Ridewoodichthys, a new genus for *Brychaetus caheni* from the marine Paleocene of Cabinda (Africa): re-description and comments on its relationships within the Osteoglossidae (Teleostei, Osteoglossomorpha)

by Louis TAVERNE

TAVERNE, L., 2009 – *Ridewoodichthys*, a new genus for *Brychaetus caheni* from the marine Paleocene of Cabinda (Africa): re-description and comments on its relationships within the Osteoglossidae (Teleostei, Osteoglossomorpha). *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, **79**: 147-153, 5 figs, Brussels, October 31, 2009 – ISSN 0374-6291.

Abstract

The marine osteoglossid "*Brychaetus*" *caheni* from the Lower Paleocene of Cabinda (Africa) is re-studied. It does not belong to the genus *Brychaetus* because of differences in teeth and premaxilla shape. It is assigned to the new genus *Ridewoodichthys* on the basis of its caudal skeleton, which differs from that of all other known fossil and Recent Osteoglossidae.

Keywords: Teleostei, Osteoglossidae, "*Brychaetus*" *caheni*, *Ridewoodichthys* gen. nov., osteology, relationships, marine Paleocene, Cabinda.

Résumé

L'ostéoglossidé marin «*Brychaetus*» *caheni* du Paléocène inférieur de Cabinda (Afrique) est redécrit. Des différences de forme des dents et du prémaxillaire montrent que cette espèce n'appartient pas au genre *Brychaetus*. Elle est rapportée au nouveau genre *Ridewoodichthys* sur la base de son squelette caudal qui diffère de celui de tous les autres Osteoglossidae fossiles et récents connus.

Mots-clefs: Teleostei, Osteoglossidae, «*Brychaetus*» *caheni*, *Ridewoodichthys* gen. nov., ostéologie, relations, Paléocène marin, Cabinda.

Introduction

The British fossil fish *Brychaetus muelleri* WOODWARD, 1901 from the Lower Eocene (Ypresian, London Clay) is the first Osteoglossidae, which was recognized as a marine species. Later, fossil osteoglossid fragments regarded as *B. muelleri* or as *B.* aff. *muelleri* were mentioned in several marine Paleocene and Lower Eocene formations of Morocco, Niger and U.S.A. (ARAMBOURG & SIGNEUX, 1952: 243, pl. 37, fig. 43, 44; CAPPETTA, 1972: 224, pl. 12, fig. 8; WEEMS & HORMAN, 1983: 43-45, fig. 4; CASE, 1994: 144, pl. 2, fig. 392-393). Recently, a *Brychaetus* sp. has been signalized in the marine Lower Eocene of Denmark (BONDE, 2008: 290-291, fig. 23, 24).

In the third part of their big monograph on the fossil fishes from the Lower-Congo and bordering countries, DARTEVELLE & CASIER (1959: 351-352, pl. 37, fig. 8, 9, pl. 39, fig. 3) described under the name *Brychaetus* aff. *muelleri* an incomplete left premaxilla, a fragment of a left dentary and one isolated tooth from the marine Montian (obsolete term, to be replaced now by Danian; Lower Paleocene) of Landana, Cabinda Territory (Africa). A few years later, TAVERNE (1969) showed that a caudal skeleton from the same deposits also belonged to that taxon. He erected the new species *Brychaetus caheni* for the osteoglossid material from Landana because of differences in the tooth shape with *B. muelleri*.

TAVERNE's (1969) choice to assign these African osteoglossid remains to *Brychaetus* WOODWARD, 1901 was exclusively based on the fact that this genus was the only marine osteoglossid genus recognized at that time. Today, this is not the case anymore, as many other marine fossil genera have been described during the last forty years (TAVERNE, 1979, 1998; BONDE, 2008; among others). This, in association with the fact that the caudal skeleton of the Landana species differs from that of all fossil and Recent Osteoglossoidei, as evidenced below, justifies its assignment to a new genus.

Material and methods

The material from Cabinda studied in this paper is kept in the paleontological collections of the Department of Geology of the Royal Museum for Middle Africa (MRAC), Tervuren, Belgium. It has been examined with a stereomicroscope LEICA MZ8, whereas the drawings of the figures were made with a *camera lucida*. Two premaxillae, respectively pertaining to *Brychaetus muelleri* (NHM 39699) and to *Phareodus testis* (COPE, 1877) (NHM P. 7488) and kept in the Natural History Museum of London (NHM), were used for comparison.

