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Presentation of so far undetermined bird remains from the Upper Miocene (MN13) of Polgárdi 4 and 5 (Fejér county, West Hungary)

Jenő (Eugen) Kessler[1] & Ida Horváth[2]*

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Abstract The authors have identified the mostly very fragmentary bird fossils from the uncatalogued material of the Hungarian Institute of Geology and Geophysics to the level that the condition of the bones allows. Almost half of the 102 bone pieces (42 fragments) could be completely or partially identified, while the rest (60 fragments represented either by bone fragments or by toe phalanges, claws, mandibles, etc.) could not be identified. The material identified includes taxa previously published and known from the site, but a good number of these are represented by other bones or parts of bones, as in previous publications (*Palaeortyx phasianoides* Milne-Edwards, 1869, *Palaeocryptonix hungaricus* Jánossy, 1991, *Porzana † kretzoii* Kessler, 2009, *Glaucidium † baranensis* Kessler, 2010, *Apus † baranensis* Jánossy, 1977, *Lullula † minor* Kessler, 2013, *Delichon † polgardiensis* Kessler, 2013, *Riparia † major* Kessler, 2013, *Sitta † gracilis* Kessler, 2013). The taxa identified at order, family or genus level are listed in the main text and complemented by one figure, as well as a rich bibliographic material.

Keywords: Hungary, Polgárdi, Upper Miocene, bird fauna

Összefoglalás A szerzők azonosították az előző vizsgálatokból fennmaradt (a Magyar Geofizikai és Földtani Intézetek nem leltározott anyagából származó), javarészt igen töredékes madárfossziliákat, olyan szintig, amit a csontok állapota megengedett. A 102 csonttöredék majdnem felét (42 darab) sikerült részben vagy teljesen azonosítani, míg a többit (amely 60 darab csonttöredék vagy lábujjpercek, karmok, mandibulák stb.) nem lehetett meghatározni. Az azonosított anyagban a lelőhelyről előzőleg már közölt és ismert taxonokat találunk, de ezek jórésze más csontokkal, illetve azok más részeivel is vannak képviselve, mint az előző publikációkban (*Palaeortyx phasianoides* Milne-Edwards, 1869, *Palaeocryptonix hungaricus* Jánossy, 1991, *Porzana † kretzoii* Kessler, 2009, *Glaucidium † baranensis* Kessler, 2010, *Apus † baranensis* Jánossy, 1977, *Lullula † minor* Kessler, 2013, *Delichon † polgardiensis* Kessler, 2013, *Riparia † major* Kessler, 2013, *Sitta † gracilis* Kessler, 2013). A csak rend, család, genus szintig azonosítottakat nem soroljuk itt fel, ezek megtalálhatóak a szövegben. A cikk szövegét egy táblakép, valamint gazdag szakirodalmi anyag egészíti ki.

Kulcsszavak: Magyarország, Polgárdi, késő-miocén, madárfauna

[1] Department of Paleontology, Eötvös Loránd University, 1117 Budapest, Pázmány Péter sétány 1/c, Hungary
[2] University of Sopron, Faculty of Forestry, Institute of Wildlife Management and Biology, 9400 Sopron, Bajcsy-Zsilinszky utca 4., Hungary
** corresponding author, e-mail: idahorvath03@gmail.com*

Introduction

Polgárdi is located in the western part of Hungary, in Fejér County. In the boundary of the village, there are quarries on the Somlyó and Kőszár hills at an altitude of 226 m above sea level. Tivadar Kormos published the fossil remains of sites 1 and 2 as early as 1911, while the bird material was published by Kálmán Lambrecht in 1912 and 1933 (Lambrecht 1912, 1933). In 1952, Miklós Kretzoi summarised the knowledge gained up to that time. In 1971 and 1984–85, sites 3 and 4 were discovered, and their material was described by Mathias Freudenthal and László Kordos in 1989. Finally, in 1988, site 5 became known.

