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THE EARLIEST BELEMNITES: NEW RECORDS FROM THE HETTANGIAN OF BELGIUM AND LUXEMBOURG

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Abstract: Belemnites s. str. (Belemnitida) appeared in Europe not earlier than the basal Lower Jurassic with the earliest representatives of the suborder Belemnitina. These ancestral forms, present in the Hettangian of Germany, Northern Ireland and Belgium are so rare that every single specimen may shed new light on the dawn of the first true belemnites. Recent field research by the authors in the Hettangian of Belgium and Luxembourg yielded some isolated rostra assignable to the Passaloteuthididae (*Schwegleria*) and the Hastitidae (aff. *Subhastites*) as well as coleoid armhooks. This new material shows a formerly unrecognized heterogeneity of morphological features in early belemnites. Though the records are isolated, two lineages can be hypothesized in the Hettangian and Sinemurian Belemnitina: the Passaloteuthididae and the Hastitidae, both present as soon as the *liasicus* Zone. However, more complete and stratigraphically well set material is needed in order to confirm this working hypothesis.

Key words: Belemnites, Hettungian, Luxembourg

INTRODUCTION

The Belemnitida (belemnites s. str.) represent the most important order within the fossil Coleoidea by number of species and frequency of the fossil record. Nonetheless, little is known about their origin: reliable fossil data about early belemnites is scarce, so that every single specimen gains a certain importance. The opinions about the earliest belemnites have diverged notably in the past. Most authors agree that the first belemnites were simple, conical Passaloteuthididae from the Early Lower Jurassic (Doyle et al., 1994). These are at the same time the first representatives of the suborder Belemnitina whilst the Pachybelemnopseina (sensu Riegraf et al., 1998) are not documented before the Middle Jurassic. The recent description of new material assignable to the early Hettangian genus *Schwegleria* (Weis & Delsate, 2005) represents an opportunity to address the problem and reconsider the facts under the light of these new records from the Belgian Lower Jurassic.

THE EARLIEST BELEMNITES: HISTORICAL REMARKS

Pre-Jurassic belemnite records have been reported occasionally but were reclassified mostly as aulacocerid or phragmoteuthid coleoids. *Eobelemnites caneyensis* from the Mississipian of Oklahoma (Flower, 1945) represents a belemnitid phragmocone but its stratigraphical position is considered as dubious. *Jeletzkya douglassae* from the Upper Carboniferous of Illinois (Johnson & Richardson, 1968) displays ten hook-bearing arms, but no phragmocone or rostrum and is just likely to be a phragmoteuthid or aulacocerid arm-crown (Doyle et al., 1994). *Permoteuthis groenlandica*, from the Permian of East Greenland (Rosenkrantz, 1946) has been redefined a phragmoteuthid proostracum by Jeletzky (1966: 38). The Sinobelemnitidae, described by Zhu & Bian (1984) from the Triassic of Sichuan, are considered by Doyle et al. (1994) to be "the only serious contenders in the search for pre-Jurassic belemnites" (p. 8). These Chinese records however need further investigations in order to specify their true nature. Judging by the figures, they could represent true belemnites, showing remarkable similarities with representatives of the Pachybelemnopseina, known from the Middle and Upper Jurassic.

According to most authors, belemnites s. str. appeared in the Early Lower Jurassic and may descend from Triassic Aulacocerida or Phragmoteuthida, or a yet unknown ancestor. Hettangian belemnites have been figured by Tate (1869), Schwegler (1939) and Weis & Delsate (2005). In Europe, the Belemnitida are first known in the Hettangian with the genus *Schwegleria*. Tate (1869) was the first to figure a Hettangian belemnite: *"Belemnites praematurus"* from the *angulata* Zone of Northern Ireland (Fig. 1). There was, however, little attention drawn to this single record and for many years, the unofficial title of "the oldest belemnite" was attributed to *Nannobelus acutus* from the Sinemurian (Quenstedt, 1845–1849; Naef, 1922). This picture changed with the work of Schwegler (1939) who described three new species, *Nannobelus feifeli*, *Nannobelus praecox* and *Holcoteuthis* (?) *psilonoti*, from the Hettangian *liasicus* Zone of Steinenberg bei Nürtingen

