Acta zoologica cracoviensia, **45**(special issue): 283-292, Kraków, 29 Nov., 2002

Pleistocene birds from Tsagan-Agui Cave (Gobian Altai)

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Received: 23 Nov., 2001
Accepted for publication: 20 Feb., 2002

MARTYNOVICH N. 2002. Pleistocene birds from Tsagan-Agui Cave (Gobian Altai). In: Proceedings of the 4th Meeting of the ICAZ Bird Working Group Kraków, Poland, 11-15 September, 2001. *Acta zoologica cracoviensia*, **45**(special issue): 283-292.

Abstract. Interdisciplinary excavations of the Joint Soviet-Mongolian expedition undertaken in the Tsagan-Agui Cave (Gobian Altai, Outer Mongolia) between 1987 and 1989 yielded Paleolithic artifacts and abundant vertebrate remains. The Pleistocene bird remains collected from friable sandy sediments are examined. This material was obtained during the course of the excavation of the Terrace Zone and the Entrance Grotto in 1988 and 1989. 29 bird species, from steppic and semi-desert landscapes, were identified from a total of 3423 bone fragments.

Key-words: Mongolia, Altai, Pleistocene, fossil birds, Tsagan-Agui Cave.

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I. INTRODUCTION

Our knowledge of Pleistocene birds from central Mongolia is incomplete. In one of the last papers in which the occurrence and history of the birds of Mongolia are described (MLIKOVSKY 1989) the following was said about the Pleistocene epoch: "No avifauna of the Mongolia Pleistocene was adequately described thus far. Few, insufficiently identified birds were mentioned only by SCHLOSSER (1924) and BATE (1931)".

Ostrich egg shell (LOWE 1931) was the first Quaternary bird material from Mongolia to be recognised. At present a large number of Pleistocene open-air sites with ostrich egg shell remains are known in Mongolia: Mogoj-Upagijn-Khets (Dornogov), Ongon (Sukhebator), Naran-Bulak (Omnogov), Tugrikijn-Us (Omnogov), Baian-Dzak (Omnogov) (MIKHAILOV & KUROCHKIN 1988).

During July and August of 1988-1989 the complex excavation of the Tsagan-Agui cave were carried out by a Soviet-Mongolian expedition. The excavations included two parts of the cave: the Terrace Zone (its rocky bottom was reached in 1988) and the Entrance Grotto (its rocky bottom was reached in 1989). The author took part in the investigation of the Entrance Grotto in 1989.

Since 1995 the cave has been studied by a Russian-Mongolian-American archaeological expedition (DEREVYANKO et al. 1996, 1998, 2000).

In the faunal list given in the first publication (DEREVYANKO & PETRIN 1995) the definition of bone remains of mammals and birds from Entrance Grotto (excavation in 1989) were presented. 27 taxa of mammals were determined by Dr. N. OVODOV, and 14 taxa of birds were defined by N. MARTYNOVICH. Unfortunately, the table in the brochure "Faunal remains from the Tsagan-Agui

cave. Excavation of 1989" was published with coarse mistakes concerning the amount of the determined bones (DEREVYANKO & PETRIN 1995, pp: 76-77).

The birds remains from the excavation of 1996 in Tsagan-Agui were investigated by A.V.PANTELEEV. The Late Pleistocene sediments of the Large Grotto yielded 17 bird species: *Anas platyrynchos*, *Aquila chrysaetos*, *Falco tinunculus*, *Falco cherrug*, *Alectoris chukar*, *Columba rupestris*, *Syrrhaptes paradoxus*, *Bubo bubo*, *Athene noctua*, *Apus apus*, *Eremophila alpestris*, *Saxicola torquata*, *Turdus* cf. *naumanni*, *Emberiza* cf. *cioides*, *Coccothraustes coccothraustes*, *Petronia petronia*, *Pyrrhocorax pyrrhocorax* (PANTELEEV 1998).

