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A new look at Pleistocene marmot diversity of Transbaikalia

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Review on Pleistocene-Holocene marmots of Transbaikalia is given on the base of new detail analysis and revisions of the previous data.

KEY WORDS: *Marmota*, distributions, diversity, Transbaikalia, Pleistocene, Holocene.

INTRODUCTION

The Recent mammal fauna of the Transbaikal area includes two taxa, the Siberian marmot or tarbagan, *Marmota sibirica* (Radde 1862), and a subspecies of the black-capped marmot, *Marmota camtschatica doppelmayri* Birula 1922. The area of distribution of extant *Marmota sibirica* is large, it spans the southern West Transbaikalia, south-eastern part of East Transbaikalia, southern Tuva (Russia), West Manchuria and East Xinjiang (China), and the wide territory of or central and north-eastern Mongolia (Fig. 1). In contrast, *M. camtschatica doppelmayri* inhabits the north-eastern part of Prebaikalia (Baikal Mountains) and the northern part of Transbaikalia (Barguzin mountain ranges).

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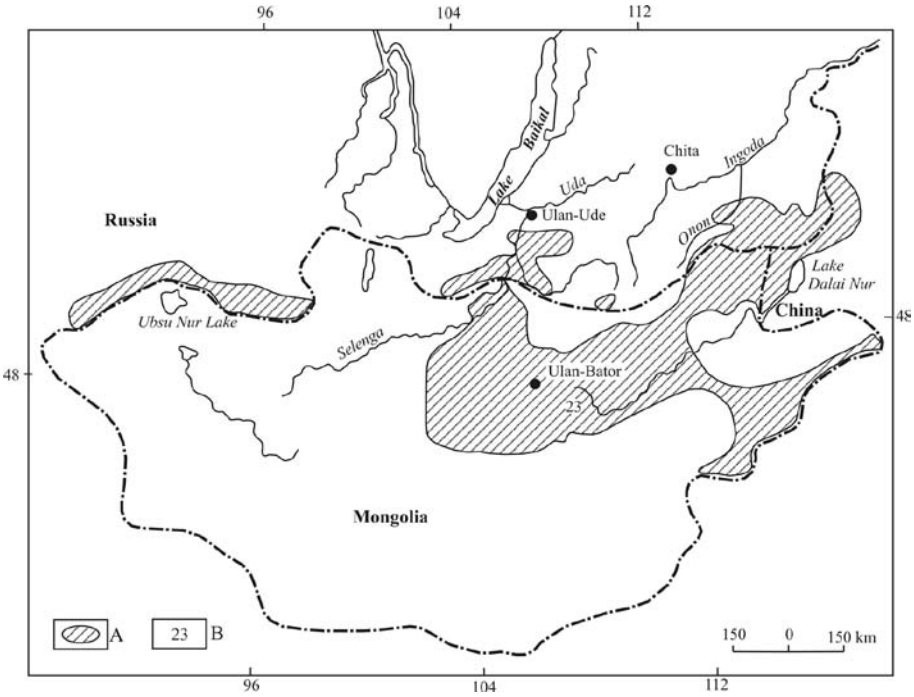

Fig. 1. — Modern distribution of *Marmota sibirica* (modified from BANNIKOV 1954, NEKIPELOV 1962, LETOV 1978, SHVETSOV 1978). A, Distribution area; B-23 (Nalaykha-Early Pleistocene locality in Mongolia).

The history of this genus in Transbaikalia extends back to the Middle Pliocene when the oldest species, *Marmota tologoica* Ivanijev 1966, appeared. Fossil remains from this region are scarce from the Late Pliocene, and so far few marmots have been recovered. During the Pleistocene the climate changed rapidly to become cool and arid. Different types of open landscapes appeared in Transbaikalia, which were occupied by steppe inhabitants, in particular, by marmots. This type of environment probably allowed an increase in the marmot population in both Transbaikalia and Mongolia in the Early Pleistocene (Fig. 2). In the Middle Pleistocene the climate became colder and more arid and dry steppes and semi-deserts in the region expanded, providing favorable conditions for marmots. Periglacial steppes were widely distributed in the region in the Late Pleistocene due to continued aridity and strengthening of the continental climate, and marmots became one of the dominant elements in the fauna (Fig. 2).

