Revision of upper Toarcian ammonites (Lytoceratidae, Graphoceratidae and Hammatoceratidae) from the Minette ironstones, southern Luxembourg

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Schlüsselwörter: Ammoniten, Typusmaterial, oberes Toarcium, Minette Eisenerze.

Zusammenfassung

Wir stellen hier eine umfassende taxonomische Studie über die Ammoniten des Toarcium-Teils der Minette Eisenerze vor. Die Untersuchung beruht auf 365 Ammoniten aus den Sammlungen des Nationalmuseums für Naturgeschichte Luxemburg, welche hauptsächlich aus historischen Sammlungen des 19ten Jahrhunderts stammen, inklusive Material das bereits von E.W. Benecke und P.L. Maubeuge, nebst anderen, untersucht wurde. Es werden neun Gattungen und 39 Arten mit dem Hauptschwerpunkt auf Dumortieriinae beschrieben. Ein geringerer Teil der Fauna umfasst Grammoceratinae und Alocolytoceratinae sowie Hammatoceratinae. Detailreiche Beschreibungen und neue Abbildungen sind verfügbar für das Typusmaterial von *Dumortieria kochi* (Benecke, 1905), *Cotteswoldia angulata* (Maubeuge, 1950), *Walkericeras pseudolotharingicum* (Maubeuge, 1950), *W. pseudoarcuatum* (Maubeuge, 1950), *W. hinsbergi* (Benecke, 1905), *W. pseudograndjeani* (Maubeuge, 1950), *W. dudelangense* (Maubeuge, 1950), *Pleydellia falcifer* Maubeuge, 1950, *P. pseudoaalense* Maubeuge, 1950, *P. funcki* Maubeuge, 1950, *P. arkelli* Maubeuge, 1950, *P. buckmani* Maubeuge, 1947, *P. spathi* Maubeuge, 1947. Die Art *Walkericeras lugdunensis*, Leitfossil der Lugdunensis Subzone (Aalensis Zone), wird als subjektives Junior-Synonym von *Walkericeras pseudolotharingicum* Maubeuge, 1950 angesehen, und demzufolge wird die Bezeichnung Pseudolotharingicum Subzone anstelle von Lugdunensis Subzone vorgeschlagen. Die stratigraphische Reichweite der untersuchten Ammoniten umfasst die Pseudoradiosa und Aalensis Zonen des oberen Toarciums, und bestätigt demnach die Annahme, dass der überwiegende Teil der Minette-Sedimente dem Toarcium und nicht dem Aalenium zuzurechnen sind, wie bereits durch die Arbeiten von P.L. Maubeuge bewiesen, im Gegensatz zu der weit verbreiteten Ansicht der Forscher des 19ten und der ersten Hälfte des 20ten Jahrhunderts.

Key words: Ammonites, type specimens, upper Toarcian, Minette ironstones.

Abstract

We present here a comprehensive taxonomic study covering the ammonites of the Toarcian part of the Minette ironstones. This study is based on 365 ammonite specimens from the collections of the National Museum of Natural History in Luxembourg, originating mostly from historical collections of the 19th century, and including material studied and published by E.W. Benecke and P.L. Maubeuge amongst others. Nine genera and 39 species are described, with a predominance of Dumortieriinae. A minor part of the fauna includes Grammoceratinae and Alocolytoceratinae, as well as Hammatoceratinae. Detailed descriptions and new illustrations are given for the type material of *Dumortieria kochi* (Benecke, 1905), *Cotteswoldia angulata* (Maubeuge, 1950), *Walkericeras pseudolotharingicum* (Maubeuge, 1950), *W. pseudoarcuatum* (Maubeuge, 1950), *W. hinsbergi* (Benecke, 1905), *W. pseudograndjeani* (Maubeuge, 1950), *W. dudelangense* (Maubeuge, 1950), *Pleydellia falcifer* Maubeuge, 1950, *P. pseudoaalense* Maubeuge, 1950, *P. funcki* Maubeuge, 1950, *P. arkelli* Maubeuge, 1950, *P. buckmani* Maubeuge, 1947, *P. spathi* Maubeuge, 1947. The species *Walkericeras lugdunensis*, used as a marker of the Lugdunensis Subzone (Aalensis Zone), is considered herein a subjective junior synonym of *Walkericas pseudolotharingicum* Maubeuge, 1950, and hence the Pseudolotharingicum Subzone is proposed to replace the former Lugdunensis Subzone. The stratigraphical range of the studied assemblage includes the Pseudoradiosa and Aalensis zones of the Upper Toarcian, confirming thus that a large part of the Minette rocks are of Toarcian but not Aalenian age, as previously demonstrated by the works of P.L. Maubeuge, contrary to the views expressed by workers from the 19th and first half of the 20th century.

Mots-clé: Ammonites, spécimens-type, Toarcien supérieur, Minette, minérai de fer.

Résumé

On introduit ici une étude taxonomique compréhensive sur les ammonites de la partie toarcienne des minerais de fer de la Minette. L'étude est basée sur 365 exemplaires d'ammonites des collections du Musée national d'histoire naturelle de Luxembourg, provenant pour la plupart de collections historiques du 19ième siècle, et incluant du matériel étudié e.a. par E.W. Benecke et P.L. Maubeuge. Neuf genres et 39 espèces sont décrites, avec une prédominance de Dumortieriinae. Une partie mineure de la faune comprend des Grammoceratinae, des Alocolytoceratinae, ansi que des Hammotoceratinae. Des descriptions détaillées et de nouvelles images sont mises à disposition pour le matériel type de *Dumortieria kochi* (Benecke, 1905), *Cotteswoldia angulata* (Maubeuge, 1950), *Walkericeras pseudolotharingicum* (Maubeuge, 1950), *W. pseudoarcuatum* (Maubeuge, 1950), *W. hinsbergi* (Benecke, 1905), *W. pseudograndjeani* (Maubeuge, 1950), *W. dudelangense* (Maubeuge, 1950), *Pleydellia falcifer* Maubeuge, 1950, *P. pseudoaalense* Maubeuge, 1950, *P. funcki* Maubeuge, 1950, *P. arkelli* Maubeuge, 1950, *P. buckmani* Maubeuge, 1947, *P. spathi* Maubeuge, 1947. L'espèce *Walkericeras lugdunensis*, utilisée comme marqueur de la sous-zone à Lugdunensis (zone à Aalensis), est considérée ici come synonyme subjectif junior de *Walkericeras pseudolotharingicum* Maubeuge, 1950, et par conséquent le nom de sous-zone à Pseudolotharingicum est proposé en remplacement de la sous-zone à Lugdunensis. La répartition stratigraphique du materiel étudié comprend les zones à Pseudoradiosa et à Aalensis du Toarcien supérieur, ceci confirme que la majeure partie des roches de la Minette sont d'âge toarcien et non aalénien, comme montré auparavant par P.L. Maubeuge, en opposition à la vue exprimée par les chercheurs du 19ième et de la première moitié du 20ième siècle.

Introduction

The Minette ironstone formation (ranging from late Toarcian to late Aalenian, ca. 176-170 Ma) crops out along a discontinuous belt in the southern part of the Grand-duchy of Luxembourg, continuing to Belgium westwards and southwards towards the surroundings of Nancy (Meurthe-et-Moselle, France) (Fig. 1a & Fig. 2b).

In southern Luxembourg, the so-called land of red rocks, the oolithic ironstones have been excavated from underground and opencast mines between ca. 1850 and 1981 (Fig.1b-c; Fig.2a). As a "side-product" of the mining activities, thousands of fossils and mostly ammonites have been collected by the miners and engineers. The ammonites of the Minette have been described in several palaeontological monographs, first by German geologists during the German occupation of Alsace-Lorraine between 1871-1918 (e.g. Branco 1879; Benecke 1905; Klüpfel 1918), and later, by French scholars (e.g. Joly & Laux 1922; Gérard & Bichelonne 1940; Maubeuge 1947, 1950).

Nonetheless, the biostratigraphic correlations have been subject to controversial debates for many decades (e.g. Lucius 1945; Maubeuge 1947, 1950, 1961, 1963) and were still considered unsati-sfying in more recent years (Thein 1975). A precise biostratigraphic correlation has been hampered by the absence or poor preservation of ammonites in the upper layers of the formation, and also by past erroneous taxonomic attributions; the best example being *Pleydellia buckmani*, established by Maubeuge (1947)

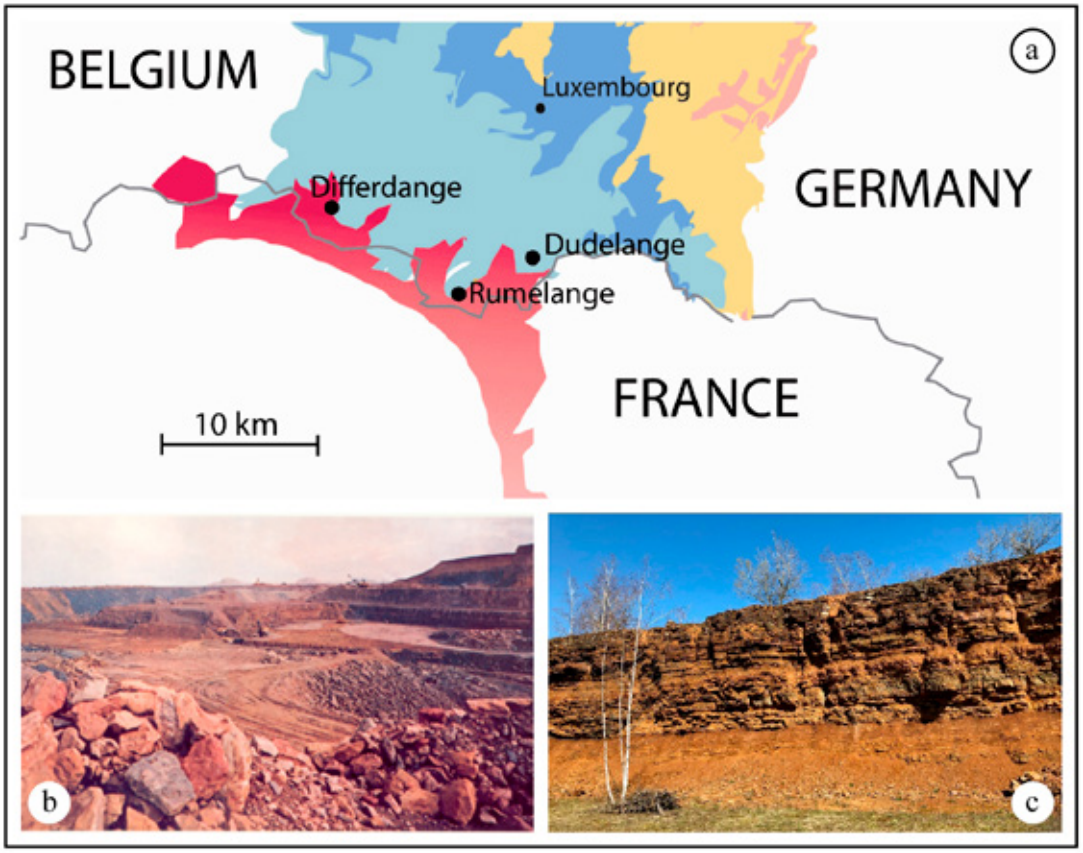


Fig. 1: a - Map showing the Minette outcrop area between France and Luxembourg; b - a typical image of a Minette open cast mine, Giele Botter, Differdange, during the 1970' (photo: MNHNL archive); c – Detail of the same former opencast mine, now part of the nature protection area "Prënzebierg-Giele Botter", image taken in March 2020 (Photo: R. Weis/MNHNL).