A c k n o w l e d g m e n t s. The author wishes to thank Dr Evgeny N. KUROCHKIN (Paleontological Institute of the Russian Academia of Sciences in Moscow (PIN) for the ability to work with the comparative osteological collection of recent birds, and for basic remarks concerning the paper. I am very grateful to Prof. Z. BOCHEŃSKI, Dr T. TOMEK and Dr Z. M. BOCHEŃSKI (Kraków) for constructive criticism and helpful comments on the manuscript. Dr T. TYRBERG (Kimstad) gave useful remarks concerning the faunal list of fossil birds from the Tsagan-Agui Cave.

II. LOCALITY, MATERIALS AND METODS

The Tsagan-Agui Cave became known to participants of the Joint Soviet-Mongolian Historic-Cultural Expedition in 1987. The cave is located in the Bayan-Khongor region of the Republic of Mongolia. It is situated about 40 km north-eastward of the Bayan-Lag somon center, on the southern face of the southeast extremity of the Ikh-Bogdo–Uul mountain ridge (44° 42’ 43.3’’ N, 101° 10’ 13.4’’ E). These ridges constitute the south-eastern part of the Gobian Altai. (Fig. 1).

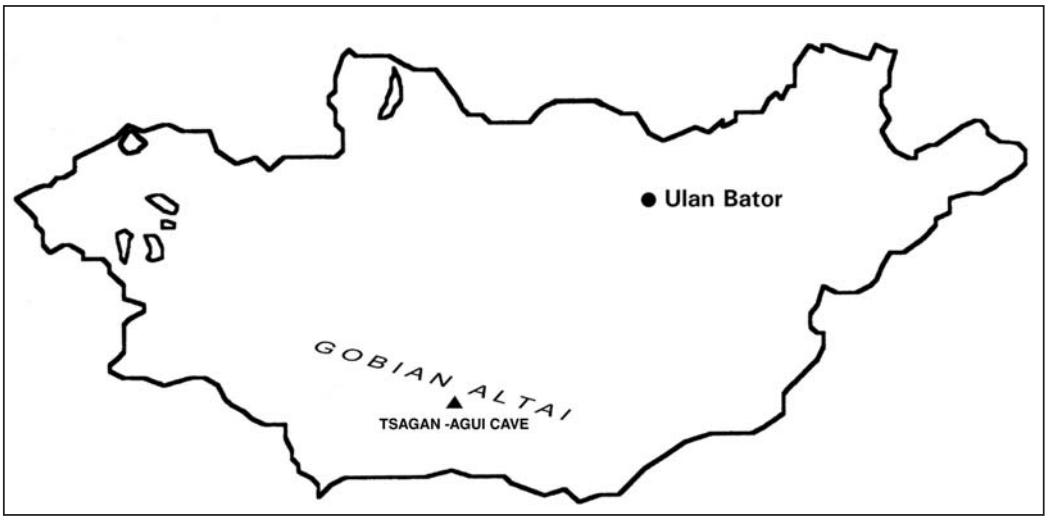

Fig.1. The geographical location of Tsagan-Agui Cave.

Tsagan-Agui Cave was formed in the light dolomitic limestone of the small ridge of Tsagan-Tsakhir. The entrance of the cave faces the southwest canyon cutting through the Tsagan-Tsakhir ridge. The mouth of the canyonis in the southern part of the ridge. The canyon abounds with bends and rock ledges are exposed in some places along the valley.

The total length of the cave constitutes more than 38 m, the maximum width of the entrance along the modern surface is more than 5 m, the height of the entrance in the center is 4.6 m.

The surface of the Terrace Zone and the Entrance Grotto is studded with limestone debris. The cave may be divided into four parts: 1) the Terrace Zone stretches to the drip line; 2) the Entrance

Grotto which is the narrowest part of the cave; 3) the Large Grotto is the largest cavity; there is a vertical chimney in the shape of the so called "organ pipe" on the roof; 4) the Small Grotto is separated from the Large Grotto by a change in height of the cave roof, one can get there by crawling (Fig. 2) (DEREVYANKO & PETRIN 1995; DEREVYANKO et al. 2000).

