New finds and revised taxa of Early Pliocene birds from Western Mongolia

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Abstract — The Late Miocene-Early Pliocene Hyargas-Nuur formation in Western Mongolia yielded a rich fauna of birds which contributes significantly to our knowledge of the Neogene avian diversity in Asia. A study of new fossil remains, collected during the last 20 years, and a revision of several previously described taxa are presented in this paper. *Cygnus pristinus* is shown to be clearly separable from extant *C. olor*. *Podiceps solidus* and *Haliaeetus fortis*, initially described from the Late Miocene sediments, were found in the Early Pliocene. *Probalearica mongolica* is moved to the genus *Grus*, and a new genus *Pastushkinia* nov. gen. is erected for *Crex zazhigini*. Several new finds – a lapwing *Vanellus* cf. *V. leucurus*, two species of gulls (*Larus* spp.), and large *Gypaetus*-like accipitrid – represent the oldest records of the corresponding bird groups in Asia. A complete list of taxa known from the Early Pliocene of Western Mongolia is also presented.

Key words: Aves, Early Pliocene, Neogene, Central Asia, Fauna

Introduction

The fossil record of Neogene birds in Asia is very scanty, and Pliocene birds are especially poorly known. A small number of taxa (*Struthio asiaticus* MILNE-EDWARDS, 1871; *Pelecanus sivalensis* DAVIES, 1880; *P. cautleyi* DAVIS, 1880; *Leptoptilos falconeri* MILNE-EDWARDS, 1868; *L. siwalikensis* HARRISON, 1974; *Cryptociconia indica* HARRISON, 1974; *Mergus* sp.) has been described long ago from the Pliocene of Siwalik Hills in the Indian region (MILNE-EDWARDS 1871; DAVIES 1880; LYDEKKER 1879, 1891; HARRISON 1974, 1979; see also LOUCHART *et al.* 2005 for review of Siwalik Leptoptiline storks). Several Pliocene birds were reported from Japan (RICH *et al.* 1986), but they were identified just up to family level. An isolated ilium from the Pliocene of Tuva (Siberia) was recently assigned to *Buteo* sp. (PANTELEEV *et al.* 2006). Several non-passeriform taxa and

a representative fauna of songbirds are known from the Late Pliocene of Northern Mongolia and adjacent territory of Russia (KUROCHKIN 1985; ZELENKOV & KUROCHKIN 2009, 2010, 2012). The famous Chinese localities Ertemte and Baode, which yielded avian remains previously regarded as being Pliocene in age (RICH *et al.* 1986), are now placed in the terminal Miocene (QIU & QIU 1995). Thus the largest and by far the only representative fauna of Pliocene birds in Asia is that from Western Mongolia. It was thoroughly studied by KUROCHKIN (1971, 1976, 1980, 1985), but unfortunately was published mainly in Russian and due to this fact is very poorly known outside paleornithological community.

Neogene birds of Western Mongolia are known from a small number of relatively closely positioned localities in the Great Lake Depression (Fig. 1). Neogene sediments in this area are several hundred meters thick (DEVJATKIN 1981)
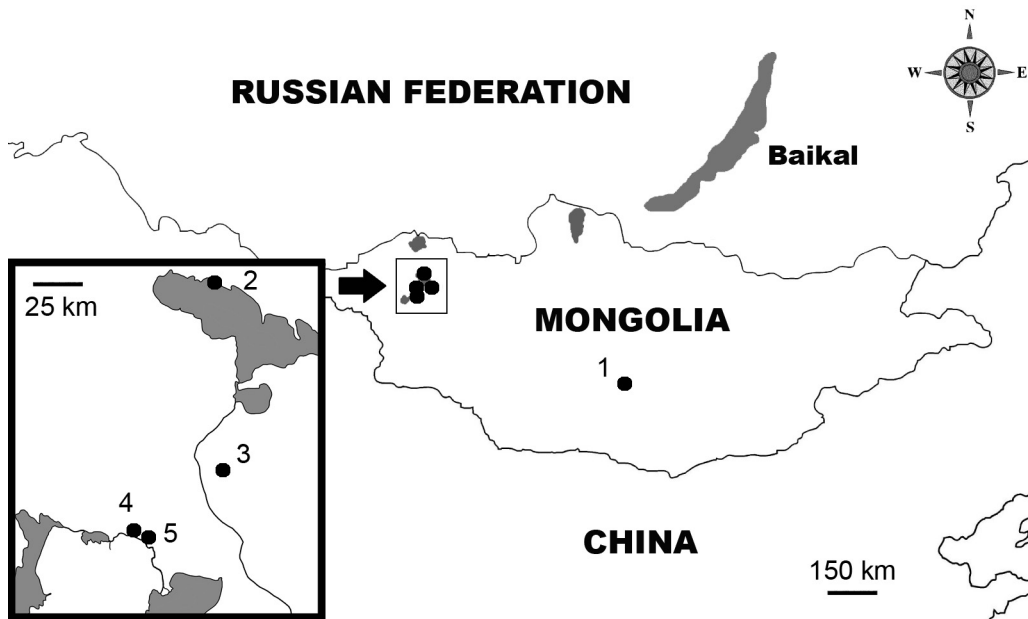
FIGURE 1. Map showing the location of the basic Late Miocene and Pliocene avian localities discussed in this paper. 1 – Hung-Kureh; 2 – Hyargas-Nuur 2; 3 – Zogsoo-Harhan 1 and 4; 4 – Chono-Harayah 1; 5 – Chono-Harayah 2.

and have been divided into several formations. Bird remains are most common in the youngest Hyargas-Nuur formation ("svita Khirgiz-Nur" of Soviet geologists), which is presumably roughly synchronous with previously described Hung-Kureh formation in Central Mongolia (BERKEY & MORRIS 1927; DEVJATKIN 1981). The Hyargas-Nuur formation was once thought to be Early-Middle Pliocene (DEVJATKIN 1981); this age was accepted by KUROCHKIN (1985 and earlier works). Later paleomagnitic and biostratigraphic data however provided evidence for the Late Miocene-Early Pliocene age of the Hyargas-Nuur formation (PEVZNER *et al*. 1983; DEVJATKIN 1994). The two most important late Neogene avian localities of the Western Mongolia, Hyargas-Nuur 2 and Chono-Harayah (also known as "Khirgiz-Nur" and "Chono-Khariakh"; both contain sediments of Hyargas-Nuur formation) are now being correlated with the well-studied Chinese mammalian localities Ertemte (MN 13) and Bilike (MN 14), respectively (VANGENGEIM *et al*. 2005). The fauna of Western Mongolian Neogene birds, previously thought to be of Pliocene age, thus should be revised in the light of new biostratigraphic data. Additionally, more avian remains were collected from the Hyargas-Nuur

formation by the Joint Soviet-Mongolian expedition since the work of KUROCHKIN. These data may shed light on systematic position and taxonomy of several taxa.

A revision of Phasianidae and most Anatidae from Hyargas-Nuur formation was published elsewhere (ZELENKOV & KUROCHKIN 2009, 2010; ZELENKOV 2012). In this paper I present new finds and revise several species of birds previously described by KUROCHKIN (1985 and earlier works) from the Early Pliocene (as currently understood) of the Hyargas-Nuur formation. This revision was possible because of both broader taxonomic comparisons and more fossil material available. In order to reduce the length of the paper, I am not discussing here species with unquestionable taxonomic or nomenclature status. A complete list of Early Pliocene birds from Western Mongolia is given in Table 1.

Materials and methods

A comprehensive description of geology and associated fauna of the Western Mongolian Pliocene avian localities can be found in DEVJATKIN (1981). The main avian localities are Hyargas-

Nuur 2 (MN 13) and Chono-Harayah 1 and 2 (MN 14). Several bone remains come from the localities Zavhan, Zogsoo-Harhan 1 and 4 (MN 14–15). The material is stored at the Borissiak Paleontological Institute of Russian Academy of Sciences in Moscow. The osteological terminology in this work follows Baumel *et al.* (1993). All measurements are in mm.

Abbreviations: CMC: Carpometacarpus, COR: Coracoid, FEM: Femur, HUM: Humerus, PIN: Borissiak Paleontological Institute of Russian Academy of Sciences, RAD: Radius, SCA: Scapula, TMT: Tarsometatarsus, TT: Tibiotarsus, ULN: Ulna.

