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**GEOLOGY AND PALAEOBIOLOGY OF THE CENTRAL AND  
SOUTHERN NAMIB**

**VOLUME 2:  
PALAEONTOLOGY OF THE ORANGE RIVER VALLEY,  
NAMIBIA**

by

Martin Pickford and Brigitte Senut



*Orangemeryx hendeyi*

**MEMOIR 19  
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by

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# Birds (Aves) from the Middle Miocene of Arrisdrift (Namibia).

## Preliminary study with description of two new genera: *Amanuensis* (Accipitriformes, Sagittariidae) and *Namibiavis* (Gruiformes, Idiornithidae)

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### Version abrégée française

La présence d'oiseaux dans le gisement d'Arrisdrift a été mentionnée brièvement par Hendey (1978), puis par P. V. Rich (1980), et enfin par Pickford *et al.* (1996). P. V. Rich a signalé des Phasianidae et des Accipitridae et Pickford *et al.* ont signalé des Struthionidae. Malheureusement les ossements attribués aux Struthionidae, des fragments de côtes, se sont révélés comme provenant en réalité de crocodiles. Il faut donc pour le moment supprimer la présence de Struthionidae dans ce gisement, bien qu'une véritable autruche, *Struthio copensi*, soit déjà présente dans le gisement un peu plus ancien d'Elisabethfeld (Mourer-Chauviré *et al.*, 1996).

Pour pouvoir identifier de façon précise les oiseaux fossiles d'Arrisdrift il aurait fallu les comparer avec le plus grand nombre possible de formes extra-européennes actuelles, plus particulièrement avec les formes afucaines actuelles. En raison de l'insuffisance du matériel de comparaison disponible, la présente étude est seulement une étude préliminaire. La terminologie anatomique suit Baumel & Witmer (1993), et quand c'est nécessaire, Howard (1929) et Ballmann (1969 a et b). L'âge des gisements néogènes est indiqué d'après Mein (1990).

### L'avifaune d'Arrisdrift

Famille Accipitridae (Vieillot)	4 espèces
Famille Sagittariidae (Finsch & Hartlaub)	<i>Amanuensis pickfordi</i> nov. gen. nov. sp. (Planche 1, figs. 1-5)
Famille Phasianidae Vigors	4 formes (Planche 2, figs. 3-10)
Famille Idiornithidae Brodkorb	<i>Namibiavis senutae</i> gen. nov. sp. nov. (Planche 1, figs. 6-9; planche 2, figs. 1-2; planche 3, figs. 1-6) Indéterminé.
Famille Otididae Gray	Petit charadriiforme, indéterminé.
Ordre Charadriiformes	
Ordre Strigiformes	Strigiforme, famille indéterminé.

### Discussion:

#### Signification Paléoécologique

L'avifaune d'Arrisdrift comporte une très grande majorité de formes vivant dans un milieu terrestre, soit un milieu boisé, soit un milieu d'espaces découverts, et une seule forme peut être aquatique, le petit Charadriiforme. Les formes les plus abondantes sont les Galliformes. Il est difficile de dire à quel milieu ils correspondent, mais les formes auxquelles ils sont apparentés, tels que les *Gallus*, où les cailles percheuses actuelles d'Asie du Sud-Est pour les *Palaeortyx*, se rencontrent surtout dans des régions boisées. Les Idiornithidae et les Sagittariidae indiquent plutôt la présence de régions ouvertes. Il est très curieux de constater qu'il n'y a qu'une forme qui peut être aquatique, alors que les fossiles se trouvent dans des dépôts

fluviaires, accumulés dans un paléo-chenal, à proximité de l'Océan Atlantique, et que, parmi les autres Vertébrés les éléments les plus abondants sont les crocodiles (Pickford *et al.*, 1996).

#### Comparaison avec les autres avifaunes connues en Afrique

Il y a relativement peu de données concernant les avifaunes du Paléogène et du Miocène d'Afrique. Une importante synthèse de ces données a été effectuée par Rich (1974). Les avifaunes les mieux connues sont celles de l'Eocène supérieur et de l'Oligocène inférieur du Fayoum, Egypte (Rasmussen *et al.*, 1987, 2001). Les avifaunes du Fayoum sont très différentes de celle d'Arrisdrift car elles comportent surtout des formes aquatiques et les formes terrestres y sont très peu abondantes. Ces formes terrestres comportent principalement *Eremopezus*, un oiseau géant, inapte au vol, appartenant à un ordre indéterminé, et un Musophagidae (Touraco). Les Galliformes sont absents de ces avifaunes du Fayoum, bien qu'ils soient connus et bien diversifiés, à la même époque, dans les gisements des Phosphorites du Quercy (Mourer-Chauviré, 1992).

Dans le Miocène moyen du Djebel Zelten (MN 4), en Libye, ont été signalés un oiseau géant du groupe des Aepyornithides (Arambourg & Magnier, 1961) et un Aves indet. qui a ensuite été décrit par Balouet (1981). C'est un héron géant, *Zeltornis ginsburgi*, qui indiqué un milieu aquatique.

