

New record of the Early Jurassic myriacanthid holocephalan *Myriacanthus paradoxus* AGASSIZ, 1836 from Belgium

by

Christopher J. Duffin (*) and Dominique Delsate (**)

Abstract: A right upper posterior ("palatine") toothplate from the Grès de Florenville (*bucklandi* zone, Lower Sinemurian, Early Jurassic) of Clairefontaine (Belgian Lorraine) is described and identified as *Myriacanthus paradoxus* AGASSIZ, 1836. This, the first record in Belgium, extends the known palaeogeographical range of the species.

Key words: Chondrichtyes, Holocephali, Myriacanthid, Jurassic, Belgium.

Résumé: Le Grès de Florenville (Zone à *bucklandi*, Sinémurien inférieur, Jurassique inférieur) de Clairefontaine (Lorraine belge) a livré une plaque dentaire postéro-supérieure droite ("palatine") de Chimère. Elle est ci-décrite et attribuée à *Myriacanthus paradoxus* AGASSIZ, 1836. Cette espèce est signalée pour la première fois en Belgique. Son extension paléogéographique connue s'en trouve ainsi élargie.

Mots-clefs: Chondrichtyes, Holocephali, Myriacanthid, Jurasique, Belgique.

Kurzfassung: Eine rechtse oberposteriore ("palatine") Zahnplatte von dem Grès de Florenville (*Bucklandi*-Zone, Unteres Sinemurium, Unter-Jurassicum) von Clairefontaine (belgische Lothringen) wird beschrieben und bestimmt als *Myriacanthus paradoxus* AGASSIZ, 1836. Dieser erste Fund in Belgien vergrößert die paläontologische Reichweite dieser Art.

Schlüsselwörter: Chondrichtyes, Holocephali, Myriacanthid, Jurassicum, Belgien.

(*) Dr. C. DUFFIN, 146 Church Hill Road, Sutton, Surrey SM3 8NF, England.

(**) Dr. D. DELSATE, 5 Rue du Quartier, 6792 Battincourt, Belgium.

Introduction

The myriacanthoids are an extinct group of holocephalans ranging from the Late Triassic (Rhaetian) to the Late Jurassic (Tithonian). They are most commonly represented by isolated toothplates, dorsal fin spines and frontal clasper spines, although some articulated specimens are known from the Lower Lias (Sinemurian) of Lyme Regis, Dorset, England (WOODWARD, 1891), Osteno in Lombardy, Italy (DUFFIN, 1992; DUFFIN & PATTERSON, in press), the Posidonienschiefer (Toarcian) of Holzmaden, Germany (FRAAS, 1910; DUFFIN, 1983), and the Plattenkalk of Solnhofen, Germany (ZITTEL, 1887). Holocephalan specimens are relatively rare components of most Jurassic vertebrate faunas, and the geographical and stratigraphical ranges of most taxa seem to be very limited. This is almost certainly due to the scarcity of material.