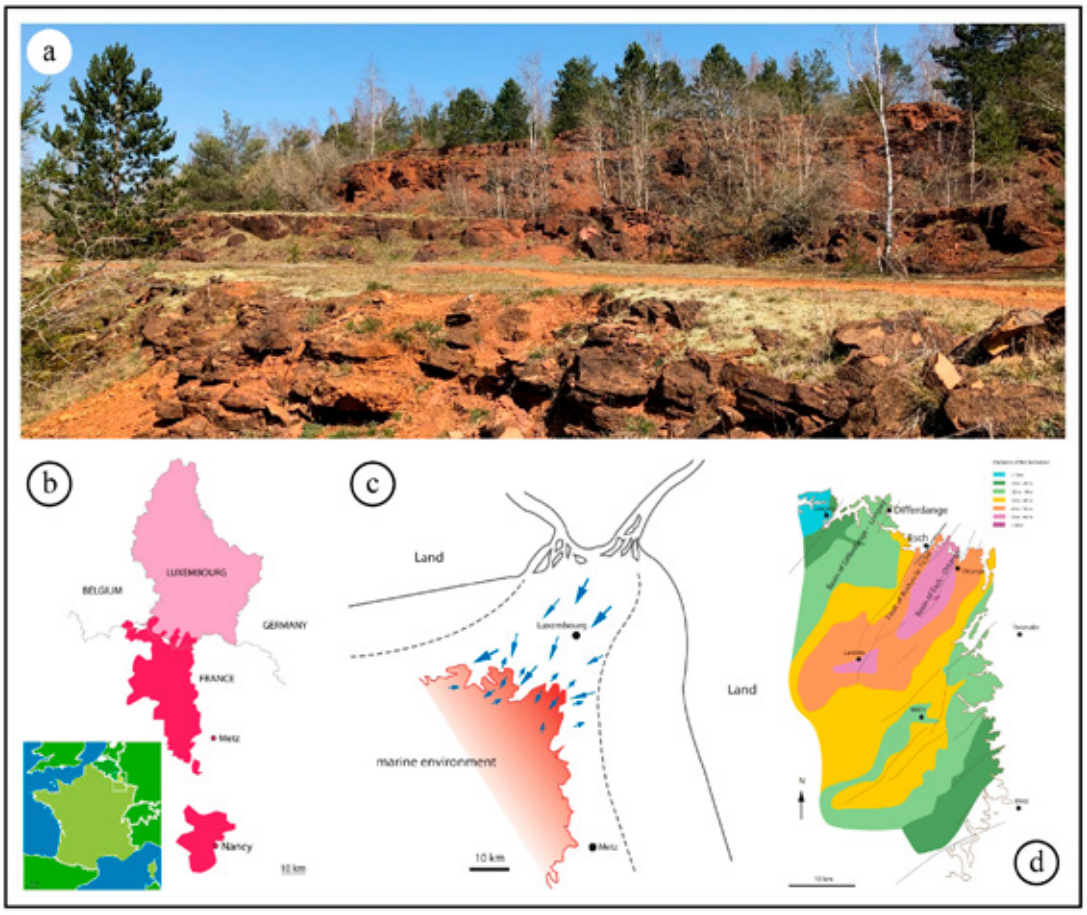


Fig. 2: a – Typical multi-scaled landscape of former open cast mine at Lalléngerbierg, Esch-sur-Alzette (March 2020, photo by R. Weis/MNHNL) ; b - Minette-like ironstone lithotype and its geographic distribution between France and Luxemburg; c - palaeogeographical situation of the Gulf of Luxembourg and surrounding landmasses (mod. after Teyssen 1984); d - a reconstruction of depocenter and thickness of the formation in the former Gulf of Luxembourg.

on originals figured by Benecke (1905) as "*Harpoceras*" *opalinum*" (=*Leioceras opalinum*). Maubeuge was the first to undertake a revision of the ammonite fauna, and his conclusions permitted to establish a biostratigraphic range of the Minette deposits in Luxembourg and northern France, as extending from the upper Toarcian Dispansum Zone to the upper Aalenian Concavum Zone, with an important stratigraphic gap in the lower Aalenian, the Opalinum Zone was not recorded (Maubeuge 1955, 1963).

The present study treats the palaeontological record from the Luxembourgish outcrops only, and is exclusively based on specimens from the collections of the National Museum for Natural History, Luxembourg. It allows for an update on the ammonite faunas of the Toarcian part of the Minette ironstones and contributes to a more detailed biostratigraphic framework of the formation. Updated information about ammonite faunas from the Aalenian part can be found in Guérin-Franiatte & Weis (2010) and Sadki et al. (in this volume).

Geological setting

The deposits of the Minette sediments took place in a near-shore environment on the north-eastern margin of the Paris Basin, in a marginal

NE-striking through ("Gulf of Luxembourg"), which was surrounded by the landmasses of nowadays Ardennes-Eifel-Hunsrück (Fig. 2c-d). The Minette sediments have been interpreted as a subtidal sandwave complexe, a strong tidal control being suggested by a bipolar cross-stratifications (Fig. 3c), bipolar orientation of belemnites and the presence of channel filling deposits (Thein 1975; Teyssen 1984; Siehl & Thein 1989). In this context, the fault of Audun-le-Tiche, active during sedimentation (Lucius 1945) led to the formation of two sub-basins with distinct sedimentological sequences: the Differdange-Longwy sub-basin in the western part; and the Esch/Alzette-Ottange sub-basin in the eastern part (Fig.4) The Minette deposits clearly show a cyclic sedimentation pattern, which led to the lithostratigraphic subdivisions still in use (Lucius 1945; Thein 1975; Fig. 5). Up to 13 sedimentary cycles were recognized in the Esch-sur-Alzette sub-basin, 9 cycles in the Differdange sub-basin, correspondingly (Thein 1975). A fully developped cycle starts with a muddy facies ("Intercalaire"), passesthrough a transitional facies and ironstone deposit ("Couche"), and ends with a coquina bed ("lumachella") (Fig. 3a-b) (Thein 1975; Teyssen 1984, fig. 3). The muddy facies corresponds to a lower-energy environment with a transgressive tendency, and some beds may yield numerous cephalopods (frequently belemnites and more rarely ammonites), but also bivalves in life position. The transitional and iron facies are almost devoid of fossils, and the coquina beds are commonly composed of both broken and complete shells of pectinid bivalves, with rare reworked cephalopods. The lower part of the Minette, which

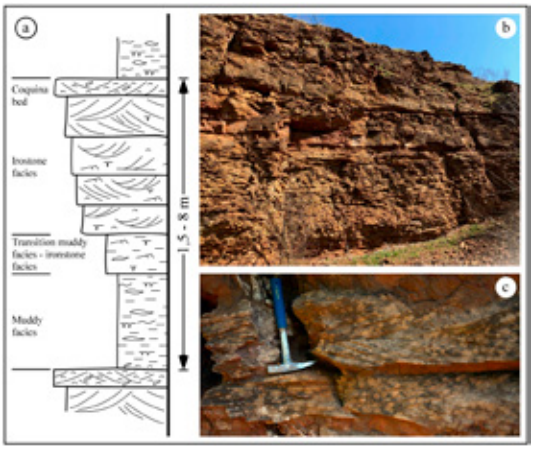


Fig. 3: a – Ideal sequence of a typical sedimentation cycle in the Minette; b – Several fully developed cycles ("Couches jaunes et rouges" cycles) at a former quarry front in Tétange-Hesselsbierg (photo: March 2020 by R. Weis /MNHNL); c - a particular of a cycle in Esch-Lallengerbierg, with well-developed cross stratification (Photo 2018 by R. Weis/MNHNL).

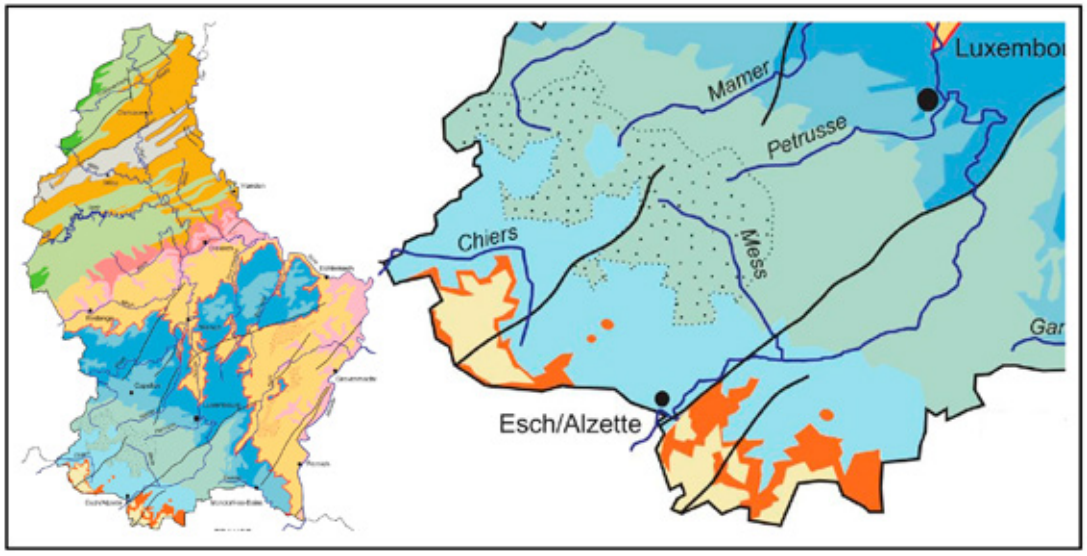


Fig. 4: Geological map of Luxembourg and the particular showing the two subbasins of Esch and Differdange. Copyright: Service géologique, Administration des Pont-et-Chaussées, Luxembourg.

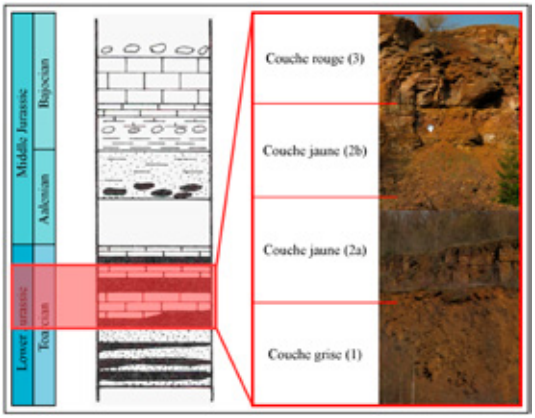


Fig. 5: - Lithostratigraphic subdivision of the Toarcian part of the Minette as exemplified for the area of Dudelange-Haardt (photos: R. Weis/MNHNL).

are late Toarcian in age, shows almost complete cycles, in which the basal muddy, ammonite-bearing facies is best developed. The upper part of the Minette shows a more calcareous matrix and irregular depositional cyclicity, with frequent coquina beds and reworked elements. The muddy facies is often missing, and ammonites are represented by reworked fragments only, very rarely in complete specimens. The cyclic iron ore deposits are overlaid at the top by a conglomerate of Aalenian age ("Conglomérats de Katzenberg et Titelberg": Lucius 1945; Guérin-Franiatte & Weis 2010). A transgressive sedimentation is subsequently represented by the "Couche rouge marno-sableuse", with abundant upper Aalenian cephalopod fauna (Murchisonae Zone, Murchisonae Subzone; Guérin-Franiatte & Weis 2010; Sadki et al. this volume). The lithological transition to the lower Bajocian beds is progressive and is not well recognized in most sections. A more precise biostratigraphic subdivision of the boundary beds has been achieved in the Rumelange-Hutberg section (Guérin-Franiatte & Weis 2010).

Biostratigraphy

The Toarcian part of the Minette rocks covers the highest two biozones of the Toarcian: Pseudoradiosa and Aalensis zones (Fig. 6). Haug (1892) instituted the Pseudoradiosa Zone, to subdivide the distribution of *Dumortieria*. The zonal index is *Dumortieria pseudoradiosa*, but the oligotypical presence of the genus *Dumortieria* characterises the full extent zone. The Pseudoradiosa Zone is commonly used in the North-Western European Domain (Cariou & Hantzpergue 1997 *cum bibl.*; Rulleau *et al.* 2001; Page 2003; Metodiev 2008;

Northwestern European Biostratigraphic Scale
(Cariou & Hantzpergue, 1997, Gradstein *et al.*, 2012, Di Cencio *et al.*, 2019, Di Cencio & Weis, this paper)

Boulila *et al.*, 2014	Gradstein *et al.*, 2012	BIOZONES	Subzones	Horizons
174,6	174,1	AALENSIS	Pseudolotharingicum	Buckmani
				Pseudolotharingicum
			Mactra	Mactra
				Tectiforme
		PSEUDORADIOSA	Pseudoradiosa	Pseudoradiosa
			Levesquei	Munieri
				Dumortieri

Fig. 6: - Biostratigraphy of the Pseudoradiosa and Aalensis Zones (uppermost Toarcian) in the north-western European domain.

Pinard *et al*. 2014; Weis *et al*. 2015, 2018) and corresponds to the Meneghinii Zone for the Mediterranean Domain (Venturi 1999; Page 2003; Di Cencio 2007). Recently, the dual scheme "North European vs Mediterranean" has been grouped into Tethys Biostratigraphic Scale, considered as Standard. It is correlated with the Boreal scheme (Di Cencio *et al*. 2019a cum bibl.).

The Pseudoradiosa Zone is subdivided into two subzones: Levesquei Subzone below and Pseudoradiosa Subzone above (Cariou & Hantzpergue 1997, Ureta *et al*., 1999). The Insignisimilis horizon, on the base, and the Munieri horizon above, subdivide the Levesquei subzone (Cariou & Hantzpergue 1997 *cum bibl*.; Page 2003). Metodiev (2008) proposed the Dumortieri horizon instead of the Insignisimilis horizon. The faunal association is characterized by several species of *Dumortieria*, except *Dumortieria moorei*, that populates the Tectiforme horizon in the base of the Aalensis Zone, and some species of *Catulloceras*, Hammatoce-ratids, *Hudlestonia*, *Osperlioceras* and Lytoceratids. *Holcophylloceras* appears for the first time during the Mediterranean equivalent of the Pseudoradiosa Zone (Di Cencio 2007).