Systematic palaeontology

Division Teleostei MÜLLER, 1846
Superorder Osteoglossomorpha
GREENWOOD *et al*., 1966
Order Osteoglossiformes BERG, 1940
Suborder Osteoglossoidei GREENWOOD *et al*., 1966
Family Osteoglossidae BONAPARTE, 1832
Genus *Ridewoodichthys* gen. nov.

Type species: Ridewoodichthys caheni (TAVERNE, 1969), by monospecificity.

Derivatio nominis
After the late English zoologist Walter G. Ridewood (1867-1921) who was the first to provide a good osteological study of the skull in all the Recent families of the superorder Osteoglossomorpha. The Greek word “ichthys” (fish) is added to his name.

Diagnosis
The same as the species (monospecific genus).

Ridewoodichthys caheni (TAVERNE, 1969)
Figs 1-4

Holotype
MRAC RG 9.169: an incomplete left premaxilla from the layer 5.

Paratypes
MRAC RG 9.170: a fragment of a left dentary with teeth from the layer 5.
MRAC RG 9.171: one isolated tooth from the layer 4.

Other Material
MRAC RG 9.183: a caudal skeleton from the layer 10.

Formation and locality
Marine Montian (Lower Paleocene) of Landana, Cabinda Territory, Africa.

Diagnosis
Large marine osteoglossid fish. Dorsal border of the premaxilla with a rounded junction between the ascending process and the oral branch. Jaws bearing long and stout teeth composed of a tumid bony base and an enamelled crown with a small acuminate apex. Crown of the teeth much deeper than the bony base. First ural vertebra (U1) bearing a wide autogenous neural arch and a long, stout neural spine. Second ural vertebra (U2) reduced to a half-centrum and bearing a small autogenous neural arch. Hypurals 1 and 2 fused in a broad autogenous ventral hypural plate. Hypurals 3, 4 and 5 joined in a broad dorsal hypural plate itself fused to U2. Hypural 6 free from the dorsal hypural plate, articulated with and partly fused to U2. One pair of uroneurals.

Osteological remarks

The jaws (Figs 1-3)
The left premaxilla is incompletely preserved. The upper part of the ascending process and the posterior part of the oral branch are lost. The remaining portion of the bone is more or less triangular in shape. The dorsal border of the bone is regularly rounded at the level of the junction between the ascending process and the oral branch. A series of five teeth are preserved, of which two are only represented by their sockets. They are closely arranged side by side in one row.

A long anterior fragment of the left dentary is the only known portion of the lower jaw. It is a thick bone bearing a series of twelve teeth, of which only four still possess their base and their crown. They are closely arranged side by side in only one row, as for the premaxilla.

The teeth on both bones are very large, stout and conical as in many Osteoglossidae. They exhibit a tumid, granulous bony base and a smooth, dark coloured, enamelled crown surmounted by a small hyaline, acuminate and slightly curved inwards apex. The crown is much deeper than the bony base. The teeth are ovoid in transverse section, with their longer diameter forming a right angle with the length of the bone.

The caudal skeleton (Fig. 4)
The technical preparation of the caudal skeleton has been completed, revealing some new osteological data

