Vol. 3 No. 1 page 43-46
DOI: 10.14456/randk.2017.11

RESEARCH & KNOWLEDGE

Research Article

Systematic revision of the Cretaceous actinopterygian fauna from Bernissart, Belgium

Sebastien Olive[1,*], Louis Taverne[1], Lionel Cavin[2] and Uthumporn Deesri[3]

[1] OD Earth and Life History, Royal Belgian Institute of Natural Sciences, Rue Vautier 29, 1000 Brussels, Belgium.
[2] Department of Geology and Palaeontology, Muséum d'Histoire Naturelle, CP6434, 1211 Geneva 6, Switzerland
[3] Department of Earth- and Environmental Sciences, Palaeontology & Geobiology, and GeoBio-Center, Ludwig-Maximilians-University

(Received 5 May 2017; accepted 14 June 2017)

Abstract - The Cretaceous locality of Bernissart, Belgium, is well known for the Iguanodon remains it yielded. Fossils were collected during coalmine exploitation at the end of the 19th century. In the frame of the ColdCase project, which aims to understand the ecological and geological conditions in the Bernissart lake/swamp during the Barremian, a revision of the actinopterygian fauna from Bernissart, found alongside Iguanodons, has been launched. The revision of the ichtyofauna has started with taxa, unstudied since 1911: *Coccolepis macroptera, Lepidotus bernissartensis, L. brevifulcratus and L. arcuatus*. The study shows that the material attributed to both genera could likely be attributed to other genera and that the reduced actinopterygian taxic diversity found at Bernissart confirms the lacustrine to swampy environment

Keywords: Barremian, Belgium, Bernissart, Coccolepis, Lepidotes

1. Introduction

The Cretaceous locality of Bernissart, Belgium, is well known for the *Iguanodon* remains it yielded. Fossils were collected during coalmine exploitation. Godefroit *et al*. (2012) documented the historical background of this discovery. Although this fossil locality has been the subject of numerous scientific papers and monographies since its discovery 136 years ago, the processes leading to the local accumulation of so many complete skeletons remain completely unexplained. This is partly due to the lack of integrative studies taking care of associated faunas and floras, geology, taphonomy, sedimentology and micropaleontology. In this context, the ColdCase project, funded by the Belgian government, saw the light of day. This project is clue to understand the evolution of the ecological and geological conditions in the Bernissart lake/swamp during the Barremian, which led to such an accumulation of Iguanodon skeletons.

In the frame of this project, the revision of the actinopterygian fauna from Bernissart has been launched. Alongside the dinosaur remains, about 3,000 actinopterygian specimens were also unearthed. These actinopterygians were studied by Traquair (1911), who recognized 16 species belonging to 11 genera. Further studies by Gaudant (1966), Taverne (1981; 1982; 1999), Grande and Bemis (1998) and Poyato-Ariza and Wenz (2004) modified the initial systematic and nomenclatural composition of the assemblage. We have started the revision of the ichtyofauna with taxa, unstudied since Traquair (1911): *Coccolepis macroptera*, *Lepidotus bernissartensis*, *L. brevifulcratus* and *L. arcuatus*.

2. *"Coccolepis"*

Coccolepidids are basal (*i.e*. non –neopterygian) actinopterygians, whose diversity was mainly due to the specious variety of the genus *Coccolepis*. However, this diversity has considerably decreased after recent morphological studies . *Coccolepis groeberi* became *Condorlepis groeberi* (López-Arbarello *et al*., 2013). *C. aniscowitchi*, *C. socialis*, *C. cockerelli* and *C. martynovi* were referred to *Morrolepis aniscowitchi*, and *Coccolepis andrewsi* became *Morrolepis andrewsi* according to Skrzycka (2014). *Coccolepis bucklandi*, the type species of the genus *Coccolepis*, was quite recently reviewed (Hilton *et al*., 2004) and *C. liassica*, *C. australis*, *C. yumenensis* and *C. woodwardi* are in need of revision. Reciprocally, the number of genera within the family Coccolepididae has increased. "*Coccolepis" macroptera*, from Bernissart (Fig. 1), is another example of a taxon with uncertain generic and specific situation.