Systematic Paleontology

Order Anseriformes Wagler, 1831
Family Anatidae Vigors, 1825

Cygnus pristinus Kurochkin, **1971**
(Fig. 2)

v. *Cygnus pristinus* Kurochkin, 1971: p. 60, fig. 2.
v. *Cygnus pristinus* Kurochkin, 1976: p. 55, figs 3–5.
v. *Cygnus pristinus* Kurochkin, 1985: p. 58, text-fig. 27; pl. VII, figs 5–8.
v. *Cygnus olor* (Gmelin, 1789): Mlíkovský & Švec 1986, p. 264.

Type locality: Hung-Kureh, Central Mongolia, Late Miocene-Early Pliocene (MN 13–15).

Stratigraphical and geographical distribution: Mongolia: Late Miocene (Hyargas-Nuur 2), Early Pliocene (Chono-Harayah 1 and 2; Zogsoo-Harhan 1 and 4).

Holotype: RAD sin., distal portion (PIN 2614/25). Figured in Kurochkin (1985) text-fig. 27; pl. VII, figs 5–8.

Emended diagnosis: Rather large swan, the size of extant *C. olor*, which can be distinguished from this species by the following characters. COR: processus acrocoracoideus not widening cranially in medial and lateral views; SCA: tuberculum coracoideum very large*, acromion oriented dorsocranially; HUM: distal end narrow with epicondylus ventralis weakly protruding

ventrally; longitudinal axis of fossa m. brachialis oriented proximodistally; RAD: fovea ligamentalis very deep*; CMC: processus extensorius markedly shorter*; phalanx proximalis digiti majoris: dorsal and ventral surfaces very releif, with deep pit on ventral surface; proximal articular surface dorsoventrally elongated; TT: incisura intercondylaris wider; TMT: fossa infracotylaris deeper*; trochlea metatarsi III oval in medial view and slightly widening distally in dorsal view; trochlea metatarsi IV with narrow sulcus on distal surface. Characters indicated by an asterisk (*) represent autapomorphies of the taxon.

Measurements: COR: depth at the level of glenoid facet, 18.5 (PIN 3222/32); diameter of cotyla scapularis, 7.4 (PIN 3222/32); SCA: maximal dorsovental height of caput scapulae, 23.3 (PIN 2614/111); length of facies articularis humeralis together with tuberculum coracoideum, 18.1 (PIN 2614/111); HUM: distal width, 35.5 (PIN 2614/108); proximodistal height of condylus dorsalis, 16.4 (PIN 2614/108); depth across condylus dorsalis, 20.1 (PIN 2614/108); ULN: maximal distal width, 22.2 (PIN 2614/109); depth of condylus dorsalis, 19.4 (PIN 2614/109); RAD: distal width, 16.6 (holotype); maximal distal depth, 7.9 (holotype); CMC: proximal craniocaudal height, 32.6 (PIN 2614/159); length of metacarpale I, 17.0 (PIN 3222/38), 17.6 (PIN 3378/100), 18.7 (PIN 2614/159); dorsoventral depth of trochlea carpalis, 13.0 (PIN 2614/159); 12.8 (PIN 3222/38), 12.5 (PIN 3222/671); distal dorsoventral depth, 1.1 (PIN 3222/40); phalanx proximalis digiti majoris: total length, 48.1 (PIN 2614/26); TT: distal width ~ 23.1 (PIN 2614/70); depth across incisura intercondylaris, 13.9 (PIN 2614/70); TMT: proximal width, 24.2 (PIN 2614/154); depth of cotyla medialis, 12.6 (PIN 2614/154); width of trochlea metatarsi III, 10.7 (PIN 3222/54); depth of trochlea metatarsi III, 15.4 (PIN 2614/54).

Description and comparisons: The processus acrocoracoideus of the coracoid is not widening in medial and lateral views (markedly widening in *C. olor;* almost straight in *C. melanocoryphus*); the cranial angle of the facies articularis humeralis is obtuse (as in *C. olor*, *C. bewikii* and *C. melanocoryphus*), but this character slightly varies individually in swans; impressio lig. acrocoracohumeralis with a markedly curved apex
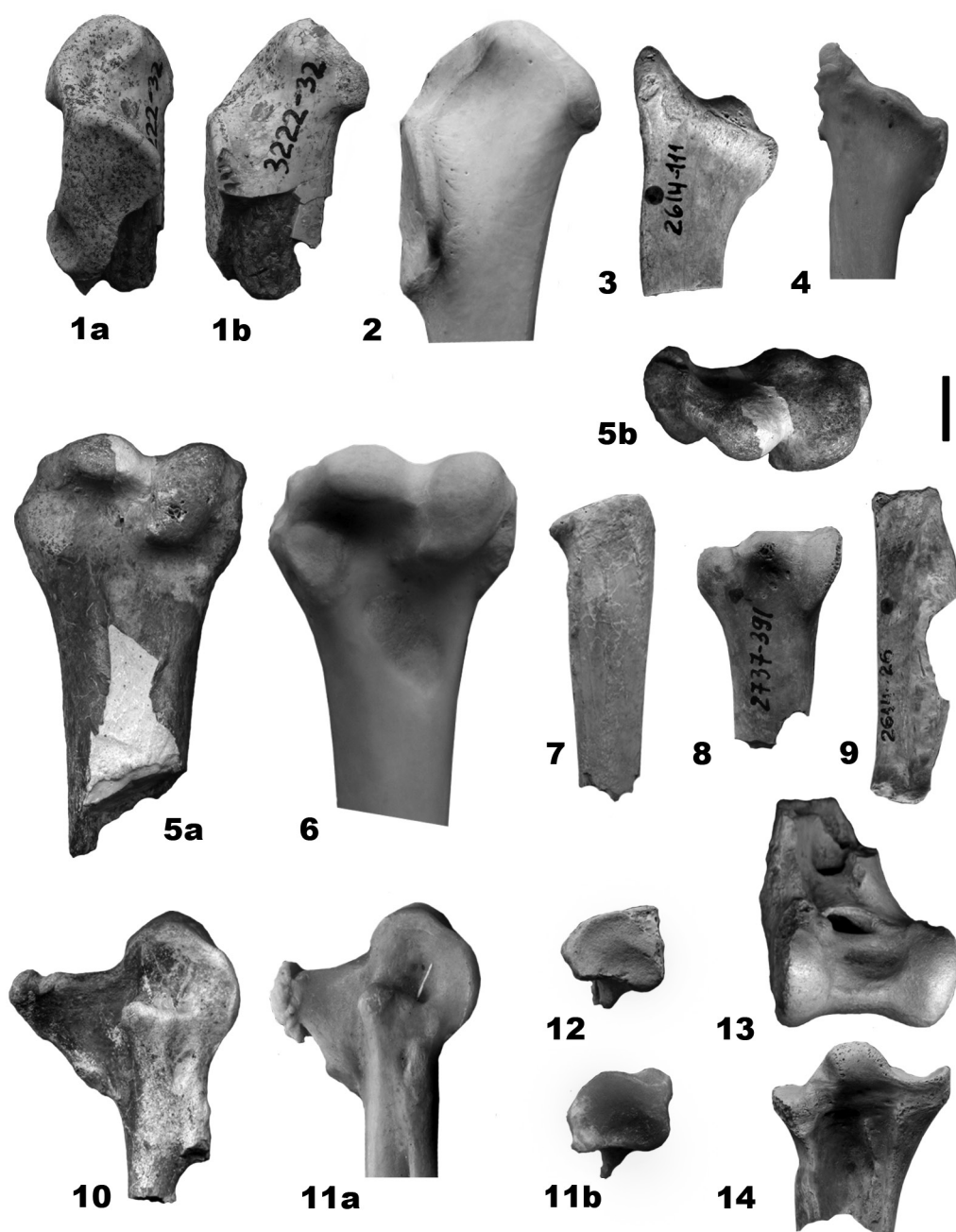
FIGURE 2. Selected remains of *Cygnus pristinus* KUROCHKIN, 1971 (**1, 3, 5, 7–10, 12–15**) from the Late Miocene and Early Pliocene of Western Mongolia compared with those of extant *C. olor* (**2, 4, 6, 11**). *Cygnus pristinus* KUROCHKIN, 1971: **1** cranial fragment of right coracoid, PIN 3222/32 in lateral (**a**) and ventral (**b**) views; **3**, cranial fragment of left scapula, PIN 2614/111 in medial view; **5**, distal fragment of right humerus, PIN 2614/108 in cranial (**5a**) and distal (**5b**) views; **7**, holotype, distal fragment of left radius, PIN, 2614/25 in dorsal view; **8**, distal fragment of left ulna, PIN 2737/391 in ventral view; **9**, basal phalanx of the major wing digit, PIN 2614/26 in dorsal view; **10**, proximal fragment of right carpometacarpus, PIN 2614/159 in ventral view; **12**, distal fragment of right carpometacarpus, PIN 3222/40 in distal view; **13**, distal fragment of right tibiotarsus, PIN 2614/70 in cranial view; **14**, proximal fragment of right tarsometatarsus, PIN 2614/154 in cranial view. *Cygnus olor,* extant: **2**, cranial fragment of right coracoid in ventral view; **4**, cranial fragment of left scapula in medial view; **6**, distal fragment of right humerus in cranial view; **11**, right carpometacarpus: ventral view of proximal part (**11a**) and distal view (**11b**). Scale bar equals 1 cm.