At the beginning of the Holocene the climate changed towards warm and humid conditions. This resulted in a significant reorganization of the biogeocenosis of the region. Open areas decreased and forest-steppe landscapes developed and the range of *Marmota sibirica* shifted to its current distribution.

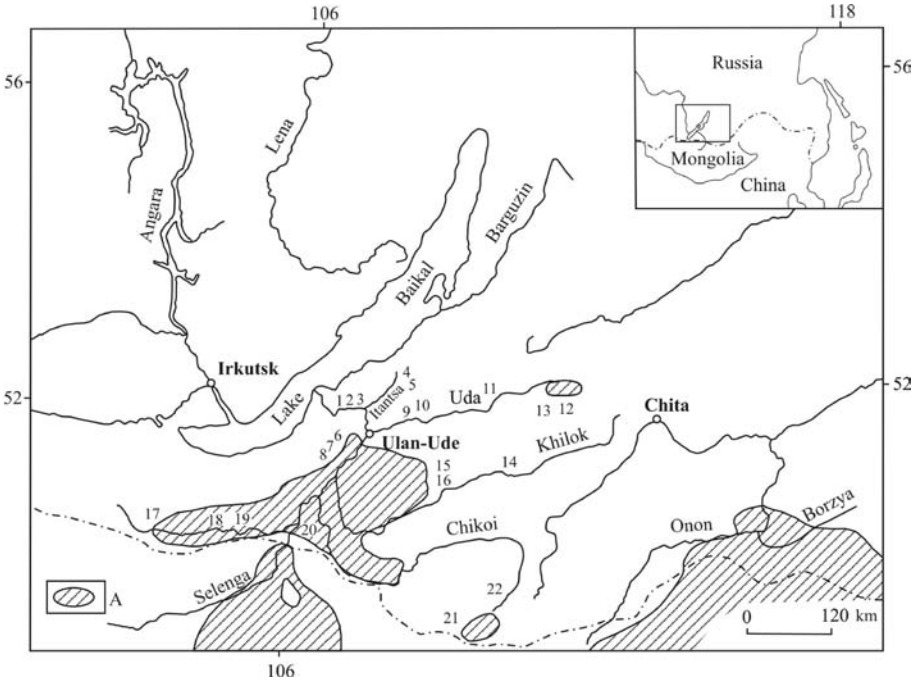

Fig. 2. — Localities of Pleistocene occurrence of *Marmota*. (**A**, Modern distribution area).
Early Pleistocene: **1** Zasukhino **A** (Zasukhino II_6; Zasukhino VII_1; Zasukhino VIII).
Middle Pleistocene: **2** Zasukhino **B** (Zasukhino II_4; Zasukhino II_3); **4** Zyryansk; **6** Tologoi **2** (Tologoi 2.5; Tologoi 2.6); **7** Tologoi **3** (Tologoi 3.1; Tologoi 3.2; Tologoi 3.3); **9** Dodogol **2-3** (Dodogol 2; Dodogol 3).
Late Pleistocene: **3** Zasukhino **C** (Zasukhino I_1; Zasukhino II_2; Zasukhino IX_2; Zasukhino IX_5; Zasukhino IX_6); **5** Ingiskhan; **8** Tologoi **2-3** (paleoravine); **10** Dodogol 5; **11** Khotyk; **12** Novokizhinginsk; **13** Lankuret; **14** Ust' Obor; **15** Varvarina Gora; **16** Kamenka; **17** Tsezhe; **18** Mikhailovka; **19** Botsi; **20** Ust' Kyakhta-17; **22** Tamir.
Holocene: **21** Malaya Kudara.