Polgárdi 4 was discovered in 1984–1985 (Kordos 1991). This locality yielded a rich mammal and bird assemblage, of which both the mammal (Freudenthal & Kordos 1989) and bird fauna were published (Jánossy 1991). Polgárdi 5 was discovered in the NE part of the quarry system in 1988 (Kordos 1991) and the bird fauna was published by Dénes Jánossy in 1991 (Jánossy 1991). Previously, Jánossy reidentified from Locality 2 the carpometacarpus of *Gallus* sp.? as *Gallus aesculapi* Gaudry, 1862 (Jánossy 1976) and the complete *carpometacarpusus* of *Mergus* sp. ? as *Anas albae* Jánossy, 1979 (Jánossy 1979). The list of the bird fauna from Polgárdi 4 and Polgárdi 5 (Jánossy 1991, 1995) includes the following taxa: *Palaeocryptonix hungaricus* Jánossy, 1991; *Pavo aesculapi phasianoides* Jánossy, 1991; *Porzana estramosi veterior* Jánossy, 1991; *Rallicrex polgardiensis* Jánossy, 1991; *Otis* aff. *khosiatzkyi* Bochenski *et* Kurochkin, 1987; *Capella* sp. ? *Cursorius* sp., *Tringa* sp., *Tyto campiterrae* Jánossy, 1991; *Chaetura* aff. *baconica* Jánossy, 1977; *Motacilla* sp., *Acrocephalus* sp. I. (’*arundinaceus’*), *Acrocephalus* sp. II., *Cettia* sp., *Sylvia* sp., *Turdus* sp. (’*iliacus*’), *Luscinia* sp., Fringillidarum gen. *et* sp. indet., *Corvus* sp. (Jánossy 1991, 1995).

From the unidentified material, the author identified and published the following taxa in 2009 and 2010: *Egretta polgardiensis* Kessler, 2009 (P4); *Anas. clypeata* L. 1758 (P4, 5), Anatidae indet. (P4, 5), *Buteo* sp. (P4), *Falco* cf. *cherrug* Gray, 1834 (P4), *Falco tinnunculus atavus* Jánossy, 1972 (P5), *Palaeortyx gallica* Milne-Edwards, 1869 (P4, 5), *Palaeortyx brevipes* Milne-Edwards, 1869 (P4, 5); *Palaeortyx phasianoides* Milne-Edwards, 1869 (from *Pavo aesculapi phasianoides*) (P4, 5); Galliformes indet. (P4, 5), *Porzana estramosi* Jánossy, 1979 (P4, 5); *Porzana kretzoii* Kessler, 2009 (P4); *Rallicrex polgardensis* Kessler, 2009 (P4, 5); *Otis kalmani* Jánossy, 1972 (P4); *Calidris janossyi* Kessler, 2009 (P5); *Gallinago veterior* Jánossy, 1979 (P4); *Charadrius lambrechti* Kessler, 2009 (P4); *Limosa* sp. (P5), *Tringa* sp. (P4), *Tyto campiterrea* Jánossy, 1991 (P4); *Athene noctua veta* Jánossy, 1992 (P4); *Surnia robusta* Jánossy, 1977 (P4, 5); *Cuculus pannonicus* Kessler, 2010 (P4); *Apus baranensis* Jánossy, 1977 (P4); *Chaetura baconica* Jánossy, 1977 (P4); *Anthus* sp. (P4), *Motacilla* sp. (P5), *Parus* sp. 1, 2 (P4), *Muscicapidae* gen. *et* sp. indet. (P5), *Luscinia* sp. (P4), *Turdus* sp. (P4, 5), *Bombycilla* sp. (P4, 5), *Acrocephalus* sp. (P4), *Prunella* sp. (P4), *Troglodytes* sp. (P4), *Certhia* sp., (P4), *Sitta* sp. (P5), *Lanius* sp. 1, 2 (P5), *Corvus pliocaenus* (P5), *Corvus* sp. indet. (P4), *Miocorvus larteti*, Milne-Edwards, 1871 (P4); *Sturnus* sp. (P4), *Fringillidae* sp. (P5), *Emberizidae* sp. indet. (P5), Passeriformes indet. (P4), Aves indet. (P4, 5) (Kessler 2009a, 2009b, 2010).

From this material, the following extinct new species have been identified and are described by Eugen Kessler (Kessler 2013a, 2013b): *Alauda tivadari* 2013; *Lullula minor* 2013;

Calandrella gali 2013; *Hirundo gracilis* 2013; *Delichon polgardiensis* 2013; *Riparia minor* 2013; *Aegithalos gaspariki* 2013; *Sitta gracilis* 2013; *Tichodroma capeki* 2013; *Muscicapa miklosi* 2013; *Luscinia denesi* 2013; *Saxicola lambrechti* 2013; *Oenanthe kormosi* 2013; *Turdicus pannonicus* 2013; *Turdus miocaenicus* 2013; *Turdus polgardiensis* 2013; *Cettia janossyi* 2013; *Acrocephalus major* 2013; *Acrocephalus minor* 2013; *Hippolais veterior* 2013; *Sylvia intermedia* 2013; *Locustella kordosi* 2013; *Phylloscopus venczeli* 2013; *Anthus híri* 2013; *Motacilla intermedia* 2013; *Bombycilla brevia* 2013; *Troglodytes robustus* 2013; *Cinclus gaspariki* 2013; *Prunella freudenthali* 2013; *Lanius capeki* 2013; *Sturnus brevis* 2013; *Passer híri* 2013; *Carduelis kretzoii* 2013; *Carduelis lambrechti* 2013; *Pyrrhula gali* 2013; *Fringilla kormosi* 2013; *Emberiza pannonica* 2013; *Emberiza polgardiensis* 2013; *Plectrophenax veterior* 2013.