(as in *C. olor*), this impressio is more narrow and straight in other species; the cranial margin of the medial surface of the acrocoracoid is semicircular in medial view (as in *C. olor*), while this outline is more or less straight in other species. The most characteristic of the scapula of *C. pristinus* is the enlarged tuberculum coracoideum, unlike that of any of the extant species of swans. The acromion is pointing dorsocranially in *C. pristinus*, while it is oriented more cranially in *C. olor* and *C. buccinator*, and more dorsally in other species.

The distal humerus of *C. pristinus* resembles *C. cygnus* and differs from that of *C. olor* by weakly protruding ventrally epicondylus ventralis (the whole distal end is thus looks narrow in *C. pristinus* and *C. cygnus*); the fossa m. brachialis is oriented proximodistally in *C. pristinus* while it is angled in other swans; the epicondylus dorsalis is more strongly developed in *C. pristinus* than in *C. cygnus*, but less than that in *C. olor* and *C. melanocoryphus*; the fossa olecrani is deep as in *C. olor* and *C. bewikii*. The tuberculum carpale of ulna is proximodistally wide in *C. pristinus* as in *C. olor*. The most characteristic feature of the distal radius is its blunt distal outline (as in *C. olor*; pointed in other swans). Fovea ligamentalis is deeper than in other swans; sulcus ligamentosus is well marked (normally vestigial in other swans but weekly developed in *C. olor*). In the carpometacarpus, there is a pit just distal to the processus pisiformis and an indistinct notch in the ventral outline of the trochlea carpalis; the trochlea carpalis itself is roundish in ventral view and its dorsal half is weakly protruding proximally. In all of these four characters of the carpometacarpus, *C. pristinus* agrees with *C. olor*. The processus extensorius is however markedly proximodistally shorter in *C. pristinus* than in all extant species. The facies articularis dig. minoris is wide in *C. pristinus* as in *C. olor*. The proximal phalanx of the major wing digit is shortened, as in *C. olor*, but its surfaces are very relief and, in contrast to all other species, deep pits are present on both ventral and dorsal surfaces (the deep ventral pit is also characteristic of extant *C. cygnus*); the proximal articular surface is dorsoventrally elongated (as in *C. cygnus*) while it is roundish in *C. olor*.

The condylus medialis of the tibiotarsus in *C. pristinus* is thin in cranial view, close to the state of *C. olor*; KUROCHKIN (1985) used the shape of the distal aperture of the canalis extensorius to distinguish various swan species, but our study shows that this character is subject of individual variation. The incisura intercondylaris is wider in *C. pristinus* than in extant swans, although it is wide in some specimens of *C. olor*. The proximal end of tarsometatarsus is rather uniform in swans, but the fossa infracotylaris is deeper in *C. pristinus* than in other species; trochlea metatarsi III is oval in medial view (roundish in *C. olor*) and gently widens distally (as in *C. cygnus*). Trochlea metatarsi IV has a narrow furrow on the distal surface, as in *C. cygnus* and *C. melanocorhyphus* (lacking in *C. olor*). KUROCHKIN (1985) already mentioned that *C. pristinus* had shortened pedal phalanges, similar to those of extant *C. olor*.

Several other fossil species of swans have been described (reviewed by LOUCHART *et al.* 2005). *Cygnus verae* BOEV, 2000 is known from a proximal humerus and thus cannot be compared directly. *C. verae* is however smaller that *C. pristinus* (BOEV 2000). *C. herrenthalsii* VAN BENEDEN, 1871 has been described on the basis of a nonrepresentative material (pedal phalange). *C. atavus* (FRAAS, 1870) from the middle Miocene of Germany is notably smaller than *C. pristinus*. *C. mariae* BICKART, 1990 is known from the Late Miocene of Arizona and is close in size to *C. pristinus*. *C. mariae* is also similar to extant *C. olor* (BICKART 1990) and thus can be a junior synonym of *C. pristinus*.

Remarks: *Cygnus pristinus* can be assigned to the genus *Cygnus* because of its large size (much larger than species of geese) and also based on the presence of several morphological features. For example, the cranial scapula is not pneumatized (pneumatic opening occurs in geese); the head of the coracoid has the typical crescentic outline in medial view, typical of swans; the distal humerus with a proximocaudally compressed ventral condyle (well visible in cranial view). In the distal tibiotarsus, *C. pristinus* agrees with *Cygnus* in having narrow condylus lateralis in distal view.

KUROCHKIN (1971) described *C. pristinus* on the basis of a distal radius and a few other very fragmentary remains. In 1982/1983, MLíKOVSKÝ & ŠVEC (1986) studied the holotype of *C. pristinus* and transferred this species to *C. olor*. For unknown reason, they were unable to examine

not only paratypes, but also materials described later, which include much more informative distal humerus and tibiotarsus (Kurochkin 1976). I agree with Mlíkovský & Švec (1986) that the distal radius of *C. pristinus* is practically indistinguishable from that of extant *C. olor,* but it is noteworthy that the distal radius alone is not informative enough to solve the taxonomic problem. *Cygnus pristinus* indeed resembles *C. olor* in many structural details and proportions (e.g., shortened wing and pedal phalanges) but differs from this and other species of the genus in several details of almost all of the known skeletal elements. Furthermore, *C. pristinus* is similar with *C. cygnus* in some details (morphology of the humerus; tarsometatarsus, phalanx proximalis digiti majoris). Although it is likely that *C. pristinus* is more closely related to *C. olor*, its specific identity seems obvious. The presence of a mixture of characters may indicate this species is more primitive than all extant species. Molecular phylogenetic data estimate the mean divergence time between swans and geese as relatively recent event, 19.5±4.8 Myr (Gonzalez *et al.* 2009), what probably corresponds to the Early or early Middle Miocene. The diversification of swans must have occurred later, probably not earlier than the second half of the middle Miocene (based on the appearance of the modern-type waterfowl fauna in the fossil record), and thus the presence of primitive taxa with a mixture of characters in the Late Miocene is expectable. A phylogenetic analysis of swans with inclusion of *C. pristinus* may add important information on the evolutionary history of swans and affinities of this species.

Material: *Cygnus pristinus* is the most common species of birds in the terminal Miocene-Lower Pliocene Hyargas-Nuur formation of Western Mongolia. For completeness, I include in this section all the known materials, even if they formally come from the layers below the Miocene-Pliocene boundary.

Latest Miocene material. Locality Hyargas-Nuur 1: proximal phalanx of the fourth toe of left foot (PIN 3222/599). Locality Hyargas-Nuur 2: COR dext., cranial fragment (PIN 3222/32); COR dext., caudal fragments (PIN 3222/53, 3222/705); SCA sin., cranial fragments (PIN 2614/27, 2614/111); ULN, distal fragment (PIN 3222/109); RAD dext., distal fragments (PIN 2614/115, 3222/25); ulnare sin. (PIN 2614/116); CMC dex., proximal fragments (PIN 3222/23, 3222/38); CMC sin., proximal fragment (PIN 322/671); CMC dext., distal fragments (PIN 3222/40, 3222/41); proximal phalanx of the major wing digit sin. (PIN 2614/26); TMT dext., proximal fragment (PIN 2614/154); isolated trochlea metatarsi III dext. (PIN 3222/54); isolated trochlea metatarsi IV dext. (PIN 3222/698); third phalanx of the third toe of left foot (PIN 2614/113); fourth phalanx of the fourth toe of right foot (PIN 2614/117).