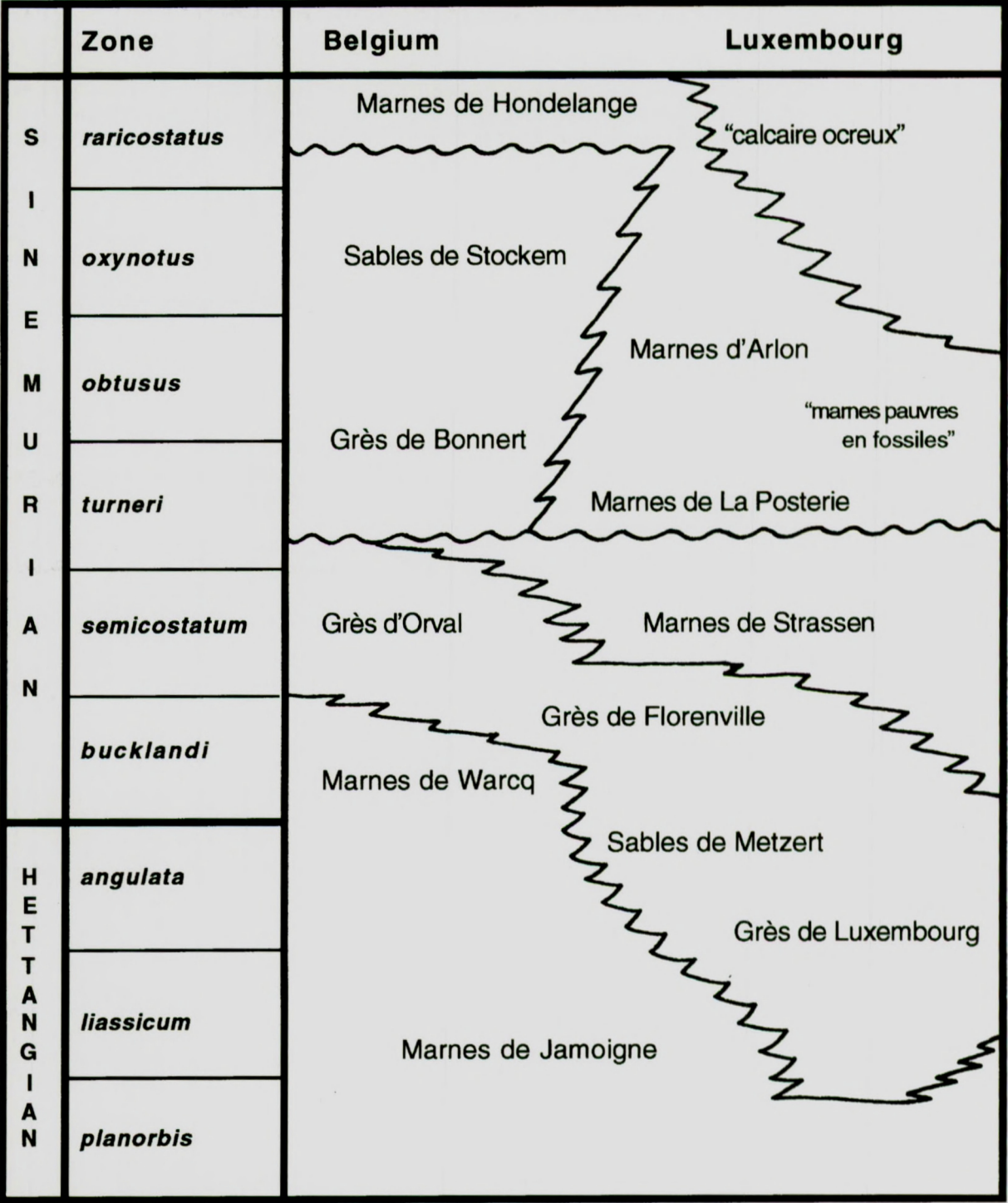
Myriacanthus is the type genus of the family, and *M. paradoxus* is the type species of the genus by monotypy. It is currently known only from the "Lower Lias" of Lyme Regis, and the Westbury Beds (Penarth Group (Rhaetian, Late Triassic) of Aust Cliff, Avon (DUFFIN, 1994). An upper anterior ("vomarine") tooth plate from the Hettangian of France (TERQUEM, 1855) may pertain to this species, but anterior upper tooth plates are not well known in myriacanthids. Indeed, the upper anterior tooth plates of *M. paradoxus* from Lyme Regis and *Halonodon warneri* DUFFIN, 1984 from the Belgian Sinemurian are virtually indistinguishable.

The purpose of the present paper is to extend the known palaeogeographical range of *Myriacanthus paradoxus* into southern Belgium.

Geological background

The Lorraine (southern Belgium and Grand Duchy of Luxembourg) consists of a sequence of *cuestas* of Early Mesozoic clastic sedimentary rocks. Three *cuestas* form the Belgian Lorraine; the Sinemurian, Pliensbachian and Bajocian *cuestas*.

The main facies of the Lower Lias in Southern Belgium consists of the strongly diachronous calacarenites of the Grès de Luxembourg (see DUFFIN & DELSATE, 1993 for a review of the stratigraphy). The northern flank of the Sinemurian cuesta exposed in the Clairefontaine area shows two spring levels; the major of these two is formed by the Marnes de Strassen, while temporary springs also arise from the Marnes Hondelange (Lotharingian). The waters fed by the springs unite to form the Clairefontaine River which erodes the base of the Marnes de Strassen at around 338m and cuts into the underlying sandstones. Many small quarries are sited on the steep wooded slopes of the river valley, exploiting the Calcaire Gréseux de Florenville for local building stone (MONTEYNE, 1958).