* Author for correspondence: Sebastien.Olive@naturalsciences.be.

The species shows several differences to other coccolepidid taxa, including the following combination of characters: pectoral fins proportionally much smaller than the pelvic fins; dermal bones and scales mainly covered with a thin striation, fin rays smooth; lower jaw long, slender and robust; branchiostegal plates ornamented with low concentric striae; supracleithrum longer than cleithrum; pentagonal postcleithrum. This unique combination of characters implies to coin a new genus name.

Coccolepididae are unknown in Triassic and already well widespread at the beginning of Jurassic, with representatives in eastern Laurasia (China, *Plesiococcolepis* (Wang, 1977)) and central Laurasia (England and Siberia, *Coccolepis liassica* (Woodward, 1890) and *Iyalepis* (Sytchevskaya, 2006), respectively). As long as the phylogenetic relationships within coccolepidids are not be resolved, it seems untimely to elaborate an accurate paleogeographic history of the family. However, the fact that the family displays a large geographic range at the beginning of Jurassic probably indicates that the origin of this group should be investigated earlier in the fossil record.

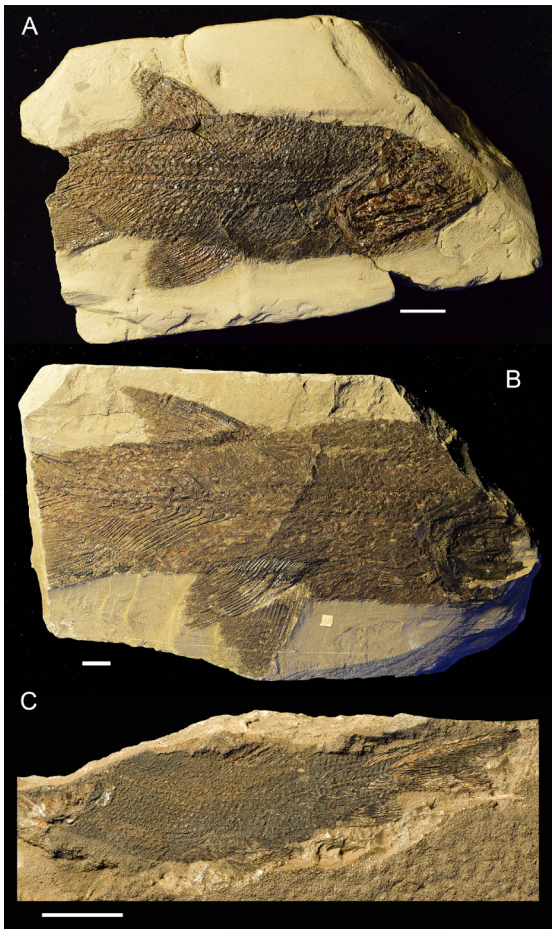

Figure 1. Photographs of three specimens of "*Coccolepis" macroptera*. (a) IRSNB.P.01199. (b) IRSNB P.01197a. (c) IRSNB.P.09894. Scale bars equal 1cm.

3. *"Lepidotes"*

"*Lepidotes*" (or "*Lepidotus*" in Traquair, 1911) are holosteans fishes grouped together with the gars among the ginglymodians. The genus *Lepidotes* has long been regarded as a wastebasket taxon gathering more than one hundred species of dubious systematic status. The phylogenetic relationships of some *Lepidotes* species, together with species of related genera, have provided general phylogenetic frameworks for ginglymodians that can be used in subsequent studies (Cavin, 2010; López-Arbarello, 2012). Traquair (1911) recorded three species of "*Lepidotes*" in the assemblage of Bernissart, but he conceded that the distinction between them is difficult because of the poor state of preservation of the material. He used mostly postcranial characters to distinguish "*L.*" *bernissartensis* from "*L.*" *brevifulcratus*, in particular the number, shape and orientation of the fulcrae of unpaired fins. Observation of the material indicates that these differences are not real but have been caused by preservational features. We regard both species as synonymous, "*L.*" *bernissartensis* having the priority. Although Traquair did not provide specific characters for "*L.*" *arcuatus*, his description indicates that the main difference of this species with "*L.*" *bernissartensis* is the occurrence of a median dorsal row of prominent scales that becomes spiny backwards. We regard this species, known by two specimens only, as dubious.