Dans le Miocène moyen de Beni Mellal (MN 7), Maroc, les oiseaux étudiés par Brunet (1961, 1971) comportent au contraire surtout des formes terrestres. Ces formes sont : un coq, *Gallus* sp., une chouette effiaie (*Tyto alba*), un calao (*Bucorvus brailloni*), et un Passériforme (*Luscinia cf. megarhynchos*). Un Piciforme a été revu par Mayr (1998) qui l'a désigné comme *Miopico benimellalensis* et l'a attribué à la famille éteinte des Miopiconidae. C'est la première fois que l'on voit apparaître des Passériformes dans ces avifaunes africaines, alors qu'ils sont connus en Europe depuis au moins l'Oligocène supérieur (Mourer-Chauviré *et al.*, 1989; Mourer-Chauviré, 1995).

Les oiseaux de la Beglia Formation, en Tunisie, sont datés du début du Miocène supérieur (MN 9) (Rich, 1972; Harrison, 1974; Harrison & Walker, 1982). A l'exception d'une autruche (*Struthio* sp.), et d'un marabout (*Leptoptilos richae*) ces oiseaux comportent également surtout des formes aquatiques telles que des cormorans, des anhingas, et un bec-en sabot (Balaenicipitidae). Le milieu indiqué est un milieu de savanes, avec des cours d'eau.

### Conclusions

L'avifaune d'Arrisdrift est très intéressante car elle montre

des affinités avec les avifaunes européennes connues à la même époque, par la présence d'un Sagittariidae, d'un Idiornithidae et l'abondance des Galliformes. La présence d'un Idiomithidae témoigne de la vaste répartition de cette famille par le passé et confirme l'idée que les Cariamidae actuels d'Amérique du Sud sont les derniers survivants d'un groupe autrefois très diversifié.

L'absence de Passériformes peut être due aux hasards de la fossilisation mais, si elle correspond à une absence réelle, elle est assez surprenante. L'hypothèse actuelle, initialement proposée par Feduccia & Olson (1982), est que ce groupe aurait pris naissance dans l'hémisphère Sud. Cet ordre, actuellement le plus abondant et le plus diversifié des oiseaux, a été signalé dans l'Eocène inférieur d'Australie (Boles, 1995), mais selon Feduccia (1996) cette découverte demande à être confirmée. En Europe il est connu à partir de l'Oligocène supérieur, et en Afrique, pour le moment, seulement à partir du Miocène moyen de Beni Mellal (MN 7), au Maroc.

## Introduction

The presence of birds at Arrisdrift was briefly mentioned by Hendey (1978), then by P. V. Rich (1980), and finally by Pickford *et al.*, (1996). P. V. Rich recorded Phasianidae and Accipitridae while Pickford *et al.*, reported Struthionidae. Unfortunately the bones attributed to Struthionidae, have turned out to be crocodile rib fragments. It is thus necessary to suppress the presence of Struthionidae in this site, even though a true ostrich, *Struthio coppensi*, was already present in the older site at Elisabethfeld (Mourer-Chauviré *et al.*, 1996).

To identify the fossil birds from Arrisdrift precisely, it would be necessary to compare them with a wide range of extant extra-European forms, in particular with modern African forms. Because of a paucity of comparative material the present study is only preliminary. The terminology follows Baumel & Witmer (1993), and when necessary, Howard (1929) and Ballmann (1969 a, b). The age of the Neogene sites is based on Mein (1990).

## Systematic descriptions

### Order Accipitriformes Family Accipitridae (Vieillot)

#### Very large Accipitridae

**Material:** Left tarsometatarsal, distal end, PQ AD 2406, and left tibiotarsus, distal end, PQ AD 841.

#### Accipitridae the size of *Aquila chrysaetos*

**Material:** Left carpometacarpal, proximal end, PQ AD 1356, and phalange 1 main digit of the wing, AD 505'95.

#### Medium sized Accipitridae

**Material:** Complete right femur, AD 575'97.

#### Small Accipitridae

**Material:** Right tarsometatarsal, distal end, AD 644'98.

## Family Sagittariidae (Finsch & Hartlaub)

### *Amanuensis* nov. gen.

**Type species:** *Amanuensis piclifordi* n. sp.

**Species included in the genus:** Type species only.

**Distribution:** Middle Miocene of Namibia, Mammal biozone MN4.

**Diagnosis:** Morphological characters generally intermediate between those of the genera *Pelargopappus* and *Sagittarius*, the only genera so far known in the family. Distal end less mediolaterally compressed than in *Pelargopappus*, but not as wide as in *Sagittarius*. Cranial surface, medial and lateral condyles less elongated in the proximo-distal direction than in *Pelargopappus*, but more elongated than in *Sagittarius*. Caudal surface, condyles relatively less projecting in the caudal direction than *Pelargopappus*, and much less projecting than in *Sagittarius*. Diaphysis proportionally more massive than in the other two genera, and tibiotarsus less elongated than in *Sagittarius*.

