

## SOME NEW DATA ON FAUNISTICAL EXCHANGES THROUGH THE BERING-BRIDGE

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Discussions and papers on faunistical exchanges through the Beringian Land Bridge are numerous in literature and it is nearly impossible to look over all of them. Several faunistical elements of different stratigraphic units, beginning with the early Tertiary and terminating with the Late Quaternary, are discussed and the botanical and faunistical connections found numerous between the two continents. However, when gleaning the literature of this complex of themes, one comes up against the striking fact that — among others — two groups of vertebrates are neglected from this point of view: the first is the group of birds, regarded not only from a zoogeographical but also from a paleontological and osteological point of view, and the other some small mammals. The results of recent investigations of smaller vertebrates from the Plio-Pleistocene — a part of them especially in Hungary and in the adjoining territories — may throw some new light on the problem.

As is well known, and as new data prove year by year, the origin of the recent boreal faunas of the Holarctic region, and chiefly that of North America, is to be traced back to the northern parts of Eurasia and mainly of Asia itself — the “great reservoir of new species”.

In the ornithological literature of the last decades, many works deal with the origin of the recent boreal bird fauna. From our point of view, only the resident groups of birds are significant, because the remains of migratory birds in the paleontological material are not convenient for further conclusions. The typical sedentary birds of the Northern Holarctic are the smaller gallinaceous forms of the tundra and the northern Forest Belt, the ptarmigans, the members of the genus *Lagopus* which spend their whole life in a very restricted area. About the origin of ptarmigans a number of hypotheses are known, placing the origin of this group chiefly in northern Asia. Paleontological remains were hitherto quite absent from the largest part of the Holarctic territory, and restricted to the Upper Pleistocene originating chiefly from Europe. My intensive investigations of bird faunas from the Middle Pliocene up to the Middle Pleistocene in Hungary and the temperate parts of Europe throw some new light upon the origin of this group in the corresponding territory. I found an ancient form of *Lagopus* from the locality Rebielice (Poland), and Dijon (France) stratigraphically well defined as Lowest Pleistocene (“Villafranchian”) on the first locality connected with the hitherto known first appearance of lemmings (genus *Lemmus*) of Europe. In these times, the lemming advanced apparently further to the south than the ptarmigan: I found in the geologically contemporaneous fauna of Northern Hun-

