

Early Pliocene avifauna of Muselievo (C Northern Bulgaria)

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Abstract. Fourteen avian finds (MNI 9) have been collected from the new site of fossil vertebrate fauna near the village of Muselievo (C Northern Bulgaria, 43°36' N, 24°50' E), 10 km from the river Danube. They are dated Early Pliocene – 2nd half of the Middle Ruscinian, MN 15 (3,3-3,1 Ma). A distal humerus is identified as *Accipiter* sp. ex gr. *gentilis*. Four phalanges of the posterior limbs of an adult individual are referred to *Pavo bravardi* (GERVAIS, 1849). A proximal humerus is determined as *Lagopus* aff. *atavus*, and a distal pedal phalanx is referred to *Falco* sp. Among the remaining finds are unidentifiable fragments of small to medium sized Passeres and Aves indet.

Key-words: Fossil birds, Early Pliocene, Bulgaria, *Pavo bravardi*, *Lagopus*, hawk, falcon, Balkan peninsula, Paleobiogeography.

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I. INTRODUCTION

The Early Pliocene avifauna of Bulgaria is still poorly known. Only three sites are known in this country: Dorkovo (Early Ruscinian, MN 14; BOEV, 1998), Sofia-1 (Late Miocene, MN 11-13 or Early Pliocene, MN 14-15; BOEV, 1996), Sofia-2 (Early Ruscinian, MN 14-15; BOEV, 2000), where a total of 4 avian taxa have been reported. The Sofia-1 site is listed in the literature only by the statement that some unidentified bird bones were collected (POPOV et al., 1921). Unfortunately, these finds were not preserved in the collections. The fourth Early Pliocene bird fauna found at Muselievo is described in the present paper.

A c k n o w l e d g e m e n t s. The author is very grateful to Dr. Cecilé MOURER-CHAUVIRÉ for the opportunity to work on these and other Bulgarian fossil materials of birds in the UCBL, the offered personal measurements of the peafowl specimens from some foreign collections, and her critical remarks to the manuscript. He also thanks Dr. Vassil POPOV, who handed for examination the paleornithological material from Muselievo, and Prof. Dr. Zygmunt BOCHENSKI (Institute of Systematics and Evolution of Animals PAS, Kraków) for helpful comments and additions to the manuscript. The study was sponsored by the Fondation Scientifique de Lyon et du Sud-Est (France) and the National Science Fund (project No NI B-202/01.10.1992) (Bulgaria).

II. DESCRIPTION OF THE SITE

The site is a rock shelter up to 1.5 m depth in a destroyed Pliocene cave in ? Sarmatian limestones, about 1 km SE of the village Muselievo (Lovech Province) and 350 m from the right bank of the river Ossam. Alt. 150 m; 43°36' N, 24°50' E; UTM code LJ 23. It has been dated to the 2nd half of the Middle Ruscinian (MN 15; 3,3-3,1 Ma) by POPOV and DELCHEV (1997).

A s s o c i a t e d f a u n a. Mr Georgi HRISTOV collected several remains of a large terrestrial tortoise (Chelonia). Also over 35 species of fossil mammals were established, among them: *Miomys occitanus*, *Pseudomeriones abbreviatus*, *Rhagapodemus hautimagnensis*, *Myomimus dehmi*, the recent *Sciurus*, *Glis*, *Apodemus*, *Rhinolophus*, *Miniopterus* and *Dolichopithecus* (POPOV & DELCHEV 1997), as well as *Talpa* cf. *csarnotana*, *Blarinoides mariae*, *Deinsdorfia kordosi*, *Mafia csarnotensis*, *Episorculus gibberodon*, *Hypolagus brachignatus*, *Trischizolagus* cf. *dimitrescuae*, *Pliopentalagus* cf. *dietrichi*, *Pratilepus kutschurganicus*, *Ochotonoides csarnotanus*, *Dolomys odessanus*, *Pliomys hungaricus*, *Dryomimus* cf. *eliomyoides*, *Glis minor*, *Apodemus* cf. *dominnans*, *Allocrietus* cf. *bursae*, *A. ehki*, *Trilophomys pyrenaicus*, *Prospalax priscus*, *Pliospalax compositodontus*, *Pseudomeriones abbreviatus*, *Myotis* sp., *Pliopetaurista* sp. and *Sciurotamias* sp. (V. POPOV, Institute of Zoology – BAS, Sofia; unpubl. data). The large mammal fauna consists of 8 species at least: Felidae gen. (?*Acinonyx*, ?*Dinofelis*), cf. *Nyctereutes* aff. *megamastoides*, Carnivora fam. (Viveridae/Mustelidae), *Sus arvernensis*, *Cervus pardinensis*, *Procapreolus* sp., aff. *Gazella* sp., *Tapirus arvernensis*, cf. *Dicerorhinus jeanvireti*. This fauna dates the site as belonging to the Viallette stage, i.e. the final Ruscinian (Nicolay SPASSOV, National Museum of Natural History – BAS, Sofia; unpubl. data).

Some data on the avian fauna from Muselievo have been published by BOEV (1996, 1997).

T a p h o n o m y. The accumulation of avian remains may be explained by a feeding place of large owls, and carnivore mammals sharing the cave. The degree of fragmentation of bird bones is high and only very small terminals of the long bones of the limbs or the smallest bones of the avian skeleton, as for example phalanges, are preserved in the collected material.

III. MATERIAL AND METHODS

A part of the material was collected in 1989-1990 by Dr. Vassil POPOV and the biologist Stefan STEFANOV (Shumen University "Constantin Preslavski", Shumen). All fossils (Table I) have been collected through screening and washing of the sediments. The finds are kept in the National Museum of Natural History in Sofia of the Bulgarian Academy of Sciences, NN: 418-424; 1612-1614; 1616-1619. The finds were identified through the comparative collections of the UCBL and the NMNHS. Collections acronyms: UCBL – Centre de Sciences de la Terre of the Université Claude Bernard – Lyon 1; NMNHS – National Museum of Natural History of the Bulgarian Academy of Sciences – Sofia; MNHB – Museum of Natural History of Basel; MHNL – Museum d'Histoire naturelle de Lyon; MNHNP – Museum national d'histoire naturelle de Paris. All measurements are given in mm. The osteological terminology follows BAUMEL and WITMER (1993). The used systematics is after DEL HOYO et al. (1994). The chronostratigraphy follows MEIN (1990).

