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Pleistocene disharmonious faunas of the Baikal region (Russia, Siberia) and their implication for palaeogeography

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Abstract: Pleistocene disharmonious micromammal faunas determined from recently studied Palaeolithic sites in Southeast Siberia dated to 10 070–21 000 years BP, are discussed. The fauna of the Baikal sites includes 3 species of lagomorphs and 14 rodents. The faunal assemblage indicates tundra-steppe and forest-steppe biomes and a cold periglacial climate.

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INTRODUCTION

The Late Pleistocene faunal assemblages are often composed of the mammalian species whose present ranges are entirely separated. They have been recorded in many regions of Eurasia, North America and Australia (NADACHOWSKI 1982, LUNDELIUS 1983, SEMKEN 1988, PANTELEEV et al. 1990, KOCHEV 1993, SMIRNOV 1994, MARKOVA 1995, etc.). Such faunas have no recent analogues. These associations are called "ecologically mixed", "lemming", "periglacial" or "intermingled" faunas. C. W. HIBBARD (1960) proposed for them the term "disharmonious faunas" which is used, though obsolete according to some authors, also in this paper. The main importance of this type of faunas is that they are a particularly good source of information on past climatic and landscape changes. In the Baikal region, disharmonious small mammalian faunas have been identified only recently (KHENZYKHENOVA 1994, 1995). The species composition testifies to a temperate cold climate in the south Central Siberia during the Middle and Late Pleistocene. This paper deals with the faunas from recently investigated archaeological sites Igetei, Mal'ta and Bolshoi Jakor in the Baikal region (Fig. 1).

I. THE IGETEI SITE

The Igetei site is situated on the right bank of the Bratsk reservoir at the confluence of the Angara and Osa Rivers. The detailed description of this archaeological complex is given in a special volume (MEDVEDEV et al. 1990) dealing with the stratigraphy, palaeogeography and archaeology of south Central Siberia, and it was also discussed by GAI and ANTOSCHENKO-OLENEV (1993). The Igetei site is located on the slope of the Igetei Gora, which is a flat-topped hill about 110 to 170 m above the Angara River. The Igetei geological section is represented by subaerial deposits, 12 m thick, underlain by the Upper Cambrian bedrock, and divided as follows.

Table 1. Micromammalia of the Palaeolithic sites in the Baikal region

Species	Igetei	Mal'ta horizons					Bolshoi Jakor horizons					
		I	II	III	IV	V	IV	V	VI	VII	VIII	IX
Lagomorpha												
Lepus timidus L.	–	–	–	–	–	–	–	2	47	4	4	–
Ochotona pusilla PALL.	3	–	10	–	–	–	–	–	–	–	–	–
O. *hyperborea* PALL. Rodentia	–	–	–	–	–	3	–	–	3	2		3
Marmota sp.	–	–	–	–	–	–	–	–	1	–	–	–
Spermophilus cf. *parryi* RICH.									31		5	200
Spermophilus undulatus PALL.		1		4	17	–	–	–	–	–	–	–
Spermophilus sp.	8											
Cricetulus sp.	5											
Clethriomomys rutilus PALL.	–	–	–	–	–	7	–	–	–	7	–	–
Cl. rufocanus SUNDEV	–	–	–	–	–	–	–	–	–	2	–	–
Lagurus lagurus PALL.	2662	25	44	126	–	4	–	–	–	–	–	–
Dicrostonyx cf. *simplicior* FEJFAR	90	–	–	–	–	–	–	–	–	–	–	–
Dicrostonyx cf. *henseli* HINT.	–	2	–	14	–	–	–	–	–	–	–	–
Myopus schisticolor LILL.	–	–	–	–	–	4	–	–	–	6	–	–
Microtus gregalis PALL.	73	–	3	19	–	36	–	–	5	–	–	–
M. oeconomus PALL.	–	–	4	–	–	–	–	–	–	–	–	–
M. hyperboreus VIN.	–	–	–	20	–	–	–	–	–	–	–	–
M. middendorffi POL.	–	–	–	–	–	6	–	–	–	–	–	–
M. ex gr. *middendorffi-hyperboreus*	–	–	–	–	2	–	3	6	11	44	1	4
M. sp.	–	–	–	2	–	–	27	3	5	10	–	3

