A reassessment of the validity and affinities of *Belemnites sulcatus* Miller, 1826, *Belemnopsis* Edwards in Gray, 1849, and *Belemnopsis* Bayle, 1878

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Abstract: A reinvestment of the validity of the belemnite genus *Belemnopsis* Bayle is undertaken, together with a survey of the early history of the usage of the names *Belemnites sulcatus*, *Belemnopsis Bayle* and *Belemnopsis Edwards*. *Belemnites sulcatus* Miller has been variously equated with either *Belemnites apiciconus* Blainville or with the group of belemnites including *Belemnites Altdorfensis* Blainville and *B. Beaumontianus* Orvigny. Rieggraf (and not Phillips) subsequently designated a lectotype which may be valid and, in case it is not, is validated here. The species concept for *Belemnites sulcatus*, as based on this lectotype, places it in the genus Holcobeloides Gustomesov. *Belemnopsis Edwards* has date priority over *Belemnopsis Bayle*, but must be interpreted as an "incorrect original spelling" and, therefore, does not enter into homonymy according to the ICZN; *Belemnopsis Bayle* is thus a valid genus. Douvillé subsequently nominated *Belemnites sulcatus*, which was figured as *Belemnopsis sulcata* by Bayle, and therefore is a valid designation because this species is amongst the original species included in *Belemnopsis by Bayle*. One of Bayle’s figures of *Belemnites sulcata* agrees with *Belemnites apiciconus* Blainville, but does not agree with *Belemnites sulcatus* as defined by its lectotype; as such this is a case of misidentified type species. *Belemnites apiciconus* Blainville, the species involved in the misidentification, is therefore designated type species of *Belemnopsis Bayle* here and validated by citing the ICZN. The actions taken here maintain nomenclature at the genus, family and suborder level in respect to the names *Belemnopsis* and *Belemnosis* and serve to stabilize the complicated nomenclature issues related to these taxa.

Key Words: Belemnites (Belemnitida); taxonomy; International Code of Zoological Nomenclature; *Belemnopsis Bayle*; *Belemnopsis Edwards*; *Belemnopsis Edwards*; *Belemnites sulcatus* Miller; *Belemnites apiciconus* Miller.


Résumé : Une réévaluation de la validité et des affinités de *Belemnites sulcatus* Miller, 1826, *Belemnopsis Edwards* in Gray, 1849, et *Belemnopsis Bayle*, 1878.- Une réévaluation de la validité du genre de bélemnites *Belemnopsis Bayle* est réalisée conjointement à un survol rétrospectif des premières utilisations des noms *Belemnites sulcatus*, *Belemnopsis Bayle* et *Belemnopsis Edwards*. *Belemnites sulcatus* Miller a été indifféremment assimilé soit à *Belemnites apiciconus* Blainville, soit au groupe de bélemnites constitué de *Belemnites Altdorfensis* Blainville et de *B. Beaumontianus* Orvigny. Ulteriormon, Rieggraf (et non Phillips) a sélectionné un lectotype qui pourrait être valide et qui, pour le cas où il ne le serait pas, est validé ici. Le concept d’espèce pour *Belemnites sulcatus*, tel que défini par le lectotype, permet de l’attribuer au genre *Holcobeloides* Gustomesov. *Belemnopsis Edwards* bénéficie de l’antériorité (date de priorité) sur *Belemnopsis Bayle*, mais doit être interprété comme une "faute orthographique originelle" et, par conséquent, ne saurait être considéré comme un cas d’homonymie selon le CINZ ; *Belemnopsis Bayle* est donc un genre valide. Ce fut ensuite au tour de Douvillé qui désigna *Belemnites sulcatus*, qui avait été figurée comme *Belemnopsis sulcata* par Bayle, et qui est donc une désignation valide parce que cette espèce fait partie de celles incluses à l’origine dans *Belemnopsis Bayle*. L’une des figurations de *Belemnopsis sulcata* par Bayle correspond bien à *Belemnites apiciconus* Blainville, mais pas à *Belemnites sulcatus* tel que défini par son lectotype ; ainsi il s’agit d’un exemple d’espèce-type mal identifiée. *Belemnites apiciconus* Blainville, l’espèce impliquée dans l’erreur d’identification, est donc choisie ici comme espèce-type de *Belemnopsis Bayle* et validée en invoquant le CINZ. Les mesures prises ici permettent de préserver la nomenclature au niveau du genre, de la famille et du sous-ordre en ce qui concerne les noms *Belemnopsis* et *Belemnosis* et de résoudre des problèmes nomenclatureaux complexes directement liés à ces taxons.

Mots-clefs : Belemnites (Belemnitida); taxonomy; Code International de Nomenclature Zoologique; *Belemnopsis Bayle*; *Belemnopsis Edwards*; *Belemnosis Edwards*; *Belemnites sulcatus* Miller; *Belemnites apiciconus* Miller.

