



## *An Early Pleistocene magpie (*Pica praepica* sp. n.) (*Corvidae* Leach, 1820) from Bulgaria*

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**Abstract.** A new fossil species of magpie is described as *Pica praepica* sp. n., based on 13 bones of six skeletal elements (coracoid, scapula, ulna, tarsometatarsus, tibiotarsus and phalanx 1 dig. pedis 1) of 2 individuals. These finds are the oldest magpie (g. *Pica*) in the Palearctic and the World. The holotypic tarsometatarsus differs from extant *Pica pica* in several characters, i.e.: (1) the wider distal epiphysis, (2) the deeper and more clearly outlined foramen vasculare distale, (3) the wider incisura intertrochlearis lateralis, and (4) the deeper posterior metatarsal groove.

**Key words:** Pleistocene corvids, fossil magpies, fossil avian record of Balkans, Varshets paleontological locality.

### Introduction

Corvids are well represented in the Pleistocene fossil record of Europe. Some of them, such as *Pyrrhocorax graculus* (Linnaeus, 1766) are considered a kind of “index fossils” for Pleistocene cave deposits (MOURER-CHAUVIRÉ, 1993). Magpies of g. *Pica* were widely spread in the Pleistocene in the Palearctic. After TYRBERG (1998, 2008) the Eurasian magpie (*Pica pica* (Linnaeus, 1758)) was established in Austria, Azerbaijan, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Czechia, France (mainland and Corsica), Germany, Greece, Hungary, Israel, Italy, Moldova, Montenegro, Morocco (cf. *Pica pica*), Poland, Portugal, Romania, Russia (European part, Siberia), Spain, Sweden, Switzerland, and Syria. In this wide former range the chronostratigraphic scope of the species is MNQ19-present. The Pleistocene record of *Cyanopica cyanus* Pallas, 1776 is known from Gibraltar and China and that of *Pica* sp. – from Austria, Russia (Siberia), Spain (Balearic Islands). Most of these finds originate from the Late and Middle Pleistocene (TYRBERG, 1998, 2008). In some countries the species is known from dozens sites. The oldest record in Poland, for example is dated ca. 300 000

years (BOCHENSKI *et al.*, 2012). The Bulgarian finds, described here, represent the oldest fossil record of g. *Pica* in the Palearctic and the World.

Today, the genus *Pica* Brisson, 1760 is represented by three (DICKINSON & CHRISTIDIS, 2014) to six (DEL HOYO & COLLAR, 2016) or even seven (SONG *et al.*, 2018) modern species. The Eurasian magpie (*Pica pica* (Linnaeus, 1758)) is the most widespread and diversified taxon within the genus.

The magpie finds from Varshets have been reported as *Pica* sp. previously by BOEV (1996, 2002, 2016). MARTINOVICH (2009: p. 124) stated that “the earliest paleontological evidence for the existence of the genus *Pica* in the Palearctic comes from Late Pliocene [now Early Pleistocene, ZB] sites in Bulgaria” referring to the fossil material described in the present paper.

### Material and Methods

The examined material includes six skeletal elements, represented by 13 bone finds of at least two individuals: coracoid sin. dist. NMNHS 232; coracoid sin. dist. NMNHS 231; coracoid dex. dist. NMNHS 233; scapula sin. prox. NMNHS 234; ulna sin. dist. NMNHS 342; ulna sin. prox.

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NMNHS 341; ulna sin. dist. NMNHS 340; tarsometatarsus dex. prox. NMNHS 230; tarsometatarsus sin. diaphysal fragment NMNHS 343; tarsometatarsus dex. dist. NMNHS 229; tarsometatarsus dist. NMNHS 146; tibiotarsus dist. (trochlea tibiotarsi) NMNHS 147; phalanx 1 dig. 1 pedis sin. NMNHS 235 (Plates 1, 2). Most of them represent bone fragments. The material was collected in the early 1990s and is now kept at the collections of the Vertebrate Animals Department of the National Museum of Natural History, Sofia, Bulgarian Academy of Sciences.

Comparative material used: *Coloeus monedula* NMNHS 9/1989, NMNHS 10/1991; *Cyanopica cyanus* NMNHS 1/1997; *Garrulus glandarius* NMNHS 1/1982, NMNHS 21/2004; *Nucifraga caryocatactes* NMNHS 9/1984; NMNHS 10/2002; *Pica pica pica* NMNHS 4/1989, NMNHS 7/1991, NMNHS 8/1992, NMNHS 14/2003; *Pyrrhocorax graculus* NMNHS 2/1986, NMNHS 8/2001; *Pyrrhocorax pyrrhocorax* NMNHS 1/1990.