IV. SYSTEMATIC PART

Accipitridae VIEILLOT, 1816

Accipiter sp. ex gr. *gentilis* (LINNAEUS, 1758)

M a t e r i a l. Humerus dex. dist. N 423 (Fig. 1-a, b, c).

M e a s u r e m e n t s. Table II (Fig. 2).

C o m p a r i s o n a n d d i s c u s s i o n. The fragment shows the general shape and the characteristic features of the humeral bones of Accipitridae. It differs from the other related

Table I

Taxonomic list of the Early Pliocene bird fauna of Muselievo

Avian taxa	No. of remains	MNI
Accipitridae		
<i>Accipiter</i> sp. ex gr. <i>gentilis</i>	1	1
Falconidae		
<i>Falco</i> sp. (size of <i>peregrinus</i>)	1	1
Tetraonidae		
<i>Lagopus</i> aff. <i>atavus</i>	1	1
Phasianidae		
<i>Pavo bravardi</i>	4	1
Passeriformes	2	2
Aves indet.	5	3
TOTAL	14	9



Fig. 1. *Accipiter* sp., humerus dex. dist. N 423: distal view (a), dorsal view (b), and cranial view (c). A bone of recent *Accipiter gentilis* for comparison: a – left, b – right (Photo. Boris ANDREEV).

Table II

Comparison of the measurements of the distal part of humerus of the fossil from Muselievo and chosen recent birds of prey. a – width of condylus ventralis; b – width of condylus dorsalis; c – diagonal between condylus dorsalis and epicondylus dorsalis. The manner of measuring is shown in Fig. 2.

Species	a	b	c
Fossil – Muselievo			
<i>Accipiter</i> sp. ex gr. <i>gentilis</i> NMNHS 423	4.5	8.9	9.2
Recent			
<i>Accipiter gentilis</i> UCBL 98/2	4.6	8.6	8.7
<i>Accipiter gentilis</i> NMNHS 10/1989	4.3	8.4	8.5
<i>Accipiter gentilis</i> NMNHS 12/1989	5.1	10.1	10.2
<i>Accipiter gentilis</i> NMNHS 13/1990	4.5	8.5	8.5
<i>Accipiter gentilis</i> NMNHS 16/1993	5.4	10.0	10.3
<i>Accipiter nisus</i> NMNHS 7/1989	2.9	6.2	6.3
<i>Accipiter nisus</i> NMNHS 17/1993	3.0	6.3	6.4
<i>Accipiter nisus</i> NMNHS 26/1998	2.6	5.4	6.3
<i>Accipiter brevipes</i> NMNHS 1/1988	2.8	5.2	5.5
<i>Accipiter brevipes</i> NMNHS 2/1990	2.8	5.2	5.5
<i>Circus aeruginosus</i> NMNHS 2/1993	4.8	9.1	9.6
<i>Pernis apivorus</i> NMNHS 1/1989	5.0	9.4	9.8
<i>Falco subbuteo</i> NMNHS 1/1989	3.6	7.9	7.9
<i>Falco peregrinus</i> NMNHS 2/1989	5.0	9.9	10.0

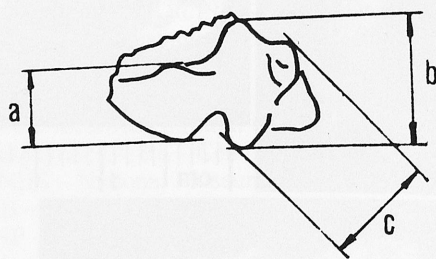


Fig. 2. The manner of measuring the distal part of humerus in Accipitridae – for Table II (Drawing: Vera HRISTOVA).

group (Falconidae) in the more elongated and less protruding condylus ventralis and the more rounded and not cranially directed (slightly sharp) contour of the condylus ventralis in dorsal view. The Accipitridae family consists of 64 genera (THIOLLAY 1994). A great many of them (most of them monotypic) may be excluded from comparison because of the considerable dimensional differences or the outlying location of the limited ranges of their species. Both, dimensional and morphological resemblance to the genus *Accipiter* and, more precisely, the *gentilis* group, is very clear. The genus *Accipiter* includes 50 recent species (THIOLLAY 1994). The majority of them have a very limited range and are endemic to some regions of the Tropical zone (chiefly island forms) or are spread only in the Neotropical zone and the Australo-SE-Asian region. All these species could be

excluded for comparison because of their limited and outlying ranges, as well as the considerable chronostratigraphical difference. The remaining 10 Palearctic, Nearctic, and Afrotropic species may also be excluded because of the smaller body size and the considerable chronostratigraphical difference. Only *A. melanoleucus* SMITH, 1830 stands somatometrically closer to *A. gentilis* LINNAEUS, 1775. The present populations are resident and the species is widespread in Africa, S of Sahara (THIOLLAY, 1994). The N 423 find stands close to *Accipiter gentilis*, but it differs from the recent nominate subspecies *A. g. gentilis*, in the deeper and symmetrical profile of the sulcus m. scapulotricipitis in caudal view, round, but not angular profile of the condylus ventralis (Fig. 1-a), the more distally positioned foramen nutricium on the fossa m. brachialis. These differences, as well as the chronostratigraphical ones, probably indicate a distinction of the Muselievo hawk as a new species.

The only Tertiary records of g. *Accipiter* in Europe originate from Bulgaria (Muselievo and Varshets; MLÍKOVSKÝ 1996 a). The finds from Varshets are dated as Late Pliocene (Villanyan; MN 17 zone; BOEV 1996) and they both (NN NMNHS 113 and NMNHS 204) represent pedal distal phalanges (BOEV 1999 a). Thus, the N 423 find from Muselievo cannot be compared with the Villanyan finds from Varshets.

The fossil taxa described in g. *Accipiter* originate from the Quaternary (BRODKORB, 1964; OLSON, 1993; TYRBERG, 1998). According to BRODKORB (1964) the only fossil species, *Accipiter alphonsi* (NEWTON & GADOW, 1893), represented by tibiotarsus and carpometacarpus, has been described from Mauritius. TYRBERG (1998) lists only *A. gentilis brevidactylus* MOURER-CHAUVIRÉ, 1975 among the fossil taxa of the genus, known from the Pleistocene deposits. It has been established in the MNQ zones 22-23 from France. Thus, the compared bone fragment from Muselievo cannot be exactly referred to any of the fossil and recent taxa known so far. The Muselievo hawk differs from *A. brevipes* and *A. nisus* both dimensionally (Table 2) and morphologically, the contour bow of the condylus dorsalis in dorsal view being more open and the general shape of the incisura intercondylaris also more open). The closer position of the foramen nutricium on the fossa m. brachialis to the condylus dorsalis is similar to *A. brevipes* – *A. nisus* and different from *A. gentilis*, besides the metrical resemblance to the goshawk.