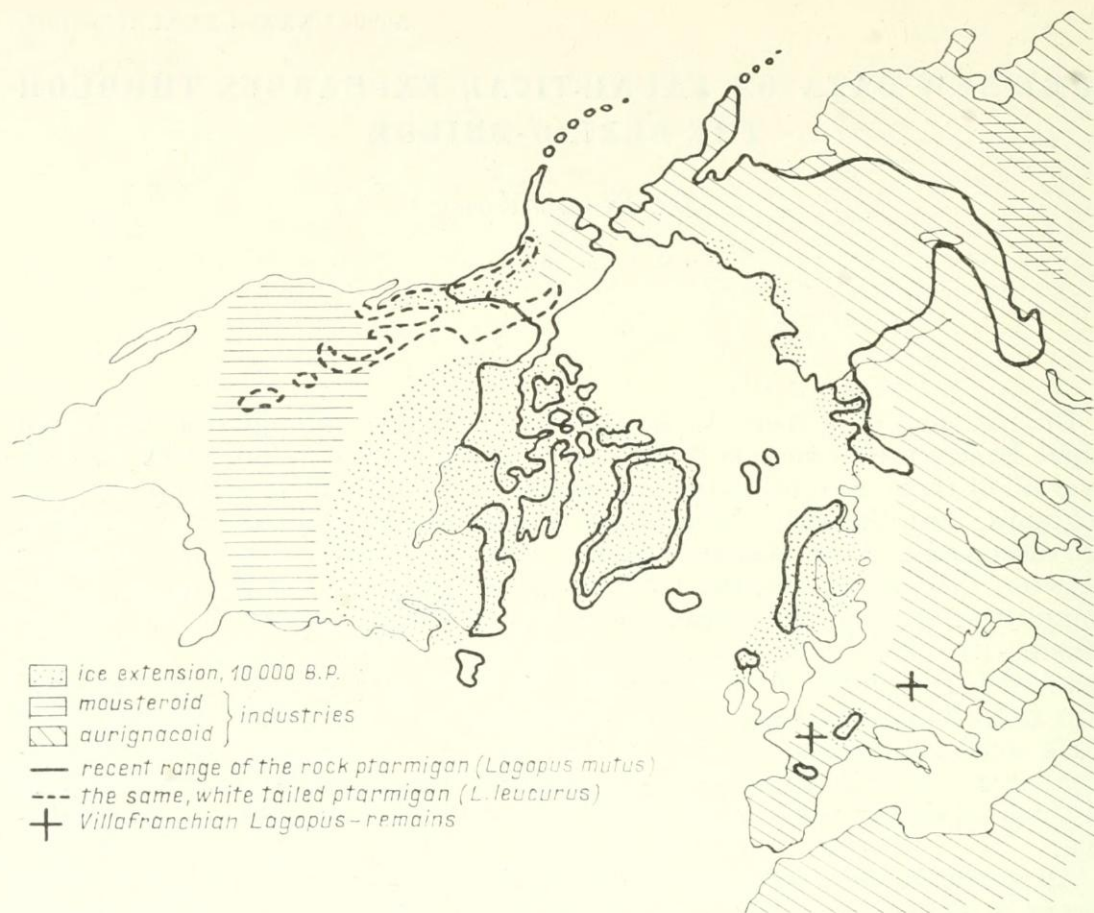


Figure 15. Recent distribution of the Eurasiatic and American species of Rock-ptarmigans (*Lagopus mutus* and *leucurus*), the Lower Pleistocene localities of *Lagopus* and the hypothetical sketch of the intrusion of man to North America (the latter one according to Müller-Beck, 1965)

gary, Osztramos (JÁNOSY, 1973) Lemmus together with only the Tertiary relict gallinaceous birds, the francolins, but not with the ptarmigan.

I pointed out in details in my previous papers (JÁNOSY, 1972, 1973) that the appearance of these recently clearly northern forms, even if they were not indicative of glaciation in a restricted sense, they certainly heralded a deterioration of climate (Donau or Günz Glaciation). The intrusion (perhaps same ancient form) of *Lagopus*—stratigraphically also well defined as Mindel-Glaciation, Biharian Phase of Kretzoi—may be followed in more southern territories: Czechoslovakia and Hungary (Stránská Skála, Vértesszőlős, Uppony). Finally, I was able to establish, for the first time in Europe, the simultaneous presence, only in the upper part of the Middle Pleistocene, at first of the two recently boreal and alpine forms of the Holarctic, *Lagopus mutus* and *L. lagopus* in a so called “Riss” fauna in Germany (Hunas) (HELLER, 1966) whether the isolation of these two forms during a former, warmer Interglacial (Mindel-Riss) period happened in Asia or Europe remains an open question.

From our point of view two conclusions may be drawn from these paleontological results. The first one is the fact that the first intrusion of Tetrao-

nids of "Eurasian Type" – must have taken place through the Bering Bridge before the Upper Pliocene and based on the hitherto known fossils of Europe, later than Miocene.

On the other hand, we have the first data about the reinvasion of a part of the birds discussed above in detail becoming from one glacial to the other, namely more boreal, in their ecological habit, also through the Bering Bridge back to North America. The oldest *Lagopus* finds originate from the prehistoric sites of Kodiak Island and Alaska (Postwisconsin times) (BRODKORB, 1964). Therefore this intrusion must have taken place in Wisconsin times or formerly.

We have to mention in this place that the recent zoogeography of the group of Rock-ptarmigans of North America speaks for an analogous intrusion of these forms to the New World with that of man, in the sense of MÜLLER – BECK's hypotheses (Fig. 15) (MÜLLER – BECK, 1966). The intrusion of the ancient form of the Rock-ptarmigan must have taken place at the latest in early Wisconsin times, and it seemed to have been isolated by a later ice sheet (perhaps of Middle Wisconsin). This isolation produced the endemic North American form:

the sibling species of the Rock-ptarmigan, the Whitetailed ptarmigan (*Lagopus leucurus*) today spread widely to the south in the Rocky Mountains and to Northern New Mexico. The reinvasion of the two recent Eurasian species, the Willow ptarmigan (*Lagopus lagopus*) and the Rock-ptarmigan (*L. mutus*) must have take place later, in late Rancholabrean times (osteological comparison see Fig. 16).