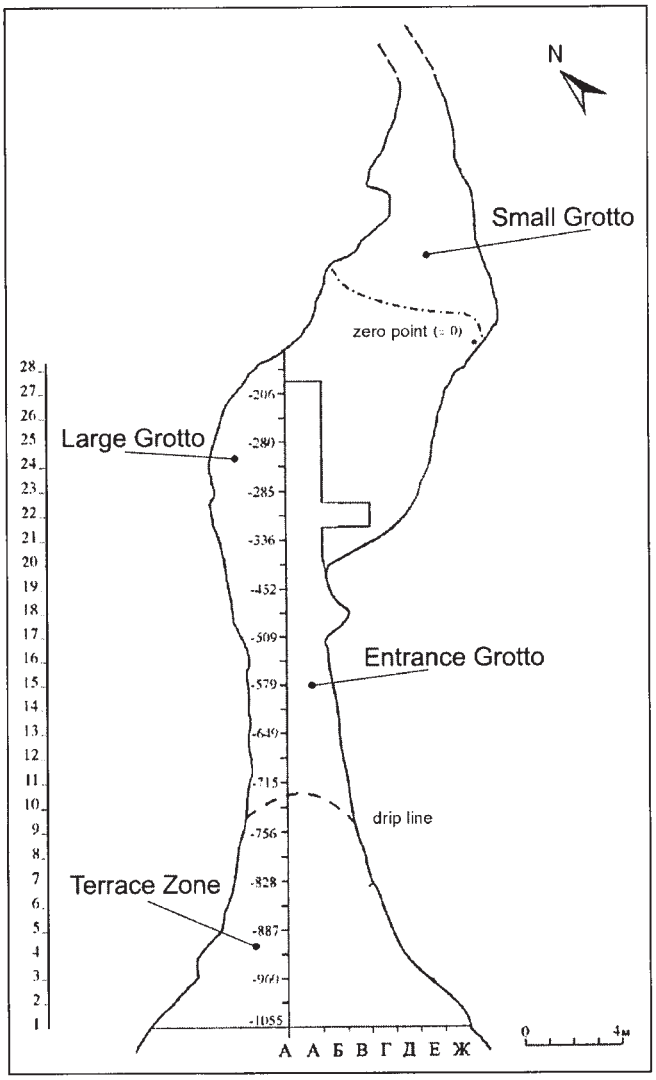

Fig. 2. The plan of the Tsagan-Agui Cave (according to DEREVYANKO et al. 2000).

T e r r a c e Z o n e. The trench in this section is oriented to the N-E, which is due to the general configuration of the cave. The specific character of the loose sediments is conditioned by eolian processes. Some of the lithological horizons are enriched with detritus of different origins: large blocks probably associated with neotectonics, small fragments of rock mainly derived from the physical and climatic weathering of the cave roof, gypsum from the cave and alluvial gravel of different sizes. 11 layers (I-XI) were allocated.

A significant feature of the sediments is the Pliocene-Miocene clay of reddish, yellow and brown colours. Two beds were isolated within the clay: the first one overlies the cave bottom; while the second overlies layers V and VI. This clay (layer IV) is undoubtedly much older than the underlying loose sediments. The majority of fossil material and Paleolithic stone tools were connected with layers V and VI.

The bottom of a layer IV yielded a date of 175±44 thousand years (RTL), for layer IX - 122±30 thousand years, and for a layer X - 470±117 thousand years (RTL) (DEREVYANKO et al. 2000).

E n t r a n c e G r o t t o. The stratigraphy of this excavated area differs sharply from that observed in the longitudinal section of the excavated area of the Terrace Zone, since they are separated by a rock ledge, though some similarities are present. This is why the section in the Terrace Zone and the Entrance Grotto are described separately. 14 layers (1-14) were allocated.