All measurements are given in millimetres (Fig. 1; Table 1, 2). The taxonomy follows DICKINSON & CHRISTIDIS (2014). The osteological terminology follows BAUMEL & WITMER (1993) and LIVEZEY & ZUSI (2006).

**Abbreviations:** Anatomical: dex. - dextra; dist. - distal; prox. - proximal; sin. - sinistra; Institutional: NMNHS - National Museum of Natural History (Bulgarian Academy of Sciences), Sofia.

### *Systematic part*

Order: PASSERIFORMES Linnaeus, 1758  
Family: Corvidae Leach, 1820  
Genus *Pica* Brisson, 1760  
*Pica praepica* sp. n.

Holotype: NMNHS 146, distal left tarsometatarsus (Plate 2 c, f). Collected in 28.09.1990 by the author.

Paratypes: coracoid sin. dist. NMNHS 231 (Plate 1 – a); coracoid sin. dist. NMNHS 232 (Plate 1 – b); ulna sin. prox. NMNHS 341 (Plate 1 – e); ulna sin. dist. NMNHS 342 (Plate 1 – f); tarsometatarsus dex. prox. NMNHS 230 (Plate 2 – a); tarsometatarsus dex. dist. NMNHS 229 (Plate 2 – b); tibiotarsus dist. (trochlea tibiotarsi) NMNHS 147 (Plate 2 – g); coracoid dex. dist. NMNHS 233; scapula sin. prox. NMNHS 234; ulna sin. dist.

NMNHS 340; tarsometatarsus sin. diaphysal fragment NMNHS 343; phalanx 1 dig. 1 pedis sin. NMNHS 235.

**Etymology:** The name *praepica* is given after the epithet of the modern Eurasian magpie *pica*, and the Latin prefix *prae-*, meaning “before”.

**Measurements:** Table 2; Fig. 1 – E, F).

**Description:** The proximal three fourths of the bone are missing and the total length of the bone fragment is 10.01 mm. All morphological details of a distal tarsometatarsus are excellently preserved. The fossil specimen is virtually indistinguishable from the corresponding bone of *Pica pica* (Linnaeus, 1758) except for some features, listed in the differential diagnosis (see below). All paratype specimens also almost completely fit with the corresponding skeletal elements of modern *P. pica*, although demonstrate some differences, for example slightly thicker shaft of the coracoid, shallower cotyla ventralis ulnae, and shorter phalanx 1 dig. pedis I.

**Differential diagnosis:** A fossil species in the genus *Pica*, whose tarsometatarsus differs from that of the extant *Pica pica* in: (1) a wider distal epiphysis; (2) the deeper and more clearly outlined foramen vasculare distale; (3) the wider incisura intertrochlearis lateralis; and (4) the deeper posterior metatarsal groove.

**Preservation:** The holotype represents a distal bone fragment, which is almost 1/4 of the estimated total length of the bone (Plate 2 – c, f).

**Locality:** A ponor in a rocky hill, 6 km NE of town of Varshets (43.13 N, 23.17 E), near Dolno Orizovo village (Montana Region, NW Bulgaria); UTM grid: FN 89; 650 m a.s.l.

**Stratigraphic position:** Unconsolidated, unstratified sediments accumulated in the filling of clay.

**Chronostratigraphy:** Middle Villafranchian. The associated fauna of large mammals attributes the site to the MN 17 zone (SPASSOV, 1997) according to the chronostratigraphic system of MEIN (1990). POPOV (2001) determines the time span of Varshets between 2.04 Ma (Stranzendorf I) and 2.4 Ma (Stranzendorf D).

### *Comparisons*

The specimens shows all the features of medium to large passeriform birds, having trochleae metatarsi 2, 3 and 4 positioned on a single (common) axis almost parallel each other and a thin and straight diaphysis of the tarsometatarsus. The

specimens from Varshets were compared with 18 corvid taxa (12 recent and 6 fossil) of 7 genera.