**Etymology:** *Amanuensis*, Latin for secretary, copier. The extant bird is called the secretary bird on account of the long feathers that it has on its head which resemble the quill pens that secretaries used to carry behind their ears in olden days.

**Description and comparisons:** The Family Sagittariidae contains only two genera, one of which, *Pelargopappus*, is extinct and the other, *Sagittarius*, extant. *Pelargopappus* contains two species, *P. schlosseri*, from the early and late Oligocene of the Phosphorites du Quercy, (France) and *P. magnus*, from the early Miocene of Saint-Gérand-le-Puy (France) (Mourer-Chauviré & Cheneval, 1983). The extant genus *Sagittarius* is exclusively African.

The form from Arrisdrift has the characters of Sagittariidae. On the cranial surface the sulcus extensorius is positioned in the median part of the bone but a bit closer to the lateral border; it is then oblique and opens proximally at the medial condyle. The pons supratendineus is wide and does not have a projecting tubercle. The medial condyle advances a bit more on the cranial side than the lateral condyle and it is less elongated proximo-distally. The incisura intercondylaris is wide. Proximal to the lateral condyle there is a small orifice which is also present in the genera *Pelargopappus* and *Sagittarius*. On the caudal surface, the two condyles form a block projecting to the caudal side. This block is wider in *Amanuensis* than in the other two genera. In *Sagittarius* this block projects strongly in the caudal direction and is proximo-distally short. In *Amanuensis* this block is much longer proximo-distally than in *Sagittarius*. The medial and lateral surfaces of the distal end are concave. The medial and lateral epicondyles are absent. One the lateral surface in *Sagittarius* and *Pelargopappus* there is a well developed tuberculum retinaculi m. fibularis. The emplacement of this tuberculum also exists in *Amanuensis*, but the tuberculum itself has been eroded. Even though it has been restored and its width and diameter cannot be measured precisely, we can observe that the diaphysis of *Amanuensis* is more robust than that of *Pelargopappus* and *Sagittarius*. The proximal end is not preserved but we can see the nutritive foramen which is on the medial surface somewhat distal to the crista fibularis. The distance between this nutritive foramen and the distal end is 133 mm. For comparison with

an extant *Sagittarius serpentarius*, we can estimate the total length of the tibiotarsus at 173 mm.

*Amanuensis pickfordi* n. sp.  
(Plate I, Fig. 1-5)

**Holotype:** Left tibiotarsus, diaphysis and distal end, AD 34°97.

**Horizon and locality:** Arrisdrift, Namibia, Middle Miocene, Mammal biozone MN 4.

**Diagnosis:** As for the genus.

**Dimensions:** Table 1

**Remarks:** The tibiotarsus of *A. pickfordi* resembles more that of the species *Pelargopappus schlosseri*, from the Oligocene, than the species *P. magnus*, from the Miocene, despite being further removed from it in time. In effect, in *P. magnus*, the distal end of the tibiotarsus is very compressed in the medio-lateral sense and the incisura intercondylaris is narrow, whereas it is less compressed and the incisura is wider in the species *P. schlosseri*. *Pelargopappus magnus* probably also had longer legs than those of *A. pickfordi*. In effect the length of the tarsometatarsal in *P. magnus* corresponds to 79 % of that of an extant *S. Serpentarius* (Lyon 6.73), whilst the estimated length of the tibiotarsus of *A. pickfordi* corresponds to only 62 % of that of the same extant specimen.

**Etymology:** This species is dedicated to Dr. Martin Pickford, in hommage to his works on African palaeontology.

**Table I : Dimensions (in mm) of the distal part of the tibiotarsus in *Amanuensis pickfordi* nov. gen. n. sp., the extinct genus *Pelargopappus* and the extant genus *Sagittarius*.**

	<i>Pelargopappus schlosseri</i>	<i>Pelargopappus magnus</i>	<i>Amanuensis pickfordi</i>	<i>Sagittarius serpentarius</i> extant
Pech du Fraysse PFR 1167	Saint-Gérard Av 8734	Arrisdrift AD 644°98 Lyon 06.73		
Distal breadth cranial surface	17.1	15.3	19.2	20.0
Diameter medial condyle	18.5	18.0	20.5	21.1
Diameter lateral condyle	16.8	16.3	19.5	20.0
Breadth of the block formed by the condyles, caudal surface	12.8	12.5	15.5	13.7
Breadth of the diaphysis, 3 cm from the distal end	10.3	-	ca 13.5	10.3
Distance between the distal end and the nutritive foramen located at the base of the fibula crest	-	-	133.0	215.0
Total length of the tibiotarsus	-	-	est. 173	280

**Conservation of the material:** Geological Survey, Ministry of Mines and Energy, Windhoek, Namibia.

**Order Galliformes**  
**Family Phasianidae Vigors**

**Remarks:** The Phasianidae are represented at Arrisdrift by at least four different forms, of which the humerus has the most distinctive morphological features. On the humerus of Phasianidae the pneumotricipital fossa of Baumel & Witmer (1993) has in reality two distinct parts, a pneumoanconeal fossa, situated distally with respect to the ventral tuberculum, and a tricipital fossa, located on the lateral side with respect to the pneumoanconeal fossa and distally with respect to the head of the humerus (Ballmann, 1969 a).