The species lists are complementary and suggest a very diverse and complex environment. In addition to the numerous open water species, wading birds, coastal sand, gravel but also shingle habitats, extensive grassland and woodland are indicated. A significant proportion of the new songbird species lived in wooded environments.

The as yet undetermined and uncatalogued, mostly very small and fragmentary bones located in the Hungarian Institute of Geology and Geophysics (HIGG) collection, have been identified by the authors and are published in this paper. As most of the material is highly fragmentary and not previously identified by J. (E). Kessler (Kessler 2013a, 2013b), the present study was also only able to identify a few bones or bone fragments to species level, the rest could only be identified to order, family or genus level. They can be compared with the characters and sizes of species already reported from the sites and their affiliations can be assumed.

Abrevations: HIGG – Hungarian Institute of Geology and Geophysics; † – fossil species; Q1-Q2 – Lower Pleistocene.

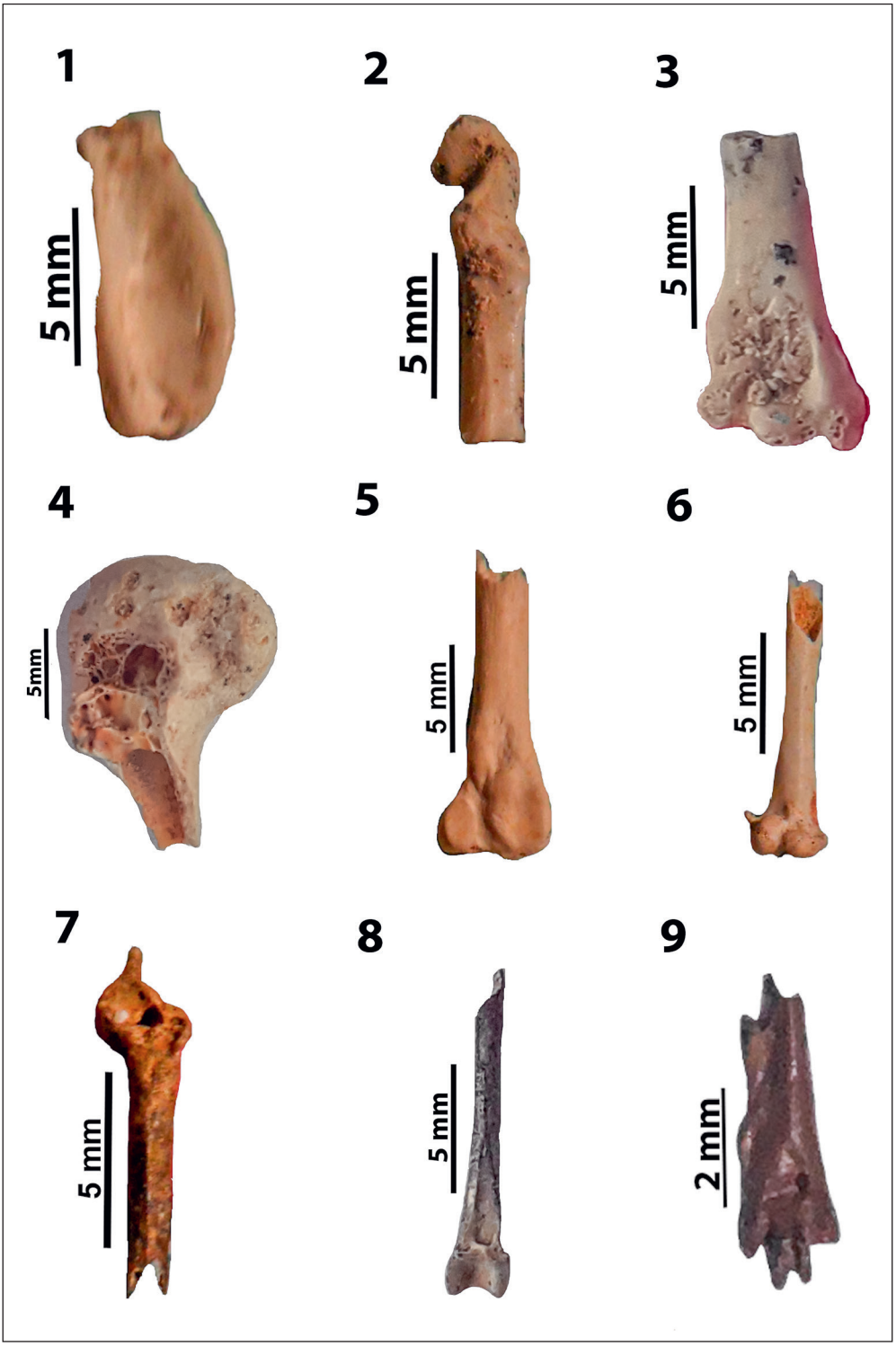
Anatomical terminology: after Lambrecht (1933), Baumel *et al.* (1979), Gilbert *et al.* (1981), Kessler (2013a).