Introduction

*Belemnites sulcatus* was erected by Miller (1826, p. 59) with the description “Guard sub-cylindrical, elongated, having a longitudinal sulcus, and terminating in an acute apex” and was recorded from the “Inferior Oolite” from “Dundry, near Oxford”. Two specimens were figured,
Miller's Pl. VIII, figs. 3-4 and Pl. VIII, fig. 5. Following an extensive discussion, Riegraf (1999) concluded that Phillips (1870), as First Reviser of Belemnites sulcatus Miller, fixed the species concept and restricted the name Belemnites sulcatus to Miller's Pl. VIII, fig. 5, a form that was regarded by Phillips (1865, p. 5; 1870) as originating from the Oxford Clay (Callovian) from near Oxford. This conclusion has had serious implications for belemnite taxonomy (Riegraf, 1999). Belemnites sulcatus was designated as type species of the genus Belemnopsis Bayle, 1878, by H. Douville in 1879, but Riegraf (1999, p. 60) maintained that the real Belemnites sulcatus Miller, 1826, as emended by Phillips, 1870, is not represented amongst the species figured by Bayle (1878) and, as such, would represent an invalid designation. Furthermore, Riegraf (1999) points out that Strand (1926) recognised that Belemnopsis Bayle, 1878, was preoccupied by Belemnopsis Edwards in Gray, 1849, and that therefore Bayle's genus name was invalid. This leads to further complication because the family name Belemnopseidae Naeft, 1922, emend Jeletzky, 1946, and the suborder name Belemnopseina Jeletzky, 1965, are derived from Belemnopsis, whereas the family name Belemnoseidae Wiltshire, 1885, is based on Belemnopsis. If Belemnopsis Edwards in Gray, 1849, is valid then this genus would be placed under the Family Belemnoseidae Wiltshire creating extensive nomenclature confusion. Further, Belemnites sulcatus Miller as emended by Phillips would be placed today in the genus Holcobeloides Gustomessov, 1958 (Dzyuba, 2011), which belongs to the Cylindroteuthididae Stolley, 1919. To reduce such nomenclatural complexity, Riegraf (1999) suggested that Pachybelemnopsis Riegraf (1980) should be used for those forms previously attributed to Belemnopsis, with the Suborder Pachybelemnopseina Riegraf (in Riegraf et al., 1998) and Family Mesohibolitidae Nerodenko, 1983, replacing Belemnopseina and Belemnopseidae, respectively. However, this course of action does not remove the problem of what to do with the generic names Belemnopsis Edwards in Gray, 1849, and Belemnopsis Bayle, 1878 (depending on which one is valid), and some belemnite workers (e.g., Challinor & Hikuroa, 2007, p. 6) are unhappy with discarding so well-entrenched a generic name as Belemnopsis Bayle, 1878.

In this paper I explore the nomenclature problems surrounding Belemnites sulcatus Miller using the rules of the International Code for Zoological Nomenclature (ICZN, 1999) and come to different conclusions. I present these arguments in this paper.

The historical concept of Belemnites sulcatus Miller

The exact composition of Miller's 1826 type series for his species Belemnites sulcatus is now impossible to determine, but some observations can be made. Miller (1826) figured two specimens of Belemnites sulcatus, and therefore Miller's 1826, Pl. VIII, fig. 5 and Miller's 1826, Pl. VIII, figs. 3-4 clearly comprise part of the type series. In giving localities for his belemnite species, Miller indicated different localities separated by commas; so that for Belemnites abbreviatus Miller (1826, p. 59), we have two localities which were written as "Weymouth, Dundry", and which now would represent different species: a species of Pachyteuthis from the Oxford Clay or Corallian of Weymouth, and a species of Brevibelus from the Inferior Oolite of Dundry — yet both are recorded as coming from the "Inferior Oolite". For Miller (1826), the "Inferior Oolite" at that time would appear to have included what we would now consider as Inferior Oolite (Aalenian-Bajocian) as well as the Oxford Clay (Callovian-earthy Oxfordian). The specimen illustrated in Miller's 1826, Pl. VIII, fig. 5 as B. sulcatus was presumably found "near Oxford" in the Oxford Clay (Phillips, 1865, p. 5; 1869, p. 101; 1870, p. 114), and Miller's 1826, Pl. VIII, figs. 3-4 illustration of B. sulcatus was presumably collected from the Inferior Oolite of Dundry, Somerset (Morris, 1843, 177; Gray, 1849, p. 136; Phillips, 1865, p. 5). Miller (1826, p. 59) also refers to a specimen from the Oxford Clay of St. Clements that was illustrated in Plot's (sic Plot) (1677, Pl. III, fig. 6) History of Oxford, and this therefore also qualifies as a syntype because Miller (1826, p. 59) specifically makes reference to it. Miller (1826) may have had more specimens available, but no other specimens are mentioned, nor preserved in museum collections as far as is known.