**Phasianidae, form 1**  
(Plate 2, Fig. 3-4)

**Material:** Almost complete left humerus, AD 714°97; right humeri, proximal ends, AD 596°99 and AD 764°99; right humeri, distal ends, AD 127°96, AD 502°97 and AD 211°98; left humerus, distal end, AD 20°99; right tarsometatarsal almost complete, AD 296°95.

**Description:** On the humerus the tricipital fossa is not deep but is delimited at its proximal part by a rounded curve, located on the proximal side and the dorsal side. The tricipital fossa is followed by a slight depression which runs obliquely from the ventral side and from the distal side. This form does not correspond to that occurring in Numidinae (for example in the genus *Numida*), nor in the Pavoninae (for example in the genus *Afropavo*). It corresponds more closely to that of the extant Gallinae, such as the genus *Gallus*, and also sometimes in the genus *Phasianus*.

The fossil Phasianidae are abundant and a large quantity of fossil species has been described, all of which need to be revised. In the revision of the Miocene material from Sansan, Cheyneval (2000) showed that the genus *Miophasianus* corresponds in reality to a peacock, and that the genus *Palaeoperdix* corresponds to a pheasant. Form 1 from Arrisdrift could represent the genus *Palaeoperdix*. For the two species present at Sansan, *P. longipes*, the smaller, and *P. media*, the larger, we do not know the proximal end of the humerus, but, in comparison with extant species of Gallinae, we can deduce that this form 1 is bigger than *Palaeoperdix media*.

**I Dimensions:** Table II

**Phasianidae, form 2**  
(Plate 2, Fig. 5-6)

**Material:** Right humerus, proximal end, PQ AD 1426.

**Description:** This form is represented by a proximal end of humerus, badly crushed, but on which we can observe that the tricipital fossa is deep and is prolonged in the mesio-distal direction by a well defined groove. This form of the tricipital fossa resembles that found in the extinct *Palaeortyx* (Mourer-Chauviré, 1992), but there is a similar form in the extant genus *Francolinus*. The proximal breadth is about 16 mm, which corresponds in size with the species *Palaeortyx phasianoides*, described by Milne-Edwards (1867-71) at Saint-Gérard-le-Puy

(Mn 2a) (France) but which also exists at Wintershof-West (MN 3) (Germany) (Ballmann, 1969a) and at La Grive-Saint-Alban (MN 7) (France) (Ballmann 1969b).

**Dimensions:** Table 11

**Phasianidae, form 3**  
(Plate 2, Fig. 7-8)

**Material:** Right humerus, proximal end, AD 226'94; right humeri, distal ends, AD 534'94 and AD 116'98; almost complete left humerus, AD 501 '97; left humerus, proximal end, incomplete, AD 181'95; left humerus, distal end, AD 119'95, and distal end incomplete, AD 244'98.

**Description:** This form is represented by an almost complete humerus (AD 501'97), but it has been badly restored which makes it appear too straight, different from the usual sigmoid aspect of humeri of Phasianidae. It is also represented by a distal end and diaphysis of a humerus (AD 116'98), which is more markedly curved. In this form 3 the tricipital fossa is not deep and is not followed by an oblique depression. The ventral tubercle is very prominent on the ventral side and has a wide open pneumatic fossa. This form resembles a small species of the genus *Gallus*.

**Dimensions:** Table 11

**Phasianidae, form 4** (Plate 2, Fig. 8-9)

**Material:** Right humerus, proximal end, AD 124'95.

**Description:** This form is represented by a proximal humerus which possesses all the hallmarks of the genus *Palaeortyx*. It seems that we can exclude it from the genus *Francolinus* because the tricipital fossa deepens greatly below the humeral head, the groove that prolongs it has a well marked border on the dorsal side and the attachment of the muscle latissimus dorsi posterioris is not greatly elongated in the proximo-distal sense. These characters are different in the extant species *Francolinus coqui*. Judging from its dimensions this form corresponds to the species *Palaeortyx gallica*, which is known from the Late Oligocene of the Phosphorites du Quercy, (France) reference level MP 28, and in the Early Miocene of Saint-Gérand-le-Puy (MN 2a) (France) (Mourer-Chauviré, 1992, 1995). ?*Palaeortyx gallica* has been recorded in the Middle Miocene of Vieux-Collonges (MN 5) (France) (Ballmann, 1972) and *Palaeortyx cf. gallica* in the Late Miocene of Aljezar B (MN 12), in Spain (Cheneval & Adrover, 1995).

**Dimensions:** Table 11

**Discussion:** Apart from the humeri and a tarsometatarsal, which have been attributed to four distinct forms, the Arrisdrift Galliformes are represented by abundant remains such as coracoids, an ulna, femora and tibiotarsi.

