

A new pleuropholid, *Gondwanapleuropholis longimaxillaris* n. g., n. sp. (Actinopterygii: Teleostei) from the Jurassic of north east Brazil

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Abstract – A basal teleost fish is described for the first time from the Upper Jurassic Pastos Bons Formation, Parnaíba Basin, northeastern Brazil. This new material is identified as a new genus and a new species, *Gondwanapleuropholis longimaxillaris*. This taxon shares a number of synapomorphies with the pleuropholids. The family Pleuropholidae is confirmed as member of the Teleostei. *To cite this article: P.M. Brito, V. Gallo, C. R. Palevol 1 (2002) 697–703.* © 2002 Académie des sciences / Éditions scientifiques et médicales Elsevier SAS

Actinopterygii / Teleostei / Pleuropholidae / Jurassic / Brazil / new taxon

Résumé – Un nouveau pleuropholidé, *Gondwanapleuropholis longimaxillaris* n. g., n. sp. (Actinopterygii: Teleostei) du Jurassique du Nord-Est du Brésil. Un téléostéen basal est décrit pour la première fois dans le Jurassique supérieur de la formation Pastos Bons, bassin du Parnaíba, Nord-Est du Brésil. Ce matériel est rapporté à un nouveau genre et à une nouvelle espèce, *Gondwanapleuropholis longimaxillaris*. Ce nouveau taxon possède certaines synapomorphies des Pleuropholidés. La position de la famille Pleuropholidae au sein des Teleostei est confirmée. *Pour citer cet article : P.M. Brito, V. Gallo, C. R. Palevol 1 (2002) 697–703.* © 2002 Académie des sciences / Éditions scientifiques et médicales Elsevier SAS

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Version abrégée

1. Introduction

Les Pleuropholidés sont des poissons de petites dimensions, facilement reconnaissables à la présence d'une petite bouche tournée vers le haut, d'un grand nombre d'os supra- et infraorbitaux et d'écaillés élevées sur les flancs [12]. Cette famille est connue du Trias supérieur au Crétacé inférieur d'Europe et d'Afrique [5, 8, 16, 17, 22, 23]. À l'exception du matériel décrit en Afrique [17], l'unique autre citation pour cette famille, dans le Gondwana, est celle de Santos [18], qui note que les pleuropholidés ont été les poissons les plus fréquents dans la formation Pastos Bons.

L'âge de la formation Pastos Bons n'est pas résolu. Pour de nombreux auteurs, ces dépôts sont datés du Crétacé inférieur [11, 15, 18], alors que des études récentes, basées sur les Ostracodes, les Conchostracés [9] ainsi que sur la présence de quelques poissons, comme les Sémionotidés, proposent un âge Jurassique supérieur. Dans la présente note, nous décrivons un nouveau pleuropholidé, provenant de la formation Pastos Bons : *Gondwanapleuropholis longimaxillaris*, n. g., n. sp.

2. Description

Cette espèce est caractérisée par sa petite taille, avec environ 60 mm de longueur standard. La longueur de la tête

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représente un cinquième de la longueur standard ; la hauteur maximale de l'animal se situe au niveau de l'opercule (Fig. 1).

Le frontal est large et ne présente pas de constriction antérieure. Postérieurement, le frontal est suturé avec le pariétal, plus long que large, ainsi qu'avec le long dermoptérotique (Fig. 2). Une paire d'extrascapulaires, plus larges que longs, est également présente.

Le préopercule est divisé en un rameau dorsal vertical et un court rameau ventral. Le rameau dorsal ne semble pas atteindre le dermoptérotique (Fig. 2).

Le prémaxillaire est un os aplati dorso-ventralement, ne comportant aucune dent. Une pièce située sous le rostral semble être le processus qui se dirige vers le nasal. Le maxillaire est édenté, son bord oral est rectiligne. Aucune trace de supramaxillaire n'a été observée. Le dentaire (Fig. 3), allongé et épais, s'élargit vers l'arrière pour former le processus coroné. L'angulaire est court et difficile à distinguer du dentaire.

Seul le carré est impliqué dans l'articulation carré-mandibule, le condyle du carré se trouvant sous le tiers postérieur de l'orbite. Le carré est un petit os en forme d'éventail, avec un processus postéroventral court, et est caractérisé par un épaississement de sa bordure postérieure, proche du symplectique.