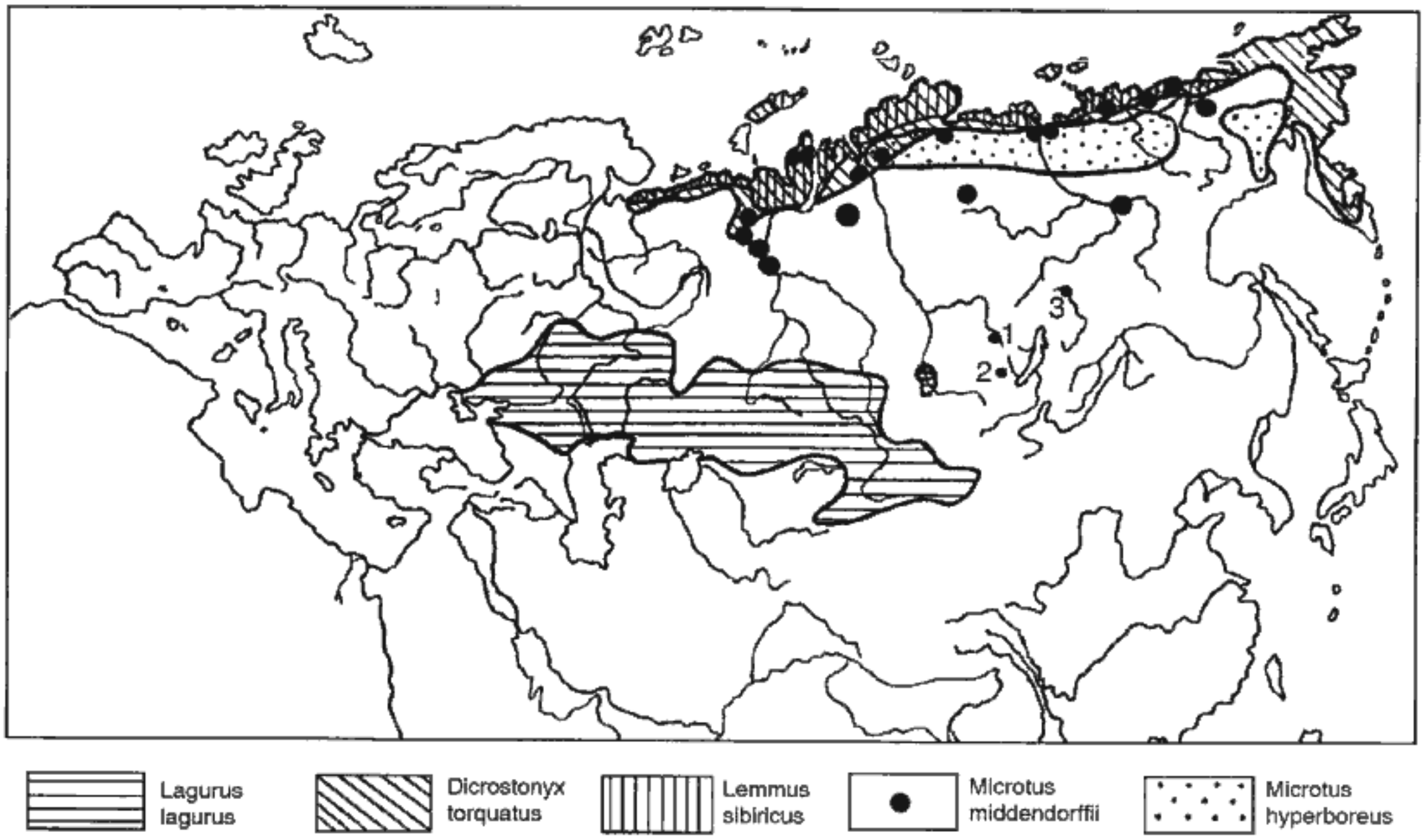

Fig. 1. The geographic position of Palaeolithic sites in the Baikal Siberia and the recent ranges of Microtinae in Eurasia (according to PANTELEEV et al. 1990). 1 – Igetei, 2 – Mal'ta, 3 – Bolshoi Jakor.