In conclusion, the find N 423 represents a fossil hawk of the *gentilis* group, differing from *A. gentilis* in: (1) the symmetrical profile of the sulcus m. scapulotricipitis in the caudal view of the distal ending of the humeral bone; (2) round, and not angular profile of the condylus ventralis; and (3) the almost twice more distally positioned foramen nutricium on the fossa m. brachialis.

Falconidae VIGORS, 1824

Falco sp. (size of *F. peregrinus* TUNSTALL, 1771)

M a t e r i a l. Phalanx dist. dig. 2 pedis dex. N 424. The proximal two thirds of the phalanx are preserved (Fig. 3).

M e a s u r e m e n t s. Table III (Fig. 4).

C o m p a r i s o n a n d d i s c u s s i o n. *Accipiter* (as well as all Accipitridae) differs from N 424 in the pear-shaped facies articularis. Strigiformes have prominent stops of the horn cover of the claw. The resemblance to Falconidae is greater, but it differs from the smaller recent species of genus *Falco*, because they have an almost triangular shape of facies articularis. The Falconidae family includes 10 recent genera and 61 recent species. All genera of the Neotropic subfamily Polyborinae and *Spizapteryx* KAUP, 1852 (Neotropic), *Polihierax* KAUP, 1847 (Afrotropic and Indo-Malayan), *Microhierax* SHARPE, 1874 (Indo-Malayan) of the Falconinae may be excluded from comparison because of their belonging to other zoogeographical regions (WHITE et al., 1994). The body measurements of the Old World *Spizapteryx*, *Microhierax*, and *Polihierax* species and most of the species of Polyborinae are about half the size of recent species of the *Falco tinnunculus* group (WHITE et al., 1994). As seen from Table III, the specimen from Muselievo was of larger size than *Falco tinnunculus* (LINNAEUS, 1758).

Fossil record of subfamily Falconinae VIGORS, 1824: BRODKORB (1964) lists four genera: *Badiostes* AMEGHINO, 1895 from the Middle Miocene of Patagonia, *Plioaetus* RICHMOND, 1908, from

Table III

Comparison of the measurements of distal phalanx digit. 2 pedis dex. of the fossil from Muselievo and some recent European species of the genus *Falco*. a – length of facies articularis; b – distance between the base and the ventral edge of facies articularis; c – total length of phallanx; d – maximum width of facies articularis. The manner of measuring is shown in Fig. 4.

Species	a	b	c	d
Fossil – Muselievo				
<i>Falco</i> sp. NMNHS 424	4.9	4.4	ca.14.5	3.4
Recent				
<i>Falco vespertinus</i> NMNHS 1/1991	2.7	2.8	8.3	1.9
<i>Falco subbuteo</i> NMNHS 3/1993	2.8	2.9	9.8	2.1
<i>Falco tinnunculus</i> UCBL 119/3	3.0	3.1	9.3	2.3
<i>Falco peregrinus</i> ♀ NMNHS 2/1989	5.7	4.9	19.3	4.0



Fig. 3. *Falco* sp. ex gr. *cherrug* – phalanx dist. dig. 2 pedis dex. N 424: proximal view (left) and lateral view (right) (Photo. Boris ANDREEV).

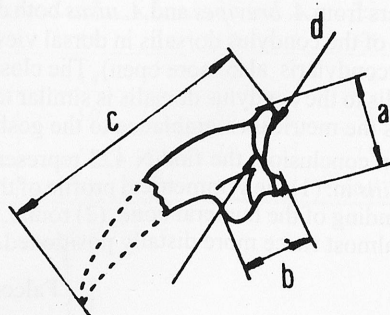


Fig. 4. The manner of measuring of the phalanx dist. dig. pedis in Falconidae – for Table III (Drawing: Vera HRISTOVA).

the Upper Pleistocene of South Australia, *Sushkinia* TUGARINOV, 1935, from the Lower Pliocene of Kazakhstan, and *Falco* LINNAEUS, 1758. The first 3 genera are fossil and monotypic and they cannot be compared because of the lack the pedal phalanges of these taxa. They may also be excluded from our comparison owing to the considerable chronostratigraphic differences. BRODKORB (1964) included in the genus *Falco* 4 fossil species: *Falco ramenta* WETMORE, 1936 (Middle Miocene of Nebraska), *F. readei* BRODKORB, 1959 (Middle Pleistocene of Florida), *F. oregonus* HOWARD, 1946 (Middle Pleistocene of Oregon), and *F. swarthi* L. MILLER, 1927 (Upper Pleistocene of California). Later on MOURER-CHAUVIRÉ (1975) described *F. antiquus* from the Middle Pleistocene of S France (a form of the *F. cherrug* group), differing in its shorter and more massive legs bones. UMANSKAYA (1979) described *F. medius* of the *F. tinnunculus* group (Late Miocene; Meotian; MN 11-13 of S Ukraine) and BOEV (1999 b) describes *Falco bakalovi* (Late Pliocene; Villanyan; MN 17 from W Bulgaria). Two other Lower Eocene (MN 8) falconid genera (*Stintonornis mitcheli*

HARRISON, 1984 and *Parvulivenator watteli* HARRISON, 1982) were described from England (BOCHENSKI 1997). No falcons are described by distal phalanges of the posterior limbs, thus the Muselievo find cannot be referred directly to any of the known taxa of the g. *Falco* and Falconidae family. It differs from *F. peregrinus* in its more prominent basal protrudence on the ventral surface of the phalanx. The Muselievo falcon was much larger than *F. subbuteo* and *F. tinnunculus* (Table III). A specimen of a female *F. peregrinus* compared was larger, but taking in account the sexual dimorphism in size, it seems that the Muselievo falcon was of similar size as a male *F. peregrinus*.

Tetraonidae VIGORS, 1825

Lagopus aff. atavus JÁNOSSY, 1974

M a t e r i a l. Humerus dex. prox. N 422 (Fig. 5).

M e a s u r e m e n t s. Table IV (Fig. 6).