The stone industry from layers VI-V of the Terrace Zone and layers 8-5 of the Entrance Grotto has attributes characteristic of the final Mousterian epoch or the beginning of the Upper Paleolithic (DEREVYANKO et al. 2000).

L a r g e G r o t t o. The sediments of the Large Grotto are better investigated, they include a large collection of stone tools of Paleolithic age. For the third layer of the Large Grotto 5 radiocarbon dates between 32 900±670 and 33 840±640 were produced. In the opinion of the cave researchers the second layer of the Large Grotto and layer 2 of the Entrance Grotto correspond to the same phase of sedimentation, which is characterized by a dry climate (DEREVYANKO et al. 2000).

Abundant bone material from the Terrace Zone and the Entrance Grotto was extracted by dry sieving the sandy sediments with coarse (5õ5 mm) and then a fine meshed sieve (1õ2 mm). In the friable sediments of the Entrance Grotto a collection of bones, numbering 3197 fragment was assembled. It is made of the remains of small mammals in the main *Àllactagus* sp. constitutes 39.8 % (of the NISP); *Ochotona* sp. – 17.9%; *Lepus tolai* – 12.2 %. The bone remains of birds make up 14.5 %.

In the Terrace Zone the remains were contained only in layers VI, V, III and II, while in the Entrance Grotto the bones come from layers 8, 7, 5, 3.

All the bird bones were selected in the laboratory and determined by the author using the comparative collection of bird skeletons at the Krasnoyarsk Regional Museum of Local Lore (KRMLL), and the Paleontological Institute of the Russian Academia of Sciences in Moscow (PIN). A short report on the results of this research was published (MARTYNOVICH 2001). The materials are now kept in KRMLL.

The final osteological diagnoses are based on research using the comparative collection of bird skeletons in PIN. Unfortunately the incompleteness of the available material of Mongolian passerines made it difficult to determine the *Ploceidae*. The determination of *Pyrrhocorax* bones was based on the corvid monograph (TOMEK & BOCHEŃSKI 2000) as well as comparative collection.

III. RESULTS

The birds remains discussed in this paper are from the friable sandy sediments of the Terrace Zone and the Entrance Grotto (Tables I and II), in the Tsagan-Agui Cave.

T e r r a c e Z o n e

In Layer VI (Table I) containing stone tools of Mousterian age, 13 species of birds were determined, making up 52.7 % (Total NISP amount minus "Passeriformes gen. indet." and minus "Fringillidae or Ploceidae gen. indet") of all the remains of birds which were found in this layer. The most numerous collection of bird remains came from this layer. The bird fauna is indicative of an open and dry habitat, perhaps even a semi-desert. The presence of the bones of ducks (*Anas* and *Aythya*) indicates the presence of a water body such as a lake. 44.8 % of the remains are indeterminate fragments of small passerines, most of which presumably belong to *Eremophilla alpestris*. The most numerous identified small passerines remains are those of *E. Alpestris*.

Table I

List of species from the Terrace Zone (NISP/MNI); layers arranged from the oldest to the youngest

