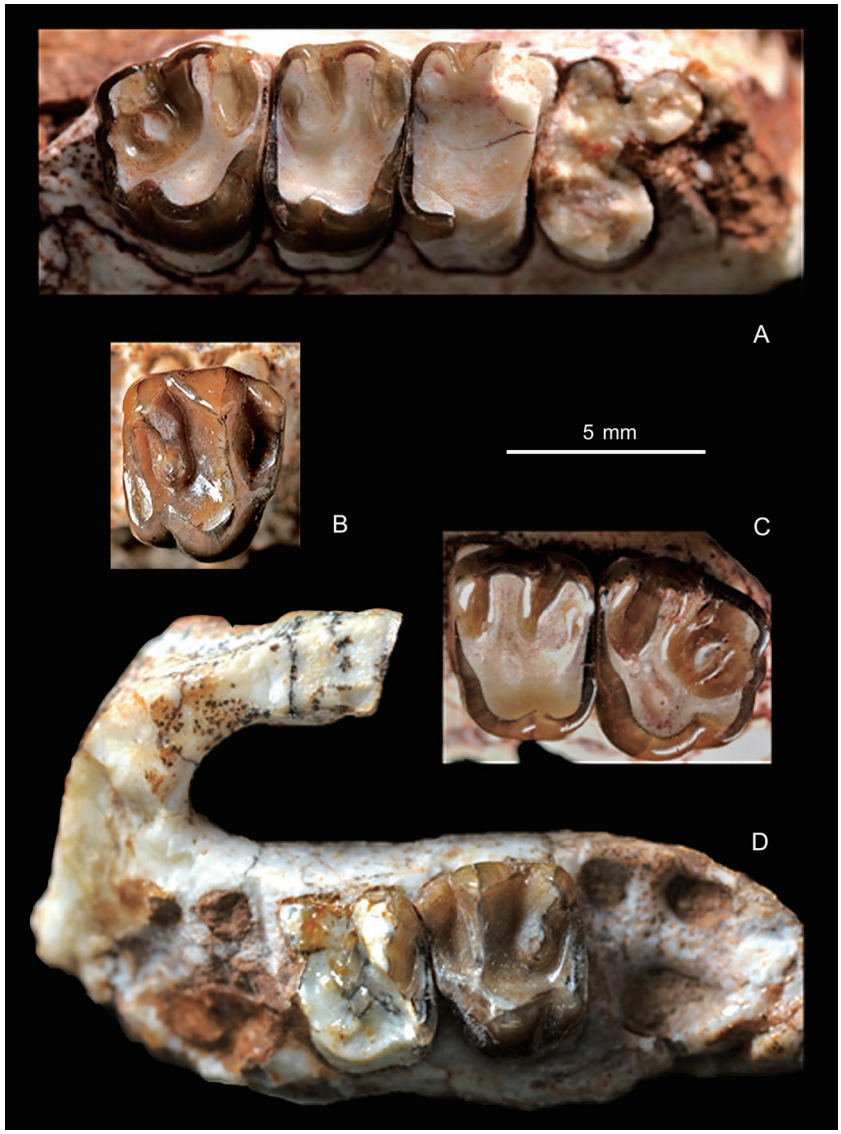

Fig. 1 Occlusal view of maxillae of *Yuomys altunensis* sp. nov.
A. right maxilla with M1–M3 and root of P4 (IVPP V 16295.1, type); B. right M2 (V 16295.4); C. left M2–M3 (V 16295.3); D. left maxilla with M1–M2 (V 16295.2)

Measurements See Table 1.

Comparison The Altun Shan specimens are similar to *Yuomys* in zygomatic process of maxilla being opposite to P3 and P4, upper cheek tooth having P3 and P4, molars being lingually hypsodont and buno-lophodont, having distinct metaconule, hypocone being located posterior to the protocone. It seems justified to refer the Altun Shan specimens to the genus *Yuomys*.

Table 1 Measurements and comparison of upper cheek teeth of known species of *Yuomys* (mm)

		Yuomys								
		altunensis sp. nov. IVPP V 16295				*cavioides* Li, 1975	*eleganes* Wang, 1978	*weijingensis* Ye, 1983	*huangzhuangensis* Shi, 1989	*huheboerhensis* Li & Meng, 2015
		.1 (type)	.2	.3	.4					
P4–M3	L					15.7				
M1–3	L	11.5e								
P4	L					4–4.2			4.2	2
	W					3.75–3.95			4	2.5
M1	L	3.4+				3.2–4.15		3.5	3.75	1.75–2.1
	W	5.5				3.75–4.2		3.6	3.5	1.7–2.25
M2	L	3.5	4.1	3.8	4.2	3.45–4.1	3.3	3.37	3.85	2.4
	W	5.4	5.1	5.3	5.2	3.85–4.4	3.9	4.17	3.6	2.5–2.6
M3	L	4.5		4.5		4.35				2.5
	W	5.3		5.3		4.25				2.3

Up to now, *Yuomys* is known to include 7 species (*Y. cavioides*[1)], *Y. eleganes*, *Y. weijingensis*, *Y. huangzhuangensis*, *Y. huheboerhensis*, *Y. minggangensis* and *Y. yunnanensis*) and several indeterminate species (Li, 1975; Wang, 1978; Wang and Zhou, 1982; Ye, 1983; Shi, 1989; Huang and Zhang, 1990; Wang, 2001; Li and Meng, 2015). Since the two latter species (*Y. minggangensis* and *Y. yunnanensis*) are known from lower jaws only, the comparison has to be confined with the first five species.