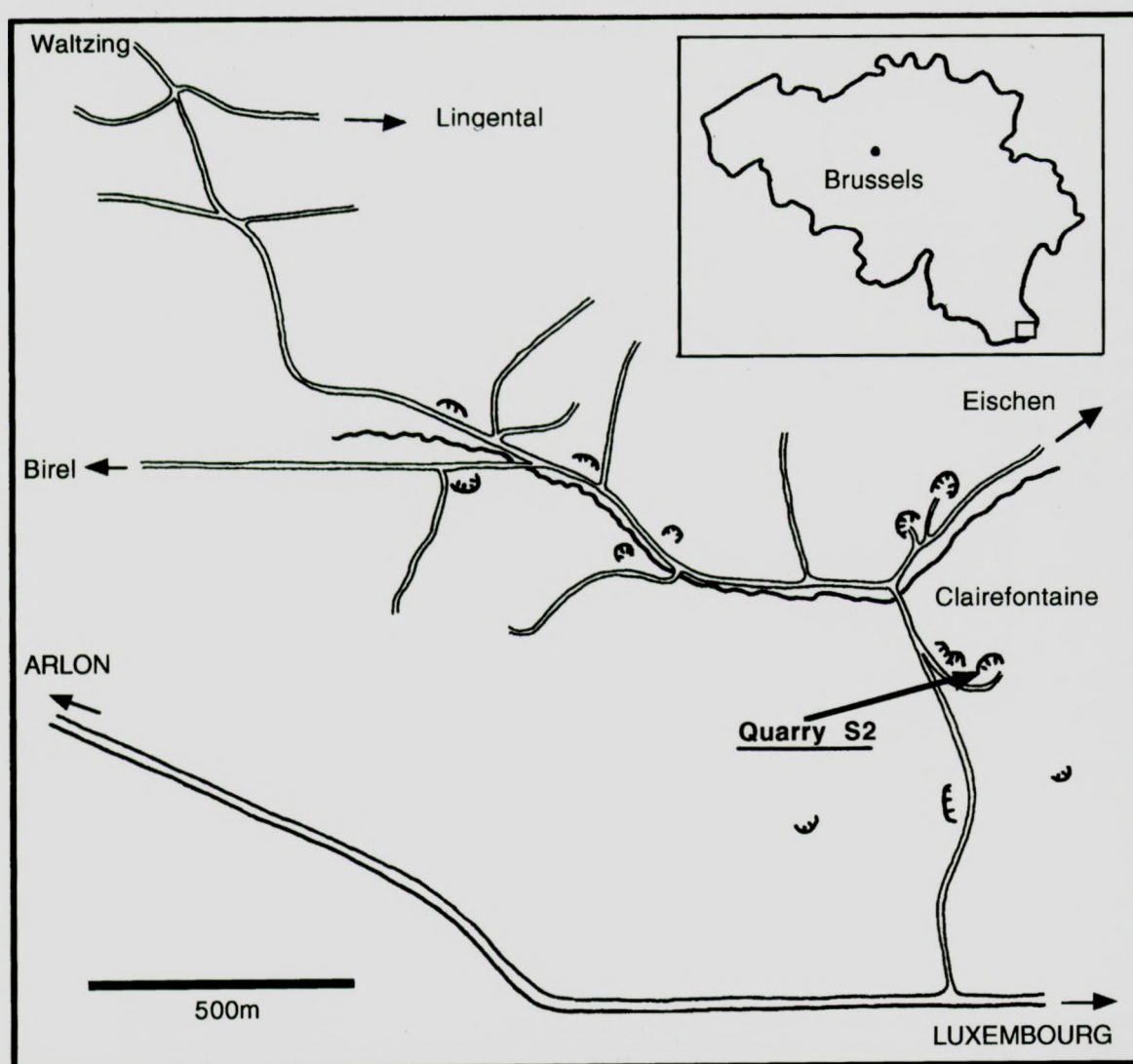
Textfigure 1. Generalised Early Jurassic stratigraphy of Lorraine.

The stratigraphy of the area has been elucidated through the work of MONTEYNE (1958), MAUBEUGE (1966) and MERGEN (1985), and is summarised in Figure 1. The small quarries mentioned above expose the following units (ascending the sequence) :

(i) **Sables de Metzert** : a demineralised facies of the Hettangian part of the Grès de Luxembourg yielding occasional *Cardinia*.