Method of measurement: (after: von den Driesch 1976, Kessler 2013a). A=TL – total length; B=PL – partial length; C=Bp – breadth of the proximal end; C1=partial breadth of the proximal end; D=partial length of the proximal end; E=Sc – breadth of the corpus; E1=partial breadth of the corpus; F=Bd – breadth of the distal end; G=thickness of the distal end; H=height of the distal end.

Systematic

Ord. Galliformes (Temminck), 1820
Fam. Phasianidae (Vigors, 1825)
***†Palaeortyx phasianoides* Milne-Edwards, 1869** */ †Palaeoperdix longipes* Milne-Edwards, 1869 / *Coturnix † longipes* Mlíkovskỳ, 2002 *(Figure 1/1)*

Site and era: Polgárdi 4 and 5, Upper Miocene (MN13)


1
5 mm
2
5 mm
3
5 mm
4
5mm
5
5 mm
6
5 mm
7
5 mm
8
5 mm
9
2 mm

Material: complete juvenile *humerus* (P4); *phalanx proximalis digiti majoris* and 3 distal fragment of *tibiotarsus* (P5)

Dimensions (in mm): *humerus* A-30.82 mm; B-7.49 mm; C-7.25 mm; E-2.29 mm; F-4.44 mm; *phalanx ungularis* A-10.10 mm; C-2.64 mm; E-4.62 mm; F-3.29 mm; *tibiotarsus* (3) 3.54–4.18 mm; F-6.71–7.48 mm; G-7.23–8.84 mm. (HIGG)

Typical pheasant-like, Grey Partridge-sized bones. The *humerus* is from an underdeveloped juvenile specimen. There are no data in the literature for the wing fingertip, but its characters and dimensions are consistent with the species indicated.

Based on size, it is considered to be the largest *Palaeortyx* species (Göhlich & Mourer-Chauviré 2005).

It has been reported from numerous sites from the Late Oligocene (MP28) Desse in France, through Germany and the Czech Republic, to the Late Miocene of the Carpathian Basin. It is also known from the Late Miocene of Spain, from the Early Miocene of Litke 2 (MN5) (Kessler & Hír 2012a) and from the Late Miocene of Rudabánya (MN9) (Kessler 2009b).

***†Palaeocryptonix* (Depéret 1892)**

***†Palaeocryptonix hungaricus* Jánossy, 1991** *(Figure 1/2)*

Site and era: Polgárdi 5, Upper Miocene (MN13)

Material: 3 fragments of *coracoideum*, 3 *radius* and 2 *tibiotarsus*

Dimensions (in mm): *coracoideum* A-ap. 24.00 mm; C-3.11 mm; D-3.25 mm; E (3) -1.77–2.37 mm; F-5.12 mm; *radius* E-1.73–190 mm; F-2.93–3.39 mm; G-1.95–2.01 mm; *tibiotarsus* E-2.02 mm; F-3.02–3.19 mm; G-3.05–3.19 mm

The quail-sized endemic fossil species is known only from the Carpathian Basin: Rátka, Upper Miocene (MN12/13) (Kessler 2009b); Polgárdi 4, 5, Upper Miocene (MN13)

Figure 1. 1. *Palaeortyx phasianoides* (Milne-Edwards, 1871) – Polgárdi 5, *phalanx proximalis digit majoris* (right side, dorsal surface); 2. *Palaeocryptonix hungaricus* Jánossy, 1991 – Polgárdi 5, *coracoideum* (left side, medial aspect); 3. *Porzana kretzoii* (Kessler, 2009) – Polgárdi 5, *humerus* (fragment distal, right side, cranial aspect); 4. *Glaucidium baranensis* (Kessler, 2009) – Polgárdi 5, *humerus* (fragment proximal, left side, caudal surface); 5. *Apus baranensis* (Jánossy, 1977) – Polgárdi 5, *femur* (fragment distal, left side, caudal aspect); 6. *Lullula minor* (Kessler, 2013) – Polgárdi 5, *humerus* (distal fragment, left side, cranial aspect); 7. *Delichon polgardiensis* (Kessler, 2013) – Polgárdi 5, *ulna* (fragment proximal, left side, ventral aspect); 8. *Riparia major* (Kessler, 2013) – Polgárdi 5, *tibiotarsus* (fragment distal, left side, cranial aspect); 9. *Sitta gracilis (*Kessler, 2013) – Polgárdi 5, *tarsometatarsus* (fragment distal, left side, plantar aspect)