Taxa	Layer VI	Layer V	Layer III	Layer II	Total NISP
Anas sp.		2/1			2
Anas platyrhynchos LINNAEUS, 1758	2/1				2
Anas cf. *querquedula* LINNAEUS, 1758		1/1			1
Aythya fuligula (LINNAEUS, 1758)	2/1				2
Falco tinnunculus LINNAEUS, 1758		1/1			1
Falco naumanni FLEISCHER, 1818				1/1	1
Perdix daurica (PALLAS, 1811)	2/1		2/1	1/1	5
Charadrius mongolus PALLAS, 1766	1/1	2/1		1/1	4
Scolopax rusticola LINNAEUS, 1758		1/1		1/1	2
Syrrhaptes paradoxus (PALLAS, 1773)	46/4	58/5	22/3	12/2	138
Columba rupestris PALLAS, 1811		2/2			2
Cuculus canorus LINNAEUS, 1758		1/1			1
Bubo bubo (LINNAEUS, 1758)				1/1	1
Athene noctua (SCOPOLI, 1769)	1/1	3/1	2/1	1/1	7
Asio cf. flammeus (PONTOPPIDAN, 1763)				2/1	2
Apus apus (LINNAEUS, 1758)		1/1			1
Eremophila alpestris (LINNAEUS, 1758)	411/81	316/70	156/30	181/38	1064
Calandrella cinerea (J. F.GMELIN, 1789)		1/1	2/1	5/2	8
Melanocorypha sp.	1/1	2/1			3
Lanius sp.	1/1				1
Turdus cf. *ruficollis* PALLAS, 1776			1/1	1/1	2
Turdus sp.		1/1			1
Monticola saxatilis (LINNAEUS, 1766)				2/1	2
Oenanthe sp.	2/1				2
Petronia petronia (LINNAEUS, 1766)	12/3	13/3	6/2	4/1	35
Bucanetes mongolicus (SWINHOE, 1870)		4/2			4
Fringillidae or Ploceidae gen. indet.	23/?	4/?	8/?	15/?	50
Pyrrhocorax pyrrhocorax (LINNAEUS, 1758)	3/1	4/1	3/1	1/1	11
Podoces hendersoni HUME, 1871	7/2	15/3	5/1	9/2	36
Passeriformes gen. indet.	418/?	215/?	404/?	507/?	1544
Total NISP	932	647	611	745	2935

In Layer V containing stone tools of the Mousterian type 18 species of birds were determined, making 66.2 % of all remains of birds in this layer. The most numerous bones belong to *E. alpestris.* Some vegetation including trees must have been present hence the presence of *S. rusticola, C.canorus, Turdus* sp.

Layer III: bird remains are less abundant (in terms of number of remains and number of species) but it points to a similar type of environment.

Layer II: 15 species are determined (29.7% from all the remains of birds). It is only in this horizon that *Bubo bubo*, *Asio flammeus* and *Falco naumanni* were found. The presence *Scolopax* and *Turdus* indicates the presence of woodland vegetation.

E n t r a n c e G r o t t o

The paleontological collection and the faunal list for the Entrance Grotto is smaller than for the friable sediments of the Terrace Zone, possibly because of the smaller size of the excavation.

Layer 8 (Table II): 13 species were determined, making 43.7% of all the bird remains. The fossil birds characterize an open semi-desert, dry landscape.

Layer 7: Few bird bones were found; 5 species of open, dry environments are determined among 21 remains.

The faunal list of layers 5 and 3 also characterizes an open steppe to semi-desert biotope. However the presence of *Scolopax* indicates the presence of woodland vegetation in the past. Only in layer 3 were the fragments of an ostrich eggshell and the remains of *Galerida cristata* found.

Table II

List of species from Entrance Grotto (NISP/MNI); layers arranged from the oldest to the youngest

Taxa	layer 8	layer 7	layer 5	layer 3	Total NISP
Struthio sp.				1/1	1
Anas cf. *querquedula* LINNAEUS, 1758			1/1		1
Aquila chrysaethos (LINNAEUS, 1758)	1/1				1
Falco tinnunculus LINNAEUS, 1758	2/1				2
Perdix daurica (PALLAS, 1811)	2/1		1/1		3
Charadrius mongolus PALLAS, 1766	8/2	1/1	4/1	7/1	20
Scolopax rusticola LINNAEUS, 1758		1/1	2/1	2/1	5
Syrrhaptes paradoxus (PALLAS, 1773)	13/2	2/1	4/1	2/1	21
Columba rupestris PALLAS, 1811	1/1				1
Athene noctua (SCOPOLI, 1769)	1/1			1/1	2
Apus apus (LINNAEUS, 1758)	2/1			1/1	3
Eremophila alpestris (LINNAEUS, 1758)	74/9	7/2	54/8	16/4	151
Calandrella cinerea (J. F.GMELIN, 1789)	1/1				1
Galerida cristata (LINNAEUS, 1758)				1/1	1
Petronia petronia (LINNAEUS, 1766)	2/1				2
Fringillidae or Ploceidae gen. indet	11/?	2/?	3/?	2/?	18
Pyrrhocorax pyrrhocorax (LINNAEUS, 1758)	3/1	1/1	3/1	3/2	10
Podoces hendersoni HUME, 1871	5/2		3/1	1/1	9
Passeriformes gen. Indet.	136/?	7/?	34/?	59/?	236
Total NISP	262	21	109	96	488