The first question to ask is if any of Miller's syntypes are still in existence? Mr. J.S. Miller was from Gdańsk and resided in Bristol where he was curator of the Museum of the Institute in Bristol (Phillips, 1865, p. 5). He wrote various papers on fossils and much, if not all, of his collection was deposited in the Bristol Museum (Bristol Mercury, Tuesday 2nd November 1830, p. 4). It is therefore likely that most of the belemnites illustrated by Miller in 1826 were in the collection of the Bristol Museum. It is notably that Phillips (1869, p. 101) stated that Miller's 1826, fig. 5 seems to be modelled on specimens that then existed (note the past tense even in 1869) in the Bristol Museum (which he states were labelled "B. sulcatus, Inferior Oolite", and presumably Miller's 1826, figs. 3-4 was also in this collection. Unfortunately, the geology department and geological collection in the Bristol Museum were destroyed by bombing during the Second World War (Western Daily Press, Friday 6th December 1940, p. 5) and these specimens no longer exist. The whereabouts of Plot's 1677, Pl. III, fig. 6 is also unknown.

Blainville (1827, p. 68-69) discussed Miller's 1826 syntypes of B. sulcatus in relation to the new species that he erected in his memoir (see Riegraf, 1999, for Blainville's various earlier papers on belemnites). Blainville (1827) introduced two new species, Belemnites Altidorsens and B. apiciconus, and unambiguously referred Miller's
1826, Pl. VIII, fig. 5 to the former, and MILLER’s 1826, Pl. VIII, figs. 3-4 to the latter. However he stated that he did not use MILLER’s name because there were at least five or six different belemnite species that had ventral grooves. As such, BLAINVILLE (1827) did not revise Belemnites sulcatus MILLER, or make an appropriate designation of a type specimen.

John PHILLIPS produced the first edition of his Geology of Yorkshire in 1829. In this work (p. 138) he recorded Belemnites sulcatus from the Oxford Clay and Kelloways Rock. PHILLIPS (1829, p. 117) stated that he referred to figures in his own work or to works of others; for Belemnites sulcatus he lists MILLER’s 1826, Pl. VIII, fig. 5. So even in 1829, PHILLIPS may have been restricting MILLER’s Belemnites sulcatus to the form from the Oxford Clay, but there is no unambiguous indication of that in his publication. By the second edition of his work, published in 1835, he no longer listed Belemnites sulcatus from Yorkshire, and later stated (PHILLIPS, 1870, p. 117): “I doubt the occurrence of the species [Belemnites sulcatus] in Yorkshire, and regard the mention of it in the first edition of my work on the geology of that county (1829) as requiring confirmation”. PHILLIPS (1829) clearly does not designate a lectotype for Belemnites sulcatus MILLER (ICZN article 74.5).

Several authors discussed the relationship between Belemnites sulcatus MILLER and B. apiciconus BLAINVILLE in the 1840s. MORRIS (1843, p. 177), in his Catalogue of British Fossils, restricted B. sulcatus MILLER to MILLER’s 1826, Pl. VIII, fig. 3, and listed it as occurring in the Inferior Oolite of Dundry, Somerset (thus excluding the reference to ‘near Oxford’). MORRIS (1843) does not refer to ORBIGNY’s work on the Jurassic of France, which was published in parts from 1838 to 1847, and which described Belemnites sulcatus in 1843. It appears that MORRIS (preface dated July 1843) had not yet seen ORBIGNY’s work on the Jurassic. ORBIGNY (1843, p. 105) also restricted Belemnites sulcatus MILLER to MILLER’s 1826, Pl. VIII, figs. 3-4 (excluding fig. 5 from his synonymy list) and stated that this form was originally described by MILLER (1823, sic 1826) under the name Belemnites sulcatus and that BLAINVILLE (1827) changed the name to Belemnites apiciconus. ORBIGNY (1843, p. 105) stated that he is returning to the first name, and includes B. apiciconus in the synonymy of B. sulcatus MILLER. Notably, ORBIGNY (1843) makes no reference to the work of MORRIS (1843), suggesting he has not seen that work. GRAY (1849, p. 136) followed MORRIS (1843) and ORBIGNY (1843) in referring only MILLER’s 1826, Pl. VIII, figs. 3-4 to B. sulcatus and also included B. apiciconus as a synonym. GRAY (1849, p. 136) also reproduced the description given by ORBIGNY (1843, p. 105). BROWN (1849) provided an illustrated guide of fossils of Great Britain and Ireland and listed Belemnites sulcatus MILLER from the “Inferior Oolite, Daudry {sic Dundry}, Somersetshire”. On his Pl. XXIX, figs. 9-11, he reproduced the illustrations of both specimens of Belemnites sulcatus as given by MILLER (1826). By 1854, MORRIS acknowledged the 1843 work by ORBIGNY (p. vi) and, on p. 301, restricted Belemnites sulcatus to MILLER’s Pl. VIII, fig. 3 and included B. apiciconus BLAINVILLE as a synonym. According to ICZN article 74.5, none of these publications (MORRIS, 1843, 1854; ORBIGNY, 1843; GRAY, 1849; BROWN, 1849) qualify as a valid designation of a lectotype for Belemnites sulcatus MILLER.