We have to mention also in this place the first subfossil proofs of the presence of another boreal species of grouches in North America, the American Spruce grouse (*Canachites canadensis*). The first subfossil remains of this gallinaceous bird originate from the early post-Wiscon-

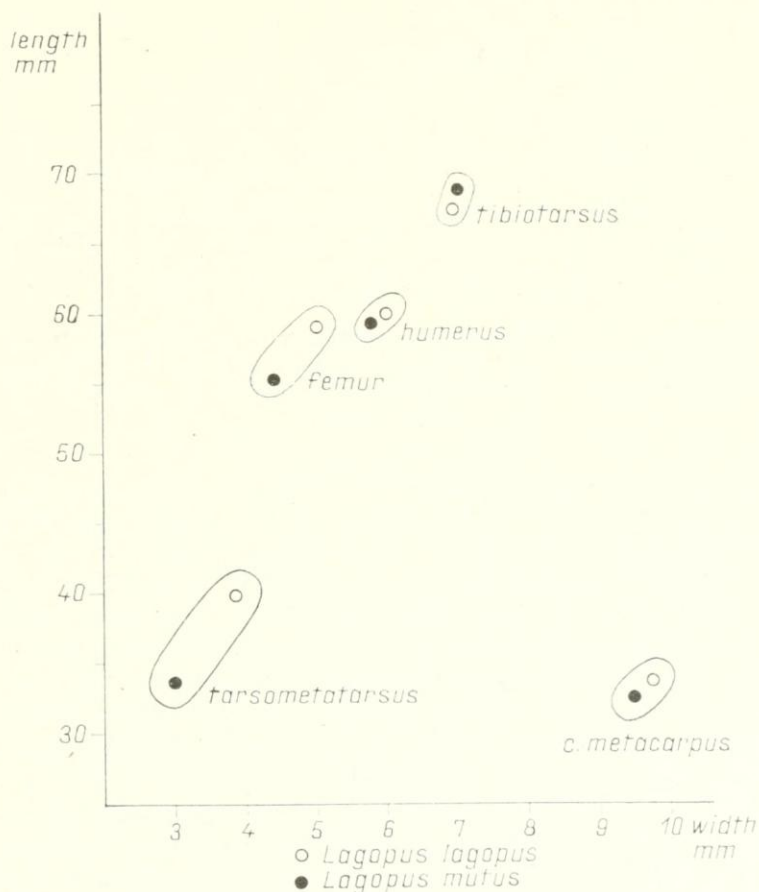


Figure 16. Ratio of length and width of extremity bones of the Rock- and Willow-ptarmigans of Eurasia (*Lagopus lagopus* and *mutus*). Measurements of widths of the bones taken as follows: c. metacarpus: proximal; humerus: diaphysis (at the middle of the bone); femur: the same; tibiotarsus: distal; tarsometatarsus: diaphysis

