

The systematic position of the genus *Basityto* Mlikovsky, 1998 (Aves: Gruiformes: Gruidae)

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Abstract.—The genus *Basityto* Mlikovsky, 1998 was described as a giant Barn Owl and placed in the subfamily Tytoninae, family Strigidae. However its morphological characteristics correspond to a crane and it is here transferred to the recent genus *Balearica*, family Gruidae. Other fossil Balearicinae have been placed in the genus *Probalearica* Lambrecht, 1933, type-species *Probalearica problematica* (Milne-Edwards, 1869). The lectotype of this species, here designated, is a partial rostrum which is now known as belonging to *Palaelodus ambiguus* (Phoenicopteriformes: Palaelodidae). The genus *Probalearica* Lambrecht, 1933 is a junior synonym of *Palaelodus* Milne-Edwards, 1863, and the species *Probalearica problematica* a junior synonym of *Palaelodus ambiguus* Milne-Edwards, 1869. The systematic position of the other elements attributed to *Probalearica problematica*, and of the other species attributed to the genus *Probalearica*, needs to be revised. *Balearica rummeli*, from the Early Miocene of Germany, is so far the oldest known occurrence of the recent genus *Balearica*.

In 1998 Mlikovsky described a new genus and a new species of Barn Owl, *Basityto rummeli*, in the subfamily Tytoninae which he places in the family Strigidae, contrary to the most widespread opinion (Sibley & Ahlquist 1990). The new species was founded on an uncatalogued left humerus in the private collection of Michael Rummel, from the Grafenmühle 21 locality, in Bavaria, Germany, the age of which is Early Miocene, Agenian or Orleanian, mammal biozone MN 2 or MN 3 (Mein 1990). I personally examined this holotype, which is now catalogued as n° 3/21-0001 in Rummel's collection. A cast of the specimen is deposited in the collection of the Université Claude Bernard - Lyon 1, with the number FSL 330816. This humerus does not belong to a member of the Tytonidae but is very similar to that of the recent genus *Balearica*, in the Gruidae. Anatomical terminology follows Baumel & Witmer (1993) and, when necessary, Howard

(1929). Institutional abbreviations: MNHN Paris, Muséum national d'Histoire naturelle de Paris; MHN Lyon, Muséum d'Histoire naturelle de Lyon; UCB Lyon, Université Claude Bernard - Lyon 1.

Order Gruiformes
Family Gruidae

Genus *Balearica* Brisson, 1760
Balearica rummeli (Mlikovsky, 1998),
new combination
Figs. 1-3

Condition of the holotype.—The proximal part of the humerus of *Basityto* has been imperfectly restored with plaster on the caudal face, so that this part is much more proximally straightened than it would normally be, although on the cranial face, there is a proper contact between the two pieces of bone. If in the photograph the part corresponding to the plaster were removed, the true appearance would not be restored

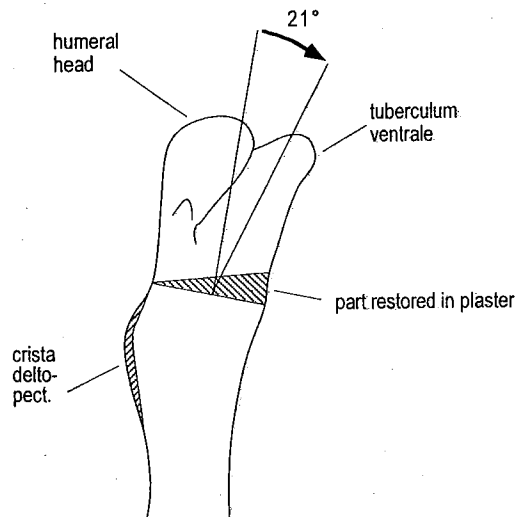


Fig. 1. *Balearica rummeli*, diagram of the humerus, in dorsal view, showing that the plaster on the caudal face has given the bone a more straightened aspect.

because it would still be necessary to rotate the proximal part about 21° caudally (Fig. 1), which would give a rather different aspect. The tuberculum ventrale then seems much less proximally elevated in relation to the humeral head, and the head forms a slight ledge above the incisura capitis and the surface of the caudal face. Because of this artificially straightened aspect, the humerus of *Basityto* does not seem completely similar to that in the Gruidae but looks a little like that of *Xenerodiops mycter* (Rasmussen et al. 1987).