At this point it is worthy of note that Dundry Hill which exposes an outlier of Aalenian-Bajocian limestone attributed to the Inferior Oolite (PARSONS in COPE et al., 1980) and contains abundant belemnites belonging to the genera Belemnopsis BAYLE, 1878 (inclusive of Belemnites apiciconus BLAINVILLE), Holocobels STOLLEY, 1927, and Brevisbelus DOYLE, 1992 (author’s pers. observ., 1992). Oxford is built on the Oxford Clay which here yields common specimens of belemnites referable to Belemnites sulcatus (B. aldorfensis and B. beaumontianus) in the sense of PHILLIPS 1870 (PHILLIPS, 1870, p. 117).

Neither MORRIS (1843, 1854) nor GRAY (1849) specifically mentioned MILLER’s 1826 specimen shown in his Pl. VIII, fig. 5. GRAY (1849, p. 140) did describe Belemnites Aldorfensis BLAINVILLE from the Oxford Clay, and MORRIS (1854, p. 300) listed Belemnites Beaumontianus ORBIGNY from the Oxford Clay of Loch Staffin on the authority of I. MURCHISON. For the Loch Staffin occurrence, HOPKINS (1852, p. lxvi) reported that Prof. FORBES had found a bed with “Ammonites cordatus, Belemnites Owenii, and B. Beaumontianus, [that] distinctly proved it to be of the period of the Oxford Clay”.

The available evidence therefore indicates that by the middle of the nineteenth century the name Belemnites sulcatus had first been (tentatively?) restricted to the Oxford Clay form by PHILLIPS (1829). Yet, by the 1840s, Belemnites sulcatus was universally used for the belemnite from the Inferior Oolite (the Belemnites apiciconus of BLAINVILLE) of southern England and France, whereas the Oxford Clay form was referred to B. aldorfensis BLAINVILLE or B. beaumontianus ORBIGNY.

John PHILLIPS’ (1865, 1869, 1870) work on the British Belemnitidae is still a major work for the Jurassic belemnites of England. In revising Belemnites sulcatus, PHILLIPS clearly looked towards his earlier record of Belemnites sulcatus in the Kelloways Rock and Oxford Clay of Yorkshire, and not the works of MORRIS (1843, 1854), ORBIGNY (1843), or GRAY (1849). PHILLIPS (1870, p. 114) therefore considered that both B. Aldorfensis and B. Beaumontianus were closely related to B. sulcatus MILLER and that B. apiciconus was distinct. RIEGRAF (1999) suggested that PHILLIPS (1870) was the “First Reviser” of Belemnites sulcatus MILLER (although even in his monograph, PHILLIPS first mentioned Belemnites sulcatus in 1865, p. 5), but PHILLIPS had indicated his interpretation of the fossil in 1829. For RIEGRAF (1999) therefore, PHILLIPS (1870, p. 114), as the
First Reviser, restricted *B. sulcatus* to the form figured by Miller (1826), Pl. VIII, fig. 5. Furthermore, Phillips (1869, p. 101) stated that Miller's 1826, Pl. VIII, figs. 3-4 appeared to represent *Belemnites apiciconus* Blainville, 1827, but did not include it in the synonymy list for *B. apiciconus* in his monograph. Phillips' 1829 work is hardly a revision of the species, but the works of Morris (1843) and Orbigny (1843) clearly are and both retain the name *Belemnites sulcatus* for the form figured as *Belemnites apiciconus* by Blainville (1827). From ICZN article 24.2 it is possible to argue that either Morris (1843) or Orbigny (1843) were first revisers, but not Phillips (1870) as indicated by Riegfr (1999).

**Lectotype of Belemnites sulcatus Miller**

The question of whether there has been a valid designation of a lectotype for *Belemnites sulcatus* is therefore very critical to the understanding of the species concept and its relationship to higher taxonomic rankings. There is no formal nomination of a lectotype in either Phillips (1829, 1865, 1869, 1870), Morris (1843, 1854), or Orbigny (1843) or Gray (1849). Riegfr (1999) took Phillips' 1870 restriction of *Belemnites sulcatus* to Miller's 1826, Pl. VIII, fig. 5 as a designation of lectotype, but this is not admissible under ICZN article 74.5.