Holocene – non-calcareous brown loam overlain by slightly podzolized forest soil; thickness 0.40–0.80 m.

Pleistocene sediments are represented by a sequence of loess-like loam, sand, soils and loam containing boulders, pebbles, gravel and sand (solifluction sediments) that correlate with Sartan (OIS 2), Karginsk (OIS 3) and Muruktin (OIS 4) deposits. Rodent remains were found in the upper part of the grey sand layer below the solifluction sediments with a radiocarbon date of 24 400 yr. BP (GIN-5327). In this layer, archaeological material is rare and Pleistocene mammal bones and palaeobotanical remains are unknown. Nevertheless, remains of large fossil mammals have been found on the beach below the section. They are the species typical of the Upper Palaeolithic faunal complex (GROMOV 1948). The bones of rodents belong to *Spermophilus* sp., *Cricetulus* sp., *Dicrostonyx* cf. *simplicior* FEJFAR and *Lagurus* cf. *lagurus* (Table 1).

The archaic morphotypes of teeth among *Microtinae* are also present. One third of M_1 and M_3 of *Lagurus* molars are of the *"transiens"* morphotype (Fig. 3: 5, 6). The other part exhibits a loop of anteroconid of M^1 of a triangular or helmet-like form. This morphology is similar to *Lagurus* cf. *transiens* from the Ilovaiskij Kordon locality from the Russian Plain (AGADJANIAN 1981). Other specimens posses a structure of the anteroconid complex intermediate between *"transiens"* and *"lagurus"* known from West Siberian localities (SMIRNOV et al. 1986). In morphology and dimensions, the *"transiens"* morphotypes resemble those of lagurids described by MARKOVA (1982).

M^1 molars showing the "*lagurus*" morphotypes (Fig. 3: 7, 8) have a variable structure of the anterior loop. One third of these molars have the elongated anterior loop with parallel lateral walls and rounded apex. The other third shows non-parallel walls of the anterior odd loop. The final third of the "lagurus" morphotypes have a poorly developed pair of synclines of the anterior loop. One specimen has 8 dentine fields. It is interesting to note that all ten specimens of *Lagurus lagurus* (AGADJANIAN and ERBAJEVA 1983) from the Krasnyy Jar Mesolithic site situated near Igetei have well-developed pairs of synclines at the upper part of anteroconid and are longer than the Igetei material.

In *Microtus gregalis* three M_1 morphotypes can be distinguished. The majority of M_1 (n = 16) have no large asymetric anterior loops with cogs at the inner wall of the tooth (Fig. 4: 1) which may represent a rather archaic state. Five specimens (3rd morphotype) are characterized by three-blade forms of the anterior loop (Fig. 4: 3, 4). Another 11 specimens (2nd morphotype) have an intermediate morphology of the first and third morphotype (Fig. 4: 2).

The morphological description of *Dicrostonyx* cf. *simplicior* from Igetei was given earlier by PHILIPOV et al. (1995). The structure of the Igetei collared lemming molars (M_1 and M_2) is quite homogenous. The posterior wall of the posterior prism is covered with a thin enamel