Le parasphénoïde est un os fin, s'étalant postérieurement jusqu'à la moitié antérieure du basioccipital. La carotide interne passe à travers une paire de petits forams percés juste en arrière de la base des processus ascendants. Le parasphénoïde n'a pas de dents.

Les centra vertébraux sont lisses, les arcs neuraxiaux ne sont pas fusionnés à ces centra. La nageoire caudale est petite, hémihétérocerque. Son lobe dorsal est composé de deux scutelles et de 17–18 fulcres basaux épaxiaux, suivis par 10 à 11 rayons principaux. Le lobe inférieur présente deux scutelles ventrales, 15 fulcres basaux hypaxiaux et 10 rayons principaux. Des fulcres frangés sont présents sur les deux lobes.

Quatre hypuraux étroits, allongés et indépendants les uns des autres sont préservés (Fig. 4). Aucun diastème n'a pu

être trouvé entre ces hypuraux. Bien que la partie antéro-dorsale de l'endosquelette caudal soit endommagée chez le spécimen étudié, nous pouvons distinguer quatre uroneuraux postérieurs allongés. Les épuraux sont difficiles à déterminer ; cependant, nous pouvons en compter trois, probablement associés au centre ural. Les écailles sont ganoïdes, celles du flanc du corps étant élevées.

3. Affinités et conclusion

En dépit de la nécessité d'une révision phylogénétique des Pleuropholidae, le nouveau genre *Gondwanapleuropholis* présente les caractères généraux de cette famille : présence d'écailles élevées sur les flancs, bouche édentée, disposition générale du toit crânien et de l'endosquelette caudal. Au sein des Pleuropholidae, les caractères suivants sont uniques à *Gondwanapleuropholis* : longueur de la mandibule, avec le condyle du carré se trouvant au-dessous du tiers postérieur de l'orbite, longueur du maxillaire s'étendant jusqu'au niveau du bord postérieur orbital et la taille courte du rameau ventral du préopercule.

Patterson [12] fut le premier auteur à considérer les Pleuropholidae comme des Téléostéens, en se basant sur la structure du prémaxillaire, du carré, les vertèbres et le squelette caudal. Plus tard, Patterson [13] laissa les Pleuropholidae dans les Téléostéens basaux, sur la base de sept synapomorphies.

Gondwanapleuropholis présente quelques-uns des caractères généralisés présentés par Patterson [13] comme synapomorphies des Téléostéens. Cependant, au cours des dernières années, la position phylogénétique des certains des Téléostéens basaux suivant Patterson, aussi bien que le niveau exact de généralité de certaines des synapomorphies ont été mis en doute [1–3, 6, 7, 14]. Dans une publication récente [1], la monophylie des Téléostéens est étayée par une synapomorphie unique : le carré portant un processus ventral allongé. Suivant cette hypothèse, *Gondwanapleuropholis*, ainsi que l'ensemble des Pleuropholidae, peuvent donc être considérés comme des Teleostei.

1. Introduction

The family Pleuropholidae was one of the families previously assigned to the order Pholidophoriformes, an order not supported phylogenetically [2]. Pleuropholids comprise small, slender fishes, readily recognized by their small and upturned mouth, the numerous supra and infraorbital bones, and the deep elongate flank scales [12]. This family occurs mainly in the Upper Triassic to Lower Cretaceous of Europe and Africa [5, 8, 16, 17, 22, 23]. Apart from the African material described by Saint-Seine [17], the only other record of this family in western Gondwana, is that of Santos [18], who noted that pleuropholids were one of

the most frequently occurring fishes in the Pastos Bons Formation of the Parnaíba Basin, Brazil.

The Pastos Bons Formation comprises a sequence of siltstones, dark shales, and greenish and brownish mudstones, considered to have been deposited in a continental environment controlled by fluvial-lacustrine systems [9]. The age of this formation is controversial. Many authors had suggested an Early Cretaceous age for its deposits [11, 15, 18]; however, recent studies, based on ostracods, conchostracans [9] and the presence of some fish taxa, like the semionotids, suggest a Late Jurassic age.

In the present note we describe the pleuropholids from the Pastos Bons Formation. These fossils were

collected in the locality known as Muzinho farm, near the town of Floriano, State of Piauí, northeastern Brazil.

2. Systematic Paleontology

Subdivision Teleostei

Order Incertae sedis

Family Pleuropholidae Saint-Seine, 1949

Genus *Gondwanapleuropholis* n. g.

Type species. *Gondwanapleuropholis longimaxillaris* n. sp.

Diagnosis. monospecific genus, cf. species diagnosis.

