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Jonoichthys challwa gen. et sp. nov., a new Aspidorhynchiform (Osteichthyes, Neopterygii, Teleosteomorpha) from the marine Upper Jurassic sediments of Argentina, with comments about paleobiogeography of Jurassic aspidorhynchids

Jonoichthys challwa *gen. et sp. nov., un nouvel Aspidorhynchiformes (Osteichthyes, Neopterygii, Teleosteomorpha) dans les sédiments marins du Jurassique supérieur d'Argentine, avec des commentaires sur la paléobiogéographie des aspidorhynchidés*

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ABSTRACT

Aspidorhynchiformes as a whole are incompletely understood. Here, a new aspidorhynchiform, *Jonoichthys challwa* gen. et sp. nov., is described based on a single three-dimensionally preserved specimen recovered from Upper Jurassic marine rocks of the Vaca Muerta Formation, Neuquén, southern Argentina. The new taxon is based on a unique combination of characters (e.g., large skull roof plate composed by the fusion of certain bones; 'L'-shaped preoperculum with a single main preopercular sensory canal that lacks sensory tubules; three predentary tooth rows; an accessory cusp in the teeth of the median predentary tooth row, and a robust and deep body). It is expected that the morphological information provided here could be useful to further understanding of aspidorhynchiform phylogeny and Neuquén Basin biodiversity.

Mots clés :
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RÉSUMÉ

Les Aspidorhychiformes dans leur ensemble sont incomplètement connus. Ici, un nouvel aspidorhynchidé *Jonoichthys challwa* gen. et sp. nov., est décrit sur la base d'un unique spécimen conservé en trois dimensions, prélevé dans les roches marines du Jurassique supérieur de la Formation Vaca Muerta, Neuquén, en Argentine méridionale. Le nouveau taxon

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est basé sur une unique combinaison de caractères, à savoir : grande voûte crânienne formée par la fusion de certains os ; préoperculum en forme de L, avec un seul canal sensoriel préoperculaire principal, sans tubules sensoriels ; trois rangées de dents sur le prédentaire ; une cuspide accessoire dans les dents de la rangée médiane du prédentaire et un corps robuste et profond. Il est attendu que les informations ici apportées puissent être utiles pour une compréhension ultérieure de la phylogénie des aspidorhynchidé et de la biodiversité du bassin de Neuquén.

1. Introduction

Aspidorhynchiformes is a group of extinct neopterygians that have been traditionally considered typical marine forms with worldwide distribution – except Asia – (Brito, 1997). They range in age from the Middle Jurassic to the Late Cretaceous (Brito, 1997). At present, a unique family, Aspidorhynchidae, with four nominal genera (*Aspidorhynchus* Agassiz, 1833, *Belonostomus* Agassiz, 1843, *Vinctifer* Jordan, 1919, and *Richmondichthys* Bartholomai, 2004), comprises the group.

The phylogeny of the Aspidorhynchiformes has a complicated history and has been the subject of study by several authors. (e.g., Arratia, 1999, 2001, 2013; Brito, 1997). Although the monophyly of the group is not doubted, its taxonomy and consequently its content remain unclear. A great part of the anatomical descriptions as well as almost the entire information about the group is based mainly on incomplete specimens (Arratia, 2004).

The Aspidorhynchiformes were interpreted as ganoid holosteans (e.g., Danil'chenko, 1967), Halecostomi (e.g., Saint-Seine, 1949) or listed as an order without indicating a higher taxon (e.g., Berg, 1940; Lehman, 1966). At the beginning of the Hennigian era, they were included in Teleostei as basal forms (Patterson, 1973, 1977; Patterson and Rosen, 1977), an interpretation followed by several authors (e.g., Bartholomai, 2004; Brito, 1997; Brito and Ebert, 2009; de Pinna, 1996; Maisey, 1991). However, Arratia (1999) showed that the position of the group changes depending on the outgroup and in 2001 she interpreted them as a possible teleost stem-group, including it in the more inclusive clade, Teleosteomorpha (Arratia, 2001: f. 3). The most recent phylogenetic hypothesis suggests that Aspidorhynchiformes and Pachycormiformes are sister taxa (Arratia, 2013: f. 95).