C o m p a r i s o n a n d d i s c u s s i o n. The fragment shows the general shape and characteristic features of the humeral bones of Galliormes. N 422 differs from Cracidae and Meleagrididae both dimensionally and in the morphology. The find from Muselievo, as well as the Tetraonidae species, differs from the Phasianidae species (including the medium-sized taxa of *Alectoris*, *Perdix*, *Phasianus*, *Gallus*) in the round, not angular and shallow contour of the clipping of the incisura capitis on the lateral surface. The similarity with the Tetraonidae species is very distinct. As JÁNOSSY (1974) writes, "for detailed comparison and for systematical identification the proximal end of the humerus is especially convenient." (p. 534). The bone under study differs from all *Tetrao* species (including those of the *Tetrao tetrix* lineage) by its smaller size and the slight constriction of caput humeri on the lateral surface. The species of genus *Bonasa* STEPHENS, 1819, were not compared, but the relative data on the skeleton proportions also indicate significant differences. JÁNOSSY (1974) states that the Nearctic genera of Tetraonidae (*Centrocercus* SWAINSON, 1832, *Dendragapus* ELLIOT, 1864, *Tympanuchus* Gloger, 1842 and *Bonasa*) and the g. *Falcapennis* ELLIOT, 1864 (N. America, E Asia) have different osteometrical proportions. (widths of the proxi-

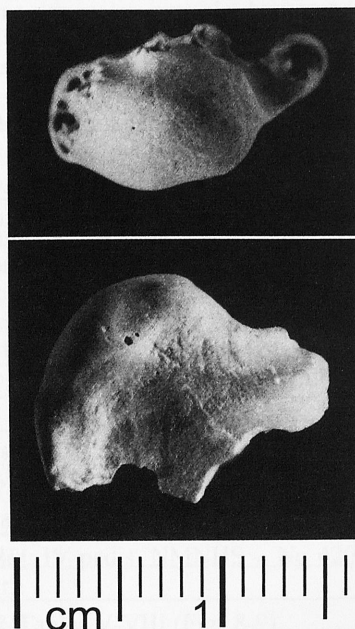


Fig. 5. *Lagopus aff. atavus* – humerus dex. prox. N 422: proximal view (upper) and cranial view (lower) (Photo. Boris ANDREEV).

Table IV

Comparison of the measurements of the proximal part of the humerus of the fossil from Muselievo and various recent Galliformes: a – length of caput humeri, b – width of proximal epiphysis, c – width of caput humeri, d – maximum width of proximal epiphysis; *measurements after JÁNOSSY (1974); **measurements after BOCHEŃSKI (1991); ***difference due to the manner of measuring. Numbers in brackets – estimated measurement in the case of damage of bone. The manner of measuring is shown in Fig. 6.

Species	a	b	c	d
Fossil				
<i>Lagopus aff. atavus</i> NMNHS 422 – Muselievo (N Bulgaria)	11.6	(16.0)	6.4	8.7
<i>Lagopus atavus</i> – Rebielice Królewskie I (S Poland)*	–	16.0 ***	–	–
<i>Lagopus atavus</i> – Rebielice Królewskie I (S Poland)**	–	15.7***	–	–
Recent				
<i>Lagopus lagopus</i> NMNHS 1/1986	10.8	15.6	5.8	7.6
<i>Lagopus lagopus</i> NMNHS 2/1999	10.8	15.6	5.8	7.6
<i>Lagopus lagopus</i> UCBL KF/4	11.8	17.4	6.9	–
<i>Lagopus lagopus</i> *	–	16.5	–	–
<i>Lagopus lagopus</i> ** (range)	–	14.9-18.9	–	–
<i>Lagopus mutus</i> *	–	16.0	–	–
<i>Lagopus mutus</i> UCBL 122/1	11.0	15.3	6.3	–
<i>Lagopus mutus</i> UCBL 40	10.4	15.3	6.2	–
<i>Lagopus mutus</i> UCBL KG/3	–	–	6.1	–
<i>Lagopus mutus</i> UCBL 40	–	–	–	6.4
<i>Lagopus mutus</i> UCBL (07.06.1964)	–	–	–	6.2
<i>Lagopus mutus</i> UCBL (24.10.1965)	–	–	–	6.0
<i>Lagopus mutus</i> UCBL (07.11.1945)	–	–	–	6.0
<i>Lagopus mutus</i> *** (range)	–	14.4-16.6	–	–
<i>Tetrao tetrix</i> NMNHS 1/1982	15.6	22.3	9.0	9.8
<i>Tetrao tetrix</i> UCBL 123/2	–	–	–	8.7
<i>Tetrao tetrix</i> UCBL 123/2	14.9	21.1	8.4	–
<i>Tetrao tetrix</i> UCBL KG/2	14.0	20.1	7.8	–
<i>Centrocercus urophasianus</i> *	–	23.5	–	–
<i>Dendragapus obscurus</i> *	–	20.0	–	–
<i>Tympanuchus cupido</i> *	–	21.0	–	–
<i>Dendragapus canadensis</i> *	–	15.0	–	–
<i>Bonasa umbellus</i> *	–	16.0	–	–
<i>Bonasa bonasia</i> *	–	14.2	–	–
<i>Alectoris graeca</i> NMNHS 3/1989	9.8	13.8	4.8	6.0
<i>Alectoris graeca</i> UCBL	10.9	14.2	5.6	–
<i>Perdix perdix</i> NMNHS 5/1989	9.6	13.4	5.3	5.7
<i>Perdix perdix</i> UCBL 129/1	10.1	13.7	5.6	–
<i>Coturnix coturnix</i> NMNHS 24/1993	5.7	7.9	3.3	3.4
<i>Gallus gallus</i> NMNHS 2/1989	11.9	16.3	6.8	7.2
<i>Numida meleagris</i> NMNHS 1/1990	14.6	20.0	8.7	9.5
<i>Phasianus colchicus</i> NMNHS 22/1989	13.9	13.7	8.2	8.9

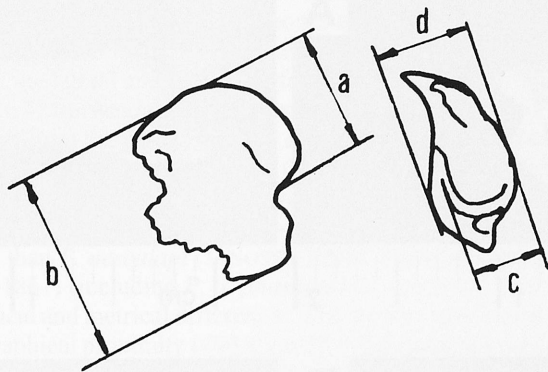


Fig. 6. The manner of measuring of the distal part of humerus in Tetraonidae – for Table IV (Drawing: Vera HRISTOVA).