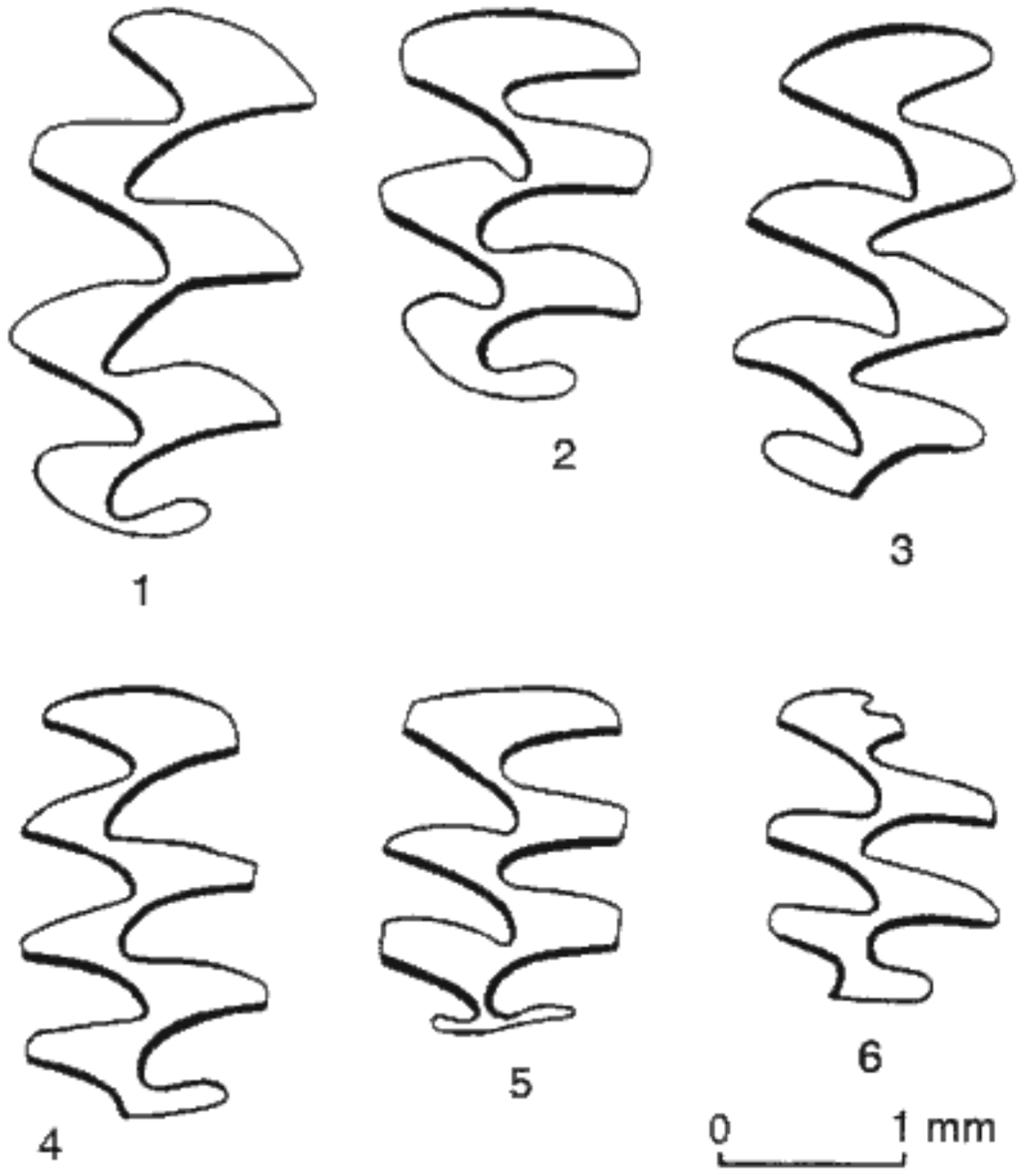

Fig. 2. The structure of *Dicrostonyx molars* from Igetei and Mafta sites: 1 – M^1; 2 – M^2 of *Dicrostonyx* cf. *simplicior* (Igetei); 3, 4 – M^1; 5, 6 – M^2 of *D. henseli* (Mafta).

layer; the last completely conid is represented by a small flat prism. It is oriented almost horizontally to the back wall of the last prism. According to the level of evolutionary development, the Igetei collared lemming (Fig. 2: 1, 2) occupies an intermediate position between *Dicrostonyx* cf. *simplicior* FEJFAR from the Lichvin section and *D.* cf. *henseli* SANDORF from the Molodova I site of Mousterian age (AGADJANIAN 1982, 1986).

Lagurids (96.35 %), *Spermophilus* (0.28 %), and striped hamster (0.17 %) indicate the presence of steppes and the collared lemming (3.2 %) that of tundra. Thus, the species composition indicates tundra-steppe landscapes and a temperate cold and dry climate. The geological age of the Igetei small mammal fauna can be defined as the late Middle Pleistocene and Upper Pleistocene.