#### *Comparison with recent Palearctic smaller corvids*

*Cyanopica cyanus*: This species is significantly smaller (Table 1, 2). *Pyrrhocorax graculus* (Linnaeus, 1766) has wider and more symmetrical trochlea metatarsi 3 and less distally positioned foramen vasculare distale. *Nucifraga caryocatactes* (Linnaeus, 1758) is smaller in size and has relatively narrower distal pre-epiphysal part of diaphysis. *Garrulus glandarius* (Linnaeus, 1758) is also smaller and its posterior metatarsal groove is shallower. *Coloews monedula* (Linnaeus, 1758) has more symmetrical trochlea metatarsi 3, less distally positioned foramen vasculare distale, and deeper relief of the trochlea metatarsi 2. According to the data provided by TOMEK & BOCHENSKI (2000), the corresponding bone of *Perisoreus infaustus* (Linnaeus, 1758) is much smaller, whereas it is considerably larger in *Pyrrhocorax pyrrhocorax* (Linnaeus, 1758) (Table 1, 2), which is further distinguished by having its dorsal surface of trochlea metatarsi 2 relatively wider.

#### *Comparison with fossil magpies*

*Pica pica major* Janossy, 1972 was described from Stranska Skala I (Czechia) as a subspecies slightly larger than the extant *Pica pica*. This subspecies was recorded also in Austria, Hungary, and France. It is a late Pleistocene magpie, that existed in MNQ21-23 (TYRBERG, 1998). Later, MLIKOVSKÝ (2002) synonymized it with *Corvus monedula*, Linnaeus, 1758, now designated as *Coloews monedula* (Linnaeus, 1758). However, Kessler (2020) restored validity of *P. p. major*, based on examined material from several other localities. JANOSSY (1972) stated that the variation of measurements of the leg bones of *P. p. major* is higher than in the extant *P. pica*. Unfortunately only total length of the tarsometatarsus (53.3 mm) of *P. p. major* is given in this publication, so the comparison with *P. praepica* is impossible.

It is worthy to mention that some bone measurements of *P. praepica* are smaller than these of *P. pica*, while *P. p. major* was slightly bigger than modern *P. pica*.

The measurements of the fossil tarsometatarsus of *Pica pica* from Texas (MILLER & BOWMAN 1955) falls within of the range of the two recent forms of North American magpies, *P. hudsonia*

and *P. nuttalli*. “The fossil falls within or barely exceeds the upper size limits of *P. p. hudsonica* (pr. *P. hudsonia*) and *P. p. japonica* (pr. *P. serica*), whereas it greatly exceeds the extremes of *P. nuttallii* (pr. *P. nutalli*)...” (MILLER & BOWMAN 1955; p. 164).

*Pica mourerae* Seguí, 2001 from the Plio-Pleistocene of Mallorca is characterized by the reduction of its wing elements and elongated legs which could not be stated (or rejected) for the Bulgarian finds. Apparently, *Pica mourerae* was an island endemic, contemporaneous with *Pica* found at Varshets.

*Pica pica tugarinovi* Martinovich, 2009 was described from the late Pleistocene (13 665±90 yrs) to early Holocene (9560±175 yrs) deposits of Central Siberia (Russia). Its chronostratigraphic differences are significant in comparison with the finds from Varshets. Specimens of the corresponding skeletal elements (ulna, tarsometatarsus) show slightly larger dimensions (Tables 1, 2).

*Pica* sp. from the Late Pleistocene of Loutra Almopias Cave (Macedonia, Greece) was represented only by its wing bones (only phalanx proximalis digitus majoris). It differs from *P. pica* by the relatively longer “neck” of prox. end, although it significantly resembles *P. pica* but was much bigger in size (BOEV & TSOUKALA, 2019). Direct comparisons with the corresponding bones of this magpie are impossible.

The tarsometatarsus (and most of other long bones) of the late Pleistocene magpie from the Binagada locality (Azerbaijan) were practically undistinguishable from recent *P. pica* (SEREBROVSKIY, 1948; PANTELEEV & BURCHAK-ABRAMOVICH, 2000). SEREBROVSKIY (1948) mentioned: “Only relative to the metatarsus should note that it is somewhat small for a normal bird. Perhaps we have a bone of an incompletely grown individual.” (p. 56). Measurements of these specimens are not provided.

#### *Comparison with recent magpies*

Yellow-billed magpie (*Pica nutalli* (Audubon, 1837)) is isolated in the western California (MILLER & BOWMAN, 1955). It is closely related to the Black-billed magpie (*Pica hudsonia*, Sabine, 1823), also a North-American magpie, spread in the western part of the continent from Alaska to California. After MILLER & BOWMAN (1955), “the genus *Pica* has generally been considered to be of Old World origin and to have reached the North

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American continent “relatively recently,” presumably via a Bering land bridge.” (p. 164). Both North-American species are of much younger (0.2 Mya) age (MILLER & BOWMAN, 1955; SONG *et al.*, 2018)), than the examined Bulgarian finds.