Holotype. Departamento Nacional de Produção Mineral, n° DGM 914-P (Fish nearly complete in lateral view).

Gondwanapleuropholis longimaxillaris sp. nov.

Additional material. Departamento Nacional de Produção Mineral: DGM 906-P, DGM 907-P, DGM 910-P, DGM 911-P, DGM 912-P, DGM 913-P, DGM 915-P; and Universidade do Estado do Rio de Janeiro: Pz.UERJ. 451, Pz.UERJ. 452, Pz.UERJ. 453, Pz.UERJ. 454, Pz.UERJ. 455, Pz.UERJ. 456, Pz.UERJ. 457, Pz.UERJ. 458, Pz.UERJ. 459, Pz.UERJ. 460, Pz.UERJ. 469, Pz.UERJ. 470.

Locus typicus. Muzinho farm, town of Floriano, Piauí State, northeastern Brazil.

Stratum typicum. Pastos Bons Formation, Parnaíba Basin, ?Upper Jurassic.

Derivatio nominis. Named after the supercontinent Gondwana, plus *pleuropholis*, related to the lateral scales; and *longimaxillaris*, referring to the extension of the jaws.

Diagnosis. A small sized pleuropholid with the following combination of primitive and uniquely derived (identified by an asterisk) features: standard length about 60 mm; head length about one fifth of the standard length; elongate mandible, with a low coronoid process (*); maxilla elongated, extending to the level of the posterior orbital border (*); quadrate condyle lying below the posterior third of the orbit (*); only the quadrate involved in the quadrate-mandibular articulation; preopercle divided into a vertical dorsal ramus and a short expanded ventral ramus (*); vertebrae formed by arcocentra; neural and hemal arches not fused to the centra; caudal fin hemiheterocercal; no diastema within the hypurals; ural centra represented by ventral hemichordocentra; long and slender uroneurals; about 27 deep scales on the flank; scales with serrated posterior border.



Fig. 1. *Gondwanapleuropholis longimaxillaris*. General view of specimen DGM 907-P (bar = 10 mm).

Fig. 1. *Gondwanapleuropholis longimaxillaris*. Vue générale du spécimen DGM 907-P. (échelle = 10 mm).

3. Description

This is a small sized teleost, with approximately 60 mm standard length. The deepest part of the fish is near the opercle, decreasing gently posteriorly (Fig. 1). The head measures, from the anterior part of the rostral to the posterior part of the opercle, about one fifth of the standard length.

Skull. Although specimens with the skull are frequent, the head is generally incompletely preserved and only a few bones can be identified. The head is short and broad (Fig. 2). Although not well preserved, the rostral appears to be relatively slender, with its lateral processes directed caudally. The nasals are slender and slightly elongate.

The posterior part of the skull roof is well preserved. The anterior suture between the rostral and the frontal is not discernible in any specimen. Like in *Pleuropholis*, *Ichthyokentema*, *Siemensichthys*, and *Eurycormus*, the frontal in *Gondwanapleuropholis* is broad, and does not exhibit the strong anterior narrowing found in *Pholidophorus bechei*, *P. latiusculus*, *Leptolepis coryphaenoides*, and the more advanced teleosts [2]. Posteriorly, the frontal sutures with the parietal, which seems to be longer than broader, and with the long dermopterotic. One pair of wider than long extrascapulars are present.

The median posterior branch of the supraorbital sensory canal extends from the frontal into the anterior part of the parietal, and does not join the infraorbital canal; a lateral branch of this canal was not observed.