As Table 1 shows, the upper molars of the Altun Shan specimens are subequal to those of *Y. cavioides* and *Y. huangzhuangensis* in size, and longer than those of the other three ones, but much wider than those of all the five species mentioned above. In addition, they differ from all the five species in having paracone higher than metacone, the postcingulum reaching to the lingual side of the metacone, and in M1–2 having hypocones smaller than protocones. Furthermore, they differ from *Y. cavioides*, *Y. eleganes*, *Y. weijingensis* and *Y. huheboerhensis* in M2–3 having metaconule separated from metacone distinctly, and metaloph being relatively longer and lower, and M2 (or and M3) lacking short ridge extending from metaconule to protocone; from *Y. cavioides* and *Y. huheboerhensis* in M3 having more lingually located and crescent metacone, and shorter and less curved postcingulum reaching to lingual end of metacone; from *Y. weijingensis* and *Y. huheboerhensis* in having sinus extending to the base of crown on lingual side; and from *Y. eleganes* and *Y. huangzhuangensis* in molars having mesostyle. Besides, the specimens from Altun Shan are larger than *Y. yunnanensis* in size.

Based on the above differences, a new species *Yuomys altunensis* is established.

Discussion Up to now, the genus of *Yuomys* is only known from Middle–Late Eocene of China. Among the known species of *Yuomys*, *Y. cavioides*, *Y. huangzhuangensis* and *Y. eleganes* are only known from late Middle Eocene, and the others are from early Middle

1) Tong (1997) referred two specimens (IVPP V 10293.1, 2) from Rencun of Henan to *Yuomys cavioides*. It seems to the author that the two specimens may not belong to that species, because the M3 has crescent metacone and shorter postcingulum connecting the lingual end of metacone etc., which are quite different from those of *Y. cavioides*.

Eocene. The two formers are larger than the others in size. Among the other four species *Y. huheboerhensis* was collected from the lower part of the Irdin Mahan Formation (IM-1) in the Erlian Basin, Nei Mongol, and represents the oldest species of *Yuomys* (Li and Meng, 2015). The molars of this species are the smallest in *Yuomys*. They are lower crowned, and have shorter sinus extending halfway to the crown on lingual side, which is similar to the other species (*Y. weijingensis*) of early Middle Eocene, while in the late Middle Eocene species, including *Y. cavioides*, *Y. eleganes* and *Y. huangzhuanensis*, the molars have higher crown and longer sinus extending to base of crown on lingual side. From the above saying the general evolutionary trends in the molars of *Yuomys* can be deduced as: the size evolves from smaller to larger, the crown from lower to higher, and the sinus on the lingual side evolves from shorter to longer and extending to base of the crown.

It is necessary to mention that Wang (2001) described two molars (IVPP V 12528.1–2) from the Late Eocene Houldjin Formation near Irenhot as *Yuomys* sp. They have some primitive features: molars are smaller in size (smaller than *Y. cavioides*, *Y. eleganes*, *Y. weijingensis*, *Y. huangzhuangensis* and larger than *Y. huheboerhensis*) and have shorter sinus on lingual side. On the other hand, they have more lophodont features than all known species of *Yuomys*: more developed metaloph parallel to protoloph. Probably *Yuomys* sp. from Irenhot may represent a different branch distinct from the main evolutionary line of all know species of *Yuomys*.

As stated above, the molars of *Y. altunensis* are close to those of *Y. cavioides*, *Y. eleganes* and *Y. huangzhuangensis* of late Middle Eocene in general morphology and may be at the same evolutionary level as the three latters. If so, *Y. altunensis* may be of late Middle Eocene (Sharamurian ALMA) in age as well. Thus, the lower part of the Xishuigou Formation may be of late Middle Eocene in age.

Alternatively, in view of the fact that the molars of *Y. altunensis* are wider than those of all the known species of *Yuomys*, *Y. altunensis* may represent a more advanced species and its age may be slightly later than that of *Y. cavioides*, *Y. eleganes* and *Y. huangzhuangensis*. If it proves true, the lower part of the Xishuigou Formation bearing *Y. altunensis* may be of latest Middle Eocene or later in age.

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豫鼠化石在我国阿尔金地区的发现

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摘要：记述了在新疆巴音郭楞蒙古族自治州若羌县阿尔金山地区彩虹沟首次发现的豫鼠一新种：阿尔金豫鼠(*Yuomys altunensis* sp. nov.)。其主要特征是臼齿的尺寸较大，比例上较宽，齿冠较高，臼齿的后小尖与后尖明显分开，后脊相对较长，但不完全，次尖明显小于原尖，舌侧内凹伸达臼齿齿冠基部，后齿带与后尖舌侧连；M3后尖为新月形，后齿带较短等。根据豫鼠臼齿的进化趋势和新种臼齿的尺寸较大、齿冠较高和舌侧内凹伸达齿冠基部的特征与*Y. cavioides*, *Y. eleganes*和*Y. huangzhuangensis*相近，但颊齿比例较宽判断，*Y. altunensis*可能与该3种处于同样的进化阶段或稍进步。其产出的地层时代很可能与它们相近或稍晚，即为晚中始新世或稍晚。

关键词：新疆阿尔金山，中始新世，溪水沟组，豫鼠

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