The first occurrence of ammonites of the genus *Cotteswoldia* defines the lower boundary of the Aalensis Zone. It has been instituted by Reynès (1868) and it is the last Toarcian biozone. Its marker is *Cotteswoldia aalensis* (Zieten, 1832). Rulleau et al. (2001) subdivided the Aalensis Zone in two subzones (Mactra and Ludgunensis) and in five bio-horizons (Tectiforme, Mactra, Celtica, Ludgunensis and Buckmani respectively). Initially, the Tectiforme bio-horizon was considered belonging to the Pseudoradiosa Zone (Goy & Martinez 1990), but the presence of the oldest *Cotteswoldia* species (i.e. *Cotteswoldia paucicostata* and *Cotteswoldia egena*) calls for assigning this bio-horizon to the Aalensis Zone.

Fauré & Cubayne (1983) define four subzones: Mactra, Celtica, Aalensis and Buckmani. Cariou & Hantzpergue (1997) adopt this subdivision partially, but only at bio-horizon level. They situate the Mactra and Celtica bio-horizons inside the Mactra subzone. *Cotteswoldia mactra* displays good parameters to be a zonal marker, but, in this paper, *Cotteswoldia celtica* is considered synonymous of *Cotteswoldia subcompta*, which means that its status as a marker needs to be reconsidered. In addition, *Cotteswoldia subcompta* has a more extended stratigraphic distribution than the Celtica bio-horizon (Rulleau et al. 2001). Therefore, the Celtica bio-horizon will not be considered.

The Ludgunensis Subzone corresponds to the Torulosum Subzone in Germany, according to German palaeontologists (Knitter & Ohmert 1983; Ohmert 1996; Schulbert 2001; Arp 2010). Cariou & Hantzpergue (1997) defined this subzone on *Pleydellia* (*Walkericeras*) *lugdunensis* Elmi & Rulleau 1997 (in Cariou & Hantzpergue, 1997). In this study, *Pleydellia* (*Walkericeras*) *lugdunensis* is considered a junior subjective synonym of *Walkericeras pseudolotharingicum*, so the subzone is called herein the Pseudolotharingicum Subzone. A similar discussion must be led for the corresponding bio-horizon. The Buckmani bio-horizon starts with the first occurrence of *Pleydellia buckmani*. The presence of *Pleydellia* with several, thin and fasciculated ribs is common in this bio-horizon. By taking into account the occurrence of *Canavarina venustula*, Maubeuge (1950) and Elmi (1967) suggested the presence of a Venustula bio-horizon at the top of the Buckmani one. Even though the idea seems to be appealing, *Canavarina venustula* is only the last species with thin and fasciculated ribs and in case of poor preservation, it may be confused with older *Pleydellia*. *Canavarina venustula* is not a good marker. Rulleau et al. (2001, cum bibl.) show the distribution of *Cotteswoldia* across the lower Aalensis Zone until the Mactra-Pseudolotharingicum subzonal boundary. *Walkericeras* has a stratigraphic distribution along the upper Aalensis Zone (Pseudolotharingicum Subzone) and *Pleydellia* and *Canavarina* have a stratigraphic distribution across the upper part of Pseudolotharingicum Subzone (upper Pseudolotharingicum and Buckmani bio-horizons) (Rulleau et al. 2001).

The assemblage of the Aalensis Zone is characterized by the last *Dumortieria*, *Paradumortieria*, *Catulloceras*, *Vacekia*, *Nadorites*, *Crestaites*, *Cagliceras*, *Hammatoceras*, *Pseudammatoceras*, *Planammatoceras*, *Polyplectus*, *Lytoceras*, *Alocolytoceras*, *Pleurolytoceras*, *Phylloceras*, *Calliphylloceras*, *Holcophylloceras*, *Bredyia*.

The Aalensis Zone ends at the first appearance datum (FAD) of *Leioceras* in the north-western European Domain, with the beginning of the Aalenian (Middle Jurassic, Cariou & Hantzpergue, 1997). In the Mediterranean domain the base of the Aalenian is connected with the FAD of *Tmetoceras* species (Di Cencio 2007).

Systematic Palaeontology

All studied specimens are housed in the palaeontological collection of the Musée National d'Histoire Naturelle in Luxembourg (acronym MNHNL). Measurements of the specimen are given in Appendix 1. The description of suture line follows the indication of Venturi & Ferri (2001), using the initials of elements (lobes and saddle) as follows: E is used to indicate the "external lobe", and it is developped on externl side of shell, across the keel; usually it is enriched by an "accessory saddle" A; ES is the "external saddle", usually it is the biggest and it is developped between the external shoulder of ammonites and external part of flank; L is the "main lateral lobe" deepest and biggest between lobes, it is developped on flank; follows the "lateral saddles", named SL, they are vdeveloped on the flank of ammonites ans they are numbered by the first, close to L, untile the last at periumbilical wall; alternated to lateral saddles are the "umbilical lobes" named U and numbered by the first close to first lateral saddle.

Class Cephalopoda Cuvier, 1797

Order Ammonoidea Zittel, 1884

Suborder Lytoceratina Hyatt, 1899

Superfamily Lytoceratoidea Neumayr, 1875

Family Lytoceratidae Neumayr, 1875

Subfamily Alocolytoceratinae Spath, 1927

Genus *Pleurolytoceras* Hyatt, 1900

1905 *Pachylytoceras* Buckman, p. 144.

v. 1949 *Preperonoceras* Maubeuge, p. 136.

2010 "*Pachylytoceras*" Buckman, 1905; Hoffmann, 2010, p. 49.

Type species - *Ammonites hircinus* Schlotheim, 1820 (p. 72); originally designated by Hyatt (1900, p. 572).

Remarks - For diagnosis, description of morphological features and distribution of this genus, refer to Hoffmann (2010). While Hoffmann (2010) claims that *Pleurolytoceras* cannot be larger than 75 mm (p. 46), all the specimens from the collections of MNHNL studied herein have a size of over 130 mm. However, all specimens belong to the genus *Pleurolytoceras* because the inner whorls are similar to those studied by Hoffmann. Hoffmann (2010, p. 49) cites a very big "*Pachylytoceras*" named *Pleurolytoceras wrighti*, probably speaking about the species here discussed. *Pleurolytoceras* and *Pachylytoceras* have been considered possible dimorphs by Hoffmann (2010). In the present paper, we consider "*Pachylytoceras*" as synonymous of *Pleurolytoceras*.

***Pleurolytoceras wrighti* (Buckman, 1888)**
(Pls. 1, 2)

1879 *Lytoceras dilucidum* (Oppel); Branco, p. 63; pl. 1, fig. 8.

1884 *Lytoceras jurense* Wright, 415, pl. 75, figs. 4–7.

1885 *Ammonites lineatus* Quenstedt, 432, pl. 54, fig. 41.

* 1888 *Lytoceras Wrighti* n. sp. Buckman, p. 44.

1896 *Lytoceras* aff. *hircinum* Schloteim; Pompeckj, p. 156; pl. 11, figs. 5, 6.

v. 1905 *Lytoceras Wrighti* Buckman; Benecke, p. 301; pl. 28, fig. 1, pl. 29, fig. 1, pl. 30, figs. 1, 2.

1923 *Lytoceras wrighti* (Buckman); Ernst, p. 86; pl. 3-7; pl. 13, figs. 7.

1992 *Alocolytoceras wrighti* Buckman; Schlegelmilch, p. 34; pl. 4, fig. 8, pl. 53, fig. 1.

1995a *Pachylytoceras wrighti* Buckman; Rulleau, p. 376; pl. 1, fig. 6.

1997a *Pachylytoceras wrighti* (Buckman); Rulleau, p. 454, fig. 3, 4.

2000 *Pachylytoceras wrighti* Buckman; Rulleau, pl. 4, figs. 1, 2.

2001 *Pachylytoceras wrighti* Buckman; Rulleau *et al*., pl. 4, figs. 1, 2.

2001 *Pachylytoceras wrighti* (Buckman, 1905); Schulbert, p. 46; pl. 4, figs. 2-6.

2006 *Pachylytoceras wrighti* Buckman; Rulleau, p. 60 figs. 12/3, 14/1; pl. 10, figs. 4, 5.

2010 *Alocolytoceras wrighti* (Buckman, 1888); Arp, p. 34; pl. 1, figs. 8-11.

Material - A set of 18 well-preserved specimens (MNHNL DOT320, DOU230, 232, 258, 265, 274, 280, 363, 368, 389, 390, 647, 680, 710, 827, 945, TO118, 159) has been studied.

Diagnosis - Moderately involute shell. Sub-ovale section, rounded flanks. Narrow and smooth external area. Deep and narrow umbilical area. High umbilical walls. Most of the shell appears

Pl. 1: a - *Pleurolytoceras wrighti* (Buckman, 1888), DOT320. Natural History Museum of Luxembourg. Scale-bar 1 cm.

smooth and an alternation of four ribs and one constriction is visible on the inner whorls. One whorl long body chamber. Sutural line typical of lytoceratids with phylloid termination on saddles.

Description - Moderately involute, plane-spiraled shell with whorls that overlap each other by more than a half of the whorl height. The growth of the coil is very fast. The section is sub-oval with slightly rounded flanks. The external area is narrow and smooth. The umbilical area is narrow and deep, very high and rounded, bounded by periumbilical walls. The shell is smooth. The ornamentation, characterized by sinuous proverse ribs and constrictions at each three to four ribs, is visible only on the juvenile stage and on the inner whorls. The body chamber measures at least one whorl. The suture line has typical elements for lytoce-ratids. The E is narrow and very indented, enriched by a narrow accessory saddle A. The ES is

Pl. 2: a - *Pleurolytoceras wrighti* (Buckman, 1888), DOU258. Natural History Museum of Luxembourg. Scale-bar 1 cm.

long, slightly narrow, very indented on each side and subdivided by a well developed accessory lobe. The L is well developed, indented and deeply trifid. These terminations are separate by well developed accessory saddles. The SL_1 is longer than ES, well developed, indented and shows projected elements around the central accessory lobe on the top. The U_2 is well developed, slightly centrifugal, and enriched in accessory saddle. Umbilical elements are indented and slightly proverse.

Remarks - The presence of constrictions, every four to five ribs, on the inner whorls, led some authors to attribute this species to *Alocolytoceras* (Buckman 1905; Schlegelmilch 1992; Arp 2010). But *Pleurolytoceras wrighti* differs from all species of *Alocolytoceras* by the shape of the whorl section, the lack of constrictions and the ornamentation in the inner whorls. Rulleau (1995a, 1997b, 2000, 2006, 2007), Rulleau et al. (2001) and Schulbert (2001) consider the species *wrighti* belonging to *Pachylytoceras*. However, *Pleurolytoceras wrighti* differs from *Pachylytoceras* by the lack of a bulged portion of shell between every constriction, the roundness of the section and the lack of ornamentation in the more adult section. *Pleurolytoceras wrighti* is different from other species of *Pleurolytoceras*, for the flatness of flanks and the missing ornamentation of the shell. Hoffmann (2010) stated that *Pleurolytoceras* has a maximum size around 75 mm, but in the collection of the Natural History Museum of Luxembourg, the size of the specimens is never less than 130 mm. It is possible that the surprisingly large sizes of *Pleurolytoceras wrighti* found in the upper Toarcian sediments of Luxembourg, is a local phenomenon.

Geographic and Stratigraphic distribution - *Pleurolytoceras wrighti* has been found in the sub-basin of Esch-sur-Alzette in the Couche grise and Couche brune cycles and is also present in the sub-basin of Differdange (upper Toarcian, Pseudoradiosa to Aalensis zones).

Suborder Ammonitina Hyatt, 1867

Superfamily Hildoceratoidea Hyatt, 1867

Family Hildoceratidae Hyatt, 1867

Subfamily Grammoceratinae Buckman, 1905

Genus *Hudlestonia* Buckman 1899

Type species - *Hudlestonia affinis* (von Seebach, 1864), by original designation (Buckman 1899).

Diagnosis – Involute, plane-spiraled shell. Oxycone section. Flat, convergent flanks. Keeled and sharp external area. Deep and narrow umbilical area. Round to tilted flat periumbilical walls. Sinuous ribs on inner whorls, smooth shell on mature stages. Several rough elements on sutural line.

Remarks - The affiliation of *Hudlestonia* to the subfamily Grammoceratinae is justified by the simple, but rude sutural line.

Geographic and Stratigraphic Distribution - *Hudlestonia* occurres from the Pseudoradiosa to the Aalensis Zones, uppermost Toarcian.

Hudlestonia affinis (von Seebach, 1864)

(Pl. 3)

* 1864 *Ammonites affinis* von Seebach, p. 143; pl. 8, fig. 4.

1938 *Hudlestonia affinis* Seeb.; Roman, p. 108; pl. 9, fig. 87.

v. 1961 *Hudlestonia affinis* (Seebach); Maubeuge, pl. 7.

1992 *Hudlestonia affinis* (von Seebach); Schlegelmilch, p. 101; pl. 47, fig. 3.

2001 *Hudlestonia affinis* (v. Seebach, 1864); Schulbert, p. 59; pl. 5, fig. 4.