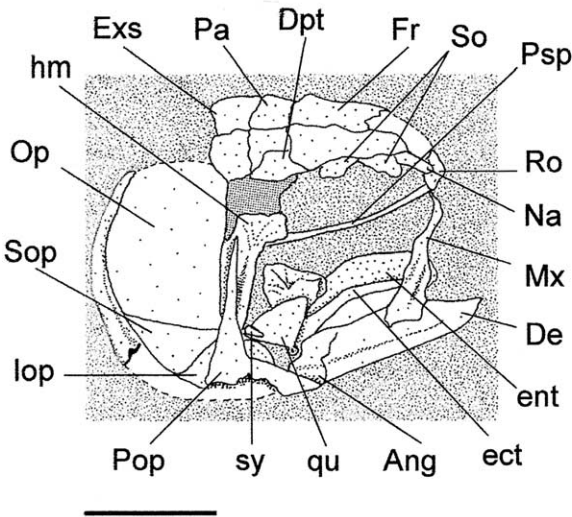


Fig. 2. *Gondwanapleuropholis longimaxillaris*. Head of the holotype (DGM 914-P; bar = 5 mm). **Ang**, Angular; **De**, dentary; **Dpt**, dermopterotic; **ect**, ectopterygoid; **ent**, entopterygoid; **Exs**, extrascapular; **Fr**, frontal; **hm**, hyomandibula; **Iop**, interopercle; **Mx**, maxilla; **Na**, nasal; **Op**, opercle; **Pa**, parietal; **Pop**, preopercle; **Psp**, parasphenoid; **qu**, quadrate; **Ro**, rostral; **So**, supraorbitals; **sy**, symplectic; **Sop**, subopercle.

Fig. 2. Tête de l'holotype de *Gondwanapleuropholis longimaxillaris* (DGM 914-P; (échelle = 5 mm). **Ang**, Angulaire; **De**, dentaire; **Dpt**, dermoptéroïque; **ect**, ectoptérygoïde; **ent**, entoptérygoïde; **Exs**, extrascapulaire; **Fr**, frontal; **hm**, hyomandibulaire; **Iop**, interopercule; **Mx**, maxillaire; **Na**, nasal; **Op**, opercule; **Pa**, pariétal; **Pop**, préopercule; **Psp**, parasphénoïde; **qu**, carré; **Ro**, rostral; **So**, supraorbitaires; **sy**, symplectique; **Sop**, subopercule.

The otic part of the infraorbital sensory canal runs medially along the dermopterotic penetrating anteriorly the dermosphenotic, and posteriorly on the extrascapulars, where the supratemporal commissure runs in their middle length.

The circumorbital series, as well as the posterior cheek region, are not completely preserved. Two supraorbitals are visible in the material, the anterior one being markedly larger than the posterior. An infraorbital, placed on the front part of the orbit, is present on

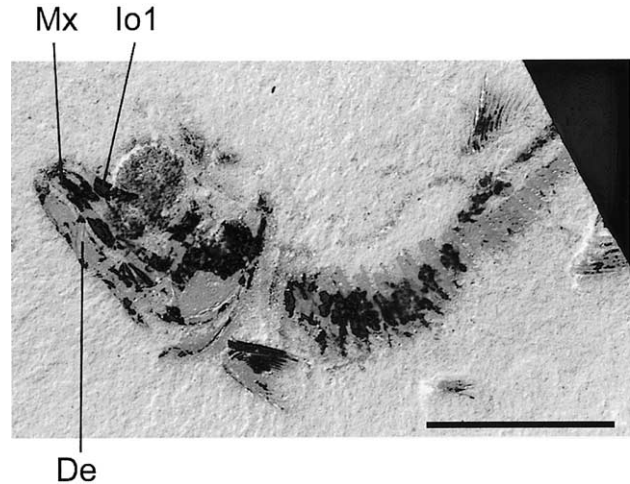


Fig. 3. *Gondwanapleuropholis longimaxillaris*. Juvenile specimen No. Pz.UERJ 470. **De**, Dentary; **Io**, infraorbital, **Mx**, maxilla (bar = 7 mm).

Fig. 3. *Gondwanapleuropholis longimaxillaris*. Spécimen d'animal jeune, n° Pz.UERJ 470. **De**, Dentaire; **Io**, infraorbitaire; **Mx**, maxillaire (échelle = 7 mm).

specimen Pz.UERJ. 470 (Fig. 3). It is a narrow bone pierced by the short tubules of the infraorbital canal.

The preopercle comprises a vertical dorsal ramus and a short expanded ventral ramus, and apparently does not reach the dermopterotic dorsally (Fig. 2). The opercular series is formed by a slightly deeper than wide opercle, a subtriangular subopercle, and a small trapezoidal interopercle. At least 10 branchiostegal rays are present. They are mostly elongate, thin bones, gradually decreasing in size anteriorly.

Only the premaxilla and the maxilla are preserved in the available material (Figs. 2 and 3). The anterior oral process of the premaxilla is a plate-like bone bearing no teeth. A possible nasal process can be seen lying under the rostral and probably reaching the nasal. Unlike the other pleuropholids, in which the jaws are small and upturned, the maxilla of *Gondwanapleuropholis* is long and stout, ending just inside the posterior border of the orbit. This maxilla is edentulous, and its oral border is straight. Anteriorly, the maxilla bears a long and medially directed articular process. No traces of a supramaxilla have been found.