It is surprising to find in the Miocene of Africa forms related to the genera *Phasianus* or *Gallus*, which today exist in the wild only in Asia. However, Brunet (1961) has already recorded from the Middle Miocene of Beni Mellal (MN 7), in Morocco, remains that he identified as *Gallus*. In Europe remains of *Gallus* have been recorded, with doubt, in the Middle Miocene (MN 7-8), but most of the fossils attributed to this genus occur only

from the Late Miocene, principally from the Turolien (MN 11-13) and later deposits (Mlikovsky, 1996).

**Order Gruiformes**  
**Suborder Cariamae**  
**Family Idiornithidae Brodkorb**  
***Namibiavis* nov. gen.**

**Type species:** *Namibiavis senutae* n. sp.

**Species included in the genus:** Only the type species.

**Distribution:** Middle Miocene, Mammal biozone MN 4, Namibia.

**Diagnosis:** Coracoid with a processes acrocoracoideus weakly developed on the ventral side, not recurved above the sulcus m. supracoracoidei and having no pneumatic foramina; excavated cotyla scapularis, elongated in the medio-lateral sense and extending onto the cranial surface of the processes supracoracoideus; processes supracoracoideus in the form of a projecting tongue on the medial side, but of which the medial extremity is absent in the two known specimens; no foramen nor hollowing of the n. supracoracoidei; diaphysis narrow and elongated, flattened on the ventral Surface; distal end with large circular foramen on the dorsal surface, occupying almost all the space proximal to the sternal articular facette.

**Etymology:** Namibia, for the name of the country where the locality occurs, and avis, bird.

**Description and comparisons:** The Family Idiornithidae contains five genera, of which two, *Idiornis* and *Elaphrocnemus*, are particularly well known and represented by several species in Eocene and Oligocene sites of the Phosphorites du Quercy, France (Mourer-Chauviré, 1983).

The coracoids (Plate 3, fig. 1-6). The holotype and paratype coracoids of the new genus and species *Namibiavis senutae* resemble not only those of *Idiornis* but also those of *Elaphrocnemus*. The processes acrocoracoideus resembles that of *Elaphrocnemus* because it is quite elongated in the proximal direction beyond the articular surface for the humerus, which does not prolong on the medial side, and which terminates on

**Table II : Dimensions (in mm) of the humerus in the four forms of Phasianidae present at Arrisdrift.**

	Form 1 AD 714 '97 AD 764 '99	Form 2 PQ-AD-1426	Form 3 AD 501 '97 AD 116 '98	Form 4 <i>Palaeortyx</i> <i>gallica</i> AD 124 '95
Total length	75.5	-	ca 58	-
Proximal breadth	ca 19.7	ca 16.0	14.8	10.3
Diameter of the head	8.6	6.1	5.6	3.7
Mid breadth	8.0	-	5.6	-
Mid diameter	6.6	-	4.7	-
Distal breadth	15.7	-	11.4	-
Distal diameter	8.1	-	6.1	-

the cranial side by a tubercle (Plate 3, Fig. 7-8). But they differ from *Elaphrocnemus* because the cotyla scapularis is hollowed out and elongated, and by the presence of a processes procoracoideus in the shape of a tongue. They resemble the coracoid of *Idiornis*, because, as in *Idiornis*, they possess an excavated, elongated scapular facette, which extends along the cranial surface of the processes procoracoideus (see Mourer-Chauviré:, 1983, Pl. 2, Fig. 7; Pl. 3, Fig. 4 and 14-15; Pl. 4, Fig. 8-9). But they differ from *Idiornis* because in the latter, the processes acrococaracoideus extends along the medial side and joins the processes procoracoideus in forming a closed ring as, for example, in *Idiornis minor* (Mourer-Chauviré:, 1983, Pl. 3, Fig. 14-15). They differ from the two genera *Idiornis* and *Elaphrocnemus* by the presence of a large pneumatic foramen on the dorsal surface, proximal to the sternal articular facette. In the extant genus *Cariama* the processes procoracoideus and acrococaracoideus also join to form a closed ring. On the dorsal surface, at the distal end, there is a deep depression, which is rounded in its superior part, but there is no foramen.

An almost complete left coracoid (MNHN Paris, n° QU 16923) was attributed to the genus *Oblitavis*, Family Idiornithidae, but was not figured (Mourer-Chauviré:, 1983). It resembles the coracoid of *Namibiavis* in its overall shape, but it differs from it because its processes procoracoideus is more curved and more projecting on the medial side, by the presence of a foramen n. supracoracoidei, and by the absence of a pneumatic foramen at the distal end, above the sternal facette. In the place where this foramen occurs, on the coracoid attributed to *Oblitavis*, there is a well marked triangular depression (Plate 3, Fig. 9-10).

The presence of a pneumatic foramen above the sternal articular facette recalls that which occurs in the Family Psophidae, or Agamis, of South America. But in the Psophidae, the coracoid has a very particular shape: the processes procoracoideus is very developed and forms a flattened blade which extends as far as the angulus medialis. The presence of a pneumatic foramen recalls also that which occurs in *Opisthocomus*, the Hoazin. The resemblances between the extant Cariamidae and the Opisthocormidae were already highlighted by Olson (1985).