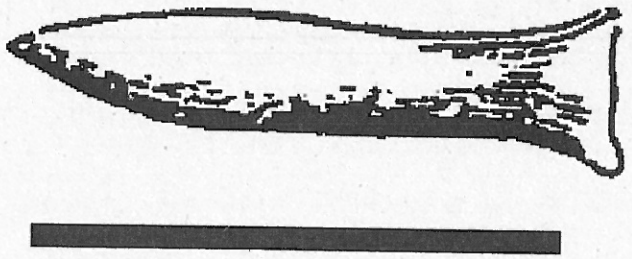

Fig. 1 ***"Belemnites praematurus"*** **Tate, 1869 (original figure, scale 1 cm).**

(Southwest Germany). Riegraf (1980) created the genus *Schwegleria* for these dwarf ancestral forms. The same author figured a belemnitid phragmocone from the *angulata* Zone of Oldentrup bei Bielefeld, Northern Germany (Riegraf, 1982). Later on, Riegraf (1996) described cephalopod arm hooks, *Paraglycerites*, from the *planorbis* Zone of Tübingen-Bebenhausen (Southwest Germany) which he linked with the *Schwegleria* rostra. Some ambiguous records are specified in Riegraf (1996). Schlegelmilch (1996) redescribed the original material of Schwegler (1939), and compared it with *Nannobelus acutus* from the Sinemurian, considering this species to be a direct descendant of *Schwegleria feifeli*.

NEW RECORDS OF BELEMNITES IN THE HETTANGIAN OF BELGIUM AND LUXEMBOURG

During the last 10 years, micropalaeontological research in marly Hettangian sediments of Southeast Belgium resulted in the discovery of some isolated belemnite rostra and fragments. The site of Fontenoille, *liasicus* Zone yielded 3 determinable rostra of *Schwegleria* (Belemnitina, Passalotheutididae) belonging to *S. feifeli* and *S. psilonoti*, 1 fragment of *Schwegleria* sp. and a belemnite phragmocone, similar to the one figured by Riegraf (1982) from the *angulata* Zone of Oldentrup. Further research in the *planorbis/liasicus*-Zone of Vance yielded a stem-fragment which diverges considerably from the conical *Schwegleria* shape and is similar to the hastate genus *Subhastites* (Belemnitina, Hastitidae) from the Pliensbachian. These new records from the Belgian Hettangian are detailed in Weis & Delsate (2005). Furthermore, Delsate & Thuy (2005) mention fragmentary coleoid arm hooks from the Hettangian *planorbis* Zone of Bourglinster, Luxembourg.

DISCUSSION

The fossil record reveals that the Belemnitida are represented since the Early Jurassic Hettangian by the suborder Belemnitina, with the Passaloteuthididae and the Hastitidae. The Pachybelemnopseina are documented since the Middle Jurassic (Bajocian/Aalenian) (Fig. 2). The position of the Sinobelemnitidae from the Upper Triassic is ambiguous, but currently we can not exclude with certainty that they are

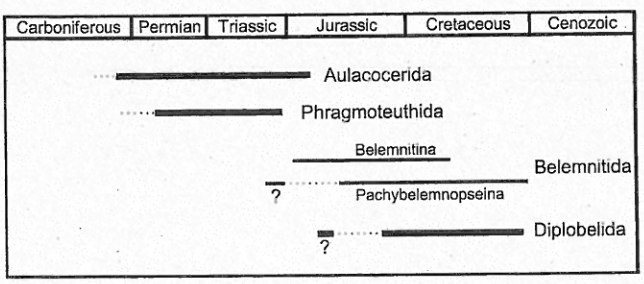

Fig. 2 Simplified stratigraphic range of the "Belemnoidea". If the the Sinobelemnitidae from the Upper Triassic represent true Belemnitida has not been established yet.

early representatives of the Pachybelemnopseina. The Sinobelemnitidae certainly need further investigation in order to determine their true nature.