Dentary and angular are preserved in the lower jaw. The dentary constitutes the major part of the mandible. This bone is elongate and stout, increases in height posteriorly to form the coronoid process. The dentary is traversed by the mandibular sensory canal, which extends along its ventral border. The angular is short and hardly distinguishable from the dentary.

Only the quadrate is involved in the quadrate-mandibular articulation, the quadrate condyle lying

below the posterior third of the orbit. The quadrate is a small fan-shaped bone, with a short posteroventral process, and is characterized by a thickening of its posterior border, which lies against the symplectic. The symplectic does not reach the mandible.

The endopterygoid and ectopterygoid are elongate and seem to lack oral teeth. The metapterygoid is a large more or less trapezoidal bone resting on the quadrate, ectopterygoid and hyomandibula. The hyomandibula is a strong bone pierced by a foramen for the hyomandibular branch of the facial nerve. The posterior ceratohyal is a small bone mostly articulated with the anterior ceratohyal through a bender suture. The anterior ceratohyal is a long and thin bone, narrow anteriorly and more expansive posteriorly.

Only the orbital and posterior parts of the parasphenoid are preserved. It is a fragile, thin bone extending caudally to the anterior half of the basioccipital. The basiptyergoid process is relatively large, its root being perforated by a large foramen for the efferent pseudo-branchial artery. The ascending process of the parasphenoid is short and directed postero-dorso-laterally. The internal carotid arteries passed through a pair of small canals entering the parasphenoid just behind the base of the ascending processes. The parasphenoid lacks teeth.

Paired girdles and fins. The posttemporal is elongate, with a rounded posterior margin. The supracleithrum is elongate, its anterior edge touching the postero-lateral corner of the posttemporal, and its ventral part overlapping the cleithrum. The cleithrum is elongate; its dorsal limb is more developed than the ventral one. The scapulocoracoid articulates ventrally with the cleithrum. A propterygium, apparently fused with the first pectoral ray, and about ten rays are preserved in each pectoral fin. The pelvic bone is severely damaged and cannot be described here. The pelvic fin has at least six rays.

Dorsal and anal fins. The dorsal fin is short and has at least nine lepidotrichia preceded by a basal fulcrum and five fringing fulcra. The dorsal fin starts at about the 20th transverse scale row. The anal fin has at least six rays and is very small, starting at the level of the 22nd row of scales.

Vertebral column and caudal skeleton. The vertebral centra are smooth, and the neural and hemal arches are not fused to the centra.

The caudal fin is small, hemiheterocercal, with both the upper and lower lobes almost equal in sizes. The dorsal lobe is composed of two scutes, 17 or 18 epaxial basal fulcra, followed by 10 or 11 principal rays. The lower lobe has two ventral scutes, 15 hypaxial basal

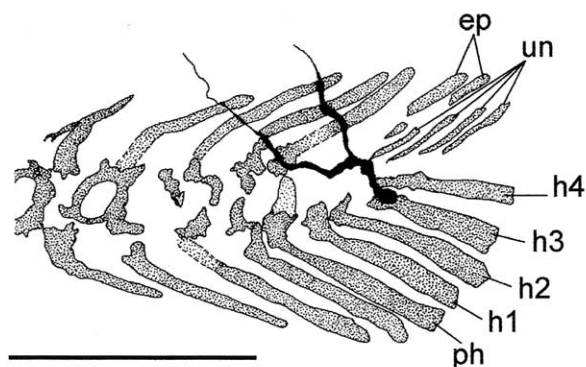


Fig. 4. *Gondwanapleuropholis longimaxillaris*. Caudal endoskeleton (Pz.UERJ 1.469). **ep**, Epurals; **h1**, first hypural; **ph**, parhypural, **un**, uroneurals (bar = 5 mm).

Fig. 4. *Gondwanapleuropholis longimaxillaris*. Endosquelette de la nageoire caudale (Pz.UERJ 1.469). **ep**, Épuraux ; **h1**, hypural 1 ; **ph**, parhypural ; **un**, uroneuraux (échelle = 5 mm).

fulcra and 10 principal rays. Fringing fulcra are present in both lobes.

The caudal endoskeleton is well preserved only in specimen Pz.UERJ. 469 (Fig. 4). As remarked for the genus *Pleuropholis* [1], *Gondwanapleuropholis* has ural chordacentra.