**The humerus** (Plate 1, Fig. 8-9; Plate 2, Fig. 1-2). The humeri which have been attributed to *Namibiavis* have a wide and flattened proximal end. The ventral and dorsal tubercles do not project very far on the proximal side. On the caudal surface, the head of the humerus does not form a pronounced margin above the pneumotricipital fossa. On the caudal surface, the proximal end is also flattened, the intumescens humeri is weakly expressed and the impressio coraco-brachialis shallow. The proximal end resembles that of the genus *Elaphrocnemus*, but in the latter the ventral tubercle is even less projecting in the proximal direction (see Mourer-Chauviré:, 1983, Pl. 1, Fig. 1-6). It differs more from the genus *Idiornis* in which the ventral tubercle is more marked in the caudal direction, and in which the head of the humerus forms a more marked border (see Mourer-Chauviré:, 1983, Pl. 4, Fig. 15). The proximal end of the humerus attributed to the genus *Namibiavis* also resembles that of the genus *Oblitavis*, which is wide and flat (see Mourer-Chauviré:, 1983, Pl. 5, Fig. 5-6). At the distal end, the humerus has a well marked curvature, and this distal end rises in the cranial direction. On the cranial surface, the elongated dorsal condyle, and the globular ventral condyle, are separated by a well marked incisura intercondylaris. The impressio m. brachialis is clearly marked and extends obliquely across the entire

width of the bone, not only above the ventral condyle but also the dorsal one. The dorsal epicondyle does not project greatly. This distal end of the humerus differs from those of other genera of Idiornithidae (*Elaphrocnemus*, *Idiornis*, *Oblitavis*) in which it is more elongated on the ventral side (see Mourer-Chauviré:, 1983, Pl. 1, Fig. 3-4; Pl. 4, Fig. 16; Pl. 5, Fig. 3-6) and in which the ventral epicondyle projects more. In *Elaphrocnemus* the impression of the m. brachialis is located only on the ventral side. In *Oblitavis* the impression of m. brachialis is more elongated on the dorsal side, but the distal extremity is flatter than in the Arrisdrift humerus. On the caudal surface of the distal end, the humeri attributed to *Namibiavis* have two deep grooves (internal and external tricipital grooves of Howard, 1929), one on the dorsal side and one ventrally, separated by a less deep groove and by a shallow olecranon fossa. These grooves, and the olecranon fossa, are absent in *Elaphrocnemus*. In *Idiornis* there is a shallow olecranon fossa and a clearly visible tricipital groove on the dorsal surface but not on the ventral side. In *Oblitavis* there is no olecranon fossa and the tricipital grooves are weakly expressed. The distal end of the humeri attributed to the genus *Namibiavis* have a certain resemblance to the genus *Psophia*, but in the latter the distal end is much wider on the ventral side and has a markedly projecting processes flexorius on the caudal side directed ventrally.

**The femur** (Plate 1, Fig. 6-7). A proximal end of femur, with the diaphysis, is attributed to the genus *Namibiavis*. It resembles that of the genera *Elaphrocnemus* and *Idiornis* (see Mourer-Chauviré:, 1983, Pl. 1, Fig. 14-15; Pl. 2, Fig. 8-9). This femur has an overall curved form, with its proximal end is curved medially. The head projects strongly medially, and it is weakly developed proximo-distally. The femoral neck is narrow and long. This femur had a trochanteric crest on the proximal and cranial sides, but the crest itself is not preserved. The intermuscular cranial line fuses with the trochanteric crest at its proximal end, and then traverses the diaphysis obliquely in the direction of the medial condyle. This femur more closely resembles the genus *Elaphrocnemus* than *Idiornis* by the strong projection of the head and by the course of the cranial intermuscular line.

#### *Namibiavis senutae* n. sp.

(Plate 1, Fig. 6-9; Plate 2, Fig. 1-2; Plate 3, Fig. 1-6)

**Holotype:** Almost complete right coracoid, AD 210'98.

**Horizon and locality:** Arrisdrift, Namibia, Middle Miocene, Mammal biozone MN 4.

**Paratypes:** Right coracoid, proximal end, AD 139'99 and right coracoid, distal end, PQ AD 112.

**Material attributed to this genus and species:** holotype and paratypes; almost complete left humeri, AD 2'94 and AD 59'94; left humerus, distal end, AD 108'00; right humeri, distal ends, AD 470'99, PQ AD 1748 and PQ AD 2643; right femur, proximal end and diaphysse, AD 341'97.

**Diagnosis:** As for the genus.

**Dimensions:** Table 1II.

**Etymology:** The species is dedicated to Dr. Brigitte Senut, in hommage to her works on Afican palaeontology.

**Table III** : Dimensions (in mm) of different elements of *Namibiavis senutae* nov. gen. n. sp.

- (1) Proximal length measured from the lateral humeral articular surface to the medial angle of the scapular articular surface.  
 (2) Dimensions of the preserved part of the bones.  
 (3) Proximal breadth measured from the dorsal tubercle to the ventral margin of the bicipital crest.