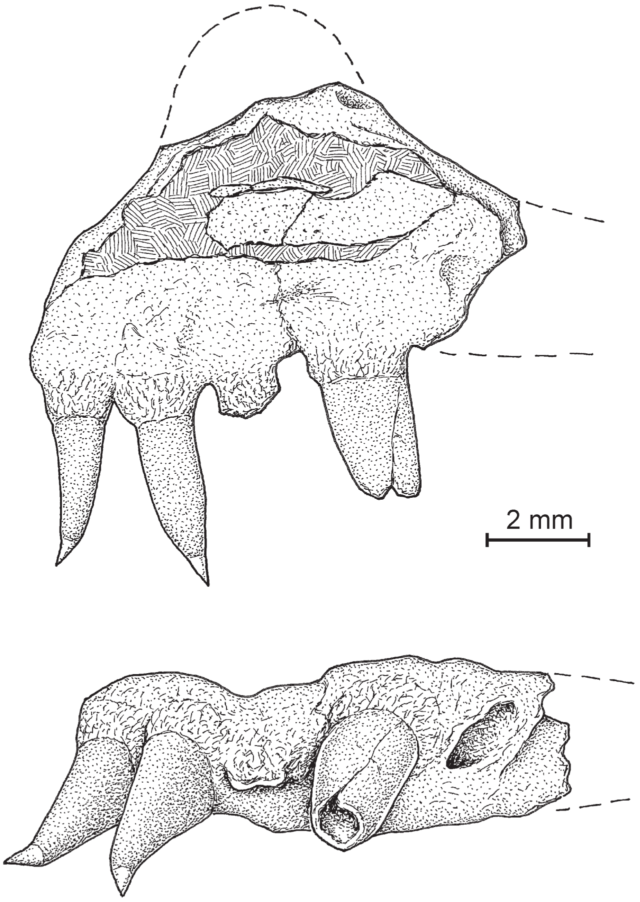

Fig. 1 – *Ridewoodichthys caheni* (Taverne, 1969). Left premaxilla (MRAC RG 9170, holotype): external view (above) and oral border (below).

not mentioned in Taverne (1969).

The first to the fourth preural and the two ural vertebrae are preserved. The axis of the three last centra is noticeably inclined upwards. All the preural, neural and haemal arches and spines, including the parhypural, are lost. Dorsally, the first ural centrum bears a broad autogenous neural arch prolonged by a long, very stout neural spine and, ventrally, a wide autogenous hypural plate formed by the fusion of the two ventral hypurals. The second ural vertebra is reduced to a half-centrum which is fused with a wide dorsal hypural plate resulting from the union of the third, fourth and fifth hypurals. A small part of the line of fusion between the fourth and the fifth hypural is still visible. The sixth hypural is long, slender and not fused to the dorsal hypural plate. It articulates with the rear of the second ural centrum but a beginning of fusion with this half-vertebra occurs at the level of the lower part of its articular head. The second ural centrum bears a small autogenous neural arch formed by a pair of thick bony wings, of which only the right element is preserved. The most anterior part of the uroneural is also preserved just above and behind the second ural centrum.

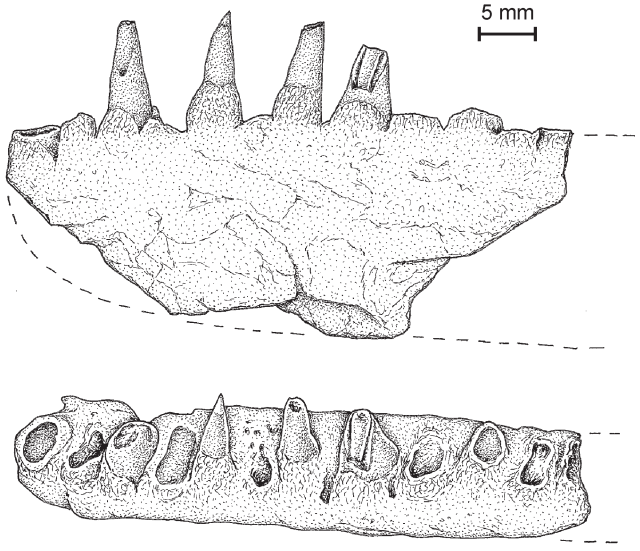

Fig. 2 – *Ridewoodichthys caheni* (Taverne, 1969). Fragment of left dentary (MRAC RG 9169, paratype): external view (above) and oral border (below).

The uroneural of Osteoglossiformes and Mormyriformes is sometimes considered as an epural (Greenwood, 1966; Li *et al.*, 1997; among others). Indeed, it is often difficult to differentiate an eventual epural from an uroneural on fossil osteoglossomorph material. However, when dissecting Recent Osteoglossiformes and Mormyriformes, this structure clearly appears as a pair of firmly joined lamellar bones, and thus represents a pair of uroneurals and not an epural. Hilton (2003) and Castro Leal & Brito (2007) also agreed on this interpretation.