mal epiphysis of the humerus of these taxa are given in Table IV for comparison). The find has shallower sulcus ligamenti transversus and wider incisura capitis than *L. mutus* and less prominent caput humeri in comparison with *L. lagopus* and *L. mutus*. It differs from *L. lagopus* in the relatively thicker caput humeri (measurement “c” of Table IV) and better distinction of caput humeri from the remaining part of the epiphysis proximalis on the lateral surface of the bone. *Lagopus atavus* JÁNOSSY, 1974 from the Late Pliocene (“Middle Villafranchian”), dated MN 16 (BOCHENSKI, 1996) from S Poland, compared with the Late Pliocene find from Muselievo (MN 15) dimensionally (Table 4 of present paper and Table II of JÁNOSSY (1974)) and morphologically (compared with Fig. 6 of Plate XXIV of JÁNOSSY (1974)), permits the supposition of taxonomic identity of the Muselievo find with *Lagopus atavus* JÁNOSSY, 1974. The Middle Villafranchian (MN zone 17) *Lagopus balcanicus* BOEV, 1995, from W Bulgaria is known from 53 bone fragments (BOEV, 1995; 1999-a): rostrum praemaxillae, vertebrae cervicales, scapula, humerus, ulnae, radius, carpometacarpus, phalanx prox. dig. majoris, furcula, sternum, synsacrum – corpora vertebrae, phalanges digitorum pedis, femur, and tibiotarsus. This species, besides its chronostratigraphical differences (ca. 2 M.Y.), was larger than recent *L. mutus* and even *L. lagopus* (BOEV 1999 a). According to BOCHENSKI (1991), *L. atavus* lies “within the limits of both recent Eurasian species ...” (p. 566; Table II). The same author enlarges the osteological description of *L. atavus* based on distal tibiotarsus and the proximal humerus. JÁNOSSY (1974) described two discriminating features in the proximal part of the humerus of *Lagopus atavus*. They are the presence of a groove in the place of the eminentia musculi latissimi dorsi, and the presence of a foramen on the inner side of epiphysis. The former character only was accepted by BOCHENSKI (1991), but that part of the bone is not preserved in the Muselievo specimen, hence cannot be compared. On the other hand, the measurements of the *L. atavus* specimen from Bulgaria (Table IV) agree with data of BOCHENSKI (1991). As seen from Table IV of BOCHENSKI (1991), the find from Muselievo is among the oldest records of g. *Lagopus*. Moreover, the site of Muselievo marks the southernmost locality of g. *Lagopus* in the Tertiary.

Phasianidae VIGORS, 1825

Pavo bravardi (GERVAIS, 1849)

M a t e r i a l. Phalanx 2 dig. II pedis – NMNHS, No 418; phalanx 2 dig. III pedis – NMNHS, No 419; phalanx 3 dig. IV pedis, NMNHS – No 420; phalanx distalis dig. I pedis – NMNHS, No 421 (Fig. 7 A-H).

M e a s u r e m e n t s. Tables V-VIII (Figs 8-9).

C o m p a r i s o n. Fossils were compared with skeletons of the following species: *Pavo cristatus* – UCBL 455/2; 1923-2257; *Pavo muticus* – UCBL I-73. Additionally listed are the meas-