Early Pliocene material. Locality Chono-Harayah 1: TT dext., distal portion (PIN 2614/70); second phalange of the third toe of left foot (PIN 2614/73). Locality Chono-Harayah 2: CMC sin., proximal portions (PIN 2614/159, 3378/100). Locality Zogsoo-Harhan 1: COR dext., cranial portion (PIN 2737/390); HUM dext., distal portion (PIN 2614/108); HUM, sin., distal fragment (PIN 3222/19); ULN, distal fragment (PIN 2737/391); TMT, dex., proximal fragment (PIN 2614/205). Locality Zogsoo-Harhan 4: TT dext., distal fragment (PIN 2614/153).

Order Podicipediformes Fürbringer, 1888
Family Podicipedidae Bonaparte, 1831

***Podiceps solidus* Kurochkin, 1985**
(Fig. 3)

v. *Podiceps solidus* Kurochkin, 1985: p. 16, text-fig. 3; pl. I, figs 3, 4.

Type locality: Hyargas-Nuur 2, Western Mongolia, Late Miocene (MN 13).

Stratigraphical and geographical distribution: Mongolia: Late Miocene (Hyargas-Nuur 2), Early Pliocene (Chono-Harayah 1 and 2; Zogsoo-Harhan 1 and 4).

Holotype: HUM dext., distal portion (PIN 3222/37). Figured in Kurochkin (1985): text-fig. 3, pl. I, figs 3–4.

Original diagnosis: Distal end of humerus wide; impressio lig. collaterale ventrale inconspicuous; fossa m. brachialis shallow but broad; longitudinal axis of condylus ventralis oriented distocranially; dorsal part of fossa olecrani shallow (translated after Kurochkin 1985).
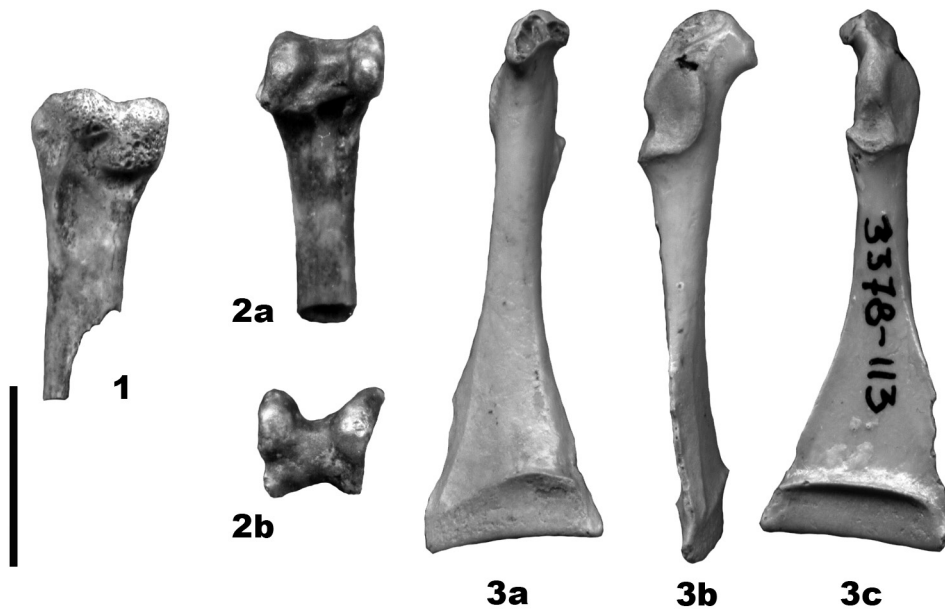
FIGURE 3. Remains of *Podiceps solidus* KUROCHKIN, 1985 from the Early Pliocene of Western Mongolia. **1**, holotype, distal fragment of right humerus, PIN, 3222/37 in cranial view; **2**, distal fragment of left tibiotarsus, PIN 3378/98 in cranial (**2a**) and distal (**2b**) views; **3**, right coracoid, PIN 3378/113 in ventral (**3a**), lateral (**3b**) and dorsal (**3c**) views. Scale bar equals 1 cm.

New materials: COR dext. (PIN 3378/113), locality Chono-Harayah 1; TT sin., distal portion (PIN 3378/98), locality Chono-Harayah 2; TMT sin., distal portion (PIN 3378/96), locality Chono-Harayah 2.

Measurements: COR: total length, 28.4; depth at the level of glenoid facet, 3.6; HUM: distal width, 7.2; TT: distal width, 6.6; distal depth, 6.2; depth across incisura intercondylaris, 4.2; TMT: distal width ~ 5.5; distal depth ~ 5.3.

Description and comparisons: I refer three new bones from the localities of Chono-Harayah to this species because of relative size and osteological similarity with extant *P. auritus* and *P. nigricollis*.

The fragmentary coracoid is morphologically similar to that of extant *P. nigricollis*, and differs only by the narrower dorsal portion of the facies articularis sternalis. The coracoid of extant *P. auritus* is more robust, with thicker shaft and wider impressio lig. acrocoracohumeralis. The fragmentary tibiotarsus, to the contrary, is similar to that of *P. auritus* in having the condylus lateralis truncated in lateral view. The condylus is more roundish in *P. nigricollis*. The tarsometatarsus belonged to an immature bird and thus displays few morphological details and cannot be compared with extant species.

Remarks: This species of a small grebe was established based on the distal end of humerus (KUROCHKIN 1985). KUROCHKIN (1985) noted that this species shared morphological features with both extant *P. nigricollis* and *P. auritus*. He further pointed that *P. solidus* was similar to *P. pisanus* from the Pliocene of Italy. OLSON & RASMUSSEN 2001 and MLÍKOVSKÝ 2002 later considered *P. pisanus* the junior synonym of extant *P. auritus*. However, *P. solidus* cannot be synonymized with *P. auritus* because it is more similar to *P. nigricollis* in some osteological details. The humerus of *P. solidus* is somewhat intermediate between the two extant species, the coracoid is more similar to those of *P. nigricollis*, and the tibiotarsus to that of *P. auritus*. Although there is a possibility that two species of similarly sized grebes inhabited the lakes of the Western Mongolia in the Late Miocene and Early Pliocene, I refer all of the known material to one species, in the absence of the contrary evidence. The intermediate morphology of *P. solidus* suggests that this species might be close to a lineage ancestral to both *P. auritus* and *P. nigricollis*.

Fossil grebes apparently related to this evolutionary lineage are known from the Pliocene

FIGURE 4. Bird remains from the Early Pliocene of Western Mongolia. 1, *Nyctanassa kobdoena* KUROCHKIN 1976, holotype, distal portion of right tarsometatarsus, PIN 2614/86 in dorsal (**1a**), ventral (**1b**) and distal (**1c**) views; 2, Otididae gen. indet., distal fragment of left tarsometatarsus, PIN 3378/129 in ventral (**2a**) and dorsal (**2b**) views. Scale bar equals 1 cm.

deposits of Europe and North America. *P. discors* MURRAY, 1967 was described from the Late Pliocene of Kansas (MURRAY 1967). A grebe similar to extant *P. nigricollis* was also found in the Late Miocene of Ukraine (VOINSTVENSKY 1967). *P. auritus* is further known from the Early Pliocene of North Carolina (USA; OLSON & RASSMUSSEN 2001), Pliocene of Florida (USA; BRODKORB 1953) and Italia (sub. *P. pisanus*; REGÀLIA 1902).

P. solidus was initially described from the Late Miocene deposits of the locality Hyargas-Nuur 2 (KUROCHKIN 1985), but the new materials from Chono-Harayah expand its geological distribution to the Early Pliocene.

Order Ardeiformes WAGLER, **1831**
Family Ardeidae VIGORS, **1825**

"Nyctanassa" kobdoena KUROCHKIN, **1976**
(Fig. 4)

v. *Nyctanassa kobdoena* KUROCHKIN, 1979: p. 54, fig. 2.
v. *Nyctanassa kobdoena* KUROCHKIN: 1985, p. 23, text-fig. 6; pl. II, figs 5, 6.

Type locality: Chono-Harayah 1, Western Mongolia, Early Pliocene (MN 14–15).