(ii) **Calcaire Gréseux de Florenville** : the local Early Sinemurian part of the Grès de Luxembourg. It consists of a 30m to 40m thick complex of sandstone units yielding *Coroniceras bucklandi*, *Ostrea irregularis*, *Cardinia copides*, *C. crassissima*, *Chlamys textorius*, *Oxytoma* sp., *Pseudomelania clathrata*, *Isastraea condeana* and *Pentacrinus tuberculatus*, mostly from lumachelle horizons.

(iii) **Marnes de Strassen** : blue-grey marls with calcareous horizons. Fossils include *Arnioceras semicostatum*, *Prototeuthis acutus*, *Chlamys textorius*, *Spiriferina walcotti* and *Liogryphaea arcuata*. Around Clairefontaine, this formation is around 60cm thick and represents the Swabian facies of the Calcaire à Gryphées. It is dated as Upper Sinemurian (sensu stricto)(*semicostatum* and *turneri* zones) in the Belgian Lorraine, but as Lower Sinemurian (*bucklandi* zone) in the Luxembourg Lorraine, due to a radical facies change. The Belgian Grès de Florenville passes laterally into the Luxembourg Marnes de Strassen (MAUBEUGE, 1966) between Steinfort (Grand Duchy of Luxembourg), a neighbouring village to Clairefontaine, and the western side of Luxembourg city (about 13km east of Clairefontaine).



Textfigure 2. Map showing the location of Clairefontaine.

The only holocephalan taxa recorded to date from the Belgian Jurassic are *Halonodon warneri* DUFFIN, 1984, and *Chimaeropsis foussi* CASIER, 1959. A second species of *Halonodon*, *H. luxembourgensis* DUFFIN & DELSATE, 1993, has been described from the Hettangian of Luxembourg.

Systematic Palaeontology

Class Chondrichthyes HUXLEY, 1880
 Subclass Subterbranchialia ZANGERL, 1979
 Superorder Holocephali BONAPARTE, 1832
 Order Chimaeriformes (BERG, 1940) sensu PATTERSON, 1965
 Suborder Myriacanthoidei, PATTERSON, 1965
 Family Myriacanthidae SMITH WOODWARD, 1889

Genus *Myriacanthus* AGASSIZ, 1837

Type species : *Myriacanthus paradoxus* AGASSIZ, 1837; Lower Lias (Early Jurassic) of Lyme Regis, Dorset, England.

Myriacanthus paradoxus AGASSIZ, 1837
 (Plate 1; Textfigure 3a)

- 1822 "External defensive organ" - DE LA BECHE, 1, 44, pl. 5 figs. 1-2.
 1836 *Myriacanthus paradoxus* AGASSIZ; AGASSIZ, 3, pl. 6.
 1837 *Myriacanthus paradoxus* ; AGASSIZ, 3, 38.
 1837 *Myriacanthus retrorsus* AGASSIZ; AGASSIZ, 3, 39.
 1838 *Myriacanthus retrorsus* ; AGASSIZ, 3, pl. 8a figs. 14, 15.
 1855 *Chimaera (Ischyodon) johnsoni* AGASSIZ ; TERQUEM, 241, pl. 14 fig. 1.
 1872 *Prognathodus guentheri* EGERTON; EGERTON, 233, pl. 8.
 1891 *Myriacanthus paradoxus* ; WOODWARD, 44, pl. 2 figs. 1-3.
 1906 *Myriacanthus paradoxus* ; WOODWARD, 2, pl. 1 figs. 1-5.
 1906 *Myriacanthus paradoxus* ; DEAN, 143, text-figs. 119, 119A, 142.
 1965 *Myriacanthus paradoxus* ; PATTERSON, 128, text-figs. 13-19; pl. 22 fig. 46; pl. 25 fig. 59; pl. 26 fig. 60; pl. 28 fig. 67.
 1992 *Myriacanthus paradoxus* ; PATTERSON, 45, figs. 7A-C.
 1993 *Myriacanthus paradoxus* ; DUFFIN & DELSATE, text-fig. 5f.
 1994 *Myriacanthus paradoxus* ; DUFFIN, 12, figs. 8a-b.

Diagnosis : see PATTERSON (1965: 136)

Holotype : BMNH P 6095, a dorsal fin spine (AGASSIZ, 1836 pl. 6 figs. 1-2) from the Lower Lias (?Sinemurian, Early Jurassic) of Lyme Regis, Dorset, England.