The isolated records of belemnites in the European basal Jurassic allow a hypothesis of two lineages in the Belemnitina during the Hettangian and Sinemurian (Fig. 3): the Passaloteuthididae (with *Schwegleria*, *Nannobelus* and *Coeloteuthis*) an the Hastitidae (with *Subhastites*). This idea

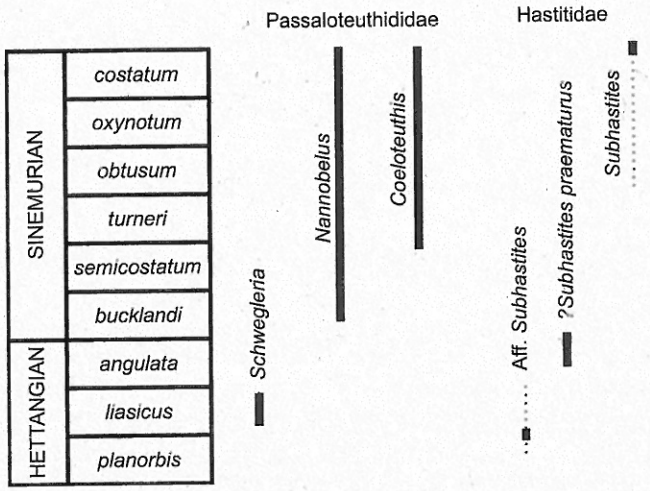

Fig. 3 Stratigraphic position of early Jurassic belemnite records in Southwest Germany, Belgium, Normandy and Northern Ireland (Riegraf, 1980; Weis & Delsate, 2005; Weis, pers. obs., 2005; Tate, 1869).

was already advanced by Naef (1922), who states about the Hastitidae: "It is noteworthy that from the beginning (Lias β-γ) the long- and thin-stemmed forms occur [...]. I do not consider their direct derivation from *Nannobelus* [...] as probable. Such extremely "clavate" rostra placed at the very posterior end of the phragmocone require a special structure and strengthening to be biologically functional, and such an adaptation would have to be recognizable in stepwise transitions in the zone of Lias β to γ. Such transitional stages are not known to date" (in Warnke et al., 2004: 134). The earliest "clavate" belemnites known to Naef come from the Sinemurian-Pliensbachian boundary (Naef, 1922: 227). The specimen described by Weis & Delsate (2005) as aff. *Subhastites* sp. demonstrates that these "clavate" forms already existed in the Hettangian. The specimen described by Tate (1869) as *"Belemnites praematurus"* from the Upper Hettangian has to be assigned to the Hastitidae as well, showing a subhastate profile, lateral lines and lacking the apical grooves (Fig. 1). The author (Tate, 1869: 167) regards it as "distinct from, though closely allied to *B. clavatus* [*Subhastites pseudoclavatus* = *Hastites clavatus* in lit.]". Dwarf Sinemurian hastate forms have also been recorded in the Upper Sinemurian of Subles, Normandy, France (Plate 1; Fig. E–F).

Jeletzky (1966: 143) considered the Hastitidae as an early off-shot of the Passaloteuthididae. If this was to be true, the off-shot would have to be located before the Hettangian *liasicus* Zone.

Furthermore, more complete future findings should allow us to split the heterogeneous *Schwegleria*-group into

some new genera. The genus *Schwegleria* with the type species *Schwegleria feifeli* would consequently be restricted to forms with a ventral groove. Whether the Hettangian hastate forms can be integrated in the genus *Subhastites* or need a new generic attribution can only be established by more complete material.

CONCLUSIONS

Currently, the unambiguous evidence of the first occurrence of belemnites appears to be the presence of the suborder Belemnitina (sensu Riegraf et al., 1998), with *Schwegleria* and aff. *Subhastites* in the Hettangian *liasicus* Zone of Southwest Germany and Belgium. Coleoid armhooks, possibly attributable to belemnites, are already present in the *planorbis* Zone of Southwest Germany and Luxembourg. The new records from Belgium confirm the presence of true belemnites in the Hettangian. The Hettangian material is remarkable by the heterogeneity of its morphological features: among forms belonging to the Passaloteuthididae (*Schwegleria*) the Hastitidae are represented by two single records (aff. *Subhastites* and *?Subhastites praematurus*). These two lineages would consequently have been separated as soon as the *liasicus* Zone and can be followed by isolated records through the upper Hettangian and Sinemurian. However, in order to confirm and precise this hypothesis, we need more complete and stratigraphically reliable material, considering that Hettangian belemnites have proved to be excessively rare. Attention should be paid also to Sinemurian belemnites, especially the hastate pre-Pliensbachian forms.

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REFERENCES

Delsate D., Thuy B., 2005: Introduction biostratigraphique à quelques affleurements hettangiens du Luxembourg belge et grand-ducal. In: Delsate D., (ed.), Biostratigraphie et Paléontologie de l'Hettangien en Belgique et au Grand-Duché de Luxembourg. Royal Institute of Natural Sciences, Memoirs of the Geological survey of Belgium 51: pp. 1–25.