The Jurassic genera *Aspidorhynchus* and *Belonostomus* have long been known (Agassiz, 1833–1844). However, to date, the best known species is *Vinctifer comptoni* (Agassiz, 1841) from Brazil, whose morphological descriptions are based on numerous mechanical and acid-prepared specimens. *Richmondichthys sweeti* (Etheridge and Woodward, 1891) from Australia is relatively well known (see Bartholomai, 2004). Meanwhile, other *Vinctifer* species as well as most of the *Aspidorhynchus* and *Belonostomus* species are very incompletely known. Like pachycormiforms, the general morphology of most of the aspidorhynchiform species (including braincase, skull bones, caudal skeleton, paired and unpaired fins, and scales) is incompletely known. This partial knowledge of most of the members of Aspidorhynchiformes leads to difficulties in the polarization of some characters, and also in differences in the interpretation of some structures (see Arratia, 2008a, 2009; Brito, 1999b).

The study of Jurassic aspidorhynchids is particularly complex mainly due to the poor and incomplete preservation of the specimens. New specimens recently recovered in Ettling, Germany, are an exception but at present they still remain incompletely known. Their braincase, caudal skeleton, vertebral column, scales, etc. remain unknown. There are only a few studies related to the anatomy of their unpaired fins (Arratia, 2008a, 2009). Cretaceous taxa have been more extensively studied, especially the genus *Vinctifer* (Brito, 1988, 1992, 1997; Maisey, 1991).

The greatest described diversity of aspidorhynchiformes comes from Jurassic and Cretaceous sediments of Europe (e.g., Agassiz, 1833–1844; Assman, 1906; Brito, 1997; Brito and Ebert, 2009; Eastman, 1914; López-Arbarello and Schröder, 2013; Maisey, 1991; Saint-Seine, 1949; Thiollière, 1848; Wagner, 1863) and lesser extend from South and Central America (e.g., Arratia and Schultze, 1999; Brito, 1997, 1999a; Brito and Suárez, 2003; Felix, 1891; González-Rodríguez et al., 2013; Jordan, 1919; Santos, 1985a,b, 1990; Schultze and Stöhr, 1996). In Argentina the group is poorly known and only few specimens were mentioned in the literature (e.g., Bogan et al., 2011; Cione et al., 1987; Leanza and Zeiss, 1990). Recently, the revision of *Pholidophorus argentinus* Dolgopol de Saez, 1939 resulted in its reinterpretation as a member of Aspidorhynchiformes (Gouiric-Cavalli and Cione, 2013a). To date, the best-preserved Argentinian aspidorhynchiform material comes from Jurassic sediments of the Vaca Muerta Formation; however its diversity has been only briefly documented (Cione et al., 1987; Cione in Leanza and Zeiss, 1990; and Gouiric-Cavalli and Cione, 2009, 2011).

The present study is a starting point attempting to answer the statement made by several authors that 'Jurassic aspidorhynchids need an urgent revision' (see Arratia, 1999, 2004; Brito, 1997; López-Arbarello and Schröder, 2013). The anatomical description of a new endemic aspidorhynchiform, *Jonoichthys challwa* gen. et sp. nov., is presented here representing the first formal description of a Jurassic aspidorhynchiform from the Tithonian of Vaca Muerta Formation, Neuquén, Argentina. It is expected that the morphological information provided here could be useful to further understanding of aspidorhynchiform phylogeny and Neuquén Basin biodiversity. The information provided could be used for a better understanding of biogeographic distribution patterns of aspidorhynchids during Jurassic times as well as the routes used in its possible migrations/dispersion.