Discussion

Ridewoodichthys and Brychaetus (Figs 3, 5)

Contrarily to the Landana specimen, the bony base of the teeth in *Brychaetus muelleri* is much deeper than the enamelled crown (Fig. 3 C). Moreover, the junction between the ascending process and the oral branch of the premaxilla, L-shaped in *B. muelleri* (Fig. 5 B), is rounded in the Landana material (Fig. 1, above) as well

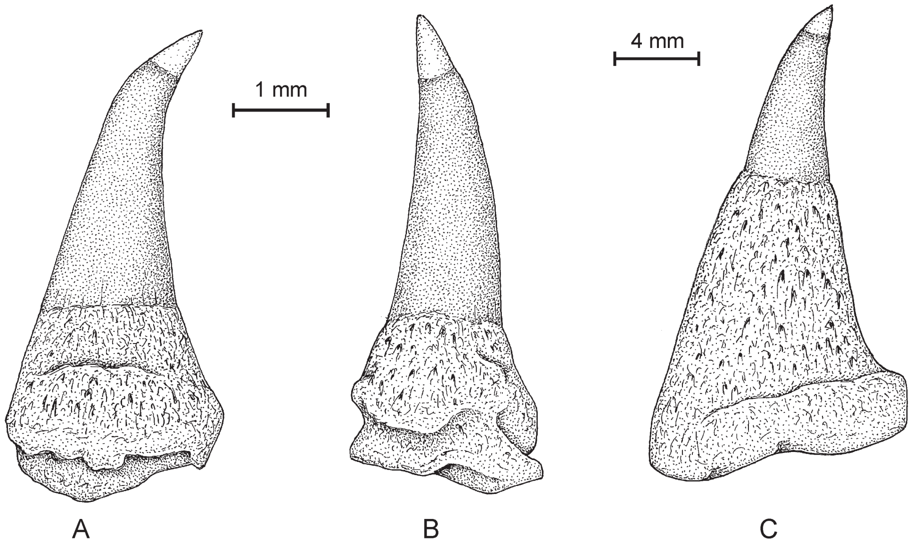

Fig. 3 – *Ridewoodichthys caheni* (TAVERNE, 1969): isolated tooth (MRAC RG 9171, paratype) in posterior or anterior view (A) and in mesial view (B). *Brychaetus muelleri* WOODWARD, 1901 (NHM P 38575): isolated tooth in posterior or anterior view (C).