Material - 4 well preserved specimens (MNHNL DOU651, 652, 961, TO125) have been studied.

Diagnosis – Involute, plane-spiraled shell. Lance-shaped shell. Sharp and keeled external area. Narrow and deep umbilical area. Sinuous ribs on inner whorls, smooth shell on mature stages. Several rough elements on sutural line.

Description - Moderately involute, plane-spiraled shell with whorls, which overlap by more than a half of the whorl height. The section is lance-shaped. The maximum whorl width corresponds to the top of the periumbilical wall. The flanks are flat and converge towards the sharp external area. The external area has a well-defined keel. The umbilical area is narrow, deep and bounded by high and rounded periumbilical walls. The ornamentation is visible on inner whorls. It is characterized by thin, sinuous and proverse ribs. External whorls are completely smooth. The sutural line is rough and characterized by several simple elements. The E is narrow, sub-rectangular and enriched by an accessory saddle A. The ES is wide, coarsely ornate and enriched by a large, deep and rounded accessory lobe. The L is rounded and slightly ornate. The SL_1 is globular and rounded and it has an accessory lobe. The U_2 is similar to L. The umbilical elements are all slightly ornate and rough.

Remarks - *Hudlestonia affinis* is the most inflated species of the group studied herein. It differs from *Hudlestonia serrodens* by the larger section and the simpler sutural line. *Hudlestonia affinis* differs from *Hudlestonia compressum* by its smoother periumbilical wall, its wider section and a simpler sutural line.

Pl. 3: a - *Hudlestonia affinis* (von Seebach, 1864), DOU651. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Geographic and Stratigraphic Distribution – *Hudlestonia affinis* has been found in the Couche grise cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone).

Hudlestonia compressum (Benecke, 1905)

(Pl. 4)

v. 1879 *Ammonites frederici* Branco, p. 58, pl. 3, fig. 1.

*v. 1905 *Oxynoticeras compressum* n. sp., Benecke, p. 324, pl. 34, fig. 1, 8; 38, fig. 1.

Material - A set of 8 specimens (MNHNL DOU275, 393, 764, 768, LO193, TO221, 243, 245) has been studied.

Diagnosis – Involute, plane-spiraled shell. Lance-shaped section. Sharp and keeled external area. Narrow and deep umbilical area. Ribs on inner whorls, mature stages smooth. Several elements on rough sutural line.

Pl. 4: a - *Hudlestonia compressum* (Benecke, 1905), TO221. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Description - Involute, plane spiral-shell with external whorls covering two-thirds of the inner whorls. The section is lance-shaped, with slightly rounded, converging flanks. The external area is sharp, with akeel. The umbilical area is narrow and deep and is bounded by sloping and flat periumbilical walls. The ornamentation consists of thin, sinuous and proverse ribs on the inner whorls. Intercalary ribs are recognizable. Overall, the shell appears to be smooth. The sutural line is rough and characterized by several simple elements. The E is narrow, sub-rectangular and enriched by an accessory saddle A. The ES is wide, rudely ornate and enriched by one or two accessory lobes. The L is rounded and slightly ornate. The SL_1 is globular, rounded and shows an accessory lobe. The U_2 is similar to L. The umbilical elements are all slightly ornate and rough.

Remarks - The most representative character of *Hudlestonia compressum* is the periumbilical wall, which is sloping and flat. This feature separates

Hudlestonia compressum from the phyletically closely related *Hudlestonia affinis*, that shows more higher and sharper periumbilical walls. *Hudlestonia compressum* is different from *Hudlestonia serrodens* for the same reason. In this paper, one of the species considered synonymous of *Hudlestonia compressum* is *Hudlestonia frederici* (Branco, 1879). It was considered synonimous of *Hudlestonia serrodens* by Benecke (1905) but he observed that the species of Branco was different by its periumbilical wall. The suture line of *Hudlestonia frederici* has two accessory lobes on the external saddle ES, as Benecke (1905) himself oberved and therefore considered as typical for *Hudlestonia compressum*. However, this feature has no influence on the classification of *Hudlestonia compressum* as considered herein.

Geographic and Stratigraphic Distribution - *Hudlestonia compressum* has been found in the Couche noire and Couche rouge cycles of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone).

Hudlestonia serrodens (Quenstedt, 1846) (Pl. 5)

* 1846 *Ammonites serrodens* Quenstedt, p. 120; pl. 8, fig. 14.

1858 *Ammonites serrodens* Quenstedt, p. 281; pl. 40, fig. 14.

1874 *Ammonites serrodens* Quenstedt; Dumortier, p. 277; pl. 58, figs. 2, 3.

1885 *Ammonites serrodens* Quenstedt, p. 389; pl. 48, fig. 15-17,

1890 *Hudlestonia serrodens* (Quenstedt); Buckman, p. 229; pl. 38, fig. 9-12.

v. 1905 *Oxynoticeras serrodens* (Quenstedt); Benecke, p. 319; pl. 35, figs. 4-6.

1938 *Hudlestonia serrodens* Buckm.; Roman, p. 108; pl. 9, fig. 88.

1959 *Hudlestonia serrodens* (Quenstedt); Brockert, p. 45; pl. 2, figs. 4, 5.

1992 *Hudlestonia serrodens* (Quenstedt); Schlegelmilch, p. 100; pl. 47, fig. 1, 2.

2001 *Hudlestonia serrodens* (Quenstedt, 1846); Schulbert, p. 57; pl. 5, figs. 5-9; pl. 26, fig. 3.

2006 *Hudlestonia serrodens* (Quenstedt); Rulleau, p. 89, fig.22/13; pl. 46, fig. 3; pl. 47, fig. 1.

Material - A set of 14 specimens (MNHNL DOU133, 134, 237, 261, 289, 513, 645, 669, 670, 739, HO127, KA108, TO114, 156) has been studied.

Diagnosis - Involute, plane-spiral, oxycone shell. Slightly converging flanks. Keeled and sharp external area. Narrow and deep umbilical area. Rounded periumbilical walls. Light, sinuous, proverse ribs on inner whorls. Smooth shell on mature stages. Rough suture line with multiple elements.

Description - Involute, plane-spiraled shell with external whorls that cover slightly less than two-thirds of the inner ones. The section is oxycone, with slightly rounded to flat flanks converging towards the external area. The larger whorl width is close to the peri-umbilical margin. The umbilical wall is rounded. The umbilical area is narrow and quite deep, bounded by rounded umbilical walls. The external area is sharp, with a keel. The ornamentation is characterized by thin, sinuous and proverse ribs on inner whorls, while it is completely faded on outer whorls. Overall, the shell appears to be smooth. The sutural line is rough and characterized by several simple elements. The E is narrow, sub-rectangular in shape and enriched by an accessory saddle A. The ES is wide, rudely ornate and enriched by two accessory lobes: a small one on the external side of the saddle and a large, deep and rounded one. The L is rounded and slightly ornate. The SL_1 is globular, rounded and it shows an accessory lobe. The U_2 is similar to L. The umbilical elements are all slightly ornate and rough.

Remarks - *Hudlestonia serrodens* differs from *Hudlestonia affinis* in being more compressed and having two accessory lobes on the external saddle ES of the suture line. *Hudlestonia serrodens* differs from *Hudlestonia compressum* in the lack of an abrupt periumbilical margin and in the shape of the two accessory lobes on the external saddle ES of the suture line.

Geographic and Stratigraphic Distribution - *Hudlestonia serrondens* occurrs in the Couche noire and Couche grise cycles of the sub-basin of Esch-sur-Alzette (upper Toarcian, Pseudoradiosa and Aalensis zones) and in the Couche noire and Couche grise cycles (upper Toarcian, Pseudoradiosa zone) of the Differdange sub-basin.

Pl. 5: a - *Hudlestonia serrodens (*Quenstedt, 1846), DOU237. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Superfamily Hildoceratoidea Hyatt, 1864

Family Graphoceratidae Buckman, 1905

The evolution of Graphoceratidae starts with the first occurrence of *Dumortieria* (Mouterde & Elmi, 1991). The family Graphoceratidae was established by Buckman (1905) on the type genus *Graphoceras* Buckman, 1898. Graphoceratidae is usually subdivided in two exclusively Aalenian sub-families; Leioceratinae Spath, 1936; Graphoceratinae Buckman, 1905 (Howarth 2013), but the similarities and the relations between the species of Dumortieriinae, Leioceratinae and Graphoceratinae justifies their attribution to one family: Graphoceratidae.

The family regroups evolute to moderately involute ammonites with generally compressed whorls and ornamentation characterized by single, more or less sinuous and fasciculated ribs

(Dumortieriinae, Toarcian), falcoids and more or less joined ribs (Leioceratinae and Graphoceratinae, Aalenian). The Aalenian Dumortieriinae embrace only the genus *Tmetoceras*.

Schindewolf (1963) considered Graphoceratidae a family of Hammatoceratoidea, for the position of umbilical lobe U_2, but considering all the common features (e.g. the simple suture line, the more or less compressed section and keel), a more adequate position of this family is inside Hildoceratoidea (see Goy & Ureta, 1986; Neige & Rouget, 2002).

Subfamily Dumortieriinae Haug, 1855

v 1950 Dumortieriae Maubeuge, p. 391.

Remarks – The genera *Dumortieria* Haug, 1855, *Catulloceras* Gemmellaro, 1886, *Tmetoceras* Buckman, 1892, *Paradumortieria* Elmi & Caloo-Fortier, 1985, *Cotteswoldia* Buckman, 1902, *Pleydellia* Buckman, 1899, *Walkericeras* Buckman, 1913, and *Canavarina* Buckman, 1904 belong to this subfamily (Di Cencio 2007, cum bibl.). For a long time, most authors considered them members of Dumortieriae, as defined by Maubeuge (1950, p. 391). In fact, Maubeuge established Dumortieriae to group those genera that were previously included in Dumortieriinae by Haug (1885). Therefore, Haug's work has priority. Maubeuge (1950) kept the genus *Pleydellia*, together with what he considered its sub-genera, *Canavarina*, *Walkericeras*, and *Cotteswoldia* amongst Grammoceratinae. The attribution of the entire group of *Dumortieria-Catulloceras-Pleydellia s.l.* to only one subfamily is actually a subject of scientific discussion.

Some authors separate *Pleydellia s.l.* from *Dumortieria* and *Catulloceras* considering *Pleydellia s.l.* as belonging to Grammoceratinae (Buckman 1905; Gérard & Bichelonne 1940; Maubeuge 1950; Venturi 1982; Ohmert 1993; Sandoval et al. 2001; Venturi & Ferri 2001) and the other two belonging to Dumortieriinae (Sandoval et al. 2001) or together with *Tmetoceras* in Tmetoceratinae (Venturi & Ferri 2001; Venturi & Bilotta 2008; Venturi et al. 2010). Schindelwolf (1963) included the genera of Dumortierinae (*sensu* Maubeuge, 1950) with the only exception of *Tmetoceras*, which was assigned to Tmetoceratinae. Other authors keep the entire group together within Grammoceratinae (Arkell et al. 1957; Jakobs 1992; Jakobs & Smith 1996; Bernad & Martinez 1996; Schulbert 2001; Seyed-Emami et al. 2004, 2005). There are also authors who instead keep the entire group together within Dumortieriinae (Schlegelmilch 1976, 1992; Gabilly 1976; Elmi & Caloo-Fortier 1985; Rulleau 1995, 1996; Rulleau et al. 2001; Neige & Rouget 2002; Pallini et al. 2003-2004; Myczynski 2004; Seyed-Emami et al. 2006a, 2008; Di Cencio 2007; Kovacs & Geczy 2008; Di Cencio & Doria 2017). Following the views from the last group of authors and also due to the possible phyletic link between *Dumortieria* and *Pleydellia s.l.*, as well as the similarity between *Dumortieria-Pleydellia s.l.-Leioceras*, which is more significant than with other genus of Grammoce-ratinae (Neige & Rouget 2002), the group *Dumortieria-Catulloceras-Paradumortieria-Pleydellia s.l.* is herein included into Dumortieriinae. Kovacs (2010) included Dumortieriinae, with the entire group of the previously mentioned genera, with exception of *Tmetoceras*, inside the family Tmetoceratidae (Spath, 1936). *Tmetoceras* is considered belonging to the subfamily Tmetoceratinae (Spath, 1936), inside the family Tmetoceratidae. This proposal is very interesting but separates into two families groups of ammonites (*Pleydellia*, *Canavarina* and *Leioceras)* that belong to a same phyletic lineage.