Comparison with Tytonidae and Gruidae, subfamily Balearicinae.—The genus *Balearica* (crowned cranes) shows osteological characteristics that are different from those of the other genera of the family Gruidae, which confirms its allocation to a distinct subfamily (Peters 1963, Feduccia & Voorhies 1992). Archibald & Meine (1996) consider that the genus comprises two species, *Balearica pavonina* (Linnaeus, 1758) and *Balearica regulorum* (Bennett, 1834) although the latter is sometimes considered a subspecies of *B. pavonina*. These two taxa have practically the same osteological dimensions (Feduccia & Voorhies 1992). Comparison of the humerus of *Basityto* with that of Tytonidae and Balearicinae

shows that it is not a barn owl but a crowned crane.

On the caudal face of the proximal part, in *Basityto*, as in *Balearica*, the caput humeri is globular and proximally raised, while in the Tytonidae it is transversely (i.e., dorso-ventrally) elongated. In *Basityto*, as in *Balearica*, the incisura capitis is wide and almost oriented along the longitudinal axis of the bone, while in the Tytonidae it is narrower and obliquely oriented. In the Gruidae (Gruinae and *Balearica*) there is a smooth ridge that crosses the incisura capitis, from the middle of the caput humeri to the crus dorsale of the pneumatic fossa. This smooth ridge is more globular in the Gruinae and more elongate in the Balearicinae. This ridge is also present in *Basityto*, while it is absent in the Tytonidae. The tuberculum dorsale is very conspicuously projecting in *Balearica* and it is an important characteristic differentiating the Balearicinae from the Gruinae. It is also strongly projecting in *Basityto*, while it is only slightly projecting in the Tytonidae. On the cranial face, in the Tytonidae, there is a depression situated between the intumescencia humeri and the delto-pectoral crest that is proximo-distally elongated. The intumescencia is bordered on its dorsal side by a distinct ledge (see Mourer-Chauviré 1987, fig. 1). This depression is absent in *Balearica* and in *Basityto*. In *Balearica* the intumescencia humeri shows a bulge distally, on the ventral side but, this part of the bone is missing in *Basityto* (Figs. 2, 3).

On the caudal face of the proximal part of the shaft, *Basityto* shows a very elongate impression of *M. latissimus dorsi* in the sagittal plane of the bone. This impression begins proximally with a tubercle and then becomes a thin, elongate impression, that is continued distally by a shallow groove. Both the tubercle and the muscular impression exist in *Balearica* and in *Basityto* whereas in the Tytonidae the impression of *M. latissimus dorsi* has a completely different shape and is situated on the dorsal side of the shaft. The shallow groove is not al-

ways very pronounced in *Balearica*, and it also exists in the Gruinae (e.g., *Grus* and *Anthropoides*).

The distal extremity in the Tytonidae is strongly ventrally elongated, whereas it is proportionally less elongated in *Basityto* and in *Balearica*. On the cranial surface, the condylus ventralis is globular in *Basityto* and in *Balearica*, but more elongate in the Tytonidae. The ectepicondylar prominence is situated more proximally in *Basityto* and in *Balearica* than in the Tytonidae. The incisura intercondylaris is deeper in *Basityto* and in *Balearica* than in the Tytonidae. In *Basityto*, as in the Gruidae, there is a muscular attachment, situated on the cranial face of the epicondylus ventralis, distally to the attachment of the anterior articular ligament. This muscular attachment has the shape of a small, deep circular depression. In the Tytonidae this muscular attachment is situated more ventrally, on the ventral face of the epicondylus ventralis (Fig. 3). On the caudal surface, in *Basityto* as in the Gruidae, the fossa olecrani is almost invisible and there are two well marked grooves (internal and external tricipital grooves of Howard 1929), while in the Tytonidae the fossa olecrani is well delimited and there is only one visible sulcus, on the ventral side.