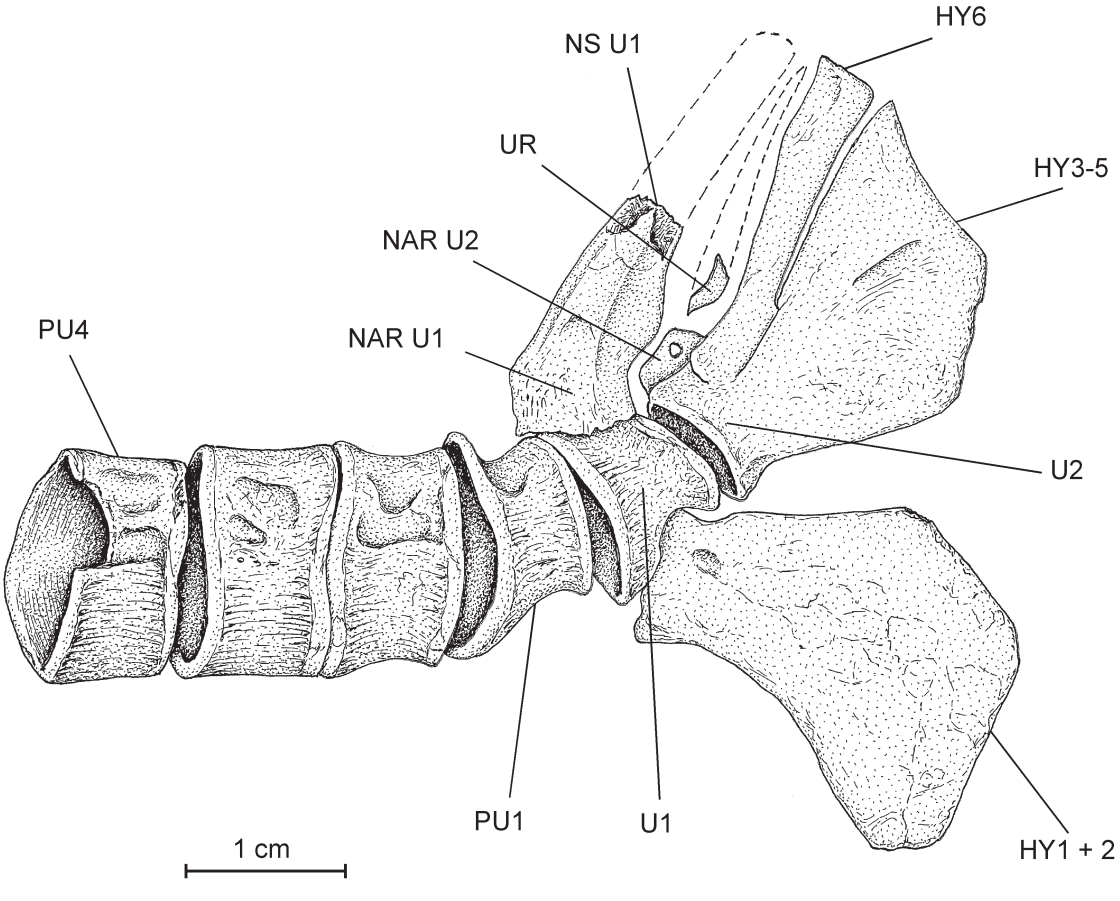

Fig. 4 – *Ridewoodichthys caheni* (TAVERNE, 1969). Caudal skeleton (MRAC RG 9183).

as in *Phareodus testis* (Fig. 5 A). Unfortunately, the caudal skeleton of *B. muelleri* is unknown, excluding further comparative analysis. However, from the foregoing it is clear that *B. muelleri* differs from the Landana fossil species by at least two important osteological features and, that therefore, there is no valid reason to keep this African osteoglossid species within the genus *Brychaetus*.

Ridewoodichthys as a member of the Osteoglossidae

The shape, the size and the morphology of the teeth of *Ridewoodichthys caheni* are characteristic of a series of fossil osteoglossid genera, among which are *Monopteros* VOLTA, 1796, *Phareodus* LEIDY, 1873, *Brychaetus*, *Musperia* SANDERS, 1934, *Opsithrissops* DANILCHENKO, 1968 and *Taverneichthys* KUMAR *et al.*, 2005, and of the two Recent members of the family, *Osteoglossum* CUVIER, 1829 and *Scleropages* GÜNTHER, 1864. No other osteoglossomorph fish exhibits such huge teeth. This apomorphy justifies *R. caheni* to be included in the Osteoglossidae.

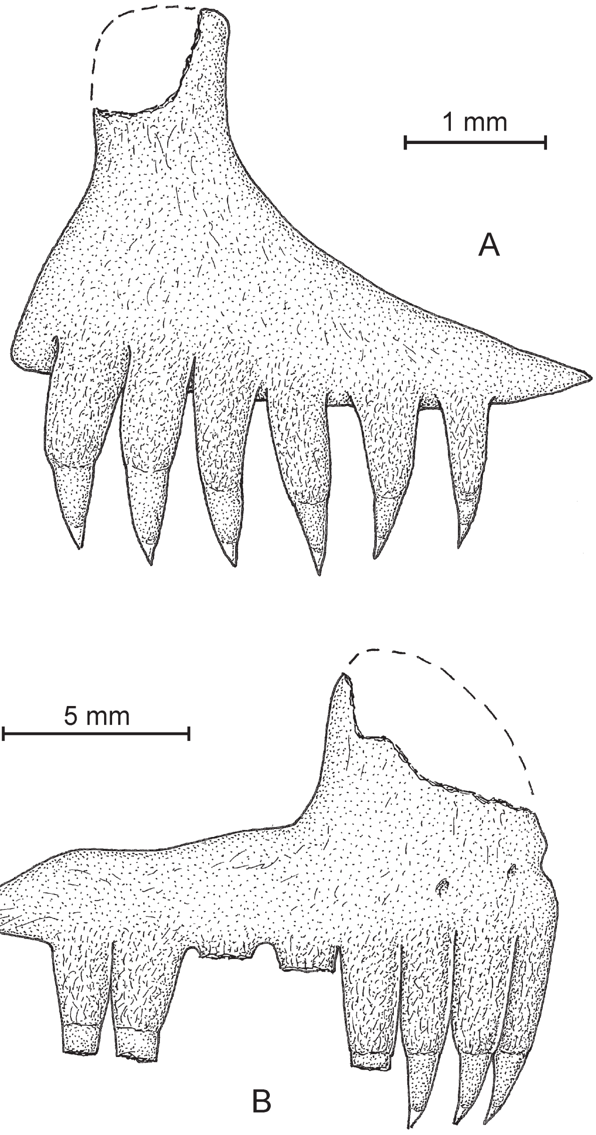

Fig. 5 – (A) *Phareodus testis* (COPE, 1877): left premaxilla (NHM P 7488). (B) *Brychaetus muelleri* (WOODWARD, 1901): right premaxilla (NHM 39699).