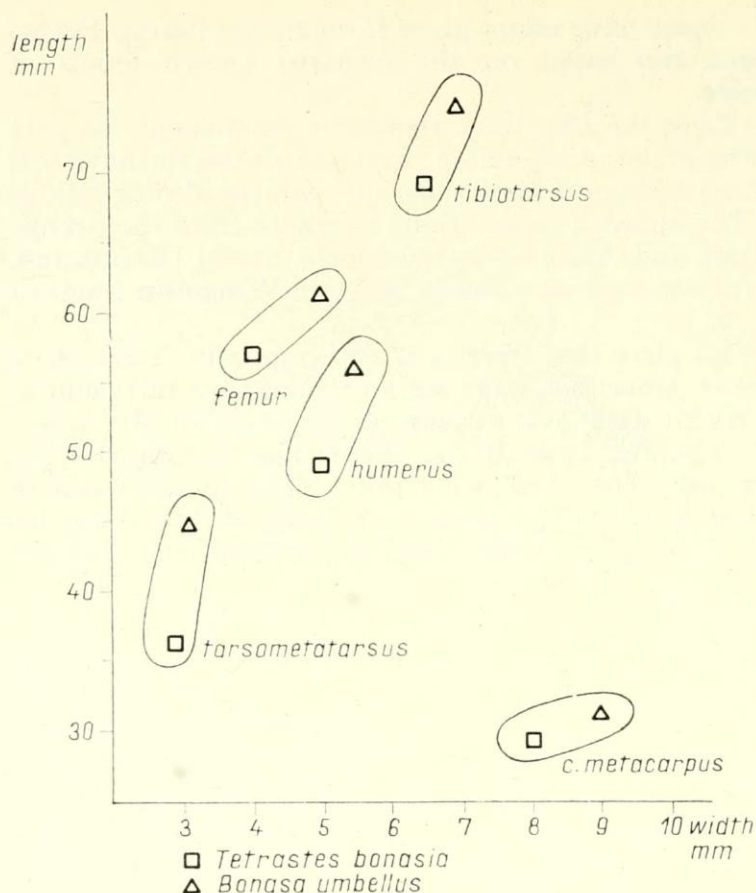


Figure 17. Ratio of length and width of extremity bones of the Eurasian and American Hazel hen viz. Ruffed grouse (*Tetrastes bonasia* and *Bonasa umbellus*, explanation of measurements as in fig. 16)

BURCHAK — ABRAMOVICH in Tbilisi, Transcaucasia, and the resemblance also in the bones is fairly close. Some allometric differences, beside the morphological homogeneity observable in the humerus, tibiotalarsus and tarsometatarsus bones, speak for and advanced evolutionary divergence and in consequence for an earlier isolation of the Asiatic and American forms (Fig. 17). Concerning the fact that both species are strictly forest-dwellers, we have to count with forest conditions during the intrusion of this form through the Bering Bridge (? pre-Irvingtonian on the basis of faunistical proofs, botanical arguments speak at the last in Alaska for dry tundra conditions during the whole Pleistocene in this territory!).

Very analogous is the case of the Eurasian Hazel hen (*Tetrastes bonasia*). I found an extinct form of this grouse in the bottom of Middle Pleistocene (Upper Biharian, Tarkó-Phase) in Northern Hungary, thus its Eurasian origin seems to be proved. The intrusion of the vicarial North American form, *Bonasa umbellus*, must have taken place also in forest conditions. This species was very widespread in the whole Wisconsin in North America, according to several fossil and subfossil remains in that territory (BRODKORB, 1964, osteological comparison see Fig. 18).

sin age from Virginia (GUILDAY, 1962). Recent ornithological literature points out the outer (phenotypical) resemblance as well as the ecological and ethological similarity of this form with the Siberian Spruce grouse (*Falcipennis falcipennis*) of the Ussuri Region. Paleontological data are lacking in Eurasia about this form, but I have had the opportunity — I think as the first —, to compare osteologically the Asiatic and American Spruce grouse. I found the skeleton of the first one in the British Museum (Natural History), that of the second — after having looked for it for several years in different larger collections of Europe — strangely in the private collection of

Passing over to some small mammals: The migration of the vole group of the sage brush voles, the genus *Lagurus*, clearly of central Asiatic origin, seems to be easier to interpret, because the members of the whole genus are unambiguously dwellers of *Artemisia*-steps – according to the botanical data very characteristic of Pleistocene conditions in the Bering Area. The American sagebrush vole (*Lagurus curtatus*) is now living in western prairie conditions. Paleontological remains are known from two localities. The first one, the Little Box Elder Cave in Colorado, is connected with the hitherto known southernmost find of the Collared Lemming in North America, the other one, the Isleta Cave in New Mexico, seems to be a little younger (ANDERSON, 1969, Fig. 19).

It is of interest that the dentition of the American Sagebrush vole is in the structure of enamel more primitiv, in the presence of cement more evolved than that of the contemporaneous Old World form (Fig. 20).

Returning to the other very important, so-called cold indicators of the European Pleistocene micromammals, the lemmings – the members of the genera *Lemmus* and *Dicrostonyx* as well – we have to mention in this place that, as I discussed this on another occasion, these Rodents were, from their very first origin, northern and in Western Europe Atlantic forms, respectively. The newest data originating from Alaska and Eastern Siberia (published by MATTHEW and GUTHRIE, 1971, and oral communication by SHER) speak – on the level of our recent knowledge – for their origin in the Bering territory in the latest sense. The zoogeographic relations of fossil lemmings in Europe are the same as those of the taxonomically far removed but today also boreal species, e.g. the Reindeer (*Rangifer*), or the Snowy owl (*Nyctea*), reaching the present northern limit of the Mediterranean Belt in Europe only in the Atlantic region during the Pleistocene. From this point of view it seems