Belgian specimen : IRSNB P 6333, a virtually complete right upper posterior ("palatine") toothplate.

Locality : old (disused) sandstone quarry in the village of Clairefontaine, Commune of Arlon, 500m north of the N4 road (Arlon to Luxembourg). Topographic maps 1/25000 : 68/7-8 and 69/5-6. Text-Figure 2.

Horizon : Grès de Florenville

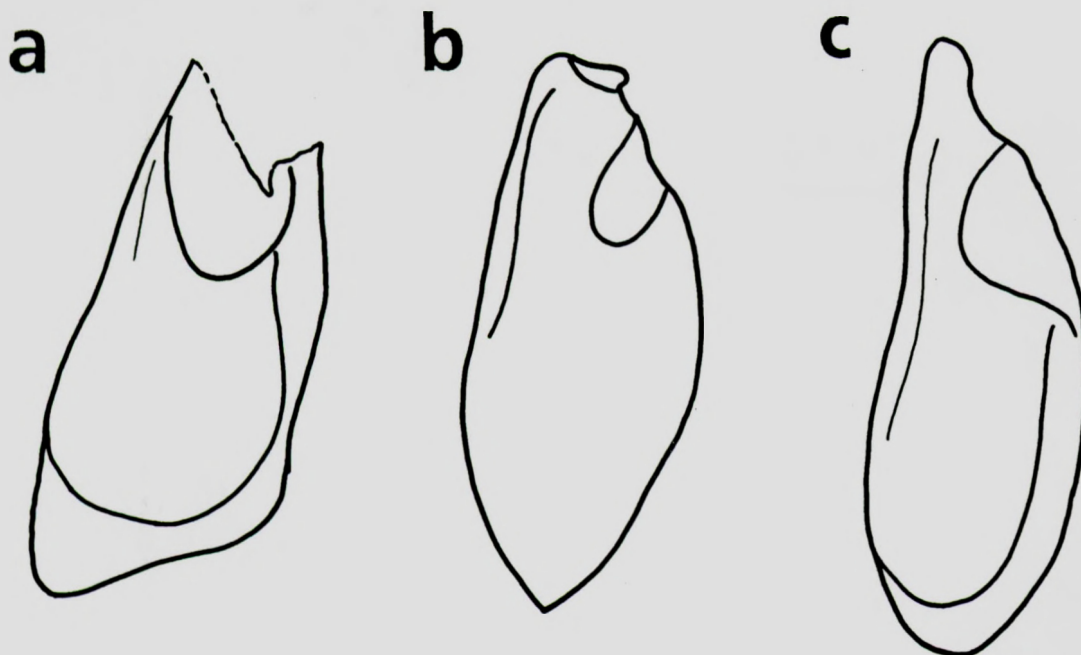
Age : *bucklandi* zone, Lower Sinemurian, Early Jurassic.

Lithology : bioclastic limestone. The specimen is associated on a small block with *Cardinia* sp. and the external mould of a spire with carina of *Coroniceras* aff. *rotiforme*.

Collector : Mr Jacques LAMURY (Thiaumont).

Description : The specimen is an almost complete right upper posterior ("palatine") toothplate preserved on a small block of bioclastic limestone (Plate 1 Figure a). The plate is preserved in occlusal view and the mesial extremity is missing. The overall shape is roughly triangular with a slightly curved symphyseal margin. The labial margin is almost complete and measures 48mm in length, while the lingual margin is 21mm long.

The mesial part of the dental plate is occupied by a deep oval antemortem wear facet measuring 19 mm long and 10mm across. The remainder of the occlusal surface is covered by a tritoral pad of hypermineralised tissue often called "pleromin". No diagonal ridges transect the occlusal surface, although a short (13mm long) convex ridge intervenes between the wear facet and the labial margin mesially.



Textfigure 3. Outline drawings of the upper posterior tooth plates of *M. paradoxus* AGASSIZ, 1836 and *Agkistracanthus mitgelensis* DUFFIN & FURRER, 1981, all in occlusal view. a: IRSNB P 6333; b: *Agkistracanthus mitgelensis* from the Cotham Member (Lilstock Formation, Penarth Group, Rhaetian) of St. Audries Bay, Somerset England. BMNH P 61526; c: *Agkistracanthus* sp. from the Kössen Beds (Rhaetian) of the Central Austroalpine Sivettra Nappe at Alpihorn, Kanton Graubünden. PIMUZ A/1870.