In 1999 (p. 66), Riegfr formally designated lectotypes for *Belemnites altdorfensis* Blainville and *Belemnites apiciconus* Blainville and these are valid under ICZN article 74.5. For *Belemnites sulcatus* Miller, Riegfr (1999) did not formally designate a lectotype, but figured "the" lectotype that he considered had been designated by Phillips (1870). Since Phillips (1870) had never selected a lectotype for *Belemnites sulcatus* Miller, Riegfr's 1999 illustration of a lectotype (on the authority of Phillips), without formal designation, may or may not be a suitable designation of a lectotype according to ICZN article 74.5. Riegfr's 1999 p. 64 statement in regard to his fig. 6 states "'Inferior Oolite' [=Oxford Clay Formation], ?Dundry near Oxford, England, Lectotype of Belemnites sulcatus" serves as a more formal designation of a lectotype according to ICZN article 74.5. In order to stabilize nomenclature, this specimen (Miller, 1826, Pl. VIII, fig. 6) is formally designated lectotype herein in case Riegfr's 1999 designation should subsequently prove to be in doubt.

**Status of Belemnopsis Edwards in Gray, 1849, and Belemnopsis Bayle, 1878**

Riegfr (1999) stated that Belemnopsis Edwards in Gray, 1849, was a senior homonym of *Belemnopsis Bayle*, 1878, and attributed the discovery of this homonymy to Strand (1926, p. 65). If correct, this means that *Belemnopsis Bayle* is invalid. The nomenclature issues that would prevail if *Belemnopsis Edwards in Gray* (1849) is deemed valid are far reaching. The generic name *Belemnopsis* would have to replace *Belemnos* in the Family Belemnoseidae Naer, 1922. The relationship and validity of *Belemnopsis Edwards in Gray*, 1849, and *Belemnopsis Bayle*, 1878, therefore, need to be more fully evaluated from insight from further studies of the literature and in light of the rules of the ICZN (1999).

In his Catalogue of the Mollusca in the British Museum, Gray (1849) described the species of mollusc then known from the British Isles. In that volume he described the belemnites, some of which have been discussed above, together with various teuthids and sepiids. Amongst the sepiids was J. de C. Sowerby's 1829 species *Beloptera anomala* which was described by Gray (1849) on page 118. In the section on "Additions and Corrections" at the end of this work, Gray (1849, p. 157-158) added a description of *Belemnopsis anomala* with the genus attributed to J.E. Edwards', as then unpublished, work on the cephalopods of the London Clay.

Edwards' 1849 monograph on the cephalopods of the lower Tertiaries describing a new sepiid taxon (both genus and species) *Belemnosis plicata* appeared in the Palaeontographical Society volume for the year 1848, which was published in July 1849 (Edward & Wood, 1887). Edwards introduced the new genus *Belemnos*, but also introduced a new specific name *plicata* which, since there was only but a single specimen that had received the specific name *anomala* by J. de C. Sowerby, becomes a junior synonym. Edwards (1849, footnote at the bottom of p. 38) indicated the derivation of the name *Belemnos* as being from: Βέληνος, telum and ευνιις, conjunctio, relating to the transition between belemnites and sepiids. In contrast Riegfr (1999, p. 60) suggested the suffix *-opsis*, as used in *Belemnopsis Edwards in Gray*, 1849, was derived from the Greek for 'form' or 'shape' which does not agree with the eponym given by Edwards (1849). The question then is: which, *Belemnos* or *Belemnopsis*, has priority?

Dating the publication of Gray's various catalogues of animals in the British Museum is difficult as each only has the year of publication indicated. Sherborn (1926) attempted to determine the date of issue of each catalogue (that is issue to book sellers), but could only determine the dates when the Catalogues were laid down on the table for the trustees of the British Museum, and not the actual date when the Catalogues were issued to dealers. Sherborn (1926) determined that Gray's Catalogue for 1849 was laid on the table for trustees on the 30th June 1849, and this was confirmed by Karat (1979). If it was immediately submitted to dealers, then Gray's 1849 work would be deemed to have appeared one month earlier than Edwards' 1849 work (ICZN, 1999, article 21.3.1). Yet Gray (1849, p. 158) cited the page numbers from Edwards' 1849 work for the description of both the genus and the species of *Belemnopsis plicata* as well as giving the plate and figure
numbers of the illustration (although he cited the title of the work incorrectly as "Cephalopes of London Clay"). GRAY (1849) also amended the specific name from plicata, which must be a junior synonym as there was only one specimen, to anomalus. The citation of actual page and figure numbers, as well as specific names, indicates that GRAY (1849) must have seen page proofs or a preprint of EDWARDS' 1849 work before publication so as to allow him to include these details in his own work. Furthermore, EDWARDS' 1849 paper was included in the volume of the Palaeontological Society for 1848, suggesting it was completed in 1848 and was awaiting publication; additionally there is no mention of GRAY's 1849 work in EDWARDS' (1849). It seems therefore irrefutable that GRAY had access to EDWARDS' 1849 work in the latter stages of completing his own (1849) Catalogue, but that his Catalogue must be deemed to have appeared a month earlier than EDWARDS' work. According to the Code (ICZN, 1999, article 21.8), prior to the year 2000, the distribution of preprints of a work before the recognized publication of the work advances the date of publication, but this does not apply to page proofs, and since no preprints have been recorded it is most likely that GRAY saw the page proofs of EDWARDS' work. Given the fact that GRAY acknowledged EDWARDS' work, it is clear that GRAY was not trying to claim authorship of EDWARDS' generic name and it would also seem clear that Belemnopsis EDWARDS in GRAY, 1849, is a spelling mistake for Belemnopsis EDWARDS, 1849, even though it was published earlier. It is worthy of note that, according to IREDALE (1913), there are many spelling mistakes in GRAY's works during the interval 1838-1845, and it would appear that the spelling Belemnopsis is another case.