Comparison with recent Gruidae.—Feduccia & Voorhies (1992) have indicated that the humerus of *Balearica* differs from that of Gruinae by the following characteristics: humerus with pneumatic fossa less excavated and with pneumatic foramen smaller; crista delto-pectoralis not extended down shaft as in Gruinae and intumescencia humeri relatively less extensive. It can be added that the tuberculum dorsale is much more proximally projecting, and that the distal end is more ventrally elongated in *Balearica* than in Gruinae.

In *Basityto*, because of the break, it is not possible to see the exact shape of the pneumatic fossa, but it seems that it was shallow. The other characteristics of the Balearicinae are also found in *Basityto*. Compared to *Anthropoides virgo*, the humerus

of which is almost the same size, in *Balearica* the crista delto-pectoralis is proximo-distally shorter, less extended in the cranio-caudal direction, and is inserted more on the cranial surface, while in *A. virgo* it is inserted along the dorso-cranial angle of the shaft. In these characteristics, *B. rummeli* corresponds perfectly to *Balearica*. In *Balearica* the condylus dorsalis tapers at its proximal end, and sometimes shows a slight distalward curvature. This characteristic does not appear in *Basityto*, where the end of the condyle seems more rounded, but is slightly incomplete (Fig. 3).

According to these morphological characteristics, I propose that the genus *Basityto* be placed in synonymy with the genus *Balearica*. The species *Balearica rummeli* differs from the recent species *B. regulorum* and *B. pavonina* by its smaller size.

Measurements of the humerus (mm), after Mlikovsky 1998: estimated total length, 175; proximal width as preserved, 35; depth of head, 10.6; proximal depth from tuberculum ventrale to intumescencia humeri, 17.2; length from proximal part of caput humeri to distal end of crista delto-pectoralis, 52.5; width and depth of shaft at midpoint, 13.1 and 11.2; distal width, ca. 26.5; distal depth, 14.6; length from ectepicondylar prominence to the distal surface of condylus dorsalis, 13.0. In *B. pavonina* the humerus length varies from 189.2 to 228.9 mm ($n = 10$), and in *B. regulorum* from 186.4 to 211.1 mm ($n = 10$) (Feduccia & Voorhies 1992). The dimensions of *B. rummeli* are about 90% of the mean dimensions of the recent crowned cranes.

Comparison with fossil Balearicinae.—Genus *Probalearica* Lambrecht, 1933: The genus *Probalearica* was created by Lambrecht (1933) for the species *Grus problematica* Milne-Edwards, 1869, described from an incomplete os premaxillare (MNHN, Av 8728 from Saint-Gérard-le-Puy (Early Miocene, mammal zone MN 2a) and two sterna from Gannat (Late Oligocene, reference-level MP 30). Cracraft (1973) incorrectly considered the anterior



Fig. 2. Humeri in caudal view. a, *Balearica rummeli* (Mlikovsky), left humerus, holotype, Michael Rummel collection, n° 3/21.0001. b, *Tyto alba*, recent, left humerus, Collection UCB, Lyon, n° 245-3. c, *Balearica pavonina*, recent, right humerus, Collection UCB, Lyon, n° I-73. a and c, natural size, b 1.5 × natural size.



