Systematic revision of the Cretaceous actinopterygian fauna from Bernissart, Belgium

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(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 ichthyofauna 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 ichthyofauna 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 Skrzynka (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” maccroptera, from Bernissart (Fig. 1), is another example of a taxon with uncertain generic and specific situation.

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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.” brevifucratus, 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 supraorbitalts, two infraorbitalts posterior to the orbit, two infraorbitalts along the anteroventral margin of the orbit and probably three infraorbitalts 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 infraorbitalts 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 infraorbitalts, 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 infraorbitalts, 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).
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