There are two ways of treating this situation. Firstly, that Belemnopsis is an "incorrect original spelling" of Belemnosis (ICZN, 1999, article 32). Secondly, that Belemnosis is an "incorrect subsequent spelling" of Belemnopsis (ICZN, 1999, article 33). From the derivation of the name Belemnosis as given by EDWARDS (1849, footnote at the bottom of p. 38) it is clear that Belemnosis was the intended spelling for the generic name and that Belemnopsis is therefore an "incorrect original spelling", rather than an "incorrect subsequent spelling" because GRAY's work appear before that of EDWARDS'. Because GRAY (1849) clearly referred to EDWARDS' 1849 work, this could be taken as an indication of where to find the correct spelling of the generic name as required in ICZN article 32.5.1. However this does not entirely fit the article. If we look at current usage, Belemnopsis EDWARDS in GRAY, 1849, is not used even by RIEGRAF et al. (1998, p. 312; even though on p. 253, Pachybelemnopsis RIEGRAF is used in preference to Belemnopsis BAYLE) and seems to be universally regarded as an "incorrect original spelling" (e.g., HERRMANNSEN, 1852, p. 17). It is therefore acceptable to consider Belemnopsis EDWARD's in GRAY (1849) as an "incorrect original spelling" which therefore cannot enter into homonymy (ICZN, 1999, 32.4).

In 1878, BAYLE introduced a new genus Belemnopsis for a group of belemnites carrying an elongate ventral groove, yet only the volume illustrating the plates, but not the text volume, was issued. Furthermore, there was no indication of a selection of a type species for Belemnopsis (or the other genera). In his volume, BAYLE (1878) illustrated four species which he included in Belemnopsis, namely: Belemnopsis Altdorfensis BLAINVILLE (BAYLE, 1878, Pl. XXIX, figs. 3-4); Belemnopsis Bessina ORBIGNY (BAYLE, 1878, Pl. XXX, fig. 1); Belemnopsis unicanaliculata HARTMAN (BAYLE, 1878, Pl. XXX, fig. 2, 5); and Belemnopsis sulcata MILLER (BAYLE, 1878, Pl. XXX, figs. 3-4).

The following year, BLAKE (1882) writing in The Geological Record for 1878 listed the new belemnite genera that BAYLE (1878) had introduced and recorded that Belemnopsis BAYLE was preoccupied. RIEGRAF (1999) stated that STRAND (1926) was the first to recognize that Belemnopsis BAYLE, 1878, was preoccupied, yet BLAKE in 1882 clearly indicated that Belemnopsis BAYLE, 1878, was preoccupied, but without specifying that it was preoccupied by Belemnopsis GRAY, 1849. Yet, because Belemnopsis EDWARDS in GRAY (1849) must be regarded as an "incorrect original spelling", Belemnopsis BAYLE, 1878, is an available, and therefore valid, name.

The first designation of a type species for Belemnopsis BAYLE was made by DOUVILLE (1879, p. 91) who selected Belemnites sulcatus MILLER as type species. BAYLE's 1878 four "species" which he placed in Belemnopsis would now be placed amongst several genera and species, but it is important to record that BAYLE's 1878, Pl. XXX, fig. 4, represents Belemnites sulcatus MILLER as represented in MILLER's 1826, Pl. VIII, fig. 3 and also equivalent to Belemnites apiciconus of BLAINVILLE, 1827. BAYLE (1878) clearly followed MORRIS (1843, 1854) and ORBIGNY (1843) in his concept of B. sulcatus and did not use the name Belem- nites apiciconus BLAINVILLE for this form. Therefore, DOUVILLE's 1879 designation of Belemnites sulcatus MILLER as type species for Belemnopsis is valid, contrary to the suggestion by RIEGRAF (1999), and BAYLE did not establish a new nominal species "Belemnopsis sulcatus BAYLE 1878".