Among the remains of small rodents, extracted from sediments of the Entrance Grotto a significant number belonged to *Allactaga* (48%), *Ochotona* sp. (20%) and *Lepus tolai* (17%), (DEREVYANKO & PETRIN 1995). This taphocenosis also includes large mammals: *Coelodonta antiquitatis, Equus hemionus, Pantholops hodgsoni, Procarpa gutturosa, Ovis ammon, Capra sibirica, Crocuta spelaea, Uncia uncia, Felis manul* etc. (OVODOV 2001).

IV. DISCUSSION

Most of the bird and small mammal bone remains are probably connected with the feeding activity of predatory birds associated with caves.

The analysis of numerous "owl fissures" made in Southern Siberia (OVODOV et al. 1998, my unpublished data), Mongolia (DINESMAN et al. 1989) and Europe (BOCHEŃSKI et al. 1993, LAROULANDIE 2000) allow such a conclusion to be made.

Taphocenoses of this type are characterized by the following peculiarities: good preservation of fossil material, the large percentage of complete bones, a large spectrum of species of mammals and birds from small to average size, and the prevalence of one or two nocturnal species in the taphocenosis. It is noted that this is connected with food remains in the cave made by eagle owl.

Most of the bones belong to *Eremophila alpestris* (about 80 %), *Syrrhaptes paradoxus* and *Podoces hendersoni.* The first two species are now dominant in desert-steppe and semidesert habitats of Mongolia (KUROCHKIN & MICHAILOV 1994). *Charadrius mongolus* and *Bucanethes mongolicus* are identified for the first time in the Pleistocene of the Palearctic (TYRBERG 1998).

One distinct difference from an avian predator assemblage is the presence of the Ostrich. The fragment of eggshell of last Quaternary Ostrich from layer 3 in the Entrance Grotto was determined by Dr K. MIKHAILOV (PIN) (personal information).

The composition of the fossil avicomplex is not homogeneous from a zoogeographical perspective. It includes elements of the following faunas: African – *Strutio* sp., *Calandrella cinerea*, *Galerida cristata*, *Oenanthe, Petronia petronia*; Siberian - *Turdus* cf. *ruficollis*, European – *Scolopax rusticola*, *Cuculus canorus*, Mongolian – *Charadrius mongolus, Syrrhaptes paradoxus, Podoces hendersoni, Bucanetes mongolicus. Aguila chrysaetos, Falco tinunculus, Bubo bubo* and ducks (*Anas platyrhynchos, Anas querquedula, Aythya fuligula*) are widely widespread in the Palearctic as a whole.

The Mongolian Altai Mts are a continuation of the Russian Altai Mts and so the comparison of Pleistocene birds of this division with the rest of the mountain system is logical.