1. ábra 1. *Palaeortyx phasianoides* (Milne-Edwards, 1871) – Polgárdi 5, szárny ujjperc (jobboldali, dorzális nézet); 2. *Palaeocryptonix hungaricus* Jánossy, 1991 – Polgárdi 5, hollócsőrcsont (baloldali, mediális nézet); 3. *Porzana kretzoii* (Kessler, 2009) – Polgárdi 5, felkarcsont (jobboldali, disztális töredék, craniális nézet); 4. *Glaucidium baranensis* (Kessler, 2009) – Polgárdi 5, felkarcsont (baloldali, proximális töredék, caudális nézet); 5. *Apus baranensis* (Jánossy, 1977) – Polgárdi 5, combcsont (baloldali, diszttális töredék, caudális nézet); 6. *Lullula minor* (Kessler, 2013) – Polgárdi 5, felkarcsont (baloldali, disztális töredék, craniális nézet); 7. *Delichon polgardiensis* (Kessler, 2013) – Polgárdi 5, *singcsont* (baloldali, proximális töredék, ventrális nézet); 8. *Riparia major* (Kessler, 2013) – Polgárdi 5, lábszárcsont (baloldali, disztális töredék, craniális nézet); 9. *Sitta gracilis* (Kessler, 2013) – Polgárdi 5, csüd (baloldali, disztális töredék, plantáris nézet)

(Jánossy 1991, 1995); Beremend 26, Lower Pliocene (MN15) (Kessler 2009b), Beremend 17, 18; Lower Pleistocene (Q1) (Jánossy 1992, 1996).

J. Mlíkovskỳ (2002) places it in the taxon *Alectoris † donnezani* (Deperet, 1892), while Zelenkov places it in the new taxon *† Eurobambusicola turolicus* (Zelenkov 2016), but we doubt this. No records from other localities than those mentioned above.

Ord. Ralliformes (Reichenbach, 1852)
Family. Rallidae (Vigors, 1825)
***Porzana † kretzoii* Kessler, 2009** *(Figure 1/3)*
Site and era: Polgárdi 4 and 5, Upper Miocene (MN13)
Material: fragments of *humerus* (P5), *femur* (P5), 2 *tibiotarsus* (P4 and P5)
Dimensions (in mm): *humerus* E-2.33 mm; F-3.80 mm; G-2.26 mm; *femur* E-1.83 mm; F-3.93 mm; G-3.17; *tibiotarsus* E-1.68–1.96 mm; F-3.34–3.53 mm; G-2.97–3.03 mm

Smaller than the smallest extant species. It was already indicated from other skeletal parts in Polgárdi 4 and 5, from where it was described (Kessler 2009b). Two other fossil species are known from the Carpathian Basin: *Porzana † estramosi* Jánossy, 1979 [Mátraszőlős 1, Middle Miocene (MN7/8) (Gál *et al.* 1998–1999); Polgárdi 4, 5, Late Miocene (MN13) (Jánossy 1991, Kessler 2009b); Osztramos 9, Early Pliocene (MN15) (Jánossy 1979a, 1979b)] and *Porzana † matraensis* Kessler, 2009 [described from the Middle Miocene of Mátraszőlős 1 (Kessler 2009b)].

The three extinct species are known only from the Carpathian Basin. Crakes are rare in Neogene fossils. Their most recent records (*Porzana porzana* Linneaus, 1758, and *Porzana* sp.) are known outside the Carpathian Basin from the Pliocene-Pleistocene boundary (MN17/18) at Mallorca in Spain (Sondaar *et al.* 1995), Văršec in Bulgaria (Boev 1996), Voigstedt in Austria (Jánossy 1965) and Stránská skála (Q2) in the Early Pleistocene of the Czech Republic (Jánossy 1972, Mlíkovskỳ 1995).

Ord. Charadriiformes (Huxley, 1867)
Fam. Charadriidae (Bonaparte, 1831)
Charadriidae gen. *et* sp. indet.
Site and era: Polgárdi 4, Upper Miocene (MN13)
Material: distal fragment of *carpometacarpus*
Dimensions (in mm): E-2.52 mm; E1-1.61 mm; F-2.04 mm

This extremely distinctive distal fragment allows identification only to the family level, but its dimensions are most suggestive of the *Charadrius* genus. From the Late Miocene of Polgárdi 4 (MN13), a nearly intact right *coracoid* bone has been described (Kessler 2009b) as *Charadrius lambrechti* Kessler, 2009. Presumably, the present remains may belong to this fossil species, but this cannot be stated with certainty.