Two subspecies of *P. pica* have been raised to species level by DEL HOYO & COLLAR (2016): the Maghreb Magpie (*P. mauritanica* Malherbe, 1845) and the Asir Magpie (*Pica asirensis* Bates, 1936). In addition, the Black-rumped magpie (*P. bottanensis* Delessert, 1840) has been recently designated also from *P. pica*.

After ERICSON *et al.* (2005) “magpies (*Pica*) appear to have speciated after immigration to the New World” (p. 233). LEE *et al.* (2003) consider the Oriental magpie (*P. serica* Gould, 1845) basal for the genus *Pica*. On the other hand, *P. serica* has been split from *P. pica*. (SONG *et al.*, 2018). All these new taxa have been based on the molecular phylogeny.

Divergences among basal three lineages (NW Africa, Arabia and the Qinghai-Tibet Plateau) is of Pleistocene age and took place

1.4–3.1 Mya (SONG *et al.*, 2018), i. e. namely during the time of existence of the Villafranchian magpie from Varshets.

**Conclusion**

The comparison presented above shows that the specimen NMNHS 146 could not be referred to any of the recent and fossil species belonging to *Pica* genus. Thus, having in mind its ancient age (2.40 to 2.04 Mya) I prefer to designate this material - six skeletal elements of forelimbs (coracoid, scapula, ulna) and hindlimbs (tibiotarsus, tarsometatarsus, phalanx I dig. pedis I) - as a distinct new species of magpie.

**Acknowledgments**

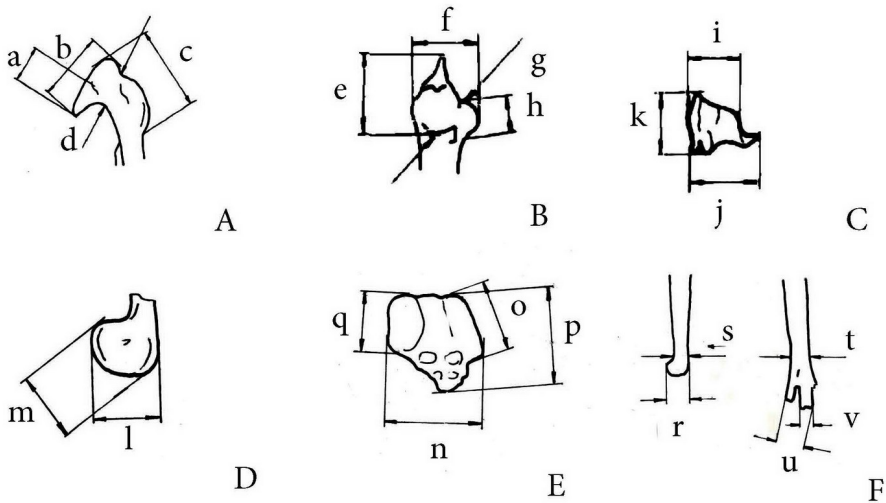
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**Table 1.** Measurements of skeletal elements of the forelimbs of some Palearctic small and medium-sized corvids (ref. to Fig. 1; Measurements (arithmetic mean) of *P. p. tugarinovi* are given after MARTINOVICH, 2009).