II. MAĽTA SITE

The Maľta site, made famous by the Palaeolithic art finds, is situated on the left bank of Belaja River, 25 km from its estuary in the Maľta village (Fig. 1). The Maľta geological section was described by LOGACHEV et al. (1964) and TSEITLIN (1979).

New excavations undertaken by G. Medvedev and K. Lipnina (Irkutsk State University) identified five faunal horizons compared with a single faunal bed determined earlier on the basis of large mammals only (ERMOLOVA 1978). The faunal horizons I–III are associ-

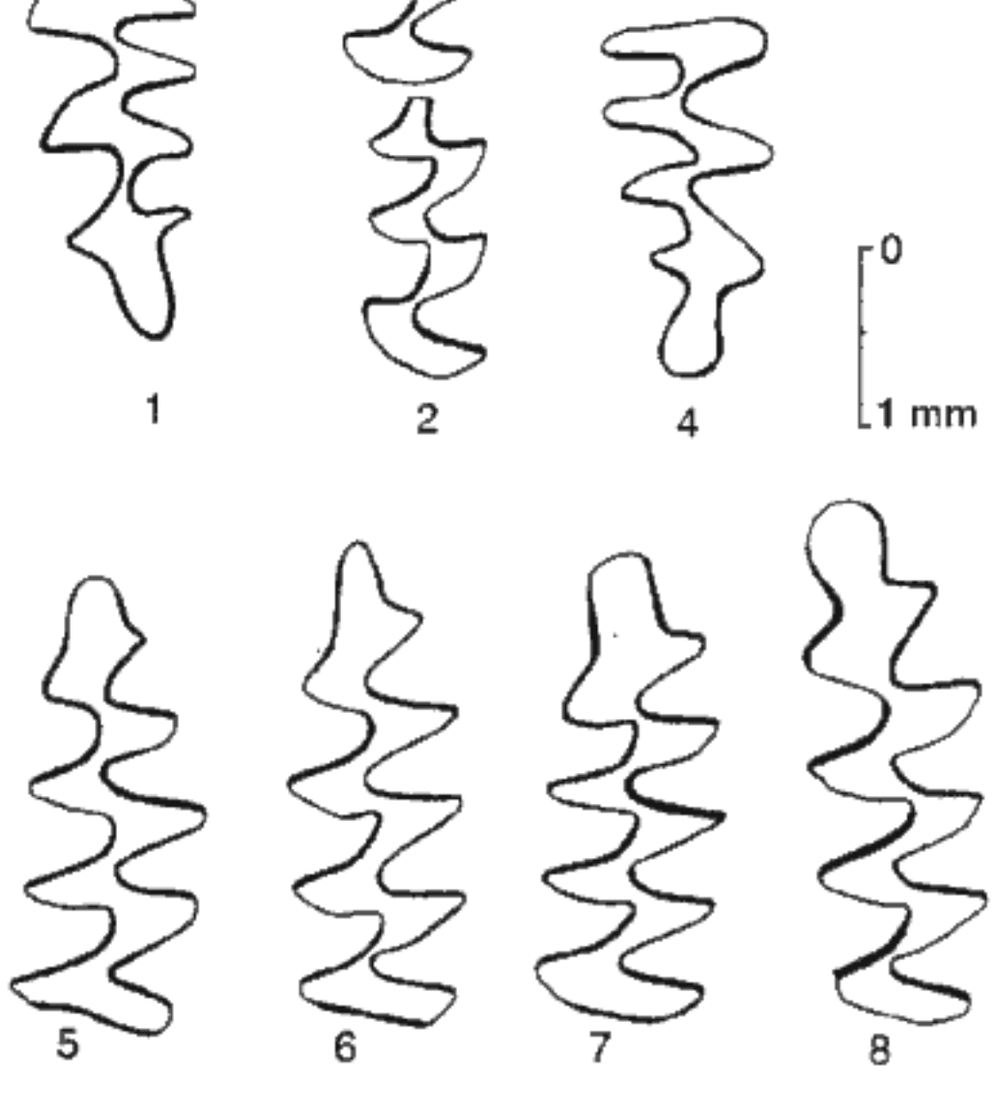

Fig. 3. The structure of *Lagurus* from Igetei and Mafta sites: 1 – M^1-M^3; 2 – M_1-M_3; 3 – M_1; 4 – M^3 of *Lagurus lagurus* (Mafta); 5–8 M_1 of *Lagurus lagurus* (Igetei).

ated with variegated solifluction loams. Horizon I is represented by a yellow-brown loam, horizon II by a light yellow-brown loam and horizon III by a dark-brown and a yellow-brown loam. The fossils of horizon IV were found in a red-brown loam. Horizon V is represented by a whitish loess-like loam.