The *Charadrius* genus was known only from the Late Pliocene (MN16) onwards. The species *Charadrius morinellus* extant is mentioned by Jánossy from Rebielice, Poland (Jánossy 1974) and from Stránská skála (Q2) in the Early Pleistocene of the Czech Republic (Jánossy 1972), while *Charadrius* sp. from Beremend 15 (MN16) (Jánossy 1987), the latter possibly belonging to the extinct species.

Ord. Columbiformes (Latham, 1790)
Columbidae (Illiger, 1811)
Columbidae gen. *et* sp. indet.
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *tibiotarsus*
Dimensions (in mm): E-2.14mm; F-3.01 mm; G-3.19 mm

A fragment of the size of the extant *Streptopelia turtur* species size can only be identified to family level.

Representatives of the family are known only from the Early Pliocene throughout Europe. The oldest are *Columba omnisanctorum* Ballmann 1976 and *C. pisana* (Portis, 1889) from the Early and Middle Pliocene of Italy (MN14/15, MN15/16) (Portis 1889, Ballmann 1976).

Ord. Strigiformes (Wagler, 1830)
Fam. Strigidae (Leach, 1820)
***Glaucidium* Boie, 1826**
***Glaucidium † baranensis* Kessler, 2010** *(Figure 1/4)*
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: proximal fragment of *humerus*
Dimensions (in mm): C-8.47 mm; D-8.40 mm

The fossil species has been described from the Early Pliocene (MN15) of Csarnóta 2 and Beremend 26 (Kessler 2009b), including a proximal epiphysis of *humerus*.

It is a species of owl largely matching the size and character of the extant Pygmy Owl *(Glaucidium passerinum)*, which may have been the ancestor of the recens species in Europe and thus, also in the Carpathian Basin. On the proximal epiphysis of the *humerus*, the *crista bicipitalis* is more articulated, the *crus dorsale fossae* is more elongated and the *tuberculum ventrale* is blurred.

From outside the Carpathian Basin, Jánossy (1974) reports another *Glaucidium* sp. from the Late Pliocene of Rebielice (Poland (MN16)), otherwise only the extant species is known in fossil material from the Early Pleistocene onwards. The genus is known from only one Late Pliocene site in Florida (USA) (Inglis, Cytrus County, Florida) with one described species: *G. explorator* Emslie, 1998, with numerous skeletal parts, but only a fragmentary *proximal humerus*, corresponding to the size of the extant *G. brasilianum*. A *tibiotarsus* from the same material, with dimensions similar to those of extant *G. minutissimum* is also reported but only defined to genus level (Emslie 1998). An extinct species described from the Pleistocene of the Bahamas as *G. dickinsoni* Brodkorb, 1959, an extinct species of *tibiotarsus*, was subsequently (Olson 1985) synonymized with the recurrent species *Speotyto cunicularia* (Mollina, 1782). The ancestor of the Pygmy Owl was already present in the Eocene. It has been described from the Middle Eocene of Geiseltal in Germany from several *humerus* specimens under the name *Eoglaucidium pallas* Fischer, 1987 and is also indicated from the Middle Eocene of Messel, also in Germany (Fischer 1987, Mayr & Peters 1998, Mlíkovskỳ 2002).

Ord. Apodiformes (Peters, 1940)
Fam. Apodidae (Olphe – Galliard, 1887)

***Apus* Scopoli, 1777**

***Apus † baranensis* Jánossy, 1977 /? *Apus † wetmorei* Ballmann, 1976** *(Figure 1/5)*

Site and era: Polgárdi 5, Upper Miocene (MN13)

Material: distal fragment of *femur*

Dimensions (in mm): E-1.74 mm; F-4.29 mm; G-2.00 mm

Fossil species from Polgárdi 4, Upper Miocene (MN13) (Kessler 2010); Csarnóta 2, Lower Pliocene (MN15) (Kessler 2010); Beremend 5 (Jánossy 1977); Osztramos 20 (Kessler 2010); Upper Pliocene (MN16).

Typical swift-shaped, but smaller fossil species than the extant species. Mlíkovskỳ (2002) assigns it to the species *Apus wetmorei* Ballmann 1976 described from the Late Pliocene in Italy (Chiro 24, MN14/15) on the basis of its size. The bones subsequently identified from Csarnóta 2 (MN15), but mainly from Polgardi (MN13), suggest a species even smaller than the Italian one and even earlier in age. In our opinion, they are not identical species.