CORACOID	AD 210 '98	AD 139 '99	PQ-AD-112			
Total length measured on the medial side	44.2	-	-			
Proximal breadth (1)	10.0	10.0	-			
Proximal diameter	7.5	8.4	-			
Minimum breadth of the diaphysis	4.7	4.9	4.5			
Diameter of the diaphysis at the same level	3.6	4.2	3.5			
Distal breadth	est. 13,0	-	-			
Diameter of the sternal surface of the medial side	3.5	-	-			
HUMERUS	AD 2' 94	AD 59 '94	PQ-AD-1748	PQ-AD-2643	AD 470 '99	AD 108 '00
Total length (2)	75.5	69.8	-	-	-	-
Proximal breadth (3)	19.3	18.7	-	-	-	-
Proximal diameter at the level of the ventral tubercle	8.1	-	-	-	-	-
Head diameter	5.0	ca 5,0	-	-	-	-
Mid breadth	6.6	6.3	5.9	-	6.6	-
Mid diameter	6.1	4.7	5.1	-	6.1	-
Distal breadth	14.9	14.2	14.7	est. 15,0	14.7	15.2
Distal diameter	-	7.8	7.6	8.4	8.2	8.1
FEMUR	AD 314 '97					
Proximal breadth (2)	14.6					
Proximal diameter	8.3					
Head diameter	5.3					
Mid breadth	6.2					
Mid diameter	5.9					

**Conservation of the Material:** Geological Survey, Ministry of Mines and Energy, Windhoek, Namibia.

**Remarks:** The suborder Cariamae today has only one family, the Cariamidae, with two monospecific genera, *Cariama* and *Chunga*, which occur only in South America. Fossil Cariamae contain three other families, Idiornithidae, known from the Palaeocene in South America and in the Eocene and Oligocene of Europe, Bathornithidae, known in North America from the Upper Eocene to the Miocene, and Phorusrhacidae, giant birds, unable to fly, known above all in South America from the Palaeocene onwards, but also occurring in Europe and North America. These Cariamae comprise part of the basal continental avifauna (Mourer-Chauviré, 1999), present in South Amer-

ica, North America and Europe, but which had never before been reported from Africa, with the exception of Phoenicopteridae, flamingos, and the Palaelodidae, extinct swimming or diving flamingos. The presence of an Idiomithidae in the Middle Miocene of Africa, shows that the Cariamae must have had a world-wide distribution from the Palaeocene, and that this family survived a bit longer in Africa than in Europe.

**Suborder Otides**  
**Family Otididae (Gray)**  
**Otididae indeterminate**

**Material:** Right tibiotarsus, distal end and diaphysis, AD 227'97, and right tarsometatarsal, distal end, PQ AD 725.

**Description:** The distal tibiotarsus has the usual shape of that of bustards. The distal tarsometatarsal is very flat and is attributed to a bustard because both the medial and lateral trochlea project greatly, and are clearly shorter than the median trochlea.

### Order Charadriiformes Charadriiform indeterminate

**Material:** Incomplete left coracoid, AD 599'99.

**Description:** On this coracoid, the acrocoracoid, the medial end of the procoracoid and the medial sternal angle are missing. The scapular articular facette is rounded and deep; and is hemispherical in outline. A small foramen n. supracoracoidei is located distal to the scapular articular facette, but is close to it. This coracoid could belong to anyone of several extant families of Charadriiformes.

### Order Strigiformes Strigiform indeterminate

**Material:** Posterior terminal phalanx (claw), AD 190'94.

### Palaeoecological significance

The Arrisdrift avifauna comprises mostly forms that are today terrestrial, living in either woodland or more open areas, and a single possibly aquatic form, the small Charadriiform. The most abundant kinds are the Galliformes. It is difficult to determine which environment they correspond to, but the forms to which they are related, such as *Gallus*, or extant perching quails of south-east Asia for *Palaeortyx*, occur mostly in wooded regions. The Idiornithidae and the Sagittariidae indicate the presence of more open country. It is curious to note that there is only one form that could be aquatic, whereas the fossils occur in fluvial deposits which accumulated in a palaeo-channel close to the Atlantic Ocean, and that, among the other vertebrates the most abundant are crocodiles (Pickford *et al.*, 1996).

### Comparison with other avifaunas from Africa

There are relatively few data concerning avifaunas From the Palaeogene and Miocene of Africa. A landmark synthesis of the evidence was effected by Rich (1974). The best known avifaunas are those of the Late Eocene and Early Oligocene of the Fayum, Egypt (Rasmussen *et al.*, 1987, 2001). The Fayum avifaunas are very different From that of Arrisdrift because they contain mostly aquatic forms while terrestrial kinds are poorly represented. The terrestrial component includes mainly *Eremopezus*, a giant bird, unable to fly, belonging to an unknown order, and a Musophagidae (Turaco). The Galliformes are absent From these Fayum avifaunas, despite being well represented and diverse during the same epochs in the Phosphorites du Quercy (France) (Mourer-Chauviré, 1992).