Ridewoodichthys as a valid osteoglossid genus

R. caheni differs from all the other known fossil and Recent Osteoglossidae by four characters of its caudal skeleton:

(1) There is one very stout neural spine on the first ural centrum (U1). No other osteoglossid, arapaimid or pantodontid fish possesses a so robust neural spine on U1 (TAVERNE, 1977: figs 66, 90, 120, 143, 144, 1978: fig. 54; 1998: fig. 14, 18; among others). The fossil osteoglossid *Phareodus* offers two neural spines on U1 (GREENWOOD, 1966: fig. 12; TAVERNE, 1978: fig. 13; LI *et al.*, 1997: fig. 5).

(2) There is a small autogenous neural arch on the second ural centrum (U2). Such an autogenous neural arch does not exist in any other Osteoglossidae. However, in *Osteoglossum* and *Scleropages*, a pair of very small and thin lamellar bones is fused to the dorsal face of U2 (TAVERNE, 1977: figs 66, 90). Those bones are the last remains of the second ural neural arch. They are also present in some other osteoglossoid fishes, such as the Pantodontidae (TAVERNE, 1978: fig. 54) and the Arapaimidae (TAVERNE, 1967: fig. 10, 1978: figs 120, 143, 144), and in the Notopteridae (TAVERNE, 1967: figs 5, 6, 1978: figs 81, 88, 110, 130).

(3) The two ventral hypurals are fused in a wide autogenous hypural plate. Once again, no other osteoglossid, arapaimid or pantodontid fish offers such a fusion of the two ventral hypurals, except *Osteoglossum* which presents the unfused (GREENWOOD, 1966: figs 9, 11; TAVERNE, 1977: fig. 66; CASTRO LEAL & BRITO, 2007: figs 2a, c, 3a, b, e, 4b, c, d, 5a, b, c, d, 6a, b, c, 7a) or the fused condition (GREENWOOD, 1966: fig. 10; HILTON, 2003: fig. 38 B; CASTRO LEAL & BRITO, 2007: figs 2b, d, e, f, 3c, d, f, 4a, 7b) depending on specimens. However, the caudal skeleton of *Osteoglossum* differs from that of *Ridewoodichthys caheni* by the loss of the sixth hypural and the great reduction of the uroneural. In the Singididae, an archaic osteoglossoid family from the lacustrine Eocene of Tanzania, the two ventral hypurals are partially or totally fused (GREENWOOD & PATTERSON, 1967: fig.

3; TAVERNE, 1978: fig. 58, 1998: fig. 19; MURRAY & WILSON, 2005: fig. 6) but the other features of the caudal skeleton in that Tanzanian fossil family are quite different from those in *R. caheni*. Among advanced Osteoglossomorpha, the fused condition also exists in Notopteridae (TAVERNE, 1978: figs 81, 87, 88, 110, 130; HILTON, 2003: fig. 37 D) and in some mormyrid genera (TAVERNE, 1967: fig. 3; HILTON, 2003: fig. 37 C; among others).

(4) The sixth hypural is articulated and partially fused with the rear of the second ural centrum (U2). In the other fossil and Recent Osteoglossidae which still possess a sixth hypural that bone is never articulated with the U2 (GREENWOOD, 1966: figs 1, 2, 4; TAVERNE, 1977: fig. 90, 1978: fig. 13, 1998: figs 14, 18; LI *et al*., 1997: fig. 5 B; HILTON, 2003: fig. 38 A). The articulation of the sixth hypural on the rear of U2 exists in the arapaimid *Heterotis* CUVIER & VALENCIENNES, 1846 at a very young stage of development (GREENWOOD, 1966: fig. 3) but is lost in adult specimens (ibid.: fig. 4; TAVERNE, 1977: fig. 120). The arapaimid *Arapaima* MÜLLER, 1843 exhibits both the non-articulated (GREENWOOD, 1966: fig. 5; TAVERNE, 1977: figs 143, 144) and the articulated conditions (GREENWOOD, 1966: fig. 6; HILTON, 2003: figs 35 A, B, 36 B, D) depending on specimens. In the Pantodontidae, the sixth hypural is preserved but remains largely separated from U2 (GREENWOOD, 1966: figs 7, 8; TAVERNE, 1978: fig. 54).