Discussion

The absence of diagonal ridges distinguishes this specimen from the upper posterior tooth plates of *Acanthorhina jaekeli* FRAAS, 1910 (Toarcian of Holzmaden) and *Metopacanthus granulatus* (AGASSIZ, 1837) (Sinemurian of Lyme Regis). The latter species has hypermineralised tissue restricted to the central diagonal ridge of upper posterior teeth, in contrast to the condition in IRSNB P 6333.

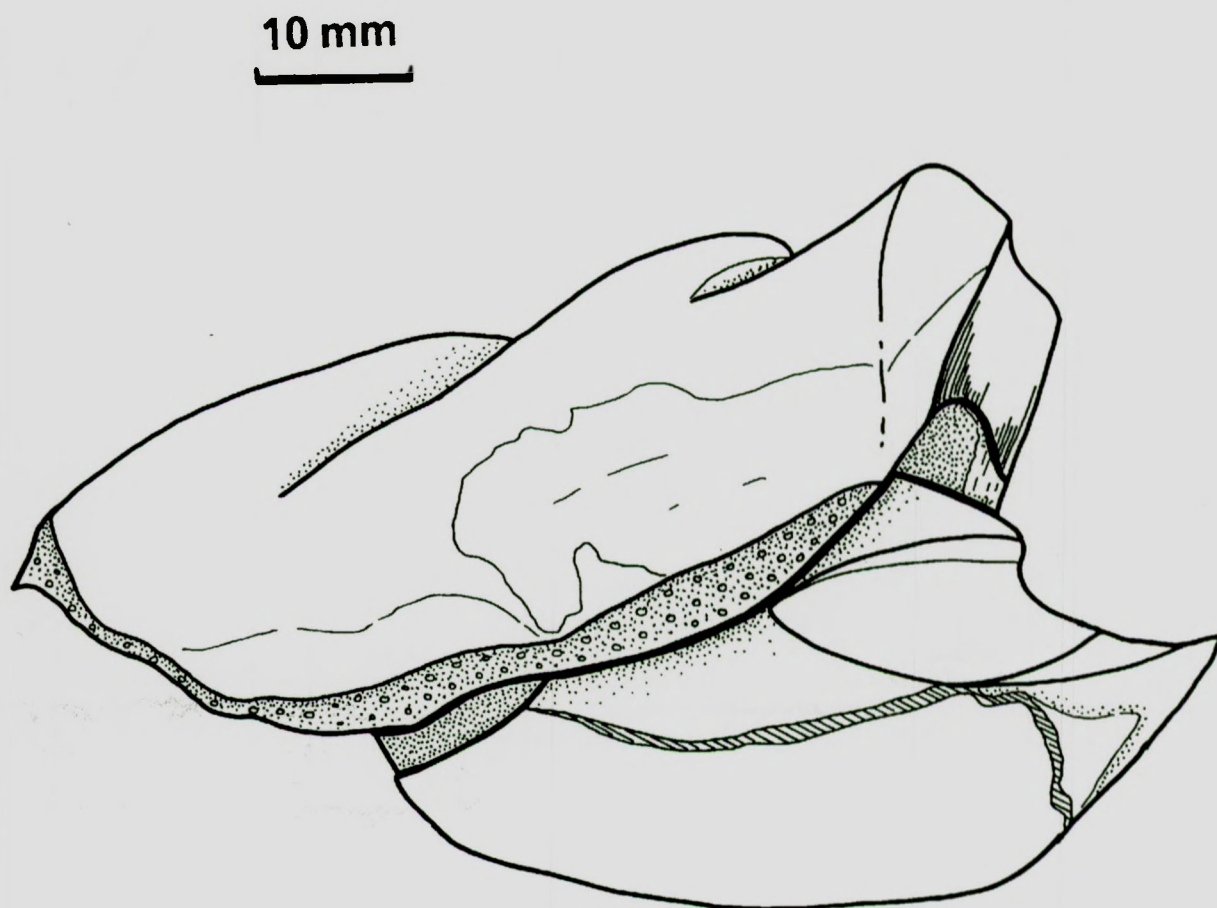
The only two further myriacanthid genera in which the upper posterior toothplates are known are *Agkistracanthus* and *Myriacanthus*. *Myriacanthus* was originally based upon an isolated dorsal fin spine. The discovery of a specimen with associated dorsal fin spine and dentition allowed WOODWARD (1906) to diagnose the *M. paradoxus* more fully. One of the most complete dentitions of *M. paradoxus* is preserved in BMNH P 477 (Plate 1 Figure b; Text-Figure 4) (AGASSIZ, 1843: 344, plate xlc fig. 22; WOODWARD, 1891: 46, plate 2 fig. 3; PATTERSON, 1992: 47), which has recently been virtually completely freed from the surrounding matrix. This specimen is particularly useful since the upper and lower dentition are preserved in occlusal view (Plate 1 Figure a; Text-Figure 4).