Generally, the suture line of Dumortieriinae is considered hammatoceratine-like. The presence of deep, narrow and indented elements, with centrifugal umbilical elements has always identified *Dumortieria* as a member of Hammatoceratoidea (Schindewolf 1963; Schlegelmilch 1976, 1992; Rulleau et al. 2001; Pallini et al. 2003-2004; Di Cencio 2007; Kovacs & Geczy 2008; Venturi & Bilotta 2008; Venturi et al. 2010). However, *Dumortieria*, the ancestor genus of Dumortieriinae, despite having the most indented suture line amongst the subfamily, has a more simple suture than hammatoceratine genera. Considering this fact, together with the similarities between the suture line of Dumortieriinae, Graphoceratinae and Leioceratinae, we include the subfamily within Graphoceratidae (Hildoceratoidea), as has been done by several authors (Levi Setti 1969; Rulleau 1996; Neige & Rouget 2002; Myczynski 2004; Seyed-Emami et al. 2006a, 2008; Di Cencio & Doria 2017).

Geographic and Stratigrafic distribution - Dumortieriinae is a cosmopolitan subfamily, widely distributed in the upper Toarcian (Pseudoradiosa and Aalensis zones) and lower Aalenian (Opalinum Zone).

Genus *Dumortieria* Haug, 1885

pars *Catulloceras* Gemmellaro 1886.
Dactylogammites Buckman 1925.
Phenakoceras Maubeuge 1949.
Phenakocerites Maubeuge 1950.

Type species - *Ammonites levesquei* d'Orbigny, 1844.

Diagnosis - Evolute, plane-spiraled shell. Compressed to sub-rounded section. Keeled external area. Wide and flat to slightly narrow umbilicus. Ornamentation characterized by single, slightly sinuous to "C"-shaped ribs. Constrictions may be present. Suture line characterized by indented elements with centrifugal umbilical ones.

Remarks - *Dumortieria* is a well known genus with worldwide distribution. It is very similar to both *Tmetoceras* and *Pleydellia* s.l. (Rulleau et al. 2001). Some species of *Dumortieria* (e.g. *Dumortieria moorei*) have an ornamentation similar to some stratigraphically older *Cotteswoldia* (e.g. *Cotteswoldia subcompta*). The adequate way to distinguish them is by studying the suture line. *Dumortieria* differs from *Cotteswoldia*, *Pleydellia*, *Walkericeras* and *Canavarina* in ornamentation and by the shape of the centrifugal periumbilical elements of the suture line.*Dumortieria* differs from *Paradumortieria* in having flat sides and sinuous ribs.

Geographic and stratigraphic distribution - *Dumortieria* is a cosmopolitan genus diagnostic for rocks of the Pseudoradiosa Zone and basal Aalensis Zone, upper Toarcian.

Dumortieria kochi Benecke 1905 (Pl. 6, fig. a)

1887 *Dumortieria subundulata* (Branco); Haug, var. *striatulo-costata*; Haug, p. 135; pl. V, fig. 4.

*v. 1905 *Dumortieria Kochi* n. n. Benecke, p. 358; pl. XLI, figs. 1, 1a; pl. XLII, fig. 5.

1927 *Dumortieria Kochi* Benecke; Schneider, p. 26.

v. 1940 *Dumortieria Kochi* Benecke; Gerard & Bichelonne, p. 30; pl. 3, fig 1.

1976 *Dumortieria kochi* Benecke; Schlegelmilch, p. 94; pl. 51, fig. 4.

1981 *Dumortieria kochi* Benecke; Hellmann, p. 113; pl. 1, fig. 4.

1992 *Dumortieria kochi* Benecke; Schlegelmilch, p. 107; pl. 51, fig. 4.

1995b *Dumortieria* aff. *kochi* Benecke; Rulleau, pl. 7, fig. 1, 2.

1995b *Dumortieria kochi* Benecke; Rulleau, pl. 7, fig. 5, 6.

2001 *Dumortieria kochi* Benecke, 1905; Schulbert, p. 69; pl. 7, figs. 4, 5, 7.

2006 *Dumortieria kochi* Benecke; Rulleau, p. 90; pl. 50, fig. 2.

2007 *Dumortieria kochi* Benecke; Rulleau, p. 90; pl. 50, fig. 2.

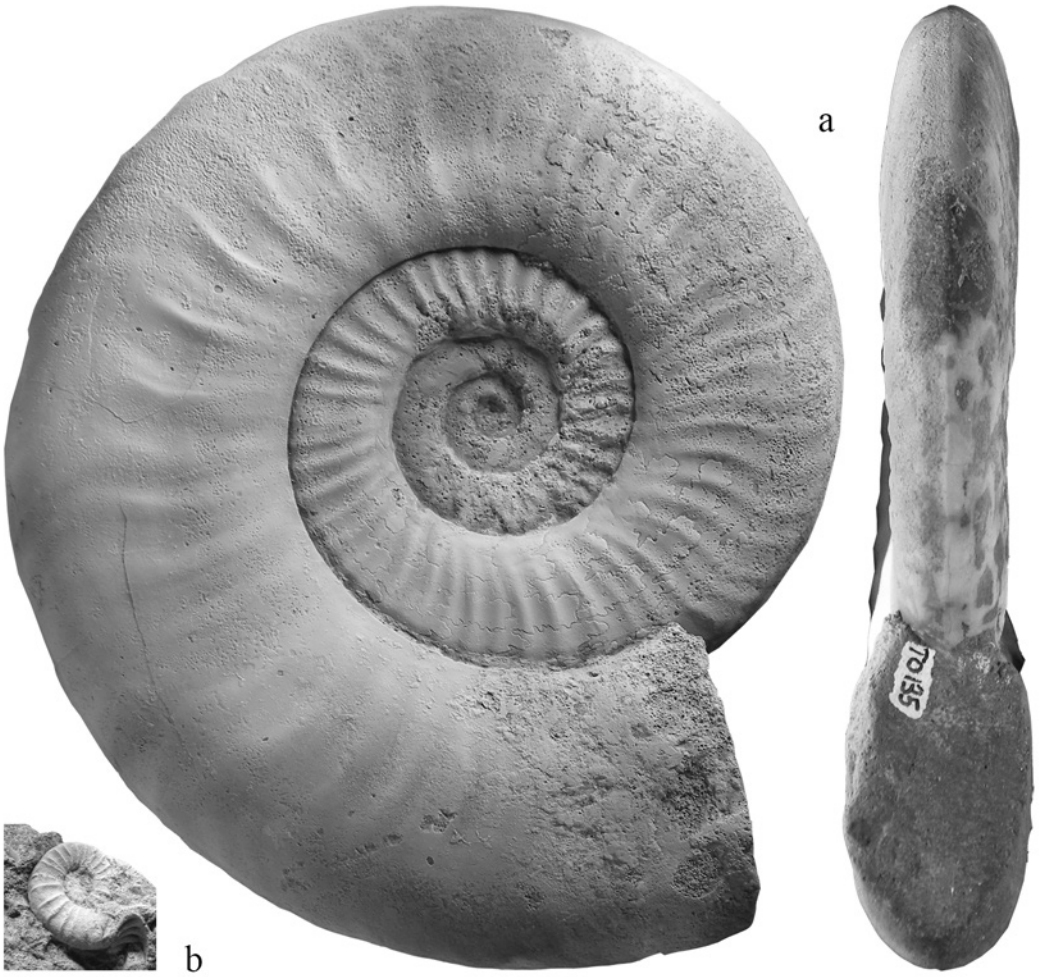
Holotype - *Dumortieria kochi* n.n. was established by Benecke (1905, p. 358, pl. XLI, figs. 1, 1a; pl. XLII, fig. 5). The holotype, coded TO135 (Pl. 6, fig, a), belongs to the palaeontological collection of the MNHN of Luxembourg.

Material - A set of 9 well-preserved specimens (MNHNL DOU317, 387, 401, 528, HO110, 135, 141, , TO134, 135) has been studied.

Diagnosis – Evolute ammonites, section sub-rectangular, with sub-rounded umbilical walls. Flat and wide umbilical area. Keeled external area with sub-triangular shape. Strong, spaced, retroverse ribs. Umbilical elements of the suture line show centrifugal tendencies.

Description - Evolve shell with whorls that overlap one third. Sub-rectangular section with slightly rounded flanks, passing from a rounded periumbilical wall into a rounded latero-ventral margin. Umbilical area is wide, flat and rounded periumbilical walls bound it. The external area is sub-triangular with a rounded keel. The body chamber is long almost two thirds of the last whorl. The ornamentation is characterized by strong, distant, slightly sinuous, slightly retroverse ribs. The suture line is simple. The E is sub-rectangular in shape, relatively deep and enriched by a triangular saddle A. The external saddle ES is sub-rectangular and indented. The lateral lobe L is large, sub-rectangular in shape, and deeply trifid. The lateral saddle SL_1 is rounded and sub-rectangular in shape. The umbilical lobes U_2 and U_3 are indented, deep and triangular in shape, with centrifugal tendencies.

Remarks - *Dumortieria kochi* differs from the closest morph of *Cotteswoldia grandjeani* by having wider section and external area with a sub-trian-



Pl. 6: a - *Dumortieria kochi* Benecke, 1905, TO135 holotype; b - *Dumortieria sparsicosta* Haug, 1887, TO249. Natural History Museum of Luxembourg. Scale 1:1.

gular shape, as well as by the centrifugal tendency of the umbilical elements of the suture line.

Geographic and stratigraphic distribution - *Dumortieria kochi* is found in the Couche brune cycle of the sub-basin of Esch-sur-Alzette and the Couche rouge cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone)

Dumortieria sparsicosta Haug, 1887 (Pl. 6, fig. b)

1885 *Harpoceras (Dumortieria) costula* Haug (non Reinecke), p.664.

1885 *Ammonites falcofila sparsicosta* Quenstedt, p. 430, pl. 54, fig. 29.

* 1887 *Dumortieria sparsicosta* Haug, p. 131, fig. 6b; pl. 5, fig. 3.

1891 *Dumortieria prisca* Buckman, p. 236; pl. 37, figs. 9-11.

1892 *Dumortieria sparsicosta* Haug; Buckman, S. 239; Taf. 45, Fig. 17-20.

1905 *Dumotieria prisca* Buckman; Buckman, p. 236; pl. 37, figs. 9-11.

1924 *Dumortieria sparsicosta* Haug; Ernst, S. 61, Taf. 10, Fig. 7,9 (non 8); Taf. 14, Fig. 15.

1927 *Dumortieria sparsicosta* Haug; Schneider, p. 22, pl. 1, fig. 1.

1995 *Dumortieria prisca* Buckman morph. *sparsicosta* Haug; Rulleau, pl. 3, figs. 10, 11.

1995 *Dumortieria prisca* Buckman; Rulleau, pl. 2, figs. 5, 6.

2001 *Dumortieria sparsicosta* Haug; Schulbert, p. 71; pl. 7, fig. 8.

2001 *Dumortieria prisca* Buckman; Schulbert, p. 79; pl. 6 fig. 7.

2006 *Dumortieria prisca* Buckman; Rulleau, p. 90; pl. 49, fig. 5.

2006 *Dumortieria prisca* Buckman morph. *sparsicosta* Haug; Rulleau, p. 90; pl. 50, fig. 5.

Material - Two specimen (MNHNL DOT445, TO249) have been studied.

Diagnosis - Evolve, plane-spiraled shell. Section is sub-circular. Wide and relatively deep umbilical area bounded by rounded periumbilical walls. Flat and wide external area, with a small keel. Radial, sometimes C-shaped, single ribs. Irregular alternation of sharp and attenuate ribs. Irregular spaced peristomatic constriction.

Description - Evolved, plane-spiraled shell with external whorls that cover less than a half of the inner whorls. The section is sub-circular with slightly rounded flanks. The umbilical area is relatively wide. It is bounded by rounded periumbilical walls. The external area is flat and wide. It has a little median keel. The ornamentation is characterized by radial, sometimes "C"-shaped, single ribs. An irregular alternation of sharp and attenuate ribs and an irregular presence of constriction are observable on the body chamber. The suture line is characterized by E which is ornate with an accessory saddle A. The ES is globular and wide. L is narrow and indented on bottom with three long termination. The SL_1 is narrow, more long than ES. The umbilical elements are centrifugal.

Remarks - Even though several authors consider *D. sparsicosta* and *D. prisca* distinct species, the strong similarities between the studied specimens and those discussed by other authors indicate that both species are synonymous. This consideration is supported by Rulleau (2006) who establishes the combination "*Dumortieria prisca* morphotype *sparsicosta*", opening on a possible phyletic connection between the two types. According to the rule of priority, the correct name for the species is *Dumortieria sparsicosta*, and *Dumortiera prisca* is therefore a junior subjective synonym. The main feature, which identify *Dumortieria sparsicosta*, is the ornamentation characterized by thin and spaced ribs. This feature is shared with *Dumortieria irregularis* Stolley in Ernst 1924, which differs in having a narrower umbilical area.

Geographic and Stratigraphic Distribution - *Dumortieria sparsicosta* has been found in the Couche noire cycle of the sub-basin of Differdange, in layers dated as Pseudoradiosa Zone.

Dumortieria suevica Haug, 1887 (Pl. 7)

1885 *Ammonites striatulo-costatus* Quenstedt, p. 414; pl. 52, fig, 10.