The genus is known from Europe only from the Middle Miocene of France (*Apus gaillardi* Ennouchi, 1930 – Grive-Saint-Alban, MN7/8). The extant species are known only from the Early Pleistocene (Czech Republic-Stránská skála, Q2).

Ord. Passeriformes (Linnaeus, 1758)

Family. Alaudidae (Vigors, 1825)

***Lullula † minor* Kessler, 2013** *(Figure 1/6)*

Site and era: Polgárdi 5, Upper Miocene (MN13)

Material: distal fragment of *humerus*

Dimensions (in mm): E-1.41 mm; F-3.51 mm; G-1.91 mm

The fossil species is also described from Polgárdi 4 and 5 (whole *ulna*, distal *humerus* and *tarsometatarsus* fragment) and corresponds in size with *Lullula minor* (Kessler 2013a, 2013b).

Three other fossil *Lullula* species have been described from the Carpathian Basin. *Lullula † neogradensis* Kessler *et* Hír, 2012 – from the Middle Miocene of Mátraszőlős 1 (MN7/8), *Lullula † parva* Kessler, 2013 – from the Early Pliocene of Csarnóta 2 and Beremend 26 (MN15), and – *Lullula † minuscula* Kessler, 2013 from the Early Pliocene of Beremend 26 (MN15). The first is much older, the second is larger and the third is smaller in size (Kessler 2013a, 2013b).

The genus is known from areas outside the Carpathian Basin through *Lullula* sp. from the Late Miocene (Boev 1996), the Late Pliocene (MN17) of Vǎršec and Slivnica (Boev 2000), also in Bulgaria as *Lullula slivnicensis* Boev, 2012 and *L. balcanica* Boev, 2012 (Boev 2012). An extant species has been reported from the island of Mallorca, Spain, from Late Pliocene – Early Pleistocene (MN18) material (Sondaar *et al*. 1995).

Alaudidae sp. indet.

Site and era: Polgárdi 4 and 5, Upper Miocene (MN13)

Material: 2 proximal and 2 distal fragments of *humerus* (P5), and distal fragment of *tibiotarsus* (P4)

Dimensions (in mm): *humerus* C-4.38–5.51 mm; D-5.03 mm; F-3.65–4.48 mm; G-2.23–2.37 mm; *tibiotarsus* E-1.44 mm; F-2.46–2.42 mm

Fragments could only be identified up to family level.

Fam. Hirundinidae (Vigors, 1825)
***Delichon* (Moore, 1854)**
***Delichon † polgardiensis* Kessler, 2013** *(Figure 1/7)*
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: proximal fragment of *ulna*
Dimensions (in mm): C-2.32 mm; D-2.46 mm; E-1.48 mm

Species also described from Polgárdi 5 but from distal fragment of *ulna* and complete *coracoideum*.

Two other fossil species are known from the Carpathian Basin: *Delichon † pusillus* Kessler, 2013 from the Early Pliocene of Csarnóta 2 (MN15) and *Delichon † major* Kessler, 2013 from the Early Pliocene of Beremend 26 (MN15) (Kessler 2013a, 2013b).

The genus is known from areas outside the Carpathian Basin only from the Early Pleistocene (Q1), from sites in Quibas, Spain (Montoya *et al*. 1999) and Stránská skála, Czech Republic (Mlíkovskỳ 1995).

***Riparia* (Forster, 1817)**
***Riparia † major* Kessler, 2013** *(Figure 1/8)*
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *tibiotarsus* (5)
Dimensions (in mm): E-0.91–1.09 mm; F-1.96–2.21 mm; G-2.03–2.27 mm

The fossil species was determined from Polgárdi 4, but from other skeletal parts. The dimensions of the present material are larger than those of the extant species.

The genus is known with the extant species only from the Early Pleistocene (Q1), in the Romanian Betfia 9 (Gál 2002) and from Stránská skála (Mlíkovskỳ 1995) in the Czech Republic.

Fam. Sittidae (Bonaparte, 1831)
***Sitta* Linnaeus, 1758**
***Sitta † gracilis* Kessler, 2013** *(Figure 1/9)*
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *tarsometatarsus*
Dimensions (in mm): E-1.59 mm

The fossil species was described from Polgárdi 4, but from a proximal fragment of a *metacarpal* bone (Kessler 2013a, 2013b).

The extremely small fragment is broken off in *trochlea* II, so the anatomically deep incision on *trochlea* III, the shape of *trochlea* IV and the location and shape of the tubercle on the dorsal aspect of the margo above helped to determine the definition.

Sitta † pusilla Kessler, 2013 (Csarnóta 2) and *Sitta † villanyensis* Kessler, 2013 (Beremend 26) are also known from the Early Pliocene of the Carpathian Basin (MN15).