Stratigraphical and geographical distribution: Mongolia: Late Miocene (Hyargas-Nuur 2; MN 13), Early Pliocene (Chono-Harayah 1 and 2).

Holotype: TMT dext., distal portion (PIN 2614/86). Figured in KUROCHKIN (1979): fig. 2;

(1985): text-fig. 6; pl. II, figs 5, 6.

Emended diagnosis: Small heron the size of extant *Nyctanassa violacea* from which it can be distinguished by the following set of characters of distal tarsometatarsus: trochleae metatarsorum (especially trochlea metatarsi II) narrow; trochlea metatarsi II gradually widening distally; incisura intertrochlearis lateralis wide; sagittal plane of trochlea metatarsi II only slightly inclined with respect to sagittal plane of trochlea metatarsi III; distal margin of trochlea metatarsi IV positioned notably proximally than distal margin of trochlea metatarsi III; ventral articular surface of trochlea metatarsi II convex.

New materials: fragmentary cervical (11th to 14th) vertebra (PIN 3378/112), locality Chono-Harayah 2.

Measurements: maximum distal width, 9.5; width at the level of foramen vasculare distale, 6.4; maximal distal depth, 5.7.

Description and comparisons: KUROCHKIN (1976, 1985) provided detailed description and broad taxonomic comparisons of the holotype, but some of his characters are not suitable to diagnose this taxon. The characters mentioned above in the diagnosis allow distinguishing *N. kobdoena* from *N. violacea*. In the latter species, dorsal part of the articular surface of trochlea metatarsi II is widened and therefore the outer margin of this trochlea in distal view is inclined with respect to the sagittal plane of the trochlea metatarsi III at an angle about 40°, while this angle is much smaller in *N. kobdoena*. Ventral articular surface of the trochlea metatarsi II is

concave in *N. violacea* while it is convex in *N. kobdoena*.

The most striking features in which this form differs from extant *Nyctanassa* and *Nycticorax* is the gradually widening trochlea metatarsi II in dorsal view (as in *Cochlearius*) and trochlea metatarsi IV protruding considerably less distally than trochlea metatarsi III (as in *Butorides*). Both of these features are present in the fossil genus *Matuku* from the Early Miocene of New Zealand. *Matuku* was shown to be basal with respect to all living herons (Scofield *et al.* 2010) and so these features may be plesiomorphic within Ardeidae.

Remarks: Olson & Wingate (2006) doubted the validity of the generic assignment of this species because of the fragmentary nature of the holotype. The two genera of herons (*Nycticorax* and *Nyctanassa*) are however strikingly different in the proportions of tarsometatarsi what evidently reflects their somewhat different adaptations. Locomotor apparatus of Ardeidae is very flexible so that osteological correlates with feeding and locomotion styles can be easily found (Boev 1988, 1989). Given these facts, it is unsurprising that the two genera are easily distinguishable on the basis of the distal tarsometatarsus alone. *Nyctanassa violacea* is the specialist in crustacean, particularly crabs, while *Nycticorax* herons are opportunist feeders with generally very diverse diet. *Nyctanassa violacea* spend much time in walking (Rodgers 1983) while *Nycticorax nycticorax* normally just stands and waits during feeding (Rusev 2011). I agree with Kurochkin (1976, 1985) that *N. kobdoena* is much more similar to extant *Nyctanassa* than to *Nycticorax* (in the fossil species, the trochleae metatarsorum are narrow and more splayed as in *Nyctanassa*), which may indicate that this fossil species was more generalized in its feeding behavior (although not necessarily in its diet) than extant *Nycticorax* species, but observed differences (see above) possibly indicate that *N. kobdoena* belongs to a more primitive extinct genus. New material is however necessary to confirm this hypothesis. At present, the generic status of *N. kobdoena* should be regarded as uncertain.

Order Otidiformes Sibley *et al.*, **1988**
Family Otididae Gray, **1840**

Otididae gen. indet.
(Fig. 4)

Material: TMT dext., distal fragment (PIN 3378/129), locality Chono-Harayah 2.

Measurements: depth of trochlea metatarsi III, 8.3.

Remarks. The fragmentary tarsometatarsus can be assigned to Otididae because of a characteristic widening of the shaft near the base of the trochlea metatarsi II in combination with flat dorsal surface and nearly symmetrical trochlea metatarsi III. The specimen however is very fragmentary which precludes from assigning it to any particular genus, but it may have belonged to the genus *Gryzaja* previously known from the Pliocene of Ukraine and Moldavia (Kurochkin & Khozatskij 1972). The Mongolian form is however larger then *G. odessana* Zubareva, 1939 and thus may represent another species. Very large bustard *Ioriotis gabunii* Burchak-Abramovich & Vekua, 1981 has been described from the Late Pliocene of Georgia based on a fragmentary proximal humerus (Burchak-Abramovich & Vekua 1981) and thus cannot be compared with the Mongolian form.

Order Gruiformes Bonaparte, **1854**
Family Gruidae Vigors, **1825**

Grus mongolica (Kurochkin, **1985**) **comb. nov.** (Fig. 5)

v. *Probalearica mongolica* Kurochkin, 1985: p. 58, text-fig. 27, pl. VII, figs 5–8.

Type locality: Chono-Harayah 1, Western Mongolia, Early Pliocene (MN 14–15).

Stratigraphical and geographical distribution: Mongolia: Late Miocene (Hyargas-Nuur 2), Early Pliocene (Chono-Harayah 1).

Holotype: TT sin., distal portion (PIN 3378/45). Figured in Kurochkin (1985): text-fig. 27, pl. VII, figs 5–8.

Emended diagnosis: Large crane, the size of extant *G. leucogeranus*, which can be distinguished from this and other large cranes by thin condylus medialis; roundish distal foramen of canalis extensorius; short and obliquely oriented ligamental scar on the medial margin of
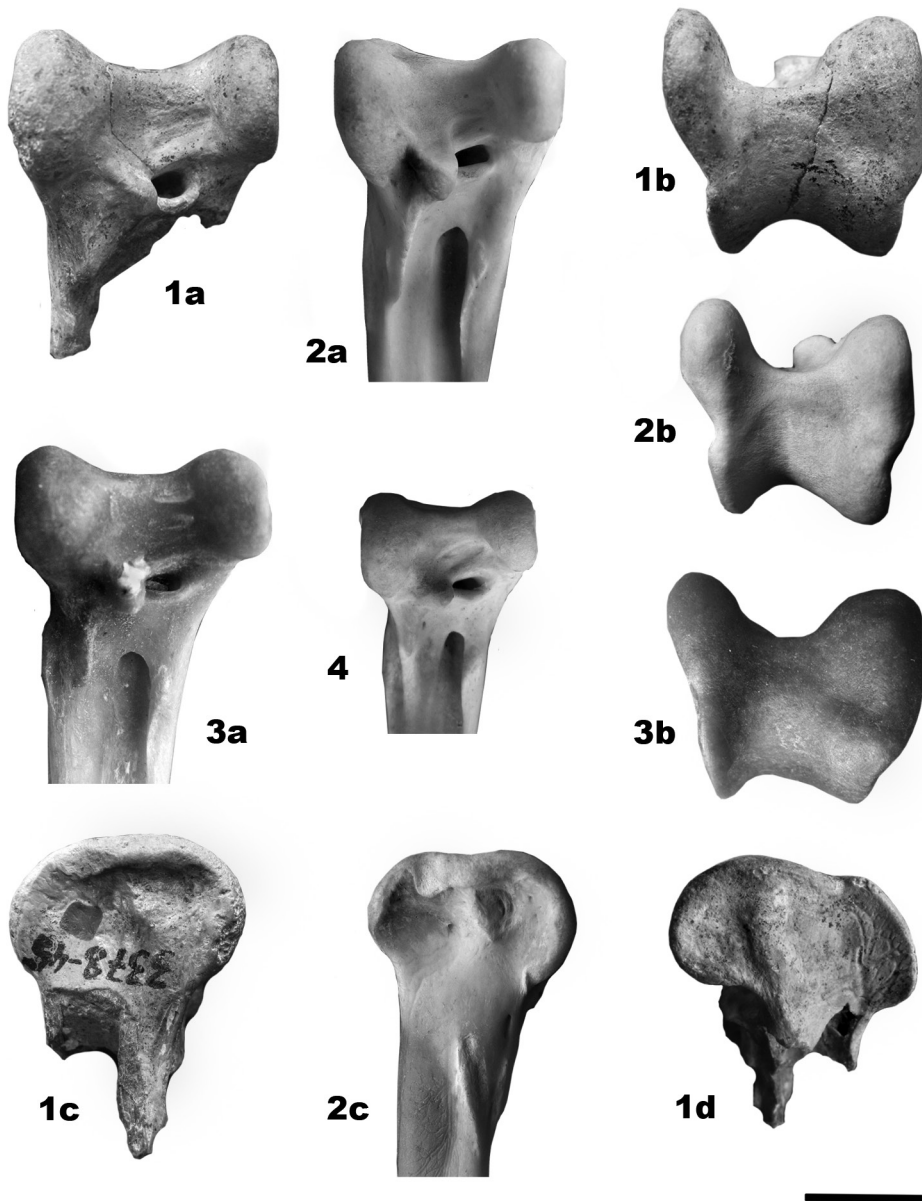
FIGURE 5. *Grus moldavicus* (KUROCHKIN, 1985) from the Early Pliocene of Western Mongolia compared with extant Gruidae. 1, *Grus moldavicus,* holotype, PIN 3378/45, distal tibiotarsus in cranial (**1a**), distal (**1b**), lateral (**1c**) and medial (**1d**) views; 2, *Grus grus*, extant, distal tibiotarsus in cranial (**2a**), distal (**2b**) and lateral (**2c**) views; 3, *Balearica regulorum*, extant, distal tibiotarsus in cranial (**3a**) and distal (**3b**) views; 4, *Anthropoides virgo*, extant, distal tibiotarsus in distal view. Scale bar equals 1 cm.