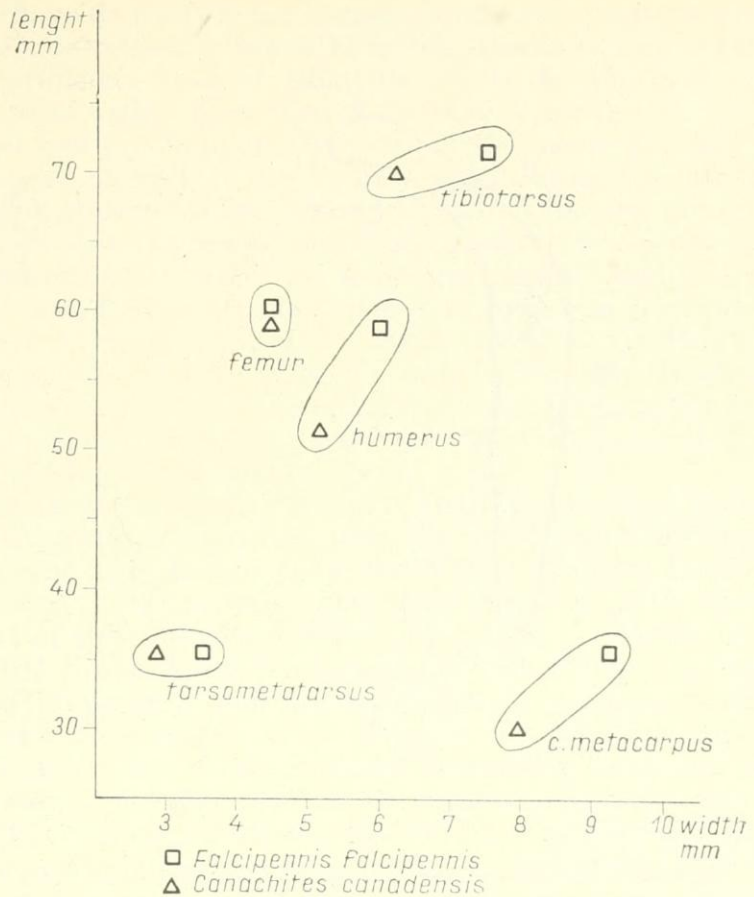


Figure 18. Ratio of length and width of extremity bones of the Asiatic and American Spruce grouse (*Falcipennis falcipennis* and *Canachites canadensis*, explanation of measurements as in Fig. 16)

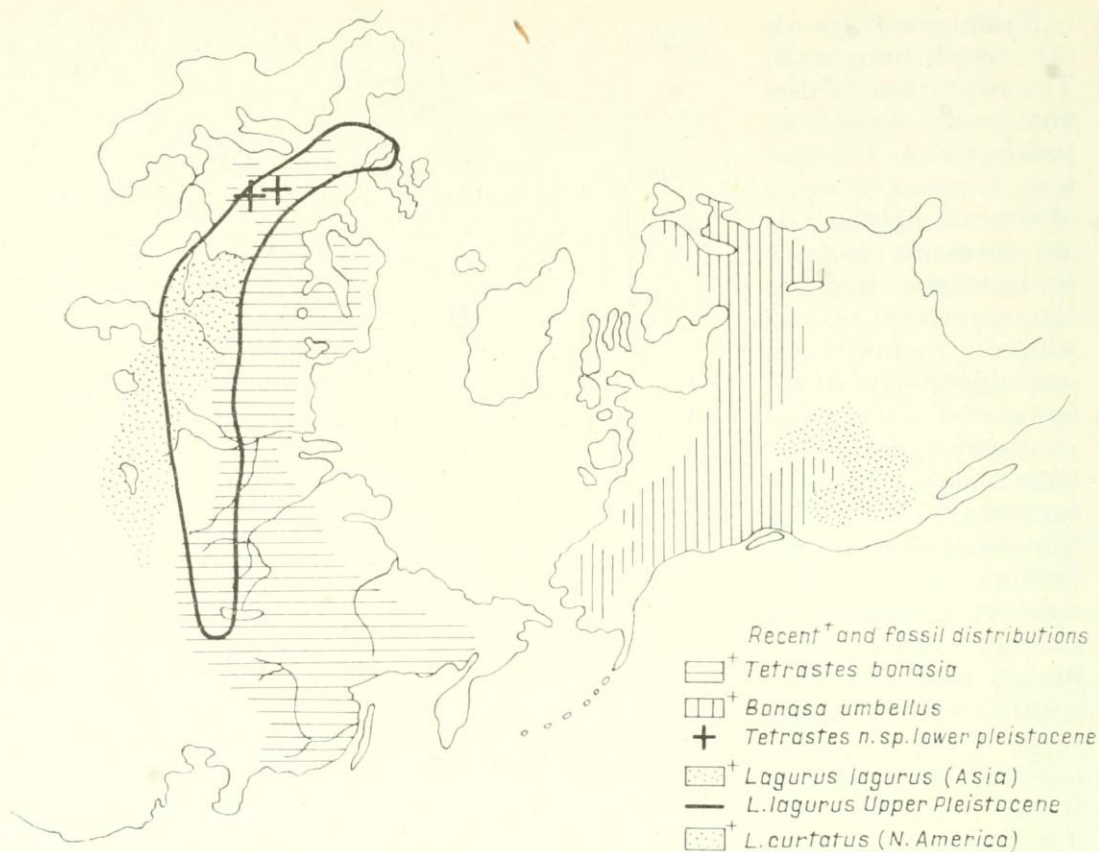
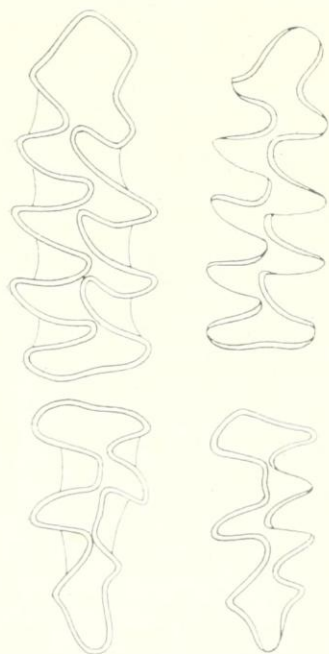