In the Altai Pleistocene fossil birds are known from a large number of sites (PANTELEEV 1999). One of the first and probably the most ancient finds is known from the caves situated further to the east – Ust'-Kanskaya Cave (RUDENKO 1961). Now, after a long break the excavation of this Mousterian locality has proceeded. The faunal list, which includes many waterfowl *(Podiceps, Cygnus, Anser, Anas, Mergus*) and waders (*Squatarola, Vanellus, Numenius* etc) includes 70 species of birds (DEREVYANKO et al. 1999, 2001). The bones of *Lagopus* are rare. The avifauna from Mousterian horizons of the cave is characteristic of sites in the modern mountain steppes of Mongolia and Tiva with lake hollows and various still water biotopes. Due to its structure and the variety of birds the fauna does not have a modern analogue in the Altai. An interesting, distinctive feature of this taphocenosis is the abundance of *Allactagina*e. Dating the Ust'-Kanskaya Cave remains to be finalised. Attempts at correlation with a well investigated cave locality nearby (Denisova Cave) have been made. The latter Pleistocene avifauna was investigated by À.V. PANTELEEV (Zoological Institute of the Russian Academy of Sciences). In the Mousterian horizons of the Central hall of Denisova Cave 52 species of bird of open mountain-steppe landscapes (*Aegypius monachus, Tetraogallus altaicus, Leucosticte arctoa, Montifringilla nivalis)* with the inclusion of elements of tundra (*Buteo lagopus, Lagopus mutus, Lagopus lagopus, Nyctea scandiaca*, *Plectrophenax*

nivalis) and taiga *(Tetrao urogallus*, *Surnia ulula, Picoides tridactylus*, *Uragus sibiricus*) were determined (DEREVYANKO et al. 1998).

Another Mousterian site in the northwest Altai Mts is Sibiryachikhinskaya (Okladnikova) Cave. The material revealed from cave sediments of the Karga epoch characterizes a «warm» forest-steppe fauna (MARTYNOVICH 1990). The presence of *Syrrhaptes paradoxus* unites the faunas of Ust'-Kanskaya Cave, Sibiryachikhinskaya Cave and Tsagan-Agui Cave, and only 2 bones of this species were found in the second site (MARTYNOVICH, my unpublished data).

Avifaunas from Upper Palaeolithic and Neolithic deposits of two karstic caves of the northwest Altai Mts - Strashnaya and Logovo Gieny have been described (BURCHAK-ABRAMOVICH & BURCHAK 1998). 21 mountain, tundra, and forest species were determined among the 84 bird remains.

The characteristic feature of the Pleistocene avifaunas in the Russias Altai Mts is the presence of *Lagopus* which is sometimes abundant and determines the appearance of the taphocenosis, and include the following taiga forms – *Bonasa bonasia, Tetrao urogalus, Strix uralensis, Strix nebulosa, Aegolius funereus, Dendrocopos major* etc.

The fossil complex of Tsagan-Agui is of steppe to semi-desert character. The presence of such endemic species as *Charadrius mongolus, Podoces hendersoni, Bucanethes mongolicus,* is typical of such.

The similarity of the fossil faunas, except for the presence of *Syrrhaptes*, is supported by the presence of *Pyrrhocorax*, and such transpalearctic species as *Aquila chrysaetos, Falco tinnunculus* and intrazonal aquatic species (*Anas, Aythya*).

In Denisova Cave the decoration made on a shell of an ostrich was found. This interesting find connected with humans is still unique from cave sediments of the Altai mountains (PANTELEEV 1999).

The birds from the Pleistocene sediments of Tsagan-Agui Cave are characteristic of modern Central-Asian low-mountain, semi-deserts steppe and its fossil avifaunas are practically identical with the recent fauna of the North Gobi desert (KOZLOVA 1975; KUROCHKIN & MIKCHAILOV 1994). The climate was perhaps more humid and the paleolandscape surrounding the cave was steppe. No large differences between successive layers have been found. The presence of woodland vegetation in the past is indicated by the presence of such forms as *Scolopax, Cuculus* and *Turdus* in layers V and II of the Terrace Zone as well as in layers 7, 5 and 3 in the Entrance Grotto.

In comparison with the well known Western Mongolian Pliocene avifauna, dominated by waterfowl (KUROCHKIN 1985), most of the birds from Tsagan-Agui are terrestrial.

The materials described here confirm the assumption of an ancient age for the modern bird fauna of the North Gobi desert (KOZLOVA 1975).

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