Doyle P., Donovan D. T., Nixon M., 1994: Phylogeny and systematics of the Coleoidea. Paleontological Contributions of the University of Kansas (new series), 5: 1–15.

Flower R. H., 1945: A belemnite from a Mississipian boulder of the Caney Shale. Journal of Paleontology 19: 490–503.

Jeletzky J. A., 1966: Comparative morphology, phylogeny and classification of fossil Coleoidea. Palaeontological contributions of the University of Kansas, 42 (Mollusca, Art. 7): pp. 1–162.

Johnson J. H., Richardson E. S., 1968: Ten-armed cephalopod from the Pennsylvanian of Illinois. Science 159: 526–528.

Naef A., 1922: Die fossilen Tintenfische. Jena. 322 pp.

Quenstedt F. A., 1845–1849: Petrefaktenkunde Deutschlands. 1 Abt. 1 Bd. Cephalopoden. Tübingen. 580 pp.

Riegraf W., 1980: Revision der Belemniten des Schwäbischen Jura. Teil 7. Palaeontographica, (A) 169: 128–206.

Riegraf W., 1982: New Coleoidea from the Lower Jurassic of Southwest Germany. N. Jb. Geol. Paläont., Mh. 1982: 91–97.

Riegraf W., 1996: Belemniten-Fanghäkchen (Cephalopoda, Coleoidea) aus der Psilonotenbank (Unterer Jura, tiefstes Hettangium) von Südwestdeutschland. Stuttgarter Beiträge zur Naturkunde (B) 239: 1–38.

Riegraf W., Janssen N., Schmitt-Riegraf C., 1998: Cephalopoda dibranchiata fossiles (Coleoidea) II., in: Westphal, F. (ed.). Fossilium Catalogus I: Animalia. Pars 135. Leiden.

Rosenkrantz A., 1946: Krogbaerende cephalopoder fra Østgronlands Perm. Dansk Geol. Foren., Medd. 11 (1946–50): 160–161.

Schlegelmich R., 1996: Neubearbeitung der Belemniten aus dem Hettangium von Nürtingen (Baden-Württemberg, Südwestdeutschland). Stuttgarter Beiträge zur Naturkunde (B) 238: 1–17.

Schwegler E., 1939: Belemniten aus den Psilonotentonen Schwabens. Cbl. Mineral. Geol. Paläont. 1939: 200–208.

Tate R., 1869: On the oldest British belemnite. Geol. Mag. 1 (6): 166–167.

Warnke K., Keupp H., Boletzky S. von (eds.), 2004: Fossil dibranchiate cephalopods. A paleozoological monograph by Adolf Naef, 1922. Translated from German (original title: "Die fossilen Tintenfische"). Berliner Paläobiologische Abhandlungen 5: 209 pp.

Weis R., Delsate D., 2005: Présence de bélemnites précoces dans l'Hettangien de Belgique, in: Delsate D. (ed.), Biostratigraphie et Paléontologie de l'Hettangien en Belgique et au Grand-Duché de Luxembourg. Royal Institute of Natural Sciences, Memoirs of the Geological survey of Belgium 51: pp. 27–31.

Zhu K. Y., Bian Z. X., 1984: Sinobelemnitidae, a new family of Belemnitida from the Upper Triassic of Longmenshan, Sichuan. Acta Palaentologica Sinica 23: 300–319. [In Chinese]