Figure 19. Recent distribution and some fossil data on the Eurasian and American Hazel hen viz. Ruffed grouse (*Tetrastes bonasia* and *Bonasa umbellus*) and the recent and hitherto known fossil distribution of the Eurasian and American Sage-brush voles (*Lagurus lagurus* and *Lagurus curtatus*)



to be of importance that I found only during the last years in Northern Hungary the oldest *Lemmus* remains hitherto known, originating from the Plio-Pleistocene boundary: the Beremend-Phase – Lower Villányian in KRETZOI's scheme, (KRETZOI, 1969) and Lower Villafranchian in the classical stratigraphy. This means that the origin of *Lemmus* must have been older than Villafranchian. Concerning the fact that the first North American *Synaptomys*, morphologically the nearest *Lemmus* form in the New World, appears in the Blancan – corresponding at least in its upper parts with the Eurasian Villafranchian – we are not far from the supposition of an Uppermost Pliocene origin of the Lemmings in the Bering Area in a widest sense.

Figure 20. Occlusal view of the lower first and last upper molar of the Eurasian and American Sagebrush vole (*Lagurus curtatus* and *lagurus*)

Last but not least, I have do deal with a Rodent family very neglected until quite recently: the whole extinct group of Eomyids. The collecting of their remains is a technical problem: teeth of Eomyids are to be obtained only by washing through screens with a mesh size of 0.5 mm or smaller.

Eomyids were typical and predominant Rodents in the whole Tertiary of Europe and North America as well. It was to be proved during the last decades that, chiefly during Miocene times, among the small rodents not only cricetine-like-forms (*Cotimus* and *Copemys*) and flying Squirrels (*Sciuropterus*) but Eomyids (*Pseudotheridomys*) were at least generically identical in Europe and North America. In recent times there was found an Eomyid in France in Lower Pliocene layers (localities) by MEIN (1968) and during the last year *Leptodontomys* from the Middle Pliocene times in Northern Hungary (Locality 1., Osztramos), with very close morphological and presumably evolutionary relations with North American forms described from the Lower Pliocene (Hemphillian of Oregon, SHOTWELL, 1965).

I discovered in some sites of the locality complex at Osztramos that Eomyids were living up to the Lowest Pleistocene times (Loc. 3, 7 and 10 of Upper Pliocene, Lower Pleistocene age). Incidentally, the Middle Pliocene Locality 1. of Osztramos (JÁNOSY, 1972) proves some other relations with North American forms: a part of the vole-like forms of the fauna, i.e. *Polonomys*, stands also very near the North American Lower Pliocene *Prosomys*. Since this period between the Pannonian (approximately contemporaneous with the Hemphillian of North America) was unknown from a biostratigraphic point of view, I established a new stratigraphical unit under the name *Estramontium* in the European microfaunistical succession. A connection between Eurasia and North America during this Middle Pliocene period is proved by the above mentioned common forms — through the Bering Strait — too.