the cranial surface of the shaft; sulcus cartilaginis tibiotarsi narrow.

Measurements: maximal distal width, 21.8; maximal distal depth, 23.2; depth across incisura intercondylaris, 11.5;

Description and comparisons: The condylus lateralis is rather wide (as in *G. japonensis*, *G. vipio*), while it is notably narrower in other cranes and fossil genus *Pliogrus*; condylus medialis is unusually thin and proximodistally elongated in both cranial and distal view, this condyle is normally thicker in cranes although it is also somewhat thin in *G. vipio*, *G. monacha* and *G. leucogeranus*. The apophysis lig. externi is moderately developed, as in extant *G. japonensis* and *G. leucogeranus,* while it is bulbous in other cranes. The ligamental scar on the cranial surface just proximal to apophysis is unusually short

and obliquely oriented (it is normally very long in cranes and usually is subparallel to the long axis of the bone). Somewhat similar morphology of the scar was found just in one specimen of *G. monacha*. A pit on the medial surface of the condylus medialis is very weakly developed; it is normally deep in cranes (shallow – but still deeper than in *G. mongolica* – pit is observed in *G. leucogeranus* and *G. japonensis*). The epicondylus medialis is weakly expressed.

Grus mongolica differs from *Anthropoides* and *Balearica* (including fossil "*Probalearica*" *crataegensis* BRODKORB, 1963) in that the condylus lateralis is not shifted laterally with respect to the shaft and also by the very thin condylus medialis. The ledge in the lateral outline of the bone in distal view is very caudally positioned in *Balearica* while it is shifted cranially in *Grus* (including *G. mongolica*). *G. mongolica* is further similar to extant *Grus* and differs from *Balearica* in having condylus medialis strongly shifted medially (well visible in distal view) and in the shape of the lateral outline of the bone in distal view.

Grus mongolica easily differs from the genus *Palaeogrus*, known from the Paleogene and Neogene of Europe, by the truncated distal surface of the condylus lateralis (flat in *Palaeogrus*) and by the presence of a well-developed ledge in the lateral outline of the bone in distal view (completely absent in *Palaeogrus*). In the putative crane *Geranopsis*, the distal surface of the condylus lateralis is also flat (HARRISON & WALKER 1979).

Another fossil genus *Pliogrus* contains two species from the Early Pliocene of Germany; distal tibiotarsus is known for one of them. The validity of this genus is not obvious; CRACRAFT (1973) and MLÍKOVSKÝ (2002) consider *Pliogrus* the junior synonym of extant *Grus*. As can be judged from a picture in LAMBRECHT (1933), the condylus lateralis in *Pliogrus* is even narrower than in *Grus*, while in *Grus mongolica* it is wider than in most extant *Grus*.

Remarks: *Grus mongolica* was initially assigned to the genus *Probalearica*, which was erected by LAMBRECHT (1933) for the supposed crane *Grus problematica* MILNE-EDWARDS, 1871 known from a fragmentary skull and sternum from the Late Oligocene-Early Miocene of France. Since the work of LAMBRECHT, three more species were assigned to this genus, all of them just because of supposed similarity to the extant cranes *Balearica*. *Probalearica crataegensis* BRODKORB, 1963, *P. moldavica* KUROCHKIN & GANYA, 1972 and *P. mongolica* KUROCHKIN, 1985 are all known from just distal tibiotarsi and thus cannot be directly compared to *G. problematica*. The type species of *Probalearica* was shown (CHENEVAL & ESCUILLIÉ, 1992; MOURER-CHAUVIRÉ, 2001) to be the junior synonym of the phoenicopteriform *Palaelodus ambiguous* MILNE-EDWARDS, 1863, and thus the generic name *Probalearica* should be treated as the junior synonym of *Palaelodus*. MOURER-CHAUVIRÉ (2001) gave a number of characters to distinguish *P. crataegensis* from *Balearica* and considered this species a member of the genus *Palaeogrus*. *P. moldavica* should be excluded from Gruidae (MOURER-CHAUVIRÉ 2001); I agree with the latter author that the familiar or even ordinal affinity of this taxon requires confirmation. *Probalearica mongolica* was thus the only remaining species within the former genus *Probalearica,* and this one also should be moved to the genus *Grus*.

Family Rallidae REICHENBACH, 1854

Pastushkinia ZELENKOV, gen. nov.

Etymology: After "Pastushok", a common Russian name for rails.

Type species: *Crex zazhigini* KUROCHKIN, 1980.

Diagnosis: The genus can be diagnosed on the basis of the following features: distal humerus is more than twice wider (measured dorsoventrally) than deep (measured craniocaudally); cranial surface between tuberculum supracondylare ventrally and dorsal margin of the bone markedly concave; sulcus m. humerotricipitalis wide and shallow; epicondylus ventralis moderately protruding ventrally relatively to the shaft.

Comparisons: The distal humerus of *Pastushkinia* is unusually narrow in distal view (Fig. 6). It is more than twice wider that deep, while in most extant and all fossil rails the distal humerus is at maximum two times wider that deep (usually even less than that). The moderately protruding ventrally condylus ventralis and shallow and wide sulcus m. humerotricipitalis are obviously connected with the general craniocau-
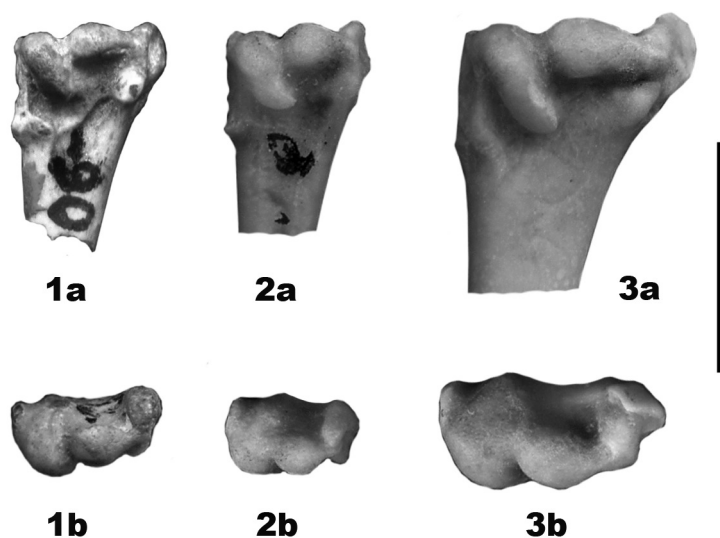
FIGURE 6. Distal humerus of *Pastushkinia zazhigini* (KUROCHKIN, 1980) in comparison with extant rails. **1**, *Pastushkinia zazhigini,* holotype, PIN 2614/90, distal end of left humerus in cranial (**1a**) and distal (**1b**) views; **2**, *Crex crex*, extant, in cranial (**2a**) and distal (**2b**) views; **3**, *Aramides saracura*, extant, in cranial (**3a**) and distal (**3b**) views. Scal bar equals 1 cm.

dal flatness of the distal end. A similar condition (narrow distal end with shallow sulcus) is found in *Aramides* and *Gallinula* – in both, however, the epicondylus ventralis is much more strongly protruding ventrally, in contrast to the condition of *Pastushkinia,* in which the distal end in cranial view is almost as narrow as in *Crex*. The new genus also differs from *Gallinula* and *Rallus* by unusually concave cranial surface of the distal end. This surface is however somewhat concave in *Crex* and *Aramides,* but it is absolutely flat in *Gallinula*.