Those four caudal characters allow to conclude that *Ridewoodichthys* is a valid osteoglossid genus.

Ridewoodichthys within the Osteoglossidae

Ridewoodichthys caheni is marked by a wide dorsal hypural plate fused to the second ural centrum (U2). Within the Osteoglossidae, it shares that apomorphic character with the fossil genus *Foreyichthys* TAVERNE, 1979 and the Recent genera *Osteoglossum* and *Scleropages* (TAVERNE, 1977: figs 66, 90, 1998: fig. 14; among others). Thus, on that level, *R. caheni* is more specialized than certain other fossil osteoglossid genera such as *Phareodus, Musperia* or *Opsithrissops* which still exhibit a series of dorsal hypurals separated from the U2 (TAVERNE, 1978: fig. 13 and p. 50, 1979: fig. 13). Nothing else can be said about the phylogenetic position of *R. caheni* within the family because of the absence of additional adequate osteological data. A dorsal hypural plate fused to U2 also occurs in the Arapaimidae, Pantodontidae, Notopteridae and Mormyridae.

Acknowledgements

I greatly thank Dr. D. Baudet, the curator of the fossil collections in the Royal Museum of Middle Africa (Tervuren), who kindly permitted me to re-study the osteoglossid material from Landana, and Mrs. M. Moreels, from the same museum, for her technical help. I am also grateful to the late Dr. C. Patterson and to Dr. P. Forey from the Natural History Museum of London for allowing me to study some fossil specimens from their collections. I am also very grateful to Dr. M. Gayet (Lyon), who kindly accepted to review the manuscript.

List of the abbreviations used in the text-figures

HY 1-6: hypurals 1-6
NAR U1: neural arch of the first ural centrum
NAR U2: neural arch of the second ural centrum
NS U1: neural spine of the first ural centrum
PU 1-4: first to fourth preural centra
U 1-2: first and second ural centra
UR: uroneural

References

ARAMBOURG, C. & SIGNEUX, J., 1952. Les Vertébrés fossiles des gisements de phosphates (Maroc – Algérie – Tunisie). *Protectorat de la République Française au Maroc*, *Direction de la production industrielle et des mines*, *Direction des mines et de la géologie*, *Service géologique*, *Notes et Mémoires*, **92**: 1-372.

BONDE, N., 2008. Osteoglossomorphs of the marine Lower Eocene of Denmark – with remarks on other Eocene taxa and their importance for palaeobiogeography. *In*: CAVIN, L., LONGBOTTOM, A. & RICHTER, M. (editors), Fishes and the Break-up of Pangaea, Geological Society, London, Special Publications **295**: 253-310.

CAPPETTA, H., 1972. Les poissons crétacés et tertiaires du Bassin des Iullemmeden (République du Niger). *Palaeovertebrata*, **5** (5): 179-251.

CASE, G.R., 1994. Fossil fish remains from the Late Paleocene Tuscahoma and Early Eocene Bashi Formations of Meridian, Lauderdale County, Mississipi. Part II. Teleosteans. *Palaeontographica*, A, **230** (4-6): 139-153.

CASTRO LEAL, M.E. & BRITO, P.M., 2007. Intraspecific variation of the caudal fin skeleton in *Osteoglossum bicirrhosum* Cuvier 1829 (Teleostei: Osteoglossomorpha: Osteoglossidae). *Zootaxa*, **1434**: 1-26.

DARTEVELLE, E. & CASIER, E., 1959. Les poissons fossiles du Bas-Congo et des régions voisines (troisième partie). *Annales du Musée du Congo Belge*, *A. – Minéralogie, Géologie, Paléontologie*, série 3, **2** (3): 267-568.