With this brief account, I merely attempted to add some mosaic-stones to the large theater of the exchange of life during several millions of years through the Bering-Bridge. I hope that small though these steps may be in the enrichment of our knowledge in this respect, they are not unnecessary and will help in the solution of some of the problems involved.

#### Irodalom — Literature

- Anderson, E. (1968): Fauna of the Little Box Elder cave, Converse County, Wyoming. — Univ. Colorado Studies. Ser. Earth Sci. 6. 1 — 59. p.
- Brodkorb, P. (1964): Catalogus of fossil birds. Part 2. Bull. Florida State Museum. Biol. Sci. 8. 3. 195 — 335. p.
- Guilday, J. E. (1962): The Pleistocene local fauna of the Natural Chimneys, Augusta County, Virginia. Annals of Carnegie Museum. 26. 87 — 122. p.
- Guthrie, R. D. — Matthew, Jr. J. V. (1971): The Cape Deceit Fauna Early Pleistocene Mammalian Assemblage from the Alaskan Arctic. — Quaternary Research, 1. 474 — 510. p.
- Heller, P. (1966): Die Fauna von Hunas (Nördliche Frankenalb) im Rahmen der deutschen Quartärfaunen. — Eiszeitalter und Gegenwart, 17. 113 — 117. p.
- Jánossy, D. (1972): Middle Pliocene Microvertebrate Fauna from the Osztramos Loc. 1. (Northern Hungary) Annales Hist. Natur Mus. Nat. Hung. 64. 27 — 52. p.
- Jánossy, D. (1973): The Boundary of the Plio-Pleistocene based on the Microvertebrates in North Hungary (Osztramos Locality 7). *Vertebrata Hungarica*, Budapest, 14. In print.

- Kretzoi, M. (1969): Sketch of the Late Cenozoic (Pliocene and Quaternary) terrestrial stratigraphy of Hungary. Földrajzi Közlemények, Budapest, 1969. 3. 198 – 204. p.
- Mein, P.: in: Hugusney, M. – Mein, P. (1968): Les Eomyidés (Mammalia, Rodentia) néogènes de la région lyonnaise. Geobios. 1. 187 – 204. p.
- Müller, B. H. (1966): Paleohunters in America: Origins and Diffusion Science, 153. 3726. 1191 – 1210. p.
- Shotwell, A. (1956): Hemphillian Mammalian Assemblage from Northeastern Oregon. Bull. Geol. Soc. America. 67. 717 – 738. p.

## Faunakieserélődések a Bering-hídon át

Dr. Jánossy Dénes

Számos adattal rendelkezünk arra vonatkozólag, hogy főleg az oligocéntől a miocén végéig (tehát 40-től kb. 10 millió évvel ezelőtti ideig) többé-kevésbé állandó szárazföldi összeköttetés volt Eurázsia és Észak-Amerika között. A pliocén elejétől mindmáig sokszoros tengerelöntés, majd újbóli szárazföldi összeköttetés váltakozott a Bering-szoros vidékén. Mindezek eredményeként egészen a pliocénig az ó- és újvilági faunaelemek eléggé egyenletesen cserélődtek ki, míg a pleisztocén második felében, az utolsó 100 000 évben úgyszólván kizárólag ázsiai elemek átvándorlása állapítható meg Észak-Amerika felé. Így a mai észak-amerikai sarkvidéki állattársaság több mint 90%-ban ázsiai eredetű.

A fenti adatokra vonatkozólag a bizonyítékokat legnagyobb részt a (főleg kihalt) nagyemlősök (ormányosok, patások, ragadozók) nagyszámú lelete szolgáltatja.

A földtörténet e nagy színjátékának rekonstruálásában két állatesoport vizsgálata mindaddig meglehetősen elhanyagolt volt: az egyik a madaraké – elsősorban őslénytani és csonttani szempontból –, a másik egyes kisemlős csoportoké.

A jelen dolgozatban ezért az utóbbiakra vonatkozólag közlök néhány újabb adatot.