The lower horizon (I–III) yielded remains of *Ochotona* cf. *pusilla* PALL., *Spermophilus undulatus* PALL., *Lagurus lagurus* cf. *henseli* HINT., *Microtus gregalis* PALL., *M. oeconomus* PALL., *M.* cf. *hyperboreus* VIN. (Fig. 5: 1–4; Table 1). *Lagurus lagurus* (70.4 %) is dominant in this fauna, whereas *Dicrostonyx* (5.8 %) is rare here as well as at Igetei. *Ochotona* cf. *pusilla* (4.7 %) – the first occurrence, *Spermophilus undultus* PALL. (1.8 %) and *M. gregalis* PALL. (7.9 %) imply a steppe landscape. The presence of *M. oeconomus* (1.4 %) and *M. hyperboreus* (7.2 %) indicates more humid conditions than at Igetei. Collared lemming and *M. hyperboreus* are both tundra inhabitants.

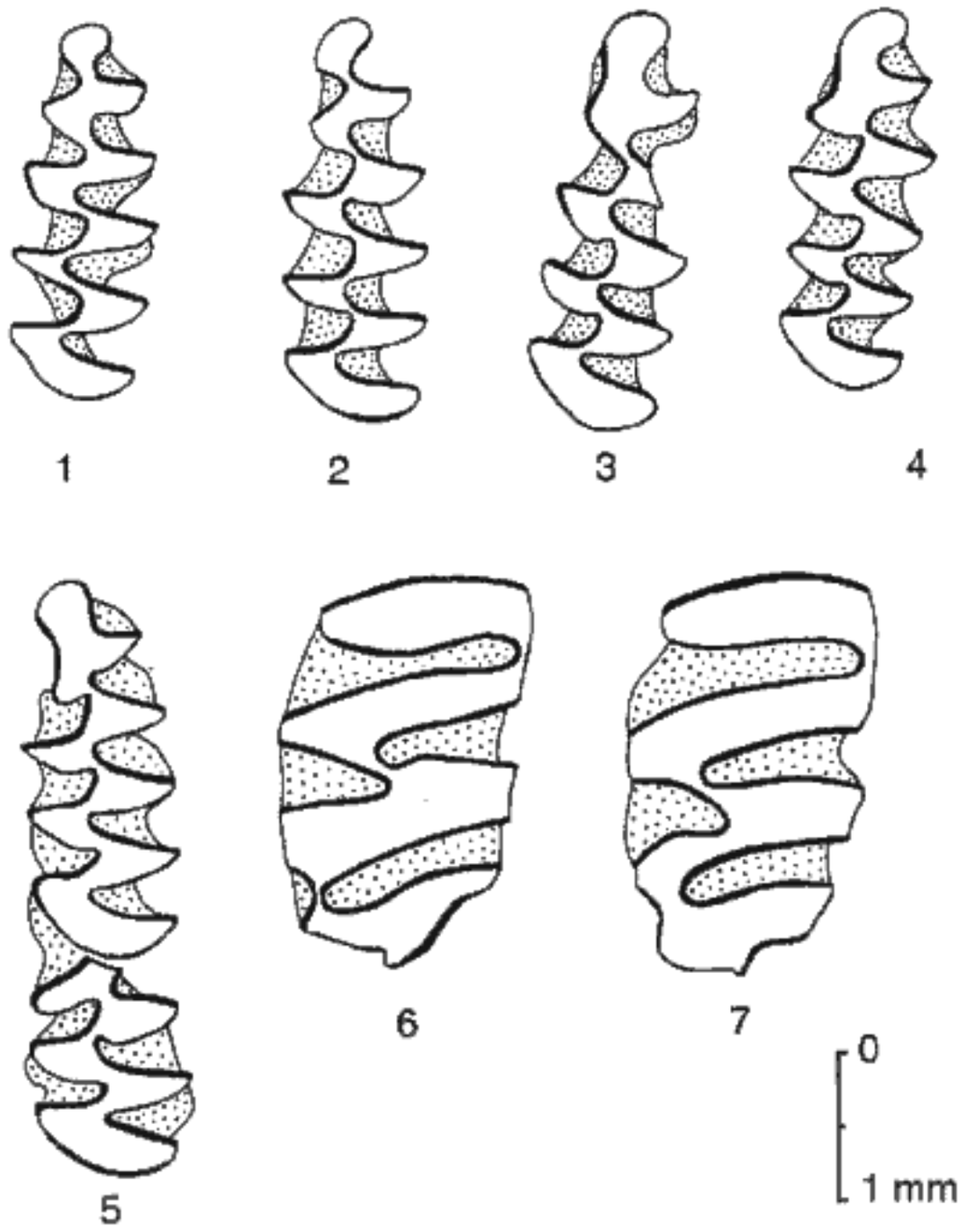

Fig. 4. The structure of molars of *Microtus gregalis* from Igetei 1–4 – M_1; 5 – M_1-M_2 of *M.* cf. *hyperboreus* (Bolshoi Jakor); 6, 7 – M^3 of *Myopus schisticolor* (Bolshoi Jakor).

The fossil fauna, along with other palaeoenvironmental proxy data such as palynological and geological, indicate severe climatic conditions (LOGACHEV et al. 1964). The reworked structure of the layers indicates permafrost processes. Reindeer and arctic fox dominate in the large mammalian fauna. Based on the composition of the large mammals, forest-tundra and forest-steppe landscapes have been suggested as the dominant biozone around the Maĭta site (ERMOLOVA 1978).

Among the large Pleistocene fauna, the following species were identified:

Mammuthus primigenius BLUM., *Coelodonta antiquitatis* BLUM., *Equus caballus* L., *Rangifer tarrandus* L., *Cervus priscus* L., *Bison priscus* BOJ., *Ovis nivicola* ESCH., *Ovis* sp., *Felis spelaea* GOLD., *Canis lupus* L., *Vulpes vulpes* L., *Alopes lagopus* L., *Gulo gulo* L. and *Ursus arctos* L.