* 1887 *Dumortieria suevica* Haug, p. 139.

v. 1905 *Dumortieria suevica* Haug; Benecke, p. 348; pl. 40, fig. 2; pl. 44, fig. 1.

v. 1940 *Dumortieria suevica* Haug; Gerard & Bichelonne, p. 29; pl. 3, fig. 1.

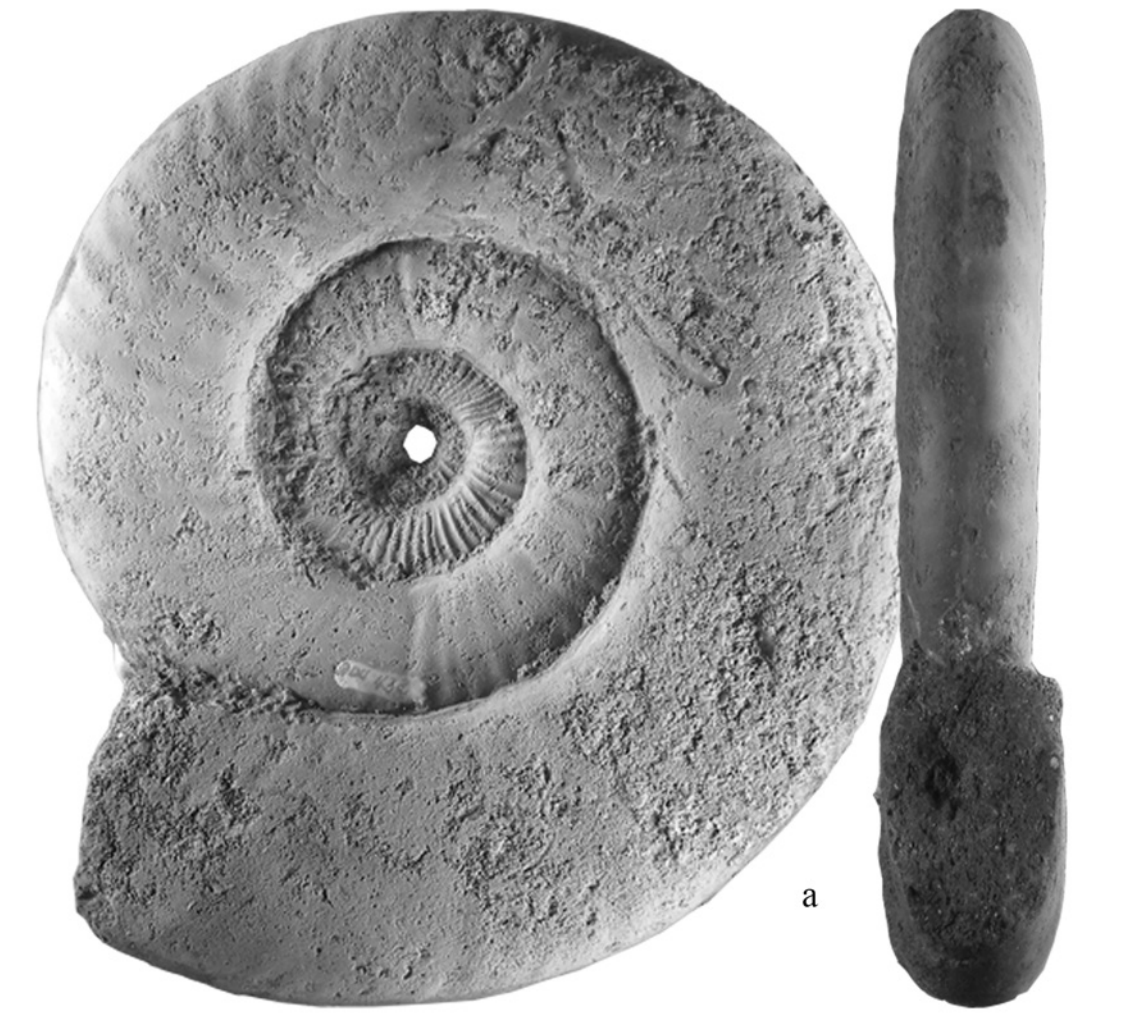
v. 1961a *Dumortieria suevica* Haug; Maubeuge, p. 102, fig. 2.

v. 1961b *Dumortieria suevica* Haug; Maubeuge, pl. 1, fig. 2.

Material - a set of 6 well-preserved specimens (MNHNL DOU343, DOU432, TO136, 253, 255, 257) have been studied. The specimen coded DOU343 was previously figured by Benecke (1905).

Diagnosis – Evolve with sub-trapezoidal whorl section. Umbilical area wide, flat and bounded by rounded periumbilical wall. Keeled external area with a sub-triangular shape. Several single, proverse and slightly sinuous to C-shaped ribs. Periumbilical elements of the suture line are centrifugal.

Description - Evolute shell, with whorls that overlap with the outer third.The section is sub-trapezoidal with maximum whorl-width close to periumbilical boundary. The flanks are flat and converge towards a triangular external area. The umbilical area is wide and flat and it is bound by a rounded periumbilical wall. The ornamentation consists of several single, proverse, slightly sinuous, more often "C"-shaped ribs, which are thicker on the latero-ventral margin. The body chamber corresponds to three-quarters of the



Pl. 7: a - *Dumortieria suevica* Haug, 1887, DOU432. Natural History Museum of Luxembourg. Scale 1:1.

last whorl. The suture line is not well preserved, but some elements are recognizable. The ES and SL_1 are rough and both are ornate with accessory lobes. The L is weakly flared, deep and indented to the bottom. The periumbilical elements are short and show a centrifugal tendency.

Remarks - *Dumortieria suevica* is similar to *Dumortieria levesquei*, but it is less evolute, with faster whorl growth, and more wider L elements of the suture line.

Geographic and stratigraphic distribution - *Dumortieria suevica* was found in the Couche brune cycle of the sub-basin of Esch-sur-Alzette and the Couche grise cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone).

Dumortieria levesquei (d'Orbigny, 1844) (Pl. 8, fig. c)

1831 *Ammonites solaris* (?) Philipps; Zieten: 19, Taf. 14, Fig. 7a–c.

* 1844 *Ammonites Levesquei*, d'Orbigny, p. 230, pl. 60, figs. 1–4.

pars 1885 *Ammonites falcofila* Quenstedt: 340, Taf. 54, Fig. 28.

1904 *Dumortieria levesquei* d'Orb.; Prinz, p. 67; pl. 24, fig. 1.

v. 1905 *Dumortieria Levesquei* Orb. sp.; Benecke, p. 340, pl. 39, figs. 1–3 , pl. 40, fig. 1.

1927 *Dumortieria Levesquei* d'Orbigny; Schneider, p. 19.

v. 1940 *Dumortieria Levesquei* d'Orbigny; Gerard & Bichelonne, p. 28; pl. 2, fig. 2.

1961 *Dumortieria levesquei* (d'Orbigny); Dean et al., pl. 73, fig. 5.

1966 *Dumortieria levesquei* d'Orbigny; Nutsubidze, p. 107; pl. 24, fig. 1.

1967 *Dumortieria levesquei latumbilicata,* Géczy, p. 146, pl. 32, figs. 1, 6; pl. 64, figs. 58, 59.

1968 *Dumortieria* cfr. *levesquei* (d'Orbigny); Levi Setti, p. 324; pl. 30, fig. 2; fig. 3(3).

1968 *Dumortieria* cfr. *levesquei* (d'Orbigny); Pinna, p. 53, pl. 6, fig. 6.

1968 *Dumortieria levesquei* (d'Orbigny); Sapunov, pl. 3 fig. 3.

1975 *Dumortieria levesquei* (d'Orbigny); Guex, p. 116; pl. 7, fig. 2.

1977 *Dumortieria levesquei* (d'Orbigny); Ulrich, pl. 6, fig. 4.

1978 *Dumortieria* cfr. *levesquei* (d'Orbigny, 1842); Dezi & Ridolfi, p. 17, figs. 2, 3.

1985 *Dumortieria levesquei* (d'Orbigny); Seyed-Emami & Nabavi, p. 256, fig. 13.

1990 *Dumortieria levesquei* (d'Orbigny); Goy & Martinez, pl. 4, fig. 1.

1992 *Dumortieria falcofila* (Qu. 1885); Schlegelmilch, p. 106; pl. 50, Fig. 3.

1992 *Dumortieria levesquei* (d'Orbigny, 1844); Schlegelmilch, p. 105, pl. 57, Fig. 6.

1995b *Dumortieria levesquei* (d'Orbigny); Rulleau, pl. 3, figs. 1-4.

1996 *Dumortieria levesquei*; Jakobs & Smith, p. 125, fig. 16k.

1997 *Dumortieria levesquei* (d'Orbigny, 1844); Metodiev, p. 20; pl. 4, fig. 2.

2001 *Dumortieria levesquei* (d'Orbigny, 1844); Schulbert, pp. 61–62, pl. 5, figs. 1–3, 10.

2002 *Dumortieria levesquei* (d'Orbigny); Fauré, p. 728; pl. 22, fig. 2.

2004 *Dumortieria* cf. *levesquei* (d'Orbigny); Myczynski, p. 56; figs. 23/2, 6.

2006 *Dumortieria levesquei* (d'Orbigny); Rulleau, p. 90.; pl. 49, fig. 6.

2007 *Dumortieria levesquei* (d'Orbigny); Rulleau, p. 90.; pl. 49, fig. 6.

2010 *Dumortieria levesquei* (d'Orbigny, 1844); Arp, pl. 1, figs. 2, 3.

2010 *Dumortieria levesquei* (d'Orbigny, 1844); Kovacs, p. 348; pl. 2, fig. 1; pl. 5, fig. 5.

Material - A set of 3 well preserved specimens (MNHNL DOU527, TO115, 154).

Diagnosis - Evolute ammonites with sub-rectangular section, and a triangle shaped keel. Wide and flat umbilical area, bounded by a sharply rounded periumbilical wall. The body chamber extends two-thirds of the whorl. Several widely spaced, "C"-shaped ribs occur. Periumbilical elements of suture line are centrifugal.

Description - Evolute shell, with slightly overlapping whorls.The section is sub-rectangular with slightly rounded flanks. The umbilical area is wide and flat. It is bounded by rounded periumbilical wall. The venter is sub-triangular, with a thin keel. The body chamber correponds to the last two-thirds of the outermost whorl. The ornamentation is characterized by several well spaced, slightly sinuous, but more often "C"-shaped ribs. Weak constrictions are also observable. On the studied specimens, the suture line is poorly preserved, but some elements are recognizable. The L is deep, narrow and very indented. SL_1 is very indented. The periumbilical elements show a typical centrifugal trend.

Remarks - *Dumortieria levesquei* is similar to *Dumortieria suevica*, but clearly differs in being more evolute and having narrower L elements of the suture line.

Geographic and stratigraphic distribution - *Dumortieria levesquei* is an important species that characterizes the lower part of the Pseudoradiosa Zone (Upper Toarcian) in the North European Domain. Goy & Martinez (1990) for instance indicate this species as marker of the Levesquei Subzone. In Luxembourg, *D. levesquei* has been found in the Couche noire cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone) and in the upper Toarcian of the sub-basin of Esch-sur-Alzette.

Dumortieria leesbergi (Branco, 1879) (pl. 8, fig. a)

v. 1879 *Harpoceras Leesbergi* Branco, p. 83, pl. V, fig. 1.

1927 *Dumortieria Leesbergi* Branco; Schneider, p. 20.

v. 1940 *Catulloceras Leesbergi* Branco; Gerard & Bichelonne, p. 33; pl. 7, fig 1.

1995b *Dumortieria* aff. *kochi* Benecke; Rulleau, pl. 7, fig. 1, 2.

1995b *Dumortieria kochi* Benecke; Rulleau, pl. 7, fig. 5, 6.

2001 *Dumortieria kochi* Benecke, 1905; Schulbert, p. 69; pl. 7, figs. 4, 5, 7.

2006 *Dumortieria leesbergi* Branco; Rulleau, p. 90; pl. 49, fig. 1.

2007 *Dumortieria leesbergi* Branco; Rulleau, p. 90; pl. 49, fig. 1.

Material - A set of 4 specimens (MNHNL DOU588, 775, LO191, TO254) have been studied.

Diagnosis – Evolute ammonites with sub-rectangular section. Flat flanks. Wide umbilical area. Narrow and keeled external area. Rounded keel. Thick, spaced, slightly sinuous, proverse ribs.

Description - Evolute ammonites with external whorls that cover the external third of the inner whorls. Sub-rectangular section with slightly rounded flanks. The umbilical area is wide, relatively deep. It is bounded by rounded periumbilical walls. The external area is quite narrow and sub-triangular in shape. It has a rounded but distinct keel. The ornamentation is characterized by strong, spaced, slightly sinuous and proverse ribs. The suture line is characterized by a narrow external lobe E, which is enriched with a coarse accessory saddle A. The ES is rough, not too much indented and divided by an accessory saddle, L is quite deep, narrow and it shows three indentations. The SL_1 is similar to, but narrower than ES, less ornate and rounded. Every umbilical element (U and SL_2 etc) is centrifugal and small in size.