Taxa	coracoid					ulna					
	a	b	c	d	e	f	g	h	i	j	k
<b>Fossil - Varshets</b>											
<i>Pica praepica</i> sp. n. NMNHS 342	-	-	-	-	-	-	-	-	4.21	4.94	4.78
<i>Pica praepica</i> sp. n. NMNHS 340	-	-	-	-	-	-	-	-	4.17	5.35	4.25
<i>Pica praepica</i> sp. n. NMNHS 344	-	-	-	-	-	-	-	-	4.01	5.32	3.72
<i>Pica praepica</i> sp. n. NMNHS 231	4.34	6.99	7.31	4.39	-	-	-	-	-	-	-
<i>Pica praepica</i> sp. n. NMNHS 341	-	-	-	-	7.70	7.15	5.15	3.55	-	-	-
<i>Pica praepica</i> sp. n. NMNHS 233	-	-	-	4.35	-	-	-	-	-	-	-
<i>Pica praepica</i> sp. n. NMNHS 232	-	-	7.33	4.28	-	-	-	-	-	-	-
<i>Pica pica tugarinovi</i>	-	-	7.4	-	-	7.1	-	-	-	5.7	-
<b>Recent</b>											
<i>Pica pica pica</i> NMNHS 14/2003	5.40	7.89	8.51	5.11	7.40	7.39	5.33	3.66	4.65	5.61	4.97
<i>Pica pica pica</i> NMNHS 4/1989	4.20	6.68	7.37	4.42	6.97	7.05	5.25	3.20	4.59	5.49	4.71
<i>Pica pica pica</i> NMNHS 7/1991	4.85	6.86	6.71	4.12	6.95	6.94	4.93	3.26	4.66	5.68	4.71
<i>Pica pica pica</i> NMNHS 8/1992	4.99	6.91	6.88	3.95	6.68	7.01	4.74	3.28	4.41	5.78	4.87
<i>Cyanopica cyanus</i> NMNHS 1/1997	3.43	4.90	5.01	2.80	5.18	4.90	3.49	2.75	3.12	3.86	3.17
<i>Pyrrhocorax graculus</i> NMNHS 8/2001	5.89	7.39	11.15	6.04	8.24	8.94	6.03	4.88	5.60	7.58	5.42
<i>Pyrrhocorax graculus</i> NMNHS 2/1986	4.57	7.01	10.51	4.63	7.92	7.99	5.70	4.37	5.03	6.94	5.28
<i>Pyrrhocorax pyrrhocorax</i> NMNHS 1/1990	6.15	9.11	12.10	5.34	9.30	9.49	6.67	4.61	5.66	7.47	6.19
<i>Nucifraga caryocatactes</i> NMNHS 10/2002	3.64	6.18	6.50	3.87	6.89	7.00	5.05	3.21	3.95	5.84	4.52
<i>Nucifraga caryocatactes</i> NMNHS 9/1984	3.87	5.76	7.90	4.51	6.56	6.64	4.73	3.25	4.17	5.49	4.47
<i>Garrulus glandarius</i> NMNHS 21/2004	3.47	5.48	5.75	3.72	6.85	6.41	4.44	3.07	4.22	5.30	4.01
<i>Garrulus glandarius</i> NMNHS 1/1982	3.31	5.81	6.63	4.85	7.01	6.96	4.96	3.31	4.91	5.95	4.54
<i>Coloeus monedula</i> NMNHS 9/1989	3.93	6.51	7.83	4.06	7.27	7.28	5.48	3.99	4.38	6.36	4.83
<i>Coloeus monedula</i> NMNHS 10/1991	4.66	6.58	7.77	4.66	7.80	7.09	5.53	3.57	4.60	6.03	5.01

**Table 2.** Measurements of skeletal elements of the hind limbs of some Palearctic small and medium-sized corvids (ref. to Fig. 1; Measurement “w” – total width of distal epiphysis.; Measurements (arithmetic mean) of *P. p. tigarinovi* are given after MARTINOVICH, 2009); Measurement “n” of *P. hudsonia* is after HARRIS (2012). Measurement “q” of *P. serica* and *P. pica* from Texas is after MILLER & BOWMAN, 1955).