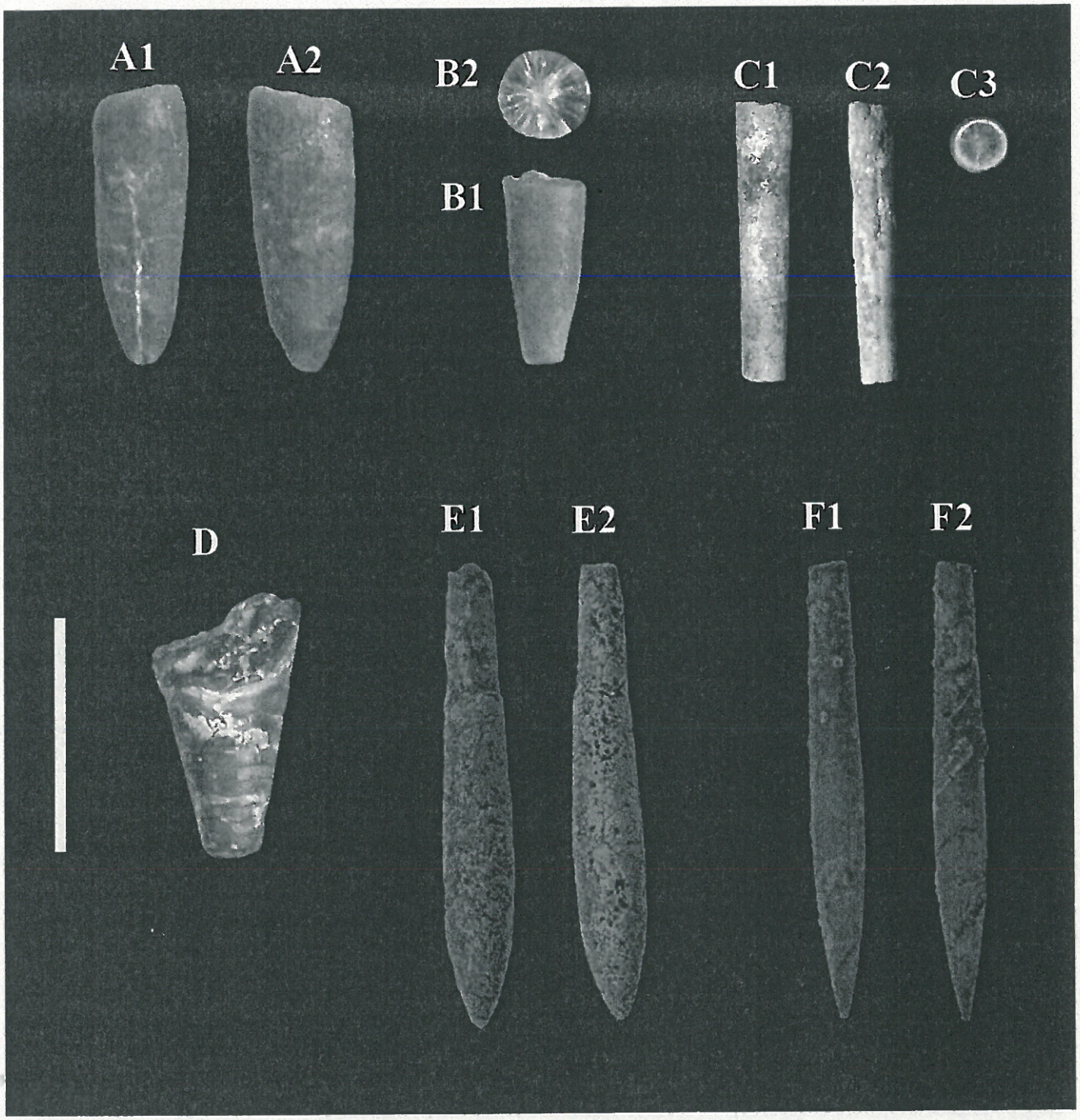

Plate 1. Early Jurassic belemnites from the Hettangian-Sinemurian of Belgium and Normandy (France). A. *Schwegleria feifeli* (SCHWEGLER, 1939), complet rostrum. Specimen QB268a. A1. Ventral view, A2. Lateral view. Hettangian, *liasicus* Zone of Fontenoille, Belgium. B. *Schwegleria psilonoti* (SCHWEGLER, 1939), fragment. Specimen QB269. B1. Lateral view, B2. Transverse section. Hettangian, *liasicus* Zone of Fontenoille, Belgium. C. aff. *Subhastites* sp., stem-fragment. Specimen HE366. C1. Ventral view, C2. Lateral view with lateral line in evidence, C3. Transverse section. Hettangian, *planorbis* or *liasicus* Zone of Vance, Belgium. D. Belemnitid phragmocone. Specimen QB271. Hettangian, *liasicus* Zone of Fontenoille, Belgium. E. *Subhastites* sp. E1. Ventral view, E2. Lateral view. Upper Sinemurian of Subles, Normandy, France. F. *Subhastites* sp. F1. Ventral view, F2. Lateral view. Upper Sinemurian of Subles, Normandy, France. Scale 1cm. Specimens A–D stored at the National Museum of Natural History, Luxembourg. Specimens E-F exposed at the Maison du Fossile, Dubrulle Collection (Lion-sur-Mer, Normandy, France).