BAYLE (1878) figured two specimens under the name Belemnopsis sulcata, his plate 30, figure 3 is attributable to Holcobelus subblainvillei (EUDES-DESLONGCHAMPS) and his plate 30, figure 4 is attributable to Belemnites sulcatus as figured by MILLER (1826) plate 8, fig. 3 (= Belemnites apiciconus BLAINVILLE) (see RIEGRAF, 1999, table 1). As such, one of the specimens illustrated by BAYLE (1878) as Belemnopsis sulcata belongs to the same species as one of the specimens in the type species of Belemnites sulcatus of MILLER (1826). Therefore, DOUVILLE's 1879 nomination of Belemnites sulcatus as type species of Belemnopsis BAYLE is valid.
However, if Riegraf's 1999 selection of a lectotype for *Belemnites sulcatus* is valid then the type species for *Belemnopsis Bayle, 1878*, can be either *Belemnites sulcatus* Miller "the nominal species originally cited as type species" as defined by Riegraf’s 1999 lectotype (article 70.3.1) or *Belemnites apiciconus* Blainville, 1827, "the taxonomic species actually involved in the misidentification" (article 70.3.2). 

Douville’s 1879 designation of a lectotype needs to be validated by citation to ICZN articles 11.10, 67.13 and 69.2.4 to serve stability and universality. The following courses are available: A) to select *Belemnites sulcatus* Miller as defined by its lectotype (Riegraf, 1999) as type species of *Belemnopsis*; or B) to define *Belemnites apiciconus* Blainville, the misidentified species in Bayle (1878), as type species of *Belemnopsis*. Stability is best served by the latter course, and herein *Belemnites apiciconus* Blainville, the misidentified species attributed to *Belemnites sulcatus* Miller by Douville (1879) and figured as *Belemnopsis sulcata* Miller by Bayle (1878) is selected as type species of *Belemnopsis* as validated by ICZN article 70.3.2.

Summary

This paper has discussed the complex nomenclature and literature relating to the species *Belemnites sulcatus* Miller and has come to the following conclusions.

1. To recognise three specimens as the synotypes of Miller’s *Belemnites sulcatus*: specimen 1: Miller’s Pl. VIII, figs. 3-4; specimen 2, Miller’s Pl. VIII, fig. 5; and specimen 3, Plot’s 1677, Pl. III, fig. 6. All the specimens appear to be lost or destroyed.

2. To conclude that there was no valid designation of a lectotype under the rules of ICZN for *Belemnites sulcatus* Miller by Blainville (1827), Phillips (1829, 1865, 1869, 1870), Morris (1843, 1854), or Orbigny (1843).

3. To accept Riegraf’s 1999 nomination of a lectotype of *Belemnites sulcatus* Miller as Miller’s 1826, Pl. VIII, fig. 5, either directly or by designation herein if such a nomination is not valid according to ICZN articles.

4. To accept *Belemnopsis* Edwards in Gray, 1849, as an “incorrect original spelling” of *Belemnosis* Edwards, 1849, as indicated by universal usage. As such *Belemnopsis* Edwards cannot enter into homonymy.

5. To designate *Belemnites apiciconus* Blainville, 1827, as the type species of *Belemnopsis* Bayle, 1878, the species misidentified by Bayle, 1878, as *Belemnites sulcatus* (as subsequently fixed by nomination of a lectotype) which was subsequently nominated as type species of *Belemnopsis* Bayle by Douville (1879).

This action has the advantage of: A) stabilizing the generic name *Belemnopsis* Bayle for a group of belemnites centred around *Belemnites apiciconus* Blainville with a correctly identified type species as illustrated by Bayle (1878) and designated by Douville (1879); B) Stabilizing the name *Belemnopsis* Edwards, 1849, for the sepiid *Belemnopsis anomalosa* (J. de C. Sowerby); and C) maintaining the previous used family names (*Belemnospisidae Naef, Belemnosoideidae Naef*) that are well entrenched in the literature.

Systematic palaeontology

No formal descriptions are given here, only systematic lists and brief discussions. For detailed descriptions of taxa see the indicated resources below.

**Order BELENNITIDA ZITTEL, 1895**

**Suborder BELENNITINA ZITTEL, 1895**

**Family HOLCOBELIDAE GUSTOMESOV, 1977**

**Genus Holacobelus Stolley, 1927**

Type species. *Belemnites munieri* Eudes-Deslongchamps, 1878.

*Holacobelus blainvillii* (VOLTZ, 1830)

1830 *Belemnites blainvillii*: VOLTZ, p. 37, Pl. 1, fig. 9. 1878 *Belemnites unicanalicularis* Hartmann; Bayle, p. XXX, fig. 5.

*Holacobelus munieri* (Eudes-Deslongchamps, 1878)

1878 *Belemnites munieri*: Eudes-Deslongchamps, p. 63, Pl. V, figs. 3-6, 12-14, Pl. VI, figs. 5-11.

1878 *Belemnites unicanalicularis* Hartmann; Bayle, p. XXX, fig. 2.

1878 *Belemnites sulcatus* Miller; Bayle, p. XXX, fig. 3.