The genus is known from areas outside the Carpathian Basin from the Late Pliocene I of Rebielice Królowskie, Poland (Jánossy 1974). From the Late Miocene of Senigallia in Italy (MN13), described in *Sitta senigalliensis* Portis 1887, an extinct species, is placed by Mlíkovskỳ (2002) in the ‚Family incertae sedis'.

Fam. Muscicapidae (Vigors, 1825)
***Erithacus* (Cuvier, 1801)**
***Erithacus* sp. indet.**
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *ulna*
Dimensions (in mm): E-1.33 mm; F-2.55 mm; G-1.88 mm

Characteristics and dimensions allowed identification only up to genus level. The known extinct species from the Carpathian Basin differ in age and are described from different types of skeletal parts. These are *Erithacus † horusitskyi* Kessler *et* Hír, 2012 – Mátraszőlős 1, Middle Miocene (MN7/8) and *Erithacus † minor* Kessler, 2013 – Beremend 26, Lower Pliocene (MN15) (Kessler & Hír 2012, Kessler 2013a, 2013b).

The genus recens has been annotated with the recens species from the Early Pleistocene of Spain and the Middle Pleistocene of France, Israel, the United Kingdom and Italy (Tyrberg 1998).

Muscicapidae gen. *et* sp. indet.
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *tarsometatarsus*
Dimensions (in mm): F-2.78 mm; G-2.20 mm

The condition of the fragment only allows identification down to the family level.

Fam. Turdidae (Rafinesque, 1815)
***Turdus* (Linnaeus, 1758)**
***Turdus* sp. indet.**
Site and era: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *femur*
Dimensions (in mm): E-2.15 mm; F-3.80 mm; G-3.16 mm

The dimensions of the bone fragment suggest the smallest species of thrush, but as there are no *femur* remains in many Carpathian Basin fossil species, it was not possible to identify the find to species level.

The following fossil thrush species are known from the Carpathian Basin: *Turdus † miocaenicus* Kessler, 2013 and *Turdus † polgardiensis* Kessler, 2013 – from the Later Miocene of Polgárdi 5 (MN13); *Turdus † major* Kessler, 2013, *Turdus † medius* Kessler, 2012 and *Turdus † minor* Kessler, 2013 – from the Early Pliocene of Csarnóta 2 and Beremend 26 (MN15).

The earliest known indication of the genus is from the Middle Miocene of Credinta, Romania (MN8), under the name *Turdus* sp. (Gál & Kessler 2006), while from the Late Pliocene it is from the sites Rebielice Królowskie I in Poland (Jánossy 1974), Văršec in Bulgaria (Boev 2000), Sandalja I in Croatia (V. Malez-Bačić 1979). From the Early Pleistocene onwards, the number of known sites multiplies throughout Europe (Austria, Bulgaria, Czech Republic, France, Germany, Romania, Spain, etc.) (Tyrberg 1998).

Fam. Sylviidae (Vigors, 1825)
Sylviidae gen. *et* sp. indet.
Site and age: Polgárdi 5, Upper Miocene (MN13)
Material: distal fragment of *femur*
Dimensions (in mm): E-1.44 mm; F-3.14 mm; G-2.01 mm

The condition of the fragment only allows identification down to the family level.

Fam. Fringillidae (Leach, 1820)
Fringillidae gen. *et* sp. indet
Site and era: Polgárdi 5, late Miocene (MN13)
Material: 4 distal fragments of *tibiotarsus*
Dimensions (in mm): E-0.89–2.22 mm; F-1.88–2.72 mm; G-1.59–2.23 mm

With few exceptions, the songbirds' beaks are not particularly suitable for genus and species identification. The specimens in the present material also vary considerably in size but morphologically show no particular differences. Thus, the condition of the fragments allows only identification down to the family level.

Conclusions

The examination of bones and bone fragments has resulted in the identification of about half of the remains to at least the level of order, in accordance with the nature of the fossil material. The two sites in question are close to each other both in age and geographic location. The vast majority of the bones are white, in keeping with the medium, but there are also some almost black specimens. There are few completely intact skeletal remains, and most of these are found in the remains of waterfowl.

The faunal assemblage corresponds to that reported in previous studies from a palaeoecological point of view. The bird fauna of both wetlands, open and wooded areas and rock faces is represented in the fossil material.

As the majority of species are of small size, only the small-medium sized patridges are represented, indicating the size of the predators. The Pygmy Owl also represents these birds of prey. Diurnal raptors are not included in the faunistics list of the new material.

In conclusion, the finds from the Upper Miocene of Polgárdi are a good representation of the former bird life in the western part of the Carpathian Basin.

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