Már régóta ismeretes, hogy a hófajdok Európa mérsékelt övében (nyugaton egészen a Pireneusokig), a felső pleisztocénban (tehát kb. 70 000 – 10 000 évvel ezelőtti időben) széltében elterjedtek voltak. Ezt sok egyéb közt hazai bükki és dunántúli barlangokból származó több ezer csont is bizonyítja. Az elmúlt évtizedben először a hazai upponyi és vértesszőlősi, majd főleg a csehszlovákiai stránská-skála-i gazdag leletek hívták fel a figyelmemet arra, hogy a hófajdok már a középső pleisztocénban, tehát mintegy félmillió évvel ezelőtt is éltek területünkön. Végül az elmúlt években sikerült Dél-Lengyelországból (Reblice), majd Franciaországból (Dijon környéke) a plio-pleisztocén határáról származó, kb. 3 millió éves hófajdleleteket meghatároznom. Ezek a régebbi pleisztocénból származó hófajdleletek csonttanilag alig különböznek a mai sarki hófajd (*Lagopus lagopus* Linné) megfelelő vázrészeitől. Végül az NSZK-beli Hunas (Nürnberg környéki) késői közép-pleisztocén (maximálisan 150 000 éves) leletegyüttesben találtam az első bizonyítékot Európában a havasi hófajd (*Lagopus mutus* Montin) megjelenésére vonatkozólag, tehát ezen boreális és alpin elemek szétválása geológiai értelemben nem sokkal előbb következett be. Ázsiából eddig hófajdleleteket nem ismerünk, és Amerikából csupán három, maximálisan 10 000 évvel ezelőtti maradvány ismeretes (Nyugat-Alaszkából) a sarki hófajdból.

Mindezek alapján a hófajdok eurázsiai (erópai?) pliocén eredete bizonyítottnak vehető, és a mai elterjedési adatok (az észak-amerikai fehér farkú hófajdot (*Lagopus leucurus*) is beleértve) amellettszólnak, hogy az Újvilágba való átvándorlás két hullámban következett be, az emberéhez hasonlóan (lásd MÜLLER – BECK elméletét és a 15. ábra elterjedési térképét). A 16. ábra grafikonja mutatja, hogy a sarki és havasi hófajdok közti eltérés a csontok méretarányában csekély.

Az Aquila előző évi számának hasábjain utaltam már arra, hogy ugyancsak az elmúlt években sikerült a császármadár kihalt alakjának leleteit megtalálnom a bükki Tarkó és a nyugati határunk közelében levő ausztriai Hundsheim középső pleisztocén (kb. félmillió éves) üledékeiben. Ezeket a *Tetrastes praebonasia* n. sp. néven írtam le. Ezek a leletek a császármadarak eurázsiai eredete mellett szólnak. Az észak-amerikai galléros fajd (*Bonasa umbellus*) ezek késői fejlődési oldalága. Ennek a fajnak a legrégebbi leletei Észak-Amerika felső pleisztocénjából származnak. A mellékelt grafikon tanúsága szerint (17. ábra) az eurázsiai és amerikai „császármadarak” (*Tetrastes* és *Bonasa*) csontozatának méretaránybeli eltérése sem nagy.

Sokkal kevesebb támpontunk van a Kelet-Mandzsúriában élő kis fajd [ezt „mandzsúriai lucfajdnak” nevezhetnénk, (*Canachites/Falci pennis/falci pennis*) és amerikai helyet-

tesítő faja („amerikai lucfajd”, *Canachites canadensis*)] törzsfajlódási kapcsolatát illetőleg. Ezek tollázatban a hófajdokra emlékeztetnek, egymáshoz külsőleg és viselkedésben is nagyon hasonló alakok (mindkettő könnyen vadászható és ezért erősen pusztuló vad). Mint a mellékelt grafikon mutatja (18. ábra), olyan nagyok a csontozat méretaránybeli eltérései, hogy egy régebbi (alsópleisztocén?) különválásra gondolhatunk.

Végül még két kisemlősalakra térek rá. Az észak-magyarországi Osztramos középső pliocénjéből (kb. 5 millió év) egy kihalt rágcsálócsalád, az *Eomyda*-k tagja került elő (*Leptodontomys*), mely az észak-amerikai középső pliocén-alakokkal szinte teljesen azonosnak látszik. A hazánk felső pleisztocénből származó üledékeiben szórványosan előforduló pocoklemminget (*Lagurus lagurus* Pallas) észak-amerikai helyettesítő alakjával hasonlítom össze (*Lagurus curtatus* Cope). Ezek átvándorlása Euráziából Amerikába a felső pleisztocénre tehető.