Unusual flatness of the distal end further allows for distinguishing *Pastushkinia* from *Palaeoaramides* and other Neogene rail genera from which humeri are known (see CRACRAFT 1973; CHENEVAL 2000). *Pastushkinia* is similar in proportions to the genus *Belgirallus* from the Early Oligocene of Belgium (MAYR & SMITH 2001), but differs from that genus by strongly protruding processus flexorius and weakly developed tuberculum supracondylare ventrale. The latter tuberculum is developed as rather broad elevated area in *Belgirallus*, while there is just a small tubercle in this position in *Pastushkinia*.

Pastushkinia zazhigini (KUROCHKIN, 1980), comb. nov.
(Fig. 6)

v. *Crex zazhigini* KUROCHKIN, 1980: p. 72, figs 4, 5f.
v. *Crex zazhigini* KUROCHKIN: 1985, p. 69, text-fig. 31, pl. IX, figs 1, 2.

Type locality: Chono-Harayah 1, Western Mongolia, Early Pliocene (MN 14–15).

Stratigraphical and geographical distribution: Type locality only.

Holotype: HUM sin., distal portion (PIN 2614/90). Figured in KUROCHKIN (1980): figs 4, 5f; (1985): text-fig. 31, pl. IX, figs 1, 2.

Diagnosis: as for the genus.

Measurements: Maximum distal width, 6,2; depth of condylus dorsalis, 3.1; depth of condylus ventralis, 1.8.

Remarks: Unusual flatness of the distal end of the humerus precludes from referring the species to the extant genus *Crex* (see above). The original diagnosis (KUROCHKIN 1980) was based on comparisons with the extant *Crex crex* alone and as such is not valid.

Rallidae gen. indet.
(Fig. 7)

v. *Asio* aff. *otus*: KUROCHKIN 1985, p. 76, text.-fig. 76.

Material: Rostral fragment of sternum (PIN

2614/89), locality Chono-Harayah 1.

Remarks: The specimen was previously referred to a small owl (Kurochkin 1985), but in Strigidae a notch in the cranial outline of the sternum is visible in dorsal view. This notch is further not concave in cranial view in owls. Additionally, the cranial surface of the keel bears a ridge which is absent in the specimen from Chono-Harayah. All extant Rallidae except *Gallinula* have a pair of deep pits on the dorsal surface of the sternum just near its cranial margin. These pits are nearly absent in *Gallinula* and in the specimen in question. I however refrain from assigning this specimen to extant *Gallinula*, because such fragmentary sternum is not diagnostic enough at the genus level in birds. The oldest currently known find of this genus (*Gallinula kansarum* Brodkorb, 1967) comes from the late Early-early Late Pliocene of North America (Becker 1987). The genus has been further documented in the Early and Late Pliocene of Europe (Boev 1999; Mayr & Gregor 1999; Mlíkovský 2002).

Order Charadriiformes Fürbringer, 1888
Family Charadriidae Vigors, 1825

***Vanellus* cf. *V. leucurus* (Lichtenstein, 1823)**
(Fig. 7)

Material: COR sin. (PIN 3378/107), locality Chono-Harayah 2.

Measurements: Maximal length of the fragment, 20.5; minimal shaft width, 3.0; depth of facies articularis humeralis, 3.3.

Description and comparisons: This specimen can be assigned to Charadriidae because of presence of the foramen n. supracoracoidei and widened base of the angulus medialis. It is similar to the subfamily Vanellinae in having narrow central part of the facies articularis sternalis (well visible in caudal view) and sub-rectangle facies articularis humeralis. In Charadriinae, the facies articularis sternalis is not narrow in its central part, and facies articularis humeralis is angled cranially. The specimen from Chono-Harayah 2 is similar to *Vanellus leucurus* because of angulus medialis not curved dorsally (the angulus is curved in other *Vanellus,* including *V. gregarius*).

Remarks. The White-tailed lapwing *Vanellus leucurus* inhabits river valleys and swamps in Asian deserts. It is morphologically distinct from other *Vanellus* and once was placed into a monotypic genus *Vanellochettusia* (Kozlova 1961).

Family Laridae Bonaparte, 1831

Larus* magn. *L. ichthyaetus
(Fig. 7)

Material: Ulnare (PIN 3378/133), locality Chono-Harayah 2.

Measurements: Maximal length, 14.2.

Remarks: Extant species of the genus *Larus* can hardly be distinguished on the basis of morphology of ulnare, and thus the exact taxonomic status of this large Early Pliocene gull remains uncertain. The specimen can be referred to Laridae because of the short ramus dorsalis, and to the genus *Larus* due to the well-defined concavity on the proximal surface.

Larus* magn. *L. canus
(Fig. 7)

Material: CMC dext., distal portion (PIN 3378/85), locality Chono-Harayah 1.

Measurements: Craniocaudal depth of the distal end, 7.7.

Remarks: This specimen belonged to a gull the size of extant *L. canus,* but its fragmentary nature precludes from detailed comparisons.

Order Accipitriformes Savigny, 1809
Family Accipitridae Savigny, 1809

***Haliaeetus fortis* Kurochkin, 1985**
(Fig. 7)

Type locality: Hyargas-Nuur 2, Western Mongolia, Late Miocene (MN 13).

Stratigraphical and geographical distribution: Mongolia: Late Miocene (Hyargas-Nuur 2), Early Pliocene (Chono-Harayah 1 and 2; Tataly; MN 14–15).

Holotype: COR sin., cranial portion (PIN 3222/31). Figured in Kurochkin (1985): text.-fig. 23, pl. II, figs 9, 10.

Newly referred material: basal phalanx of the first toe sin. (PIN 3378/89+91), locality Chono-Harayah 2; second phalanx of the
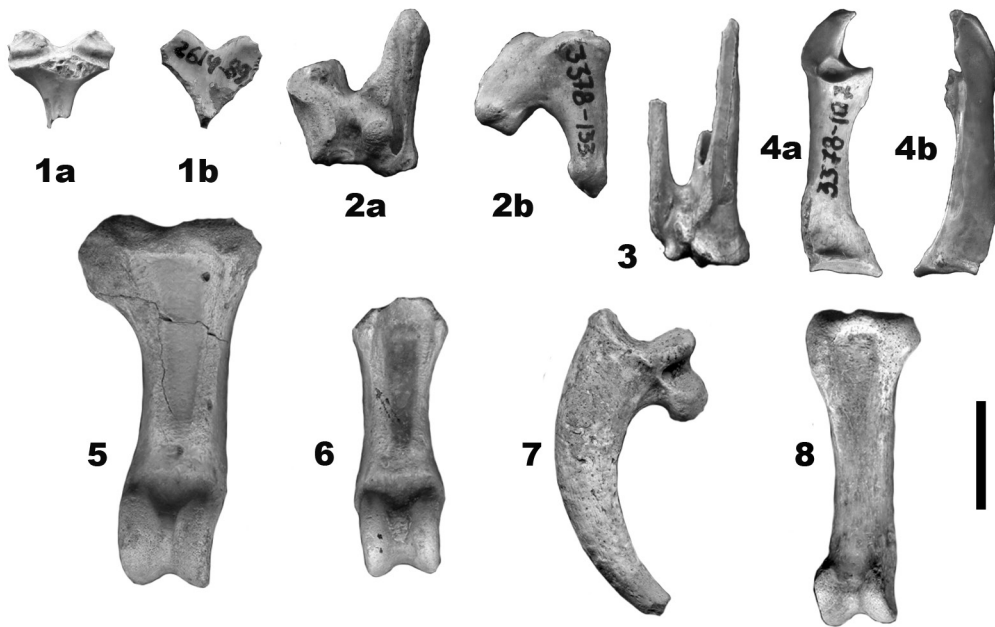
FIGURE 7. Various bird remains from the Early Pliocene of Western Mongolia. **1**, Rallidae gen. indet., fragmentary sternum, PIN 2614/89 in cranial (**1a**) and dorsal (**1b**) views; 2, *Larus* magn. *L. ichthyaetus*, left ulnare, PIN 3378/133 in ventrocaudal (**2a**) and dorsocranial (**2b**) views; **3**, *Larus* magn. *L. canus*, right distal carpometacarpus, PIN 3378/85, in ventral view; **4**, *Vanellus* cf. *V. leucurus*, left coracoid, PIN 3378/107, in dorsal (**4a**) and ventral (**4b**) views; **5–7**, *Haliaeetus fortis* (KUROCHKIN, 1985): **5**, basal phalanx of the first toe of left foot, PIN 3378/89+91, in ventral view; **6**, second phalanx of the second toe of right foot, PIN 3378/126, in ventral view; **7**, ungulate phalange, PIN 2614/161 in lateral view; **8**, Accipitridae gen. indet., proximal phalanx of the third digit of left foot, PIN 3378/105, in ventral view. Scale bar equals 1 cm.