Fig. 3. Humeri in cranial view. a, *Balearica rummeli* (Mlikovsky), left humerus, holotype, Michael Rummel collection, n° 3/21.0001. b, *Tyto alba*, recent, left humerus, Collection UCB, Lyon, n° 245-3. c, *Balearica pavonina*, recent, right humerus, Collection UCB, Lyon, n° I-73. a and c, natural size, b 1.5 × natural size.

part of rostrum to be the holotype, whereas it is actually one of three syntypes. I therefore designate the partial rostrum as the lectotype.

Cheneval & Escuillié (1992) have demonstrated that this premaxillare does not belong in the Gruidae but is a part of the skull, previously unknown, of *Palaeolodus ambiguus*, in the Phoenicopteriformes. The genus *Probalearica* thus becomes a synonym of the genus *Palaeolodus* Milne-Edwards, 1863, and the species *Probalearica problematica* becomes a synonym of *Palaeolodus ambiguus* Milne-Edwards, 1863.

The sternum illustrated in Milne-Edwards, 1867–1871, pl. 76, fig. 4, was one of the other syntypes of the species "*Grus*" *problematica*, and is in the collection of the Paris MNHN, n° Av 8729, and needs re-study. The other syntypical sternum (Milne-Edwards, 1867–1871, pl. 76, fig. 3) is missing at the present time (Cheneval & Escuillié 1992). These two sterna were from birds the same size as the recent crowned cranes, whereas *Balearica rummeli* is slightly smaller.

Three other species were later placed in the genus *Probalearica*, *P. crataegensis*, *P. moldavica*, and *P. mongolica*. The generic allocation of these species must be revised.

"*Probalearica*" *crataegensis* Brodkorb, 1963: This species, from the early Miocene of Florida is represented only by the distal part of a tibiotarsus (Brodkorb 1963). In *Balearica* the tibiotarsus widens medially in the distalmost part of the bone, at the level of the medial condyle, while in the Gruinae, the widening is more progressive and begins more proximally. In the Gruidae, there is a strong tubercle at the distal part of the supratendinal bridge, on its lateral side, close to the distal opening of the canalis extensorius. In *Balearica*, on the cranial face, the lateral condyle is short and does not extend very far proximally, while in the Gruinae, it is longer and extends up to the level of this tubercle. In *Balearica* the sulcus extensorius is wide and occupies a large part of the cranial face of the distal end,

while in the Gruidae it is narrower and occupies only the medial part of the cranial face. In *Balearica*, the supratendinal bridge is wide medio-laterally and extends on the lateral side to the tuberositas retinaculi extensoris, while in the Gruinae it is much narrower in the medio-lateral direction. In distal view, in the Gruinae, the condylus medialis is more medially projecting than in the Balearicinae. In lateral view in the Gruinae, the distal outline of the lateral condyle forms an indentation that is much less pronounced in the Balearicinae.

The distal part of tibiotarsus of "*P.*" *crataegensis* differs from that of *Balearica* because it does not show a conspicuous widening at the level of the condylus medialis, the condylus medialis in distal view does not show pronounced projecting in the medial direction, and the indentation of the distal outline of the lateral condyle is absent. The species may be referable to the genus *Palaeogrus*.

Aramornis longurio Wetmore, 1926: The genus *Aramornis*, from the earliest middle Miocene of Nebraska, was described by Wetmore (1926) from the distal part of tarsometatarsus and placed in the family Aramidae. Olson (1985) has indicated that it is a *Balearica*-like crane and Becker (1987) has classified it in the subfamily Balearicinae. There is a large amount of new, unstudied crane material, from Oligocene and Miocene localities in North America which should make it possible to clarify the systematic position of "*P.*" *crataegensis* and *A. longurio* (Olson 1985, and pers. comm.). The size of *A. longurio* is 67% of the mean size of the recent *Balearica*, and "*P.*" *crataegensis* is 76%. These two species are thus smaller than *B. rummeli*, the humerus of which is 90% smaller than the mean size of the recent forms.