"*Lepidotes*" *bernissartensis* is characterized, among other features, by elongated frontals tapering anteriorly and ca. 2.5 longer than the parietals; parietals probably asymmetrical; symphysal region of the mandible low and bearing pedicellate semi-crushing teeth; coronoid teeth shorter but broader and stronger than dentary teeth. The circumorbital pattern is composed, with some variations, of a dermosphenotic, two supraorbitals, two infraorbitals posterior to the orbit, two infraorbital along the anteroventral margin of the orbit and probably three infraorbitals anteriorly, without contact with the orbit. In two specimens (IRSNB.VERT-01680-00012 (Fig. 2) and IRSNB.P.269) with the cheek visible in medial view, the infraorbitals located ventrally to the orbit possess a lamina that extends ventrally up to the level of the preopercle. The surface of lamina is located more internally than the dorsal part of the bone, indicating that it is placed underneath the plan of the suborbitals. In a third specimen (IRSNB.VERT-01680-00013) visible in lateral view, a shifted suborbital reveals a similar lamina of one of the infraorbitals, indicating that the suborbital originally rested above the ventral extension of the infraorbital. Consequently, it appears that the ventral suborbitals at least rest above hidden ventral expansions of the infraorbitals, thus constituting two superposed layer of dermal bones in this part of the cheek. As far as we know, this arrangement is not known in other ginglymodians. But because fossils ginglymodians rarely expose their cheek in internal view, it is possible that the situation occurs in other taxa but has remained unnoticed until now.

A cladistic analysis will be performed. It is likely that "*Lepidotes*" *bernissartensis* will be referred to another genus than *Lepidotes* (new or already existing genus, possibly *Scheenstia*).