Molars of *Microtinae* of the Maĭta site are more progressive than those from Igetei. In lagurids the *"transiens"* morphotype is missing (Fig. 3: 1–4), collared lemming is of the *"henseli"* morphotype (Fig. 2: 3–6), and *Microtus gregalis* has the progressive morphotypes only. An evolutionary advancement level of the small mammals indicates the end of the Upper Pleistocene. Radiocarbon dates of 20 700–21 000 yr. BP (GIN–7706, GIN–7709) have been obtained from these deposits.

The fauna of horizon IV is not representative and consists of *Spermophilus undulatus* (89.2 %) and *M.* ex gr. *middendorffi-hyperboreus* (10.8 %). The species assemblage implies a meadow-steppe landscape.

The fauna of horizon V significantly differs from the others and indicates forest-steppe conditions. It is also disharmonious and characterized by predominance of *Microtus gregalis* (57.1 %), with less frequent *Lagurus lagurus* (6.4 %) and *Microtus* ex gr. *hyperboreus-middendorffi* (9.5 %). The forest species consitute up to 27 % of the fauna. These are *Ochotona hyperborea* PALL., *Clethrionomys rutilus* PALL., *Myopus schisticolor* LISS. The climate was more humid and warm during the formation of horizons I–III, but colder than at the present time. The typical steppe species *Ochotona pusilla* and *Lagurus lagurus*, and tundra species *Lemmus sibiricus*, *Dicrostonyx* and *M.* ex gr. *hyporboreus-middendorffi* are unknown in the present day fauna of the Baikal region (Fig. 1).