GREENWOOD, P.H., 1966. The caudal fin skeleton in osteoglossoid fishes. *Annals and Magazine of Natural History*, series 13, **9**: 581-597.

Greenwood, P.H. & Patterson, C., 1967. A fossil osteoglossoid fish from Tanzania (E. Africa). *Journal of the Linnean Society*, *(Zoology)*, **47** (311): 211-223.

Hilton, E.J., 2003. Comparative osteology and phylogenetic systematics of fossil and living bony-tongue fishes (Actinopterygii, Teleostei, Osteoglossomorpha). *Zoological Journal of the Linnean Society*, **137**: 1-100.

Li, G.-Q., Grande, L. & Wilson, M.V.H., 1997. The species of + *Phareodus* (Teleostei: Osteoglossidae) from the Eocene of North America and their phylogenetic relationships. *Journal of Vertebrate Paleontology*, **17** (3): 487-505.

Murray, A.M. & Wilson, M.V.H., 2005. Description of a new Eocene osteoglossid fish and additional information on +*Singida jacksonoides* Greenwood and Patterson, 1967 (Osteoglossomorpha), with an assessment of their phylogenetic relationships. *Zoological Journal of the Linnean Society*, **144**: 213-228.

Taverne, L., 1967. Le squelette caudal des Mormyriformes et des Ostéoglossomorphes. *Académie Royale de Belgique*, *Bulletin de la Classe des Sciences*, 5^e^ Série, **53** (6): 663-678.

Taverne, L., 1969. Sur un squelette caudal d'ostéoglossomorphe (*Brychaetus* ?) dans le Paléocène (Montien) de Landana (Enclave de Cabinda). – Etablissement d'une nouvelle espèce pour les restes de *Brychaetus* de Landana: *Brychaetus caheni* sp. nov. *Revue de Zoologie et de Botanique Africaines*, **79** (1-2): 125-131.

Taverne, L., 1977. Ostéologie, phylogénèse et systématique des téléostéens fossiles et actuels du super-ordre des ostéoglossomorphes. Première partie. Ostéologie des genres *Hiodon*, *Eohiodon*, *Lycoptera*, *Osteoglossum*, *Scleropages*, *Heterotis* et *Arapaima*. *Académie Royale de Belgique*, *Mémoires de la classe des Sciences*, collection in-8°, 2^{e} série, **42** (3): 1-235.

Taverne, L., 1978. Ostéologie, phylogénèse et systématique des téléostéens fossiles et actuels du super-ordre des ostéoglossomorphes. Deuxième partie. Ostéologie des genres *Phareodus*, *Phareoides*, *Brychaetus*, *Musperia*, *Pantodon*, *Singida*, *Notopterus*, *Xenomystus* et *Papyrocranus*. *Académie Royale de Belgique*, *Mémoires de la Classe des Sciences*, collection in-8°, 2^{e} série, **42** (6): 1-213.

Taverne, L., 1979. Ostéologie, phylogénèse et systématique des téléostéens fossiles et actuels du super-ordre des ostéoglossomorphes. Troisième partie. Évolution des structures ostéologiques et conclusions générales relatives à la phylogénèse et à la systématique du super-ordre. Addendum. *Académie Royale de Belgique*, *Mémoires de la Classe des Sciences*, collection in-8°, 2^{e} série, **43** (3) : 1-168.

Taverne, L., 1998. Les ostéoglossomorphes marins de l'Éocène du Monte Bolca (Italie): *Monopteros* Volta, 1796, *Thrissopterus* Heckel, 1856 et *Foreyichthys* Taverne, 1979. Considérations sur la phylogénie des téléostéens ostéoglossomorphes. *In*: Studi e Ricerche sui Giacimenti Terziari di Bolca, 7, Museo Civico di Storia Naturale di Verona: 67-158.

Weems, R.E. & Horman, S.R. (1983). Teleost fish remains (Osteoglossidae, Blochiidae, Scombridae, Triodontidae, Diodontidae) from the Lower Eocene Nanjemoy Formation of Maryland. *Proceedings of the Biological Society of Washington*, **96** (1): 38-49.

L. Taverne
Résidence "Les Platanes"
Boulevard du Souverain, 142 (Box 8)
B-1170 Brussels, Belgium
E-mail: louis.taverne@gmail.com

Typescript submitted: January 15, 2009
Revised typescript received: June 17, 2009