The palatine teeth of *Agkistracanthus mitgelensis* DUFFIN & FURRER, 1981 and *Agkistracanthus* sp. (Rhaetian and Hettangian of Switzerland; Rhaetian of England) possess a mesial wear facet on the occlusal surface (DUFFIN & FURRER, 1981, plate 2 fig. 3a; DUFFIN, 1994 fig. 5), but DUFFIN (1994: 10) was incorrect in stating that such a feature was exclusive to that species. The upper posterior dental plate of *Myriacanthus paradoxus* also has a mesial wear facet (Text-Figure 4). The long axis of the wear facet in *Agkistracanthus* is much more lingually situated than

in *M. paradoxus*, leaving a wide strip of hypermineralised tissue labially (compare Text-Figures 3a, b and c). Furthermore, the long axis of the wear facet is declined lingually from the long axis of the toothplate in *Agkistracanthus*, but the two axes are subparallel in *Myriacanthus* and IRSNB P 6333.

The outline of the upper posterior dental plates in the two genera also differ. *Agkistracanthus* has the form of an elongate tear-drop, while *Myriacanthus* and IRSNB P 6333 are both much more triangular in outline.

Thus, by comparison with BMNH P 477, IRSNB P 6333 described above must belong to *Myriacanthus paradoxus*, and as such, is the first record of this species in Belgium.



Textfigure 4. Camera lucida drawing of BMNH P477 (EGERTON Coll.), articulated toothplates of *M. paradoxus* from the Lower Lias of Lyme Regis.

Conclusions

A myriacanthid right upper posterior toothplate is described from the Lower Sinemurian of the Belgian Lorraine as *Myriacanthus paradoxus* AGASSIZ. This is the first confident record of the species outside of Britain.

Acknowledgments

We are very grateful to J. LAMURY (Thiaumont) for allowing us to study the specimen, and for donating it to the IRSNB. Dr. P. FOREY kindly gave access to the collections of the BMNH in order to study comparative material from Lyme Regis. Drs. P. MAUBEUGE, P. MERGEN and R. MONTEYNE provided information on the local geology. The manuscript was critically appraised by Dr. B. STAHL and Mr. D. WARD.