The results of paleontological study of the Maĭta fauna allow to trace environmental and climatic changes from 21 000 yr. BP to the beginning of Holocene. The revealed trend shows transition from tundra-steppe and meadow-steppe to forest-steppe landscapes, corresponding to a climatic shift from temperate cool and dry climatic phase to a mild phase in the Baikal region.

III. BOLSHOI JAKOR SITE

The archaeological site Bolshoi Jakor is situated on the right bank of Vitim River (at the estuary of Bolshoi Jakor brook) near the Mamakan village (Fig. 1). The site was discovered and described by INESHIN (BELOUSOV - INESHIN 1990). In total, 19 cultural horizons have been distinguished in fluvial and glaciofluvial deposits, with well-preserved ice wedge casts in the section. The absolute age of horizon IV is radiocarbon dated to 10 320–10 070 yr. BP and of horizon VI to 12 400–19 400 yr. BP. Micromammal bones were found in horizons IX–IV (Tab. 1). The large mammalian fauna (E. INESHIN, pers. comm. 1996) is represented by *Alces, Rangifer tarandus, Cervus elaphus, Bison priscus, Equus caballus, Capreolus capreolus, Canis lupus, Alopex lagopus, Meles meles* and *Ursus arctos.*

Remains of *Lepus timidus* L., *Ochotona hyperborea* PALL., *Spermophilus* cf. *parryi* RICH., *Lemmus* cf. *sibiricus* KERR., *Microtus* ex gr. *middendorffi-hyperboreus* (Fig. 5: 5), and *M.* sp. were obtained from the lower IX and VIII horizons. The predominant form is *Spermophilus* cf. *parryi.*

The fauna of horizons VII–V consists of *Lepus timidus, Ochotona hyperborea, Marmota* sp., *Spermophilus* sp., *Clethriomys rutilus* PALL., *M.* ex gr. *middendorffi-hyperboreus* and *M.* sp. Isolated bones of hare are particularly numerous in the material.

The Bolshoi Jakor micromammalian fauna is also

disharmonious. In general, the fauna indicates a temperate cold and humid climate. The remains of tundra partridge were also found here. Reindeer dominated the large mammalian fauna. The palaeontological analysis enables different palaeogegraphic conditions to be reconstructed for the time of formation of the IX–VIII and VII–V horizons. Thus, the remains of the tundra species *Spermophilus* cf. *parryi, Lemmus* cf. *sibiricus* and *Microtus* ex gr. *middendorffi-hyperboreus* from the IX–VIII horizons indicate more severe climatic conditions than those for the upper VII–V horizons with the predominance of forest species. It should be noted that the present distribution of *Lemmus sibiricus, Spermophilus parryi, Microtus middendorffi, M. hyperboreus* extends more to the north (Fig. 1).

CONCLUSIONS

Five disharmonious micromammal faunas have been recognized in the Baikal region from Palaeolithic sites. Contextually they come from:

a) grey sands at Igetei
b) horizons I–III at Maľta
c) horizon V at Maľta
d) horizons IX–VIII at Bolshoi Jakor
e) horizons VII–IV at Bolshoi Jakor.

These faunas contain 3 lagomorph and 14 rodent species. The inevitably incomplete character of the data obtained enables only general conclusions to be drawn. The faunal assemblages indicate that the following changes of landscapes and climatic conditions occurred in the Baikal region during the Palaeolithic. At least three periods of temperate cold climate can be identified during the Palaeolithic in southern Central Siberia and assigned to:

1. the end of the Middle Pleistocene (Igetei fauna)
2. the late Upper Pleistocene, 21 000 yr. BP – Maľta I–III
3. final Pleistocene (Late Glacial) – B. Jakor XII, IX to VIII, followed by mild phases, corresponding to the formation of horizons V, IV at Maľta and horizons VII–IV at Bolshoi Jakor (12 400–10 320 yr. BP).

The data indicate a gradual transition from the late Middle and late Upper Pleistocene tundra-steppes, through meadow-steppes to the formation of forest-steppes at the end of Pleistocene.

Most likely, the species correlation provides the base for distinguishing two types of co-existent faunas: the tundra-steppe (a, b) fauna and a forest-steppe fauna (c, d, e).

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