Remarks - *Dumortieria leesbergi* is similar to *Dumortieria sparsicosta* by its section and general type of ornamentation, however *D. leesbergi* differs from *D.sparsicosta* by the trajectory of the ribs, which are always sinuous, and for a higher number of ribs. Historically, the species *leesbergi* was included in the genus *Catulloceras*, but the only similarity with this genus is the rounded keel, while all other features belong to *Dumortieria*.

Geographic and stratigraphic distribution – The studied specimens lack precise stratigraphic information. However, *Dumortieria leesbergi* has been previously reported from the upper Toarcian, Pseudoradiosa Zone (Rulleau 2006).

Dumortieria pseudoradiosa (Branco, 1879) (Pl. 8, fig. b)

1874 *Ammonites radiosus* Seebach; Dumortier, p. 66; pl. 14, figs. 2-5.

*v. 1879 *Harpoceras pseudoradiosum* Branco, p. 77; pl. 2, figs. 1-4.

1885 *Ammonites undulatus* Quenstedt, p. 429; pl. 54, fig. 26.

1890 *Dumortieria pseudoradiosa* (Branco); Buckman, p. 246; pl. 41, figs. 1-3.

v. 1905 *Dumortieria pseudoradiosa* (Branco); Benecke, p. 361; pl. 41, figs. ?2-7; pl. 43, fig. 1, 2.

1927 *Dumortieria pseudoradiosa* Branco em. Buckman, p. 29, pl. 1, fig. 4.

v. 1940 *Dumortieria pseudoradiosa* Branco; Gerard & Bichelonne, p. 31; pl. 5, fig. 1.

1959 *Dumortieria pseudoradiosa* (Branco); Brockert, p. 52; pl. 7, figs. 3-4; pl. 22, fig. 8.

v. 1961b *Dumortieria pseudoradiosa* (Branco); Maubeuge, pl. 2, fig. 1.

1976 *Dumortieria pseudoradiosa* (Branco); Schlegelmilch, p. 106; pl. 51, fig. 1.

1990 *Dumortieria pseudoradiosa* (Branco); Goy & Martinez, pl. 4, figs. 4, 5.

1992 *Dumortieria pseudoradiosa* (Branco); Schlegelmilch, p. 106; pl. 51, fig. 1.

1995b *Dumortieria pseudoradiosa* (Branco); Rulleau, pl. 6, figs. 1-5; pl. 7, figs. 3, 4.

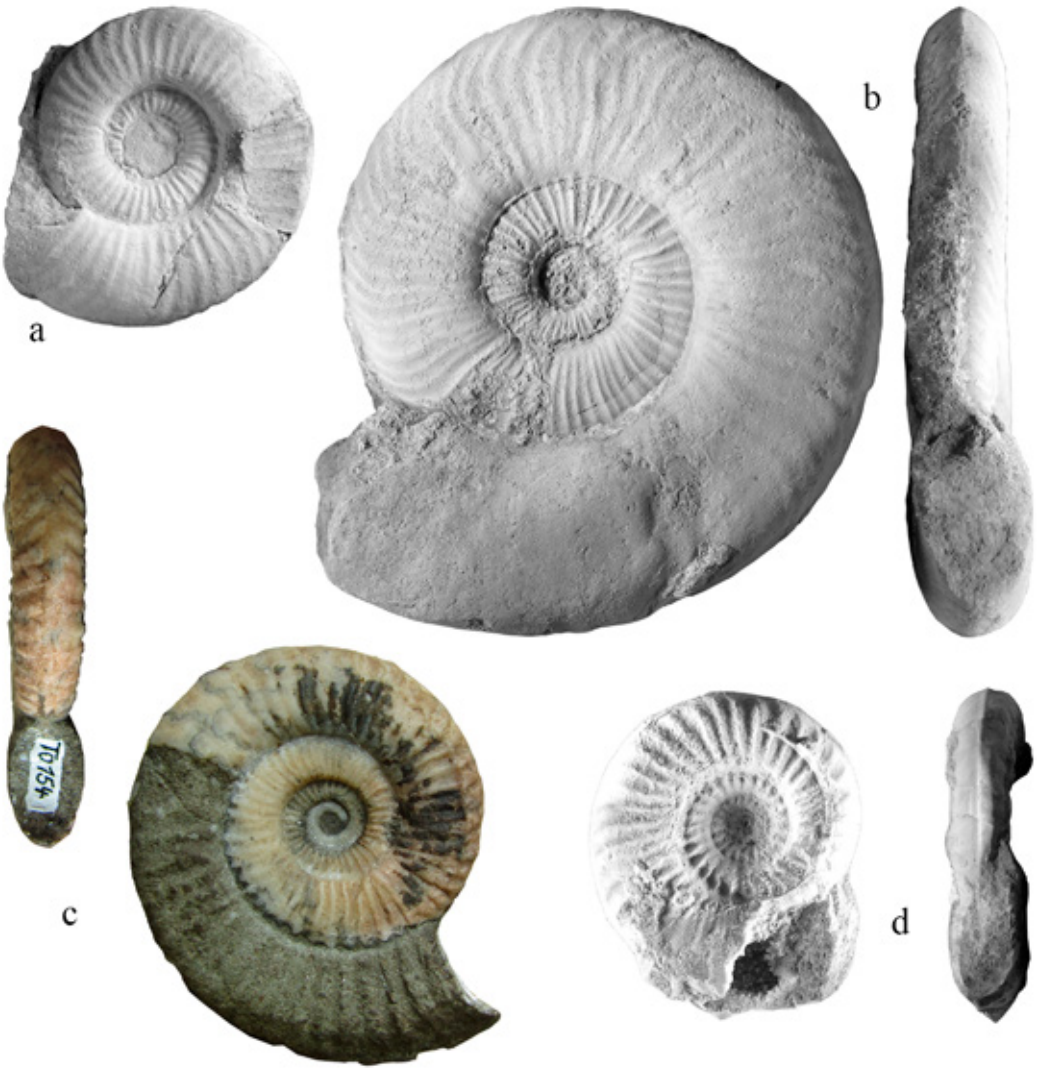
1996 *Dumortieria pseudoradiosa* (Branco, 1879); Bernad & Martinez, p. 18, pl. 4, fig. 5.

1997 *Dumortieria pseudoradiosa* (Branco); Cariou & Hantzpergue, pl. 11, figs. 11, 12.

2000 *Dumortieria pseudoradiosa* (Branco); Rulleau, pl. 13, figs. 1, 2.

2001 *Dumortieria pseudoradiosa* (Branco, 1879); Schulbert, p. 75; pl. 8, figs. 2-4.

2001 *Dumortieria pseudoradiosa* (Branco); Rulleau *et alii*, pl. 14, fig. 4; pl. 15, fig. 2.



Pl. 8: a - *Dumortieria leesbergi* (Branco, 1879), TO254; b - *Dumortieria pseudoradiosa* (Branco, 1879), TO136; c - *Dumortieria levesquei* (d'Orbigny, 1844), TO154; d - *Dumortieria costula*, TO251. Natural History Museum of Luxembourg. Scale 1:1.

2006 *Dumortieria pseudoradiosa* (Branco); Rulleau, p. 90; pl. 50, fig. 3.

2007 *Dumortieria pseudoradiosa* (Branco); Rulleau, p. 90; pl. 50, fig. 3.

Material - A set of 7 specimen (MNHNL DOU432, 611, 781, 947, HO133, 140, TO136, 244, 246, 247) have been studied.

Diagnosis - Evolute ammonites with sub-rectangular section. Wide and flat umbilical area. Rounded periumbilical wall. Triangular and keeled external area. Several single, sinuous, proverse ribs. Peristomatic constriction. Periumbilical bulge after constriction. The body chamber measures two-thirds of the last whorl. The umbilical elements of suture line are centifugal.

Description - Evolute shell with external whorls that cover the outer third of the inner whorls. The section is sub-rectangular in shape, with flat flanks. The umbilical area is wide and flat, bounded by rounded periumbilical walls. The external area is triangular and bears a low keel. The ornamentation is characterized by several single, sinuous and proverse ribs. Some ribs seem to be stronger than others and a constriction which involves two inter-rib spaces and a rib can be observed between two stronger ribs. The rib immediately before the constriction shows a sort of nodule in its inner portion. This nodule can be observed at each quarter of coil. The body chamber is more than two-thirds of a whorl length and covered with ornamentation characterized by sinuous, spaced and fasciculate ribs. The suture line is characterized by several rugged elements. The E is sub-rectangular in shape, narrow and enriched with a short accessory saddle A. ES is rough, rugged and enriched by an accessory lobe. L is flared, short and indented at the base: SL_1 is rough and rugged. The umbilical lobes are small but show a centrifugal trend.

Remarks - Two of the studied specimens show different features. Specimen HO133 has more ribs and a wider external area than specimen DOU947, but they have the same nodules and ornamentation design on both phragmocone and body chamber. Specimen HO140 is a half whorl larger than the other specimens and shows a fading ornamentation on the last whorl. Nonetheless, it has the same ornamentation of ribs, constrictions and nodules with the other specimen on the rest of the inner whorls.

Geographic and stratigraphic distribution - *Dumortieria pseudoradiosa* is index species for the Pseudoradiosa Zone and Subzone (upper Toarcian) in the North European Domain (Standard Biostratigraphic Scale). In Luxembourg, *D.pseudoradiosa* is found in the Couche brune cycle of the sub-basin of Esch-sur-Alzette and the Couche noire cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone).

Dumortieria costula (Reinecke, 1818) (Pl. 8, fig. d)

* 1818 *Nautilus costula* Reinecke, (68); figs. 33, 34.

1885 *Ammonites costula* (Reinecke); Quenstedt, p. 425; pl. 54, figs. 7-14, 49.

1891 *Dumortieria costula* (Reinecke); Buckman, p. 237; pl. 37, figs. 12,13.

1905 *Dumortieria costula* (Reinecke); Buckman, Suppl.; p. 175, p. 196, fig. 166.

1927 *Dumortieria costula* (Rein.) Buckman; Schneider; p. 23.

1967 *Dumortieria costula* (Reinecke); Klöcker, p. 77; figs.. 7a, c; figs. 8b, c.

1991 *Pleydellia costula* (Reinecke); Schlegelmilch, p. 107; pl. 51, fig. 7.

1994 *Dumortieria costula* (Reinecke); Ohmert & Rolf; Pl. 1, fig. 1.

2001 *Dumortieria costula* (Reinecke, 1818); Schulbert, p. 66; pl. 6, figs. 2, 19, 11.

2001 *Dumortieria* cf. *costula* (Reinecke 1818); Schulbert, p. 68; pl. 6, figs. 3, 8.

2010 *Dumortieria* cf. *costula* (Reinecke, 1818); Arp, p. 39; pl. 2, figs. 5-8.

Material - A set of 3 specimen (MNHNL DOU346, HO117, TO251) has been studied.

Diagnosis - Evolute ammonites, with sub-ovale section Wide and flat umbilical area. Rounded periumbilical wall. Rounded and keeled external area. Single, spaced, retroverse ribs.

Description - Evolute ammonites with moderately over-lapping whorls. The section is sub-oval with rounded flanks. The umbilical area is wide and flat, bounded by rounded periumbilical walls. The external area is rounded and has a low keel. The ornamentation is characterized by single, sinous, strong, spaced, retroverse ribs. Some ribs have a stronger relief, The central and retroverse portions of each rib are better preserved, while the external and proverse part are less visible. On immature specimens, or on inner whorls, the ornamentation is slightly different, consisting of several proverse ribs. The body chamber is poorly preserved. The ribs on the body chamber are more widely spaced and less strong. The suture line is poorly preserved.

Remarks - The number of ribs and their shape in adult specimens of *D. costula* are very different from every other species of *Dumortieria*; the same holds true for the external area.

Geographic and stratigraphic distribution - *Dumortieria costula* is found in the Couche brune cycle of the sub-basin of Esch-sur-Alzette and the Couche noire cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone).

Pl. 9: a - *Dumortieria moorei* (Lycett, 1857), TO252; b - *Dumortieria moorei* (Lycett, 1857), TO256. Natural History Museum of Luxembourg. Scale 1:1.

Dumortieria moorei (Lycett, 1857) (Pl. 9)

* 1857 *Ammonites Moorei*, Lycett, p. 122; pl. I, fig. 2a.

1892 *Dumortieria moorei* (Lycett); Buckman, p. 255; pl. 30, fig. 15-17,19; pl. 44, fig. 4-9.

1883 *Harpoceras aalensis*, Wright (non Zieten), pl. 53, figs. 1, 2.

1902 *Dumortieria moorei* (Lycett); Buckman, p. 182, fig. 179.

1905 *Dumortieria Moorei* (Lycett) Wright; Buckman, p. 182, fig. 179; pl. 44, fig. 9.

v. 1905 *Harpoceras (Grammoceras) moorei* (Lycett); Benecke, p. 376; pl. 45, fig. 1, 2.

1927 *Grammoceras Moorei* Lycett; Schneider, p. 38.