DIVERSITY OF TRANSBAIKALIAN MARMOTS

As illustrated in Fig. 2, marmots are known from a number of localities in Transbaikalia. Their fossil remains are abundant, however most of them are represented by fragments of the postcranial skeleton, isolated teeth, or by fragments of the mandible with or without teeth. Only a few specimens are represented by nearly complete skulls with maxillary dentition and associated mandibles. Marmot remains are known from several sites including Dodogol 3, Zasukhino II_3, Ust' Obor, Tsezhe, and Malaya Kudara.

In the Pleistocene, the only marmots from the locality Dodogol 3 are the Siberian marmot subspecies *M. sibirica nekipelovi* Erbajeva 1966. Some characteristic features of its skull and teeth, as well as comparison with extant

species, were given in previous publications (ERBAJEVA 1966, 2003). Based on addition material, new morphologic data revealed that *M. sibirica nekipelovi* can be referred to a separate species, *Marmota nekipelovi* (Erbajeva 1966), which is close to the "*sibirica* group". *Marmota nekipelovi* differs much from extant species by a number of features: skull robust, axial dimension of the skull long, wide zygomatic arches, long nasals whose anterior width is twice that of their posterior width, wide and short frontal bone, supraorbital processes thin and pointed, parietal bones long, almost parallel, and directed backwards, sagittal ridge long and rather high, upper incisors massive with a single longitudinal grove on the anterior surface, palatal bone long with the distance between P^3s significantly wider than between M^3s, and choanae wider anteriorly than posteriorly (Table 1).

A specimen from the Late Pleistocene Tsezhe site is very close to extant species, but differs from the latter by its slightly more robust skull and mandible. It is recognized as *Marmota* ex gr. *sibirica*. Another Late Pleistocene form from Ust' Obor locality is recoqnized as *Marmota* cf. *sibirica*. It is characterized by its larger size than extant species and by more robust skull and lower jaws, however it can be referred to "*sibirica* group" on the base of its tooth structure (Table 1). One more Pleistocene marmot is known from Zasukhino site (Zasukhino II_3). It is characterized by relatively large size of skull, by robust upper incisors, and large and long nasal bones ((Table 1). Based on tooth structure, it is close to *Marmota camtschatica doppelmayri*, however it differs much from the latter by larger size and by a number of peculiar features. Doubtless it belongs to new species within the "*camtschatica* group". At present, it is best recognized as *Marmota* aff. *camtschatica*.

A Holocene sample from Malaya Kudara belongs to *Marmota sibirica* based on morphology of skull and teeth.

Table 1.

Measurements of nearly complete skull and teeth (in mm) of Transbaikalian marmots.

	Marmota sibirica (Recent) (mean value, n=14)	*M. nekipelovi* Middle Pleistocene (n=1)	*M.* cf. *sibirica* Late Pleistocene (n=1)	*M.* aff. *camtschatica* Middle Pleistocene (n=1)
Skull length	93.5	106.0	104.0	107.0
Jugal width	62.0	64.0	67.0	—
Interorbital width	26.0	27.0	33.0	28.0
Rostrum width	20.0	21.5	24.0	24.5
Incisor width	4.0	5.0	4.2	6.0
Alveolar length P^2-M^2	22.8	22.3	24.8	24.0
Crown length P_4-M_3	20.6	21.2	23.5	23.2

CONCLUSIONS

As illustrated in Table 1, Pleistocene forms have larger skull and teeth measurements than the modern species. The trend in marmot evolution from the Pleistocene to the Recent is of decreasing body size and slight shortening of the upper and lower tooth row.

In Transbaikalia two different type of marmots are recognized, the "*sibirica*" and "*camtschatica*" groups. Paleontological data show that Transbaikalian marmots diversified during the Middle Pleistocene. The evolution of modern Transbaikalian species occurred most likely during the end of the Middle and beginning of the Late Pleistocene.

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