second toe dext. (PIN 3378/126), locality Chono-Harayah; ungual phalanges (PIN 2614/161), locality Chono-Harayah 2 and (PIN 3376/64), locality Tataly.

Measurements of the new material: specimen PIN, 3378/89: total length, 34.6; proximal width, 17.4; proximal depth, 8.3; distal width, 8.8; distal depth, 8.4; specimen PIN, 3378/126: total length, 27.5; proximal width, 8.9; proximal depth, 10.3; distal width, 7.3; distal depth, 7.6; specimen PIN, 2614/161: proximal depth, 13.4; proximal width, 8.5; specimen PIN 3376/64: proximal depth, 11.9.

Remarks: *Haliaeetus fortis* was described from the Latest Miocene of Western Mongolia (KUROCHKIN 1985). Newly referred phalanges from the Early Pliocene beds agree with the holotype in relative size (roughly similar to extant *H. leucocephalus*) and on this basis are assigned to this species. The avian faunas of the Late Miocene and Early Pliocene sections of the Hyargas-Nuur formation are very similar and contain many common species (KUROCHKIN 1985;

ZELENKOV 2012), so such assignment seems to be plausible. The proximal phalanx of the first toe is somewhat larger than the corresponding bone from the Hyargas-Nuur 2 (see KUROCHKIN 1985) but such differences can be explained by sexual dimorphism. The first phalanx of the first digit agrees with that of extant *Haliaeetus* in its proportions and short medial (internal) process on the proximal part. The process is also short in *Gyps*, but the distal end of the phalanx in *Gyps* is twisted. The second phalanx of the second toe is also similar to those of extant *Haliaeetus* in its proportions and high articular surfaces. The ungual phalanges agrees with those of extant *Haliaeetus* in its curvature (unguals are normally considerably less curvated in other large Accipitines) and well developed (but not as robust as in *Aegypius*) flexor tubercles.

Gypaetinae indet.

Material: Proximal phalanx of the third digit sin. (PIN 3378/105), locality Chono-Harayah 2.

Measurements: total length, 29.5; proximal depth, 8.1; proximal width, 10.7; distal depth, 8.5; distal width, 7.1.

Description and comparisons: The proximal phalanx of the third toe is similar to that of extant *Gypaetus barbatus* in being elongated and relatively narrow, but differs by smaller size and considerably more asymmetrical distal articular surface and more elongated flexor tubercle. It clearly differs from those of *Haliaeetus* by its narrower proportions and thus cannot be assigned to

Haliaeetus fortis. The specimen significantly differs from the corresponding elements of *Aegypius* and *Gyps* in several characters, including asymmetrical distal articular surface with the condyles strongly protruding ventrally.

Conclusions

The study of the new material and revision of the previously described remains of the Early

TABLE 1. A full list of taxa currently known from the Pliocene of Western Mongolia. Localities: 1 – Chono-Harayah 1; 2 – Chono-Harayah 2; 3 – Chono-Harayah 3; 4 – Zavhan; 5 – Tataly; 6 – Hung-Kureh; 7 – Zogsoo-Harhan 1; 8 – Zogsoo-Harhan 4. References: 1 – KUROCHKIN 1971; 2 – KUROCHKIN 1976; 3 – KUROCHKIN 1980; 4 – KUROCHKIN 1985; 5 – MLÍKOVSKÝ & ŠVEC 1986; 6 – ZELENKOV & KUROCHKIN 2010; 7 – ZELENKOV 2012. Taxa marked with an asterisk (*) are also recorded from the latest Miocene of Mongolia (see KUROCHKIN 1982, 1985; ZELENKOV 2012).

Taxon name	Localities	References
Syrmaticus kozlovae KUROCHKIN, 1985	1, 2	4, 6
Perdicinae gen. indet.	2	4 (sub. *Alectoris* sp.), 6 (sub. Phasianidae gen. indet.)
Anser (Chen) devjatkini KUROCHKIN,1971	1	1, 7
Anser (Chen) liskunae KUROCHKIN, 1976	4	2, 4, 5 (sub *Olor liskunae*), 7
Cygnus pristinus KUROCHKIN, 1971	1, 2, 6, 7, 8	1, 2, 4, 5 (sub *Cygnus olor*), this study
Cygnus sp.	1, 2, 4, 8	4
Anserinae/Tadorninae gen. indet.	2, 5	4 (sub Tadorninae gen.)
Aix sp.	1	7
Anas cf. *A. pullulans* BRODKORB, 1961	2	4, 7
Anas magn. *A. strepera*	1, 4	4, 7
Anas sp.	2, 8	4 (sub *Anas molesta*), 7
Aythya molesta KUROCHKIN, 1985	3	4 (sub *Anas molesta*), 7
Aythya? *spatiosa* KUROCHKIN, 1976	1	2, 4, 5, 7
Podiceps solidus KUROCHKIN, 1985	1, 2	4; this study
Phalacrocorax reliquus KUROCHKIN, 1976	1	2, 4
Phalacrocorax mongoliensis KUROCHKIN, 1971	1	1, 4
Nyctanassa kobdoena KUROCHKIN, 1976	1	2, 4; this study
Ciconia lucida KUROCHKIN, 1982	1	4
Urmiornis dzabghanensis (KUROCHKIN, 1985)	2; 4; 8	4
Otididae gen. indet.	2	this study
Grus mongolicus (KUROCHKIN, 1985)	1	4; this study
Pastushkinia zazhigini (KUROCHKIN, 1980)	1	3, 4 (sub. *Crex zazhigini*), this study
Rallidae gen. indet.	1	4 (sub *Asio* aff. *otus*), this study
Vanellus cf. *V. leucurus*	2	this study
Limosa lacrimosa KUROCHKIN, 1985	1	4
Larus magn. *L. ichthyaetus*	2	this study
Larus magn. *L. canus*	1	this study
Haliaeetus fortis KUROCHKIN, 1985	1, 2, 5	this study
Accipitridae indet. (aff. ?*Gypaetus*)	2	this study
Syrrhaptes sp.	1	4

Pliocene birds from Western Mongolia broaden the list of taxa currently known from the Hyargas-Nuur formation and provide evidence for systematic position of some taxa described earlier. A bustard, two species of gulls, a gypaetine raptor, and a lapwing are for the first time documented in the Early Pliocene of Asia and represent the oldest finds of the corresponding evolutionary lineages in Asia. The find of a lapwing very similar to extant *V. leucurus* is especially interesting and present evidence for a long history of this charadriid bird in Asia, now inhabiting only arid zone. Two more bird taxa, *Podiceps solidus* and *Haliaeetus fortis* were initially described from the Late Miocene sediments but are now known from the Early Pliocene of the same area. The crane *Probalearica mongolica* belongs to the extant genus *Grus*; the presumed corncrake *Crex zazhigini* is moved to a separate genus *Pastushkinia*; the generic position of the heron *Nyctanassa kobdoena* remains uncertain, but further materials may prove its separate generic status. Owls are not yet reported from the Pliocene of Asia since the presence of the genus *Asio* in the Early Pliocene of Mongolia is deleted.

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