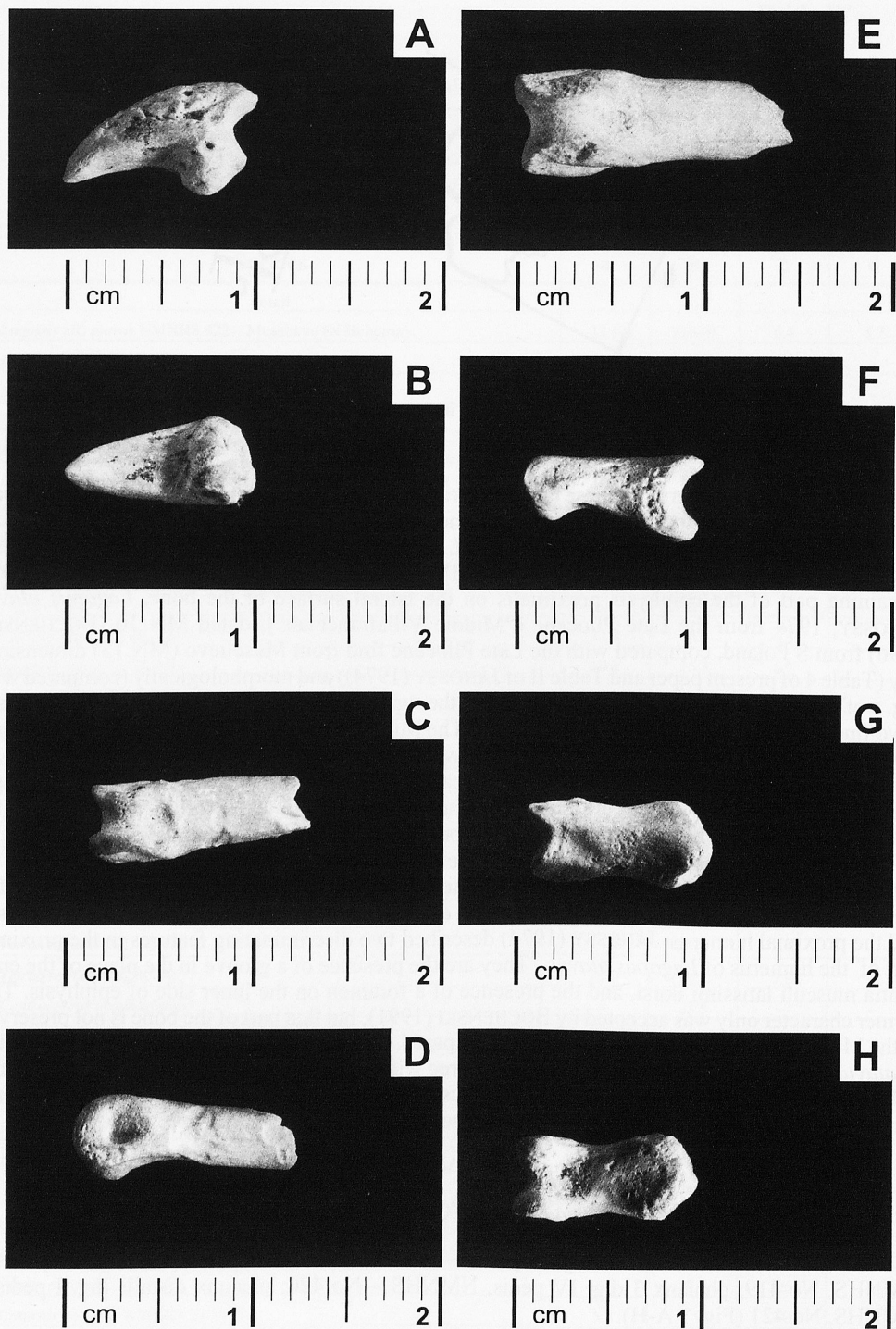


Fig. 7. *Pavo bravardi*: phalanx dist. dig. 1 pedis, NMNHS-421, lateral view (A) and ventral view (B); phalanx 2 dig. III pedis, NMNHS-419, dorsal view (C) and lateral view (D); phalanx 2 dig. II pedis, NMNHS-418, dorsal view (E); phalanx 3 dig. IV pedis, NMNHS-420, lateral view (F), dorsal view (G), and ventral view (H) (Photo. Boris ANDREEV).

urements of 10 specimens of *P. cristatus*, *P. muticus*, and *P. bravardi* measured by Dr. MOURER-CHAUVIRÉ. The general shape of the bones and the articular details in morphology fully correspond to these of the peafowls (g. *Pavo*). The find No 421 differs from *P. cristatus* in the better developed grooves on the lateral and medial surfaces at the distal end. The facies articularis interphalangealis of find No 421 in caudal view has less developed incisurae for the trochleae (shallower foveae articulares phalangis) than those of *Pavo cristatus*. Metrically (total length of the phalanx), the find No 418 is not very far from *P. aesculapi* (Table V), but that species is known from an older age – MN 12-13 from S Greece (MLÍKOVSKÝ 1996 b), 6 to 5 Ma, and is much smaller in size than *P. bravardi* (JÁNOSSY 1976). *P. bravardi* is enormous and *P. moldavicus* BOCHENSKI & KUROCHKIN, 1987, is “also larger” than *P. aesculapi* (JÁNOSSY 1991). Thus, the taxonomic identity with *Pavo aesculapi* (GAUDRY, 1861) (including *P. a. phasianoides* JÁNOSSY, 1991) is excluded because of the chronostratigraphical and metrical differences. The morphological and morphometric similarity and the relative geographical proximity (490 km) of the Bulgarian site of fossil peafowl finds to the Moldavian site of that species permit to refer the four peafowl phalanges from Muselievo to *P. bravardi*.

The genus *Pavo* LINNAEUS, 1758 is represented by two recent species – *P. cristatus* LINNAEUS, 1758, and *Pavo muticus* LINNAEUS, 1766. *P. cristatus* is naturally spread chiefly in the Indian Peninsula and Sri Lanka, while *P. muticus* still survives in some regions of the western parts of Indochina. The third species of peafowl, separated in a distinct genus, *Afropavo congensis* CHAPIN, 1936, has a restricted range in C & CE Zaire (DELACOUR 1977; MCGUROCHKIN 1994). It is supposed that the separation into the two recent genera occurred during the Miocene (MOURER-CHAUVIRÉ, 1989).

Until recent *Pavo bravardi* was the only known fossil species of the genus *Pavo*. Formerly it had been described as *Gallus bravardi* by P. GERVAIS, but MOURER-CHAUVIRÉ (1989; 1990) has proved its belonging to *Pavo*. Thus, the stratum typicum of *P. bravardi* is Lower Villanyian, MN 16 (MOURER-CHAUVIRÉ 1990). JÁNOSSY (1991) moved *Gallus aesculapi* GAUDRY, 1861, to the genus *Pavo* and has proposed the name *Pavo aesculapi phasianoides* for the Late Miocene materials from Polgardi in W Hungary, dated MN 13 (MLÍKOVSKÝ, 1996 c). In addition, BOCHENSKI and KUROCHKIN (1987) described from the “Moldavian Roussillon” a new species from Lucheshty (S Moldova), *Pavo moldavicus*, after a sternal part of a coracoid. Later it was considered as a junior synonym of *P. bravardi* (MOURER-CHAUVIRÉ 1989; 1990; BOCHENSKI 1997). This find can be dated MN 15 zone (P. MEIN and C. MOURER-CHAUVIRÉ – pers. comm.), i.e. the 2nd half of the Early Pliocene. TCHERNOV (1962) notes that the holotype of *Phasianus hermonis* BATE 1937, shows a certain resemblance to *Pavo*. This species was described by a proximal tarsometatarsus from the Upper Palaeolithic of Palestine, but no further examinations of it were carried out. *P. bravardi* is established in 4 localities from France (Fig. 10): 1) Serrat-d'en-Vacquer, near Perpignan (Pyrenees-Orientales), Late Ruscinian, MN 15 – tarsometatarsus sin.; 2) Ardé, Montagne de Perrier near Issoire, MN 16, 2,6-2,35 Ma – a diaphysal fragment of a tarsometatarsus sin.; 3) Saint-Vallier, near Valence, Drome, Late Villanyian, MN 17 – humerus sin., coracoid dex. dist., femur sin. prox., and posterior phalanx; 4) Seneze, near Domeyrat and Brioude (Haute-Loire), Late Pliocene, MN 17 – femur dex. dist., tibiotarsus dex., tarsometatarsus dex., metatarsal I, and 7 posterior phalanges (MOURER-CHAUVIRÉ, 1990; 1993; 1996). *P. bravardi* was the largest bird in the European Pliocene (MN 15-17) woodland avifauna. It was the largest avian species established at those four sites from France (MOURER-CHAUVIRÉ, 1990). (The body length of the males of recent *Pavo* species is 180-300 cm and the body mass – 4-6 kg /DELACOUR, 1977; MCGOWAN, 1994/). In the diagnosis of *Pavo moldavicus* (i.e. of *P. bravardi*) BOCHENSKI & KUROCHKIN (1987 p. 80) write: “The size is distinctly larger than any living species (15 % larger than the largest bone of *P. muticus*).”. Unfortunately, these authors cited bone measurements of only two non-aged and non-sexed specimens of *P. muticus*. As is known, the osteometrical differences among sexes in many phasianids, including peafowls, are significant.