Literature

- BECHE, H.T. de la (1822) : Remarks on the Geology of the South Coast of England, from Bridport Harbour, Dorset, to Babbacombe Bay, Devon. *Transactions of the Geological Society of London*, (2)1: 40-47. London.
- BERG, L.S. (1940): Classification of fishes, both recent and fossil. *Travaux de l'Institut de Zoologie. Académie des Sciences U.R.S.S.*, 5(2): 1-517, 190 figs.
- BONAPARTE, C.L.J.L. (1832) : Selachorum tabula analytica. *Nuovi Annali delle Scienze Naturali*, (1)2: 195-214. Bologna.
- DEAN, B. (1906) : Chimaeroid fishes and their development. *Publications of the Carnegie Institution*, 32, 194pp., 11pls. Washington.
- DUFFIN, C.J. (1983a): Holocephalans in the Staatliches Museum für Naturkunde in Stuttgart. 1. Myriacanthoids and Squalorajoids. *Stuttgarter Beiträge zur Naturkunde. B*, 97, 1-41, 7 figs., 5 pls. Stuttgart.
- DUFFIN, C.J. (1984): A new myriacanthid holocephalan from the Sinemurian (Lower Jurassic) of Belgium. *Zoological Society of the Linnean Society*, 82(1): 55-71, 4 figs. London.
- DUFFIN, C.J. (1992): A myriacanthid holocephalan (Chondrichthyes) from the Sinemurian (Lower Jurassic) of Osteno (Lombardy, Italy). *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano*, 132(23), (1991): 293-308, 10 figs. Milano.
- DUFFIN, C.J. (1994): Myriacanthid holocephalans (Chondrichthyes) from the British Late Triassic. *Neues Jahrbuch für Geologie und Paläontologie Abhandlungen*, 192(1): 1-16. Stuttgart.
- DUFFIN, C.J. & DELSATE, D. (1993a): A new myriacanthid Holocephalan (Chondrichthyes) from the Early Jurassic of Luxembourg. *Neues Jahrbuch für Geologie und Paläontologie Monatshefte*, 1993(11): 669-680. Stuttgart.
- DUFFIN, C.J. & PATTERSON, C. (in press): The Jurassic fishes of Osteno. *Palaeocronache*. Milano.
- EGERTON, P. DE M.G. (1872) : On *Prognathodus guentheri* EGERTON, a new genus of fossil fish from the Lias of Lyme Regis. *Quarterly Journal of the Geological Society of London*, 28: 233-238, pl. 8. London.
- FRAAS, E. (1910) : Chimäridenreste aus dem oberen Lias von Holzmaden. *Jahresheft des Vereins für Vaterländische Naturkunde in Württemberg*, 66: 55-63, 1pl. Stuttgart.
- GARMAN, S. (1901) : Genera and families of the Chimaeroids. *Proceedings of the New England Zoological Club*, 2: 75-77. Boston.
- GODEFROIT, P. (1994) : Les Reptiles marins du Jurassique inférieur en Lorraine belgoluxembourgeoise. Unpublished Ph.D. thesis, Faculty of Science, Catholic University of Louvain, Belgium.
- MAUBEUGE, P.L. (1966) : Le Problème du Grès de Luxembourg. *Histoire Naturelle du Pays de Luxembourg. Géologie. Musée d'Histoire Naturelle, Luxembourg*.
- MERGEN, P. (1984) : Géologie et Hydrogéologie du Lias Inférieur et Moyen en Lorraine belge. Thesis, University of Brussels.

- MONTEYNE, R. (1958) : *Recherches sur le Lias Inférieur du Sud de la Belgique*. Thesis, University of Brussels.
- PATTERSON, C. (1965) : The phylogeny of the chimaeroids. *Philosophical Transactions of the Royal Society of London*, **B249**: 101-219. London.
- PATTERSON, C. (1992) : Interpretation of the toothplates of chimaeroid fishes. *Zoological Journal of the Linnean Society*, **106**: 33-61, 11 figs. London.
- TERQUEM, O. (1855) : Paléontologie de l'étage inférieur de la formation liasique de la province de Luxembourg d'Hettange. *Mémoires de la Société Géologique de France*, (2)**5**: 219-343. Paris.
- WOODWARD, A.S. (1889) : On the Myriacanthidae - an extinct family of chimaeroid fishes. *Annals and Magazine of Natural History*, (6)**4**: 275-280. London.
- WOODWARD, A.S. (1891) : *Catalogue of the Fossil Fishes in the British Museum (Natural History)*, II. London: British Museum (Natural History).
- ZANGERL, R. (1979): New Chondrichthyes from the Mazon Creek Fauna (Pennsylvanian) of Illinois. pp. 449-500. In : NITECKI, M.H. (ed.), *Mazon Creek Fossils*. Academy Press : New York.
- ZITTEL, K.A. von (1887): *Handbuch der Paläontologie*.1 .Abtheilung Paläozoologie,3.Vertebrata(Pisces, AmphibiaReptilia,Aves). xii + 900 pp., 719 figs. Oldenbourg : München & Leipzig.

Explanation of Plate 1

Plate 1. Figure a, IRSNB P 6333, a right upper posterior ("palatine") toothplate of *Myriacanthus paradoxus* AGASSIZ from the Grès de Florenville (*bucklandi* zone, Lower Sinemurian, Early Jurassic) of Clairefontaine (Belgian Lorraine) in occlusal view (x 1.56); Figure b, BMNH P477, articulated toothplates of *M. paradoxus* from the Lower Lias of Lyme Regis, Dorset. The photograph was taken part way through chemical development of the dentition from the matrix.

a



b



Plate 1