Four hypurals are preserved. They are narrow, elongated elements whose size and length gradually decrease caudally. The hypurals are independent from each other, including their proximal regions, where traces of arcocentra are found. No diastema could be found within the hypurals.

Although the antero-dorsal part of the caudal endoskeleton is damaged in the studied specimens, four, long and slender posterior uroneurals can be distinguished. We suppose that the number of these elements, in a complete specimen, should be at least six.

The number of epurals is difficult to determine precisely. However, we could detect three epurals,

probably associated with the ural centra. Due to the state of preservation in our specimens, it is difficult to determine if preural centrum 1 presents an epural or a full neural spine.

Squamation. There are about 37 lateral line scales from the supracleithrum to the base of the axial lobe of the caudal fin. They are thick ganoid-type scales, juxtaposed, and displaying a peg and socket type of articulation. The flank scales (about 27) are deep and posteriorly serrated.

It is not possible to determine the number of scales dorsal to the flank row. However, they are small, quadrangular, and smooth. Ventral to the flank scales there are two or three rows of small rectangular smooth scales. The histology of these scales show a lepidosteoid-type in that the basal lamellar bone layer is directly overlain by ganoin, without an intercalated dentine layer [10, 19–21].

4. Taxonomic affinities

4.1. *Gondwanapleuropholis* as Pleuropholidae

Despite the necessity of a phylogenetic revision of the family Pleuropholidae, the new genus *Gondwanapleuropholis* shows the generalized characters of this family, such as the presence of excessively deep scales on the flank, an edentulous mouth, as well as the general pattern of the caudal endoskeleton. Within the pleuropholids, the following characters are unique to *Gondwanapleuropholis*: the length of the mandible, with the quadrate condyle lying below the posterior third of the orbit; the length of the maxilla, extending until the level of the posterior orbital border; and the short size of the ventral ramus of the preopercle.

The family Pleuropholidae was erected by Saint-Seine [16] to include the species of the genus *Pleuropholis*. Later, this author [17] added two new genera to this family, *Austropleuropholis* and *Parapleuropholis*. Patterson [12] considered the differences between these three genera weak, probably due to difficulties in interpretation of the fossils, but considered this family as almost certainly monophyletic.

4.2. Pleuropholids as teleosts

Patterson [12] was first to consider the Pleuropholidae as teleosts, based on the structure of the premaxillae, the quadrate, the vertebrae, and the caudal skel-

eton. Later, Patterson [13] let the pleuropholids in the basal teleosts based on six unquestionable synapomorphies (e.g., ural neural arches modified as uroneurals; small mobile premaxilla, lying lateral to the rostral bone; internal carotid enclosed in the parasphenoid; pectoral propterygium fused with first pectoral fin ray; six epurals; and a median tooth plate covering basibranchials 1–3), and also the doubtful feature “quadratojugal (= posteroventral process of the quadrate, see [4] for discussion) fused to quadrate as a postero-dorsal process, enclosing a groove for the symplectic”.

Gondwanapleuropholis presents some of these generalized characters proposed by Patterson [13] as teleost synapomorphies, such as the presence of uroneurals, a small mobile premaxilla placed lateral to the rostral bone, internal carotid enclosed in the parasphenoid, fusion between the pectoral propterygium and the first fin ray, and the presence of a posteroventral process on the quadrate. However, in recent years, the phylogenetic position of some of Patterson’s basal teleosts, as well as the exact level of generality of certain of his synapomorphies have been questioned [1–3, 6, 7, 14].

In a recent paper [1] the Teleostei have been stated as monophyletic based on a unique synapomorphy: the quadrate bearing an elongated posteroventral process. Following this proposition, we can consider *Gondwanapleuropholis*, as well as the pleuropholids, as teleosts.

5. Conclusion

This is the first record and description of a pleuropholid for South America. The presence of this taxon, as well as the associated fauna, suggests a Late Jurassic age for the Pastos Bons Formation.

The presence of deep scales on the flank, the shape of the frontals, an edentulous mouth, as well as the general pattern of the caudal endoskeleton, place *Gondwanapleuropholis* within the Pleuropholidae. However, *Gondwanapleuropholis* differs from all other pleuropholids in at least two characters: the length of its jaw and the short size of the preopercle ventral ramus.

Although the family Pleuropholidae requires further investigation, and much work on their interrelationships remains to be done, the features found in *Gondwanapleuropholis* confirm the pleuropholids within the teleosts, on the basis of at least one synapomorphy: the presence of a posteroventral process in the quadrate.

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