Table V

The measurements of phalanx II dig. 2 pedis in fossil and recent members of *Pavo*: a - ticknes in the base of the phalangeal condyle; b – diameter of the phalangeal condyle; c – minimum heigth of distal articular face; d – maximum width of distal articular face; e – total length; f – ticknes in the middle; g – width of the proximal articular face. The manner of measuring is shown in Fig. 8.

Species	a	b	c	d	e	f	g
Fossil – Muselievo							
<i>Pavo bravardi</i> MNMHS 418	3.0	3.9	3.3	4.2	ca.16.0	3.2	–
<i>Pavo aesculapi phasianoides</i> (Polgardi, W Hungary; JANOSSY, 1976)	–	–	–	–	15.4	–	–
Recent							
<i>Pavo cristatus</i> UCBL 455/2	3.1	3.2	2.8	4.3	18.0	3.0	5.1

Table VI

The measurements of phalanx II dig. 3 pedis of fossil and recent *Pavo*. For explanations see Table V. The manner of measuring is shown in Fig. 8.

Species	a	b	c	d	e	f	g
Fossil							
<i>Pavo bravardi</i> MNMHS 419 – Muselievo	2.6	5.0	4.1	5.5	c.19.5	3.5	–
<i>Pavo bravardi</i> MNHB (Seneze)	–	–	–	–	23.6	–	–
<i>Gallus</i> sp. (Ostramos – 1)					17.5	3.2	–
Recent							
<i>Pavo cristatus</i> UCBL 455/2	2.8	4.7	3.9	5.5	20.0	4.2	7.5
<i>Pavo cristatus</i> 1024 (Regalia coll.)*	–	–	–	6.1	22.7	4.6	c.8.0
<i>Pavo cristatus</i> UCBL 1923-2257	–	–	–	6.3	21.5	4.4	8.6
<i>Pavo cristatus</i> 18 894 (BRODKORB coll.)*	–	–	–	4.7	19.8	3.7	6.1
<i>Pavo cristatus</i> NHML*	–	–	–	6.0	c.22.0	4.9	9.5
<i>Pavo muticus</i> UCBL (I-73)	–	–	–	6.5	22.0	–	9.0
<i>Pavo muticus</i> NHML*	–	–	–	6.7	23.9	4.9	c.10.0
<i>Pavo muticus</i> 18912 (BRODKORB)*	–	–	–	5.2	22.0	4.0	6.4

* Measured by Dr. C. MOURER-CHAUVIRÉ

The habitats of *Pavo bravardi*: The paleobotanical analysis of the localities shows the presence of some thermophilous elements exotic for Europe whose endemic analogues now are spread in Caucasus, Japan, Himalayas, Southeast Asia, or Central America: *Cathaya*, *Sciadopitys*, *Pterocarya*, *Parrotiopsis* cf. *jacquemontiana*, *Microtropis fallax* (MOURER-CHAUVIRÉ, 1989). The remains of cervids are numerous at those sites and they are indicators of woodland with scattered trees. A considerable abundance of finds of Cervidae has also been established in the site of Muselievo (N. SPASSOV – pers. comm.). The fluviatile, loessic, or lacustrine sites were among the preferred habitats of *P. bravardi* (MOURER-CHAUVIRÉ, 1990). As that author concludes, the European peafowls disappeared soon after the first cold phases of Pretiglian. The open forest with undergrowth along streams, open woodlands, forest edge, and riverine forest from sea level up to 1000 m are also the favoured habitats of the two recent species of peafowl.

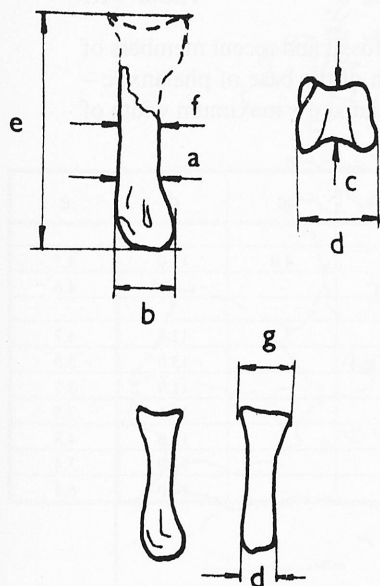


Fig. 8. Manner of measuring phalanges II-IV digitorum pedis in Phasianidae – for Tables V-VII (Drawing: Vera HRISTOVA).

Table VII

The measurements of phalanx III dig. 4 pedis of fossil and recent *Pavo*. For explanations see Table V. The manner of measuring is shown in Fig. 8.

Species	a	b	c	d	e	f	g
Fossil							
<i>Pavo bravardi</i> NMNHS 420 – Muselievo	2.6	3.2	2.4	4.4	9.7	3.1	4.5
<i>Pavo bravardi</i> MNHB (Seneze)	–	–	–	4.3	10.8	4.0	5.0
Recent							
<i>Pavo cristatus</i> UCBL 455/2	–	–	–	4.3	9.3	3.7	4.8
<i>Pavo cristatus</i> UCBL 1923-2257	–	–	–	–	9.5	3.8	5.0
<i>Pavo cristatus</i> 18 894 (BRODKORB coll.)*	–	–	–	3.9	9.3	3.4	4.3
<i>Pavo cristatus</i> NHML*	–	–	–	4.3	10.1	3.9	5.4
<i>Pavo cristatus</i> 1024 (Regalia coll.)	–	–	–	4.4	10.5	4.1	5.2
<i>Pavo muticus</i> NHML*	–	–	–	4.6	10.2	4.1	5.4
<i>Pavo muticus</i> UCBL (1 – 73)	–	–	–	4.5	10.8	4.0	5.4
<i>Pavo muticus</i> 18 512 (BRODKORB coll.)*	–	–	–	4.2	11.1	3.3	4.4

*Measured by Dr. C. MOURER-CHAUVIRÉ.

Passeriformes indet.

M a t e r i a l. carpometacarpus dex. – fragment of os metacarpale majus, size of the Lark N NMNHS 1614; femur sin. – fragment of diaphysis, size of the Great Tit. N NMNHS 1619;

Aves indet.