In the Middle Miocene of Jebel Zelten (MN 4), in Libya, a giant bird belonging the Aepyornithidae (Arambourg & Magnier, 1961) was reported and an Aves indet. which was later described by Balouet (1981) as a gigantic heron, *Zeltornis ginsburgi*, which indicates an aquatic environment.

In the Middle Miocene of Beni Mellal (MN 7), Morocco, the birds studied by Brunet (1961, 1971) in contrast, comprise mostly terrestrial forms. These are: a cock, *Gallus* sp., a barn owl

(*Tyto alba*), a hornbill (*Bucorvus brailloni*), and a passeriform (*Luscinia cf. megarhynchos*). A woodpecker was reviewed by Mayr (1998) who described it as *Miopico benimellalensis* attributing it to the extinct Family Miopiconidae. This is the first time that we have evidence of Passeriforms in African avifaunas, whereas they are known in Europe From the Late Oligocene onwards (Mourer-Chauviré *et al.*, 1989; Mourer-Chauviré, 1995).

The birds of the Beglia Formation, in Tunisia, date from the onset of the Late Miocene (MN 9) (Rich, 1972; Harrison, 1974; Harrison & Walker, 1982). With the exception of an ostrich (*Struthio* sp.), and a marabou stork (*Leptoptilos richae*) these birds consist mainly of aquatic species such as cormorants, anhingas and a shoe-bill stork (Balaenicipitidae). The environment was one of savanna with water courses.

### Conclusions

The Arrisdrift avifauna is of great interest because it reveals affinities with European faunas of the same epoch, by the presence of a Sagittariidae, an Idiornithidae and the abundance of Galliformes. The presence of an Idiornithidae evidences the wide distribution of this family during the past, and confirms the idea that the extant Cariamidae of South America are the last survivors of a group that was previously highly diverse.

The absence of Passeriforms may be due to vagaries of the fossil record but if it corresponds to the real situation, then it would be a great surprise. The modern hypothesis, initially proposed by Feduccia & Olson (1982), is that this group would have arisen in the southern hemisphere. This order, at present the most abundant and most diverse among birds, was reported in the Early Eocene of Australia (Boles, 1995), but according to Feduccia (1996) this discovery needs to be confirmed. In Europe it is known From the Late Oligocene, and in Africa, for the moment, only From the Middle Miocene of Beni Mellal (MN 7), Morocco.

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**Plate 1:**

1-5, *Amanuensis pickfordi* n. gen. n. sp. Left tibiotarsus, diaphysis and distal part, holotype, n° AD 34'97, natural size. 1 - cranial surface, 2 - lateral surface, 3 - medial surface, 4 - distal surface, 5 - distal surface.  
6-9, *Namibuvius semita* n. gen. n. sp., 6-7 Right femur, proximal end and diaphysis, n° AD 341'97, x 1,33, 6 - caudal surface , 7 - cranial surface, 8-9 Right humerus, distal end, n° PQ AD 1748, x 1,33, 8 - cranial surface, 9 - caudal surface.



Plate 2:

1-2, *Namibiavis senutae* n. gen. n. sp. Left humerus almost entire, n° AD 2'94, x 1,33, 1 - caudal surface, 2 - cranial surface.  
3-4, Galliforme, Family Phasianidae, form 1. Almost complete left humerus, n° AD 714'97, x 1,33, 3 - caudal surface, 4 - cranial surface.  
5-6, Galliforme, Family Phasianidae, form 2. Right humerus, proximal end, n° PQ AD 1426, x 1,33, 5 - caudal surface, - cranial surface  
7-8, Galliforme, Family Phasianidae, form 3. Almost complete left humerus, n° AD 501'97, x 1,33, 7 - caudal surface, 8 - cranial surface.  
9-10, Galliforme, Family Phasianidae, form 4. Right humerus, proximal end, n° AD 124'95, x 2, 9 - caudal surface, 10 - cranial surface.



**Plate 3:**

1-6, *Namibiavis senutae* n. gen. n. sp., 1-2 Almost complete right coracoid, holotype, n° AD 210'98, x 2, 1 - dorsal surface, 2 - ventral surface, 3-4 Right coracoid, proximal end, paratype, n° AD 139'99, x 2, 3 - dorsal surface, 4 - ventral surface, 5-6 Right coracoid, distal end, paratype, n° PQ AD 112, x 2, 5 - dorsal surface, 6 - ventral surface;  
 7-8, *Elaphrocnemus phasianus* Milne-Edwards, Phosphorites du Quercy, Eocene or Oligocene, Almost complete right coracoid , collection Muséum national d'Histoire naturelle, Paris, n° QU 15872, x 2, 7 - dorsal surface, 8 - ventral surface;  
 9-10, *Oblitavis insolitus* Mourer-Chauviré, Phosphorites du Quercy, Eocene or Oligocene, Almost complete left coracoid, collection Muséum national d'Histoire naturelle, Paris, n° QU 16923, x 2, 9 - dorsal surface, 10 - ventral surface.