Discussion. Weis et al. (2012) have revised the belemnite Family Holacobelidae Stolley, but I disagree that it should be placed in the Belemnopseinae Jeletzky (Pachybelemnopseinae Riegraf) and instead place it in the Belemnitinae Zittel following Jeletzky (1965).

**Family CYLINDROTEUTHIDIDAE STOLLEY, 1919**

**Subfamily LAGONIBELINAE GUSTOMESOV, 1977**

**Genus Holocbeloides Gustomesov, 1958**

Type species. *Belemnites beaumontianus* Orbigny, 1843 (=Holocbeloides altdorfensis Blainville, 1827 = Belemnites sulcatus Miller, 1826).

*Holocbeloides sulcatus* Miller, 1826

1826 *Belemnites sulcatus*: Miller, p. 59, Pl. VIII, fig. 5 [non figs. 3-4 = *Belemnopsis apiciconus* (Blainville, 1827)]

1827 *Belemnites Altorfensis*: Blainville, p. 67-69, Pl. 2, fig. 1.

1843 *Belemnites Beaumontianus*: Orbigny, p. 118, Pl. XVI, figs. 7, 11.

1849 *Belemnites sulcatus* Miller; Brown, p. 248, Pl. XXIX, fig. 10 [non fig. 9 = *Belemnopsis apiciconus* (Blainville, 1827)]

1870 *Belemnites sulcatus* Miller; Phillips, 115-117, Pl. XXIX, figs. 71-73, Pl. XXX, figs. 74-75.

1878 *Belemnopsis altorfensis* Blainville; Bayle, p. XXX, figs. 3-4.

Discussion. The genera of the Family Cylindro-
teuthididae have been revised recently by Dzyuba (2011).

**Suborder BELEMNOPSIDINA**

JELETZKY, 1965

(=Pachybelemnopsinea RIEGRAF in RIEGRAF et al., 1998)

**Family BELEMNOPSEIDAE NEAF, 1922, emend JELETZKY, 1946**

(=Mesohibolitidae NERODENKO, 1983)

**Genus Belemnopsis BAYLE, 1878**

Type species. Belemnites apicicus BLAINVILLE, 1827 (= Belemnites sulcatus MILLER as designated type species by DOUVILLE, 1879, and figured as *Belemnopsis sulcatus* MILLER by BAYLE, 1878).

(= Pachybelemnopsis RIEGRAF, 1980, type species: *Belemnites canaliculatus* SCHLOTHEIM, 1820; *Belemnopsis* GRAY, 1849, which is an unavailable name which cannot enter in homonymy because it is based on an incorrect original spelling of *Belemnopsis* EDWARDS, 1849).

**Belemnopsis apicicus**

BLAINVILLE, 1827

1826 Belemnites sulcatus: MILLER, p. 59, Pl. VIII, figs. 3-4 [non fig. 5 = Holcobeloides sulcatus (MILLER, 1826)]

1827 Belemnites apicicus: BLAINVILLE, p. 69, Pl. 2, fig. 2.

1843 Belemnites sulcatus: MILLER; MORRIS, p. 177 (restricted to MILLER’s 1826, Pl. VIII, fig. 3).

1849 Belemnites sulcatus MILLER; GRAY, p. 136 (restricted to MILLER’s 1826, Pl. VIII, figs. 3-4).

1849 Belemnites sulcatus MILLER; BROWN, p. 248, Pl. XXIX, fig. 9 [non fig. 10 = Holcobeloides sulcatus (MILLER, 1826)]

1854 Belemnites sulcatus MILLER; MORRIS, p. 301 (restricted to MILLER’s 1826, Pl. VIII, fig. 3).

1869 Belemnites sulcatus BLAINVILLE; PHILLIPS, p. 101-102, Pl. XXV, fig. 58.

Type specimen. Specimen figured by BLAINVILLE, 1827, Pl. 2, figs. 2, 2a; designated lectotype by RIEGRAF (1999, p. 66).

**Order SPIRULIDA POMPECKJ, 1912**

**Family BELEMNOSTEIDAE WILTSHIRE, 1869**

**Genus Belemnosis EDWARDS, 1849**

(= Belemnopsis EDWARDS in GRAY, 1849, an unavailable incorrect original spelling of *Belemnosis* EDWARDS, 1849)

Type species. Beloptera anomalus J. de C. SOWERBY, 1829.

**Belemnosis anomala**

(J. de C. SOWERBY, 1829)

1829 Beloptera anomalus J. de C. SOWERBY, p. 183, Pl. 591, fig. 2.

1838 Belemnata anomala SOWERBY; BROWN, p. 43, Pl. XXIX, figs. 23-24.

1849 Beloptera anomala SOWERBY: GRAY, p. 118.

1849 Belemnopsis anomala (SOWERBY): GRAY, p. 157-158.

1849 Belemnosis plicata: EDWARDS, p. 40, Pl. 2, fig. 3a-c.

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