M a t e r i a l. phallanx dig. alulae/minoris/majoris N NMNHS 1613; tarsometatarsus dex. – fragment of diaphysis, N NMNHS 1617-1618; humerus/femur – splinter of diaphysis, N NMNHS 1616; phallanx dig. pedis, N NMNHS 1612. All these fragments belonged to small birds of size between sparrow and starling.

Table VIII

The measurements of distal phalanx dig. I pedis of fossil and recent members of the genus *Pavo*: a – basal length of phalanx, b – height of the base of phalanx, c – length of facies articularis, d – maximum length of phalanx, e – maximum width of phalanx. The manner of measuring is shown in Fig. 9.

Species	a	b	c	d	e
Fossil					
<i>Pavo bravardi</i> NMNHS 421 – Muselievo	9.5	3.7	4.0	11.0	4.7
<i>Pavo bravardi</i> MNHB(Seneze)	–	–	–	c.15.0	4.6
Recent					
<i>Pavo cristatus</i> UCBL 455/2	11.7	4.5	5.5	12.8	4.7
<i>Pavo cristatus</i> UCBL 1923-2257	–	–	–	13.0	5.0
<i>Pavo cristatus</i> 18 894 (BRODKORB coll.)*	–	–	–	11.0	3.7
<i>Pavo cristatus</i> NHML	–	–	–	16.1	7.5
<i>Pavo muticus</i> UCBL (I – 73)	–	–	–	15.0	4.8
<i>Pavo muticus</i> 18 512 (BRODKORB coll.)*	–	–	–	11.0	3.4
<i>Pavo muticus</i> NHML*	–	–	–	14.0	6.4

*Measurements of Dr. C. MOURER-CHAUVIRÉ.

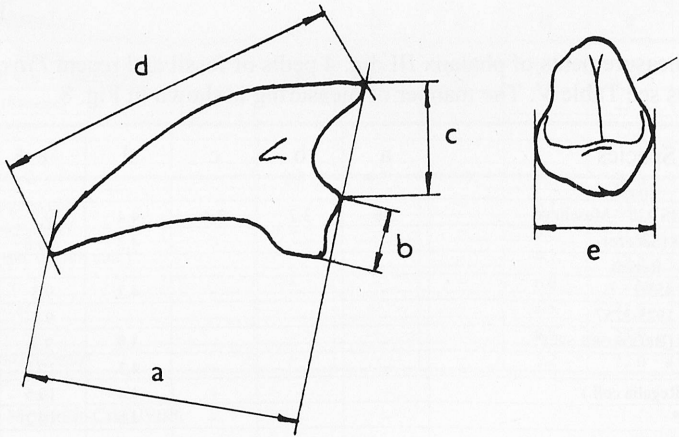


Fig. 9. Manner of measuring phalanx dist. dig. I pedis in Phasianidae for Table VIII (Drawing: Vera HRISTOVA).

V. GENERAL COMMENTS

As is seen, the fossil avifauna of Muselievo is very scanty. In spite of the small number of the avian finds, 4 orders at least are found: Accipitriformes, Falconiformes, Galliformes and Passeriformes.

The find of *Accipiter* sp. is the oldest record of the g. *Accipiter* so far and provides the second fossil species of that genus. The established morphological and, possibly, taxonomical, differences probably suggest a distinct ancestral form of the same evolutionary lineage as the recent *A. gentilis*.

The find of *Lagopus* aff. *atavus* is among the oldest records of g. *Lagopus* and marks the southernmost distribution of g. *Lagopus* in the Tertiary. Most interesting is the coexistence of *Lagopus*

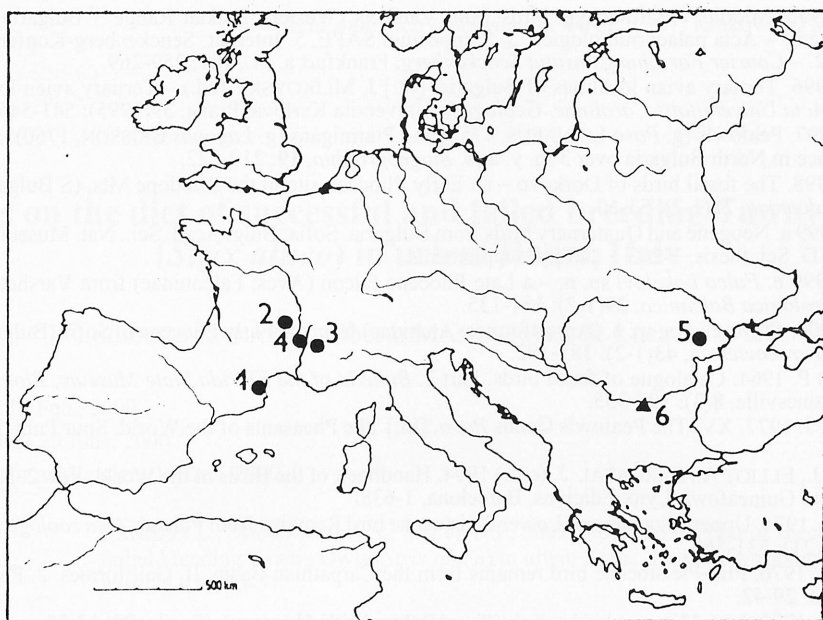


Fig. 10. Geographical distribution of *Pavo bravardi* in the European Plio-Pleistocene: 1 – Serrat-d'en-Vacquer; 2 – Ardé; 3 – Saint-Vallier; 4 – Seneze (France: MOURER-CHAUVERÉ, 1990); 5 – Lucheshty (Moldova: BOCHENSKI, KUROCHKIN, 1987); 6 – Muselievo (Bulgaria: present paper) (Drawing: Vera HRISTOVA).

and *Pavo* in the Early Pliocene of SE Europe. It reveals an association that has not hitherto been known (BOEV 1997).

The stratigraphical distribution of European peafowls encompasses MN 15 to MN 17 zones. The Bulgarian finds have approximately the same age as the oldest ones from Perpignan known so far. This suggests that the Bravard's peafowl roamed South-European forests, both in the West and the East of the continent, and possibly appeared there not later than the Late Miocene – Early Pliocene. The other European fossil peafowl, *P. aesculapi*, was possibly of more eastern distribution in the southernmost parts of East Europe, Asia Minor, and the Middle East, where it was spread much earlier than *P. bravardi*.

According to the MNI, the correlation between raptors and prey among the birds is 1:2, but the data available so far are insufficient for drawing any further conclusions about the structure of the palaeornithocoenosis of Muselievo.

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