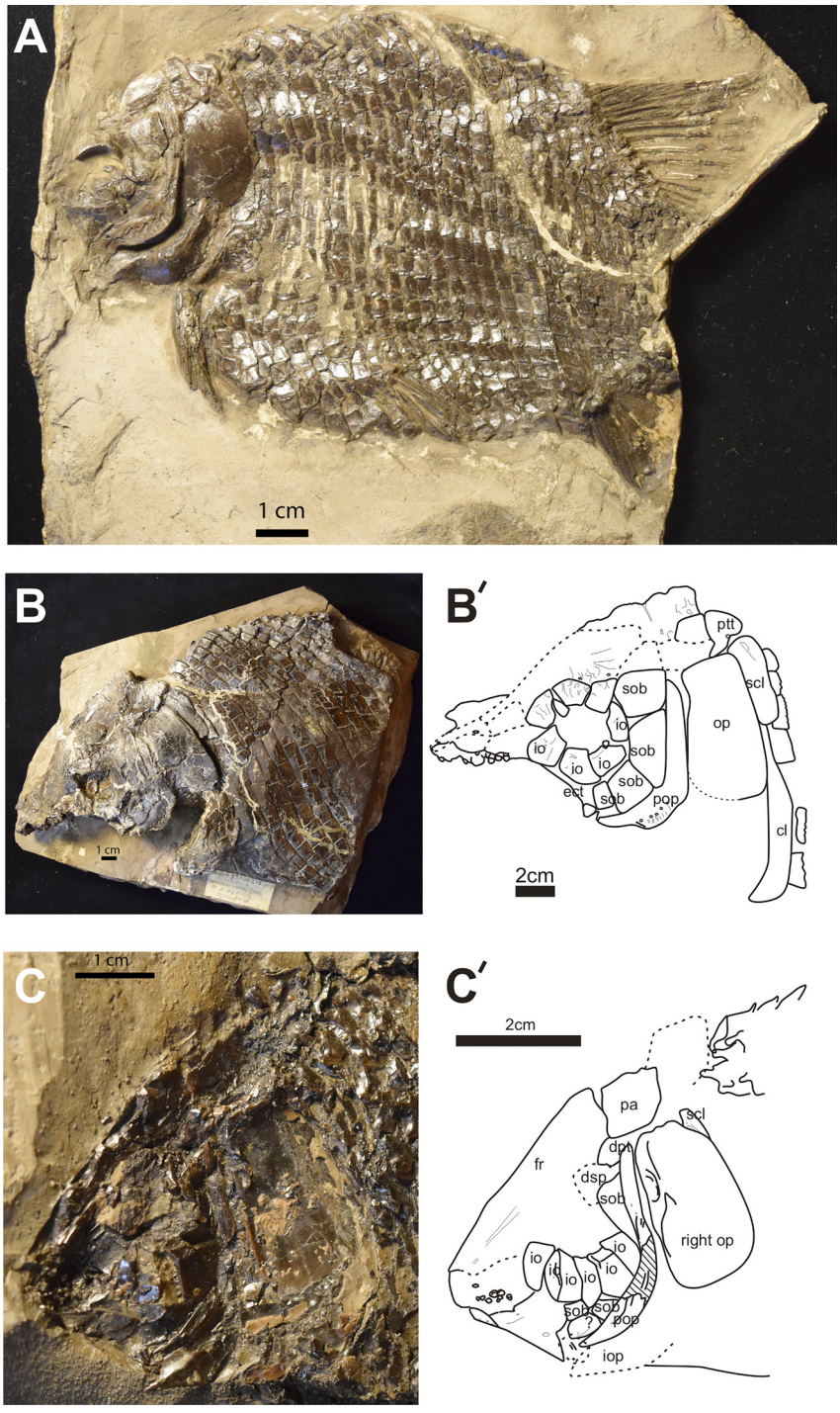

Figure 2. "*Lepidotes*" *bernissartensis*. (a) IRSNB.P.1207: subcomplete specimen in left lateral view. (b) IRSNB.P.1205: head in left lateral view. (c) IRSNB.VERT-01680-00012: head in left internal view. Abbreviations: cl, cleithrum; dpt, dermopterotic; dsp, dermosphenotic; ect, ectopterygoid; fr, frontal; io, infraorbital; iop, interopercle; op, opercle; pa, parietal; pop, preopercle; ptt, posttemporal; scl, supracleithrum; sob, suborbital.

4. Palaeoenvironment

The environment of Bernissart is interpreted as lacustrine to swampy (Yans, 2007; Schnyder *et al*., 2009; Spagna *et al*., 2012). The taxic diversity of the actinopterygian assemblage as initially established by Traquair (1911) has significantly decreased following systematic revisions of the taxa found in Bernissart (from 16 to 12 species so far). This decreasing diversity corresponds better with the diversity expected in a closed environment.

Acknowledgements

This abstract is a contribution to the project BR/143/A3/ColdCase funded by the Belgian Science Policy. U.D. benefited from the financial support of the French project GDRI PalBioDiv ASE.

References

Cavin, L. 2010. Diversity of Mesozoic semionotiform fishes and the origin of gars (Lepisosteidae). Naturwissenschaften 97, 1035–1040.

Gaudant, J. 1966. Sur la nécessité d'une subdivision du genre *Anaethalion* White (Poisson Téléostéen). Comptes Rendus Sommaire Société Géologique France 8, 308–310.

Godefroit, P., Yans, J., Bultynck, P. and Godefroit, P. 2012. Bernissart and the Iguanodons: historical perspective and new investigations. In: Godefroit, P. (Ed.), Bernissart dinosaurs and early Cretaceous terrestrial ecosystems. University Press, Indiana, pp. 1–20.

Grande, L. and Bemis, W. E. 1998. A Comprehensive Phylogenetic Study of Amiid Fishes (Amiidae) Based on Comparative Skeletal Anatomy. an Empirical Search for Interconnected Patterns of Natural History. Journal of Vertebrate Paleontology 18, 1–696.

Hilton, E. J., Grande, L. and Bemis, W. E. 2004. Morphology of † *Coccolepis bucklandi* Agassiz, 1843 (Actinopterygii,† Coccolepidae) from the Solnhofen Lithographic Limestone deposits (Upper Jurassic, Germany). In: Arratia, G.and Tintori, A. (Eds.), Mesozoic Fishes 3 - Systematics, Paleoenvironments and Biodiversity. Verlag Dr. Friedrich Pfeil, München, pp. 209–238.