Taxa	tibiotarsus					tarsometatarsus						
	l	m	n	o	p	q	r	s	t	u	v	w
<b>Fossil - Varshets</b>												
<i>Pica praepica</i> sp. n. NMNHS 146	-	-	-	-	-	-	2.27	1.96	3.26	3.57	1.80	5.54
<i>Pica praepica</i> sp. n. NMNHS 229	-	-	-	-	-	-	2.83	1.83	3.15	3.46	1.82	-
<i>Pica praepica</i> sp. n. NMNHS 230	-	-	7.74	4.61	7.11	4.27	-	-	-	-	-	-
<i>Pica praepica</i> sp. n. NMNHS 147	6.10	5.82	-	-	-	-	-	-	-	-	-	-
<i>Pica pica tugarinovi</i>	-	-	-	-	-	-	3.1	-	-	-	-	-
<i>Pica pica</i> Palo Duro Falls (Texas)	-	-	-	-	-	4.8	-	-	-	-	-	-
<b>Recent</b>												
<i>Pica pica pica</i> NMNHS 14/2003	6.45	6.13	7.24	4.91	7.32	4.51	2.51	2.06	3.13	3.67	1.76	4.97
<i>Pica pica pica</i> NMNHS 4/1989	5.61	5.51	6.98	4.55	6.74	4.50	1.81	1.76	3.13	3.17	1.85	5.15
<i>Pica pica pica</i> NMNHS 7/1991	5.86	5.88	6.73	4.65	7.09	4.20	2.33	1.77	2.77	3.39	1.71	4.71
<i>Pica pica pica</i> NMNHS 8/1992	5.94	6.03	6.84	4.71	7.05	4.51	2.39	1.79	3.12	3.25	1.82	4.79
<i>Pica nutalii</i>	-	-	-	-	-	3.9	-	-	-	-	-	-
<i>Cyanopica cyanus</i> NMNHS 1/1997	3.96	3.88	4.58	3.05	4.21	2.64	2.04	1.21	1.91	2.22	1.20	3.37
<i>Pica hudsonia</i>	-	-	ca.750	-	-	4.5	-	-	-	-	-	ca.500
<i>Pica serica</i>	-	-	-	-	-	4.7	-	-	-	-	-	-
<i>Pyrrhocorax graculus</i> NMNHS 8/2001	6.16	6.30	5.66	5.02	7.28	4.61	2.57	1.81	3.41	2.69	1.86	5.80
<i>Pyrrhocorax graculus</i> NMNHS 2/1986	5.67	5.45	7.35	4.73	6.83	4.09	2.61	1.69	3.11	3.32	1.52	5.51
<i>Pyrrhocorax pyrrhocorax</i> NMNHS 1/1990	6.75	6.36	9.06	5.41	7.82	5.01	3.33	2.18	4.34	2.25	4.50	6.27
<i>Nucifraga caryocatactes</i> NMNHS 10/2002	5.17	5.12	6.38	3.94	6.12	3.98	2.12	1.72	2.59	2.95	1.56	4.28
<i>Nucifraga caryocatactes</i> NMNHS 9/1984	5.23	5.19	6.22	4.09	6.23	3.13	2.59	1.75	2.57	2.95	1.66	4.40
<i>Garrulus glandarius</i> NMNHS 21/2004	5.21	5.13	5.96	3.39	5.71	3.57	1.92	1.59	2.49	2.83	1.58	4.14
<i>Garrulus glandarius</i> NMNHS 1/1982	5.44	5.30	6.16	4.18	7.11	3.86	1.95	1.61	2.62	3.35	1.78	4.64
<i>Coloeus monedula</i> NMNHS 9/1989	5.89	5.86	7.11	4.50	6.37	4.01	2.40	1.82	3.14	3.34	1.64	5.05
<i>Coloeus monedula</i> NMNHS 10/1991	5.71	5.74	6.95	4.74	6.72	4.08	2.49	2.02	2.97	3.22	1.94	5.42



**Fig. 1.** Manner of measuring of some skeletal elements of Palearctic smaller corvids: coracoid, humeral part (A); ulna prox. (B); ulna dist. (C); tbt dist. (D); tmt prox. (E); tmt dist. (F). Drawings: Vera Hristova.



**Plate 1.** Forelimb bones of *Pica praepica* sp. n., compared with recent *Pica pica* NMNHS8/1991: coracoid, hum. part NMNHS 231 (a); coracoid, hum. part NMNHS 232 (b); coracoid, hum. part NMNHS 233 (c); scapula sin. prox. NMNHS 234 (d); ulna sin. prox. NMNHS 341 (e); ulna dex. dist. NMNHS 242 (f); ulna dex. dist. NMNHS 344 (g); ulna dex. dist. NMNHS 340 (h); ulna sin. prox. NMNHS 341 (above), and ulna sin. dist. NMNHS 242 (below) (i). Photographs: Z. Boev.



**Plate 2.** Hindlimb bones of *Pica praepica* sp. n., compared with recent *Pica pica* NMNHS8/1991: tmt dex. prox. NMNHS 230 (a); tmt dex. dist. NMNHS 229 (cranial view) (b); tmt dex. dist. NMNHS 229 (lateral view) (c); tmt dex., diaphysal fragment NMNHS 343 (d); tmt prox. epiphysis (above), and distal epiphysis (below) (e); tmt sin. dist. NMNHS 146, cranial view (above), and cadudal view (below) (f); tbt dex. dist. NMNHS 147, caudal view (above), and lateral view (below) (g); tbt dex. dist. NMNHS 147, cranial view (h); phalanx 1 dig. pedis I dex. NMNHS 235, dorsal view (above), and medial view (below) (i). Photographs: Z. Boev.

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