"*Probalearica*" *moldavica* Kurochkin & Ganya, 1972: This species, from the Sarmatian of Moldavia, was described from an incomplete distal portion of tibiotarsus. Its age corresponds to the beginning of the late Miocene, MN 9 ? (Mlikovsky 1996). This

specimen does not show much resemblance to the Gruidae. The condylus medialis is only slightly displaced medially. On the cranial face, the condylus lateralis is very proximo-distally elongated. The presence of a tubercle on the supratendinal bridge is not mentioned in the description. The distal width is inferior to the distal depth, which is not the case in the recent Gruidae. Its size is similar to that of the recent *Balearica*, so it is larger than *B. rummeli*.

"*Probalearica*" *mongolica* Kurochkin, 1985: This species, from the middle Pliocene of Mongolia, was described from the distal part of tibiotarsus, an incomplete distal portion of tarsometatarsus, and a quadrate. The tibiotarsus actually shows similarities with the genus *Balearica*. On the tarsometatarsus, the three trochleae are broken, but it can be seen that trochlea metatarsi II is more elongate distally, compared to trochlea metatarsi III, than in the Gruinae, and this characteristic corresponds to the Balearicinae. Its size is large, comparable to that of the Common Crane, *Grus grus*, and thus is larger than *B. rummeli*.

Balearica exigua Feduccia & Voorhies, 1992: This species, known from most of the skeleton, was described from the early late Miocene of Nebraska. It is characterized by its small size, which is about 75 to 80% of that of the recent *Balearica*, and thus it is smaller than *B. rummeli*. The humerus differs strongly from that of *B. rummeli* by its very robust shaft, by the very strong proximal projection of the tuberculum dorsale, and by the fact that the distal part shows almost no ventral widening.

Comparison with Palaeogrus excelsa (Milne-Edwards, 1869).—This species is known from the Early Miocene of the Saint-Gérand-le-Puy area, MN 2a (Milne-Edwards 1867–1871), and is also present in the middle Miocene of Sansan, MN 6 (Cheval 2000). It is only mentioned here as a matter of interest because it shows a mosaic of the morphological characteristics of the Balearicinae and the Gruinae. There is a large amount of new, unstudied material in

the collections of MNHN Paris, MHN Lyon, and UCB Lyon. The proximal part of the humerus, which has not yet been described or illustrated, has the morphological characteristics of the Gruinae and differs from the Balearicinae. Its size is large, comparable or even slightly superior to that of the recent Common Crane, and thus is larger than *B. rummeli*.

Conclusions.—*Balearica rummeli*, the Crowned Crane of Grafenmühle, Bavaria, is as yet the oldest known occurrence of the recent genus *Balearica*, but there is a large amount of new, unstudied material, in Europe as well as in North America, that may provide an earlier appearance. The Balearicinae were widespread in the whole Northern Hemisphere and lived there at least until the middle Pliocene of Mongolia, while at the present time they only survive in tropical Africa, south of the Sahara.

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Literature Cited

- Archibald, G. W., & C. D. Meine. 1996. Family Gruidae (Cranes). Pp. 60–89 in J. del Hoyo, A. Elliott, and J. Sargatal, eds., Handbook of the Birds of the World, vol. 3. Hoatzin to Auks. Barcelona, Lynx Edicions, 752 pp.
- Baumel, J. J., & L. M. Witmer. 1993. Osteologia. Pp. 45–132 in J. J. Baumel, ed., Handbook of Avian Anatomy. Nomina Anatomica Avium, 2nd edition. Nuttall Ornithological Club 23, 779 pp.
- Becker, J. J. 1987. Neogene Avian Localities of North America. Smithsonian Research Monographs. Washington D.C. and London, Smithsonian Institution Press, 171 pp.
- Brodkorb, P. 1963. Miocene birds from the Hawthorne