López-Arbarello, A. 2012. Phylogenetic interrelationships of ginglymodian fishes (Actinopterygii: Neopterygii). PLoS ONE 7, e39370.

López-Arbarello, A., Sferco, E. and Rauhut, O. W. 2013. A new genus of coccolepidid fishes (Actinopterygii, Chondrostei) from the continental Jurassic of Patagonia. Palaeontologia Electronica 16, 7A.

Poyato-Ariza, F. J. and Wenz, S. 2004. The new pycnodontid fish genus *Turbomesodon*, and a revision of *Macromesodon* based on new material from the Lower Cretaceous of Las Hoyas, Cuenca, Spain. In: Arratia, G. and Tintori, A. (Eds.), Mesozoic Fishes 3 - Systematics, Paleoenvironments and Biodiversity. Verlag Dr. Friedrich Pfeil, München, pp. 341–378.

Schnyder, J., Dejax, J., Keppens, E., Tu, T. T. N., Spagna, P., Boulila, S., Galbrun, B., Riboulleau, A., Tshibangu, J. -P. and Yans, J. 2009. An Early Cretaceous lacustrine record: organic matter and organic carbon isotopes at Bernissart (Mons Basin, Belgium). Palaeogeography, Palaeoclimatology, Palaeoecology 281, 79–91.

Skrzycka, R. 2014. Revision of two relic actinopterygians from the Middle or Upper Jurassic Karabastau Formation, Karatau Range, Kazakhstan. Alcheringa: An Australasian Journal of Palaeontology 38, 364–390.

Spagna, P., Yans, J., Schnyder, J. and Dupuis, C. 2012. The Paleoenvironment of the Bernissart Iguanodons: Sedimentological Analysis of the Lower Cretaceous Wealden Facies in the Bernissart Area. In: Godefroit, P. (Ed.), Bernissart dinosaurs and early Cretaceous terrestrial ecosystems. University Press, Indiana, pp. 87–96.

Sytchevskaya, E. K. 2006. *Iyalepis* nom. nov., a new replacement name for *Angarichthys* Sytchevskaya et Yakovlev, 1985 (Pisces, Palaeonisciformes, Coccolepididae). Paleontological Journal 40, 339–339.

Taverne, L. 1981. Ostéologie et position systématique d'*Aethalionopsis robustus* (Pisces, Teleostei) du Crétacé inférieur de Bernissart (Belgique) et considérations sur les affinitiés des Gonorynchiformes. Bulletin de l'Académie Royale de Belgique, Classes des Sciences 67, 958–982.

Taverne, L. 1982. Sur *Pattersonella formosa* (Traquair, RH, 1911) et *Nybelinoides brevis* (Traquair, RH, 1911): Téléostéens Salmoniformes Argentinoides du Wealdien inférieur de Bernissart, Belgique, précédemment attribués au genre *Leptolepis* Agassiz, L., 1832. Bulletin de l'Institut royal des Sciences naturelles de Belgique - Sciences de la Terre 54, 1–27.

Taverne, L. 1999. Ostéologie et position systématique d'*Arratiaelops vectensis* gen. nov., téléostéen élopiforme du Wealdien (Crétacé inférieur) d'Angleterre et de Belgique. Bulletin de l'Institut royal des Sciences naturelles de Belgique - Sciences de la Terre 69, 77–96.

Traquair, R. H. 1911. Les poissons wealdiens de Bernissart. Mémoires du Musée Royal d'Histoire Naturelle de Belgique 6, 1–65.

Wang, N. -C. 1977. Jurassic fishes from Lingling-Hengyang, Hunan and its stratigraphical significance. Vertebrata PalAsiatica 15, 233–243.

Woodward, A. S. 1890. Notes on some Ganoid Fishes from the English Lower Lias. The Annals and Magazine of Natural History 5, 430–436.

Yans, J. 2007. Lithostratigraphie, minéralogie et diagenèse des sédiments à faciès wealdien du Bassin de Mons (Belgique). Mémoires de la Classe des sciences, Académie royale de Belgique 9, 1–179.