- Foramtion.—Quarterly Journal of the Florida Academy of Sciences 26 (2):159–167.
- Cheneval, J. 2000. L'avifaune de Sansan. Pp. 321–388 in L. Ginsburg, ed., La Faune miocène de Sansan et son environnement.—Mémoires du Muséum national d'Histoire naturelle 183, 392 pp.
- , & F. Escuillié. 1992. New data concerning *Palaelodus ambiguus* (Aves: Phoenicopteriformes: Palaelodidae): Ecological and Evolutionary Interpretations.—Natural History Museum of Los Angeles County, Science Series 36:209–224.
- Cracraft, J. 1973. Systematics and Evolution of the Gruiformes (Class Aves). 3. Phylogeny of the Suborder Grues.—Bulletin of the American Museum of Natural History 151 (1):1–127.
- Feduccia, A., & M. R. Voorhies. 1992. Crowned Cranes (Gruidae: *Balearica*) in the Miocene of Nebraska.—Natural History Museum of Los Angeles County, Science Series 36:239–248.
- Howard, H. 1929. The avifauna of Emeryville shell-mound.—University of California Publications in Zoology 32 (2):301–394.
- Kurochkin, E. N. 1985. Birds of the Central Asia in Pliocene. The joint Soviet-Mongolian paleontological expedition.—Transactions 26:1–120 (in Russian).
- , & I. M. Ganya. 1972. Pticy srednego sarmata Moldavii (Birds of the middle Sarmatian of Moldavia). Pozvonochnye neogena i plejstocena Moldavii (Vertebrates of the Neogene and Pleistocene of Moldavia). Akademia Nauk Moldavskoy SSR:45–70 (in Russian).
- Lambrecht, K. 1933. Handbuch der Palaeornithologie. Berlin, Borntraeger, 1024 pp.
- Mein, P. 1990. Updating of MN Zones. Pp. 73–90 in E. H. Lindsay et al., eds., European Neogene Mammal Chronology. New York, Plenum Press, ix + 658 pp.
- Milne-Edwards, A., 1867–71. Recherches anatomiques et paléontologiques pour servir à l'histoire des oiseaux fossiles de la France. Paris, Victor Masson et Fils. t. 1, 474 pp., atlas pl. 1–96; t. 2, 627 pp., atlas pl. 97–200.
- Mlikovsky, J. 1996. Tertiary Avian Localities of Moldavia. Pp. 685–691 in J. Mlikovsky, ed., Tertiary Avian Localities of Europe.—Acta Universitatis Carolinae 39 (1995) (3–4):519–848.
- , 1998. A new Barn Owl (Aves: Strigidae) from the early Miocene of Germany with comments on the fossil history of the Tytoninae.—Journal für Ornithologie 139:247–261.
- Mourer-Chauviré, C. 1987. Les Strigiformes (Aves) des Phosphorites du Quercy (France): Systématique, Biostratigraphie et Paléobiogéographie. Pp 89–135 in C. Mourer-Chauviré, coord., L'Evolution des Oiseaux d'après le Témoignage des Fossiles, Table Ronde internationale du CNRS.—Documents des Laboratoires de Géologie de Lyon 99, 248 pp.
- Olson, S. L. 1985. The fossil record of birds. London and New York, Academic Press, Avian Biology 8:79–252.
- Peters, J. L. 1963. Check-list of the birds of the world, vol. 2, 2nd edition. Cambridge, Harvard University Press, 401 pp.
- Rasmussen, D. T., S. L. Olson, & E. L. Simons. 1987. Fossil birds from the Oligocene Jebel Qatrani Formation, Fayum Province, Egypt.—Smithsonian Contribution to Paleobiology 62: iv + 20 pp.
- Sibley, C. G., & J. E. Ahlquist. 1990. Phylogeny and classification of birds. A study in molecular evolution. New Haven and London, Yale University Press, 976 pp.
- Wetmore, A. 1926. Description of additional fossil birds from the Miocene of Nebraska.—American Museum Novitates 211:1–5.