1981 *Dumortieria moorei* (Lycett); Hellman, p. 113; pl. 1, Fig. 5.

1992 *Dumortieria moorei* (Lycett); Schlegelmilch, p. 107; pl. 51, Fig. 5.

1993 *Dumortieria moorei* (Lycett, 1857); Seyed-Emami et al., p. 16, pl. 1, fig. 2.

1995 *Dumortieria moorei* (Lycett); Rulleau, pl. 10, fig. 1-6.

2001 *Dumortieria moorei* (Lycett, 1857); Schulbert, p. 63; pl. 7, figs. 1-3.

2006 *Dumortieria moorei* (Lycett); Rulleau, p. 90; p. 92, fig, 24/5; pl. 52 fig. 5.

2008 *Dumortieria moorei* (Lycett, 1857); Seyed-Emami et al., p. 250; figs. 4W, 5I, K.

Material – Two well-preserved specimens (MNHNL TO252, 256) have been studied.

Diagnosis - Evolute ammonites with sub-rectangular section. Flat to slightly rounded flanks. Keeled external area. Wide umbilical area. Distant, proverse, fasciculate, sinuous "C"-shaped ribs. Centrifugal elements on suture line.

Description - Evolute shell with whorls overlapping about one third of the whorl height. The section is sub-rectangular with a rounded external portion. Flanks are flat, slightly rounded. The external area is narrow and flat, with a clear keel. The umbilical area is wide and flat, bounded by low periumbilical walls. The ornamentation is characterized by more or less sinuous, proverse, "C" shaped ribs. The ribs tend to fasciculate. Occasional constrictions, visible in ribs that are more distant than usual are observable. The suture line is characterized by a deep E enriched with a big accessory saddle A. The ES is wide and ornate: L is deep, narrow, indented by three deep termination on the bottom. On the two sides of lateral lobe L, different ornaments may be present. SL_1 is ornate, narrow, longer than ES. LS_1 has a well developed accessory lobe in lateral position, which gives a floreal design to the saddle. The umbilical elements are centrifugal.

Remarks - The studied specimens are very similar to the type figured by Rulleau (2007) which is also a juvenile specimen. *Dumortieria moorei* belongs to a group of *Dumortieria* that usually shows distant and mainly fasciculate ribbing. This latter feature is a common morphological attribute of *Cotteswoldia* (e.g. *C. mactra* or *C. subcompta*) and on some *Pleydellia* (e.g. *P. buckmani*). However, *Dumortieria moorei* differs from *Pleydellia* spp. and *Cotteswoldia* spp. by the *Dumortieria*-like suture line and especially the centrifugal umbilical elements. *Dumortieria moorei* differs from every other species of *Dumortieria* by its ornamentation pattern.

Geographic and stratigraphic distribution – *Dumortieria moorei* has been found in the Couche grise cycle of the sub-basin of Differdange (upper Toarcian, Pseudoradiosa Zone). *Dumortieria moorei* is distributed between the upper part of Peudoradiosa Zone and lower part of Aalensis Zone (Mactra Subzone, Tectiforme biohorizon) (Rulleau et al. 2001).

Genus "*Pleydellia s.l.*"

The analysis of the morphological characters of all members historically included into *Pleydellia s.l.* has made it possible to upgrade the taxonomic hierarchy for those taxa formerly reported either as genera, subgenera, or synonyms: *Cotteswoldia*, *Pleydellia sensu stricto*, *Walkericeras*, *Canavarina.* In this paper, these generic names are considered at the same hierarchical level. Below, descriptions and remarks for each genus are proposed, in order to do a useful revision of the entire "*Pleydellia*" group.

Genus *Cotteswoldia* Buckman, 1902

Type-species - *Cotteswoldia paucicostata* Buckman, 1902 (pl. 23, figs.a-3), by original designation Buckman 1902, p. 133).

Diagnosis - Evolute, planulate to oxycone shell. More or less oxycone section. Wide umbilical area. Very low periumbilical wall. Triangular to sharp and keeled external area. Body chamber has a length of half a whorl. Simple peristome. Ornamentation characterized by a few to multiple, strong ribs. Fasciculation, overlapping and joining are present. Simple suture line with a sub-rectangular lateral lobe L.

Remarks - Buckman (1902) established the genus based on the type species *Cotteswoldia paucicostata*, an evolute ammonite with sub-rounded to flat flanks, wide umbilical wall, simple suture line with deep lobal elements (Ohmert 1993; Schulbert 2001). Important contributions to the knowledge of the genus *Cotteswoldia* are the works of W. Branco, E.W. Benecke and P.L. Maubeuge, who studied the ammonites of the Minette ironstones in Luxembourg and French Lorraine. During the last century, three different views on the hierarchical rank of *Cotteswoldia* and on its relationship with the closely related genus *Pleydellia* have been applied and debated. Many authors, working on North European and Mediterranean domains, have considered *Cotteswoldia* as independent from *Pleydellia* (Buckman 1899, 1902, 1904, 1905; Gérard 1936; Gérard & Bichelonne 1940; Maubeuge 1946, 1947, 1950, 1953, 1961, 1963; Scheibner 1964; Klocker 1967; Barfety et al. 1972; Elmi et al. 1974; Goy & Alferez 1974; Campos 1979; Elmi & Caloo-Fortier 1985; Goy & Ureta 1986; Kalin & Ureta 1987; Alvaro et al. 1989; Goy & Martinez 1990; Cecca et al. 1991; Bernad 1993; Ohmert 1993; Goy et al. 1994; Ohmert & Rolf 1994; Rulleau 1996; Cariou & Hantzpergue 1997; Ureta et al. 1999; Schulbert 2001; Sandoval et al. 2001, 2002, 2008; Floquet et al. 2003, 2007; Pallini et al. 2003-2004; Fauré & Alméras 2006; El-Hariri et al. 2006; Kovacs & Géczy 2008; Sekatni et al. 2008; Kovacs 2009; Arp 2010; Weis et al. 2010, 2018).

Following Arkell et al. (1957), other authors considered *Cotteswoldia* to be synonymous with *Pleydellia* (Donovan et al. 1981; Schlegelmilch 1976, 1992; Venturi 1982; Knipper & Ohmert 1983; Bilotta 2007; Galacz et al. 2007; Venturi & Bilotta 2008; Venturi et al. 2010).

There are also authors who consider *Cotteswoldia* a sub-genus of *Pleydellia* (Karakova 1984; Rulleau 1995, 2000, 2006; Rulleau et al. 2001; Seyed-Emami et al. 2005, 2008; Metodiev 2006, 2008; Becaud 2006; Di Cencio 2007; El Hammichi et al. 2008; Ippolitov et al. 2008).

In this paper, *Cotteswoldia* is considered as an independent genus. It has enough resemblance with *Pleydellia,* from which can be assumed that they are phyletically close. *Cotteswoldia* differs from *Pleydellia* by its higher evolution degree, the lack of umbilical wall and the roundness of the flanks. Ohmert (1994) and Schulbert (2001) assigned species usually considered as belonging to *Walkericeras,* to the genus *Cotteswoldia*. The differences between *Cotteswoldia* and *Walkericeras* consist in the absence of periumbilical wall, the roundness of the flanks and the narrow lateral lobe L in the former genus. *Cotteswoldia* is very similar to *Paradumortieria*. The controversial attribution of the *distans* species to both genera (in accord with Buckman, 1899 and Elmi & Caloo-Fortier, 1985) is another argument for the phyletic link between them. Both *Cotteswoldia* and *Paradumortieria* are characterized by evolute shell with wide umbilical areas, shallow periumbilical wall and an ornamentation with sparse, slightly sinuous ribs. However, *Cotteswoldia* differs from *Paradumortieria* by its sharper external area, and its ornamentation which is characterized by slightly stouter and more sinuous ribs. In *Cotteswoldia*, the overlapping of the outer whorls and the body chamber are present. Due to these transient features between *Paradumortieria* and *Cotteswoldia*, *Cotteswoldia egena* (Buckman, 1898) can be considered a morphologically transitional species between these two genera. The overlapping stratigraphic position of *Cotteswoldia egena* and *Paradumortieria* spp. confirm this idea (Elmi et al. 2007).

Geographic and stratigraphic distribution - *Cotteswoldia* is a cosmopolitan genus found in the rocks of the lower Aalensis Zone (Mactra subzone) (Rulleau et al. 2001).

Cotteswoldia bifax Buckman, 1904 (Pl. 10, fig. b)

* 1904 *Cotteswoldia bifax* Buckman, p. 136, fig. 110.

v. 1940 *Cotteswoldia bifax* Buckman; Gerard & Bichelonne, p. 36; pl. 11, fig. 3.

1985 *Dumortieria bifax* (buckman); Seyed-Emami & Nabavi, p. 256, fig. 24.

1988 *Cotteswoldia bifax* Buckman; Goy & Ureta, p. 25; pl. 1, figs. 6-7.

1995b *Pleydellia (Cotteswoldia) bifax* Buckman; Rulleau, pl. 11, figs. 8, 9.

2000 *Pleydellia (Cotteswoldia) bifax* Buckman; Rulleau, pl. 16, fig. 2.

2001 *Pleydellia (Cotteswoldia) bifax* Buckman; Rulleau *et al*., pl. 17, fig. 4.

2005 *Pleydellia (Cotteswoldia) bifax* Buckman, 1904; Seyed-Emami et al., p. 362, figs. 6K, L.

2006 *Pleydellia (Cotteswoldia) bifax* (Buckman); Rulleau, p. 93; pl. 53, fig. 5.

2007 *Pleydellia (Cotteswoldia) bifax* Buckman, 1904; Galacz et al., p. 348, fig. 4.10.

2007 *Pleydellia (Cotteswoldia) bifax* (Buckman); Rulleau, p. 93; pl. 53, fig. 5.

2008 *Pleydellia (Cotteswoldia) bifax* Buckman; Metodiev, p. 104, fig. 6z.

2008 *Pleydellia (Cotteswoldia) bifax* Buckman, 1904; Seyed-Emami et al., p. 252, fig. 5p.

2011 *Cotteswoldia* cf. *bifax* Buckman, 1904; Kovacs, p. 360; pl. 4, fig. 2.

Material - Two specimens (MNHNL DOU347 and DOU417) have been studied.

Diagnosis – Evolute, sub-oxycone section. Wide umbilical area bounded by rounded periumbilical wall. Sub-triangular and sharp external area, distinct keel. Two-thirds of a whorl long body chamber. Sinuous, retroverse, single ribs, sometimes fasciculated on inner whorls.
Description - Moderately evolute ammonites, with whorls that overlap by less than a half. The section is sub-oxycone with slightly rounded flanks. The umbilical area is wide and relatively flat and it is bounded by a rounded periumbilical wall. The external area is sharp and sub-triangular on the last whorl, with a keel. The body chamber correponds to two-thirds of the length of a whorl. The ornamentation is characterized by slightly sinuous and retroverse single ribs, which show fasciculation on the inner whorls. The suture line is poorly preserved but some elements are recognizable. The E is sub-rectangular in shape and enriched with a short accessory saddle A. ES is globular and short, enriched with an accessory lobe. L is sub-rectangular, short and large. LS_1 is globular and rude. The periumbilical elements are rough and they run parallel to the coiling.

Remarks - *Cotteswoldia bifax* is very similar to *Dumortieria moorei*, but distinguished by its suture line, which is typical for *Cotteswoldia,* as well as by its sharper external area. *Cotteswoldia bifax* is similar to *Cotteswoldia mactra* and *Cotteswoldia subcompta*, but it differs in the regularity of rib fasciculation.

Stratigraphic and Geographic distribution - *Cotteswoldia bifax* is found in lower Aalensis Zone (Upper Toarcian). The two studied specimens lack the exact stratigraphic and geographic information.

Cotteswoldia costulata (Zieten, 1830) (Pl. 10, fig. a)

* 1830 *Ammonites costulatus* Zieten, pl. 7, fig. 9.

1858 *Ammonites aalensis* Quenstedt (non Zieten), S. 282 Taf. 40, Fig. 10, 11.

v. 1879 *Harpoceras costula* Branco, p. 76; pl. 1, Fig. 9.

1885 *Ammonites costula* Quenstedt, pl. 54, figs. 7-14.

1886 *Harpoceras costula* Reinecke; Vacek, pl. 8, figs. 3-15.

1890 *Grammoceras costulatum* (Zieten); Buckman, p. 179, Taf. 33, Fig. 3,4.

1904 *Cotteswoldia costulata* (Zieten); Buckman, p. 133, pl. 13, Fig. 4.

1927 *Grammoceras costulatum* Zieten; Schneider, p. 36.

1981 *Pleydellia costulata* (Zieten); Hellman, p.117, pl.1, fig.1.

1992 *Pleydellia costula* (Reinecke); Schlegelmilch, S. 107; Taf. 51, Fig. 7.

1996 *Cotteswoldia costulata* (Zieten, 1830); Bernad & Martinez, p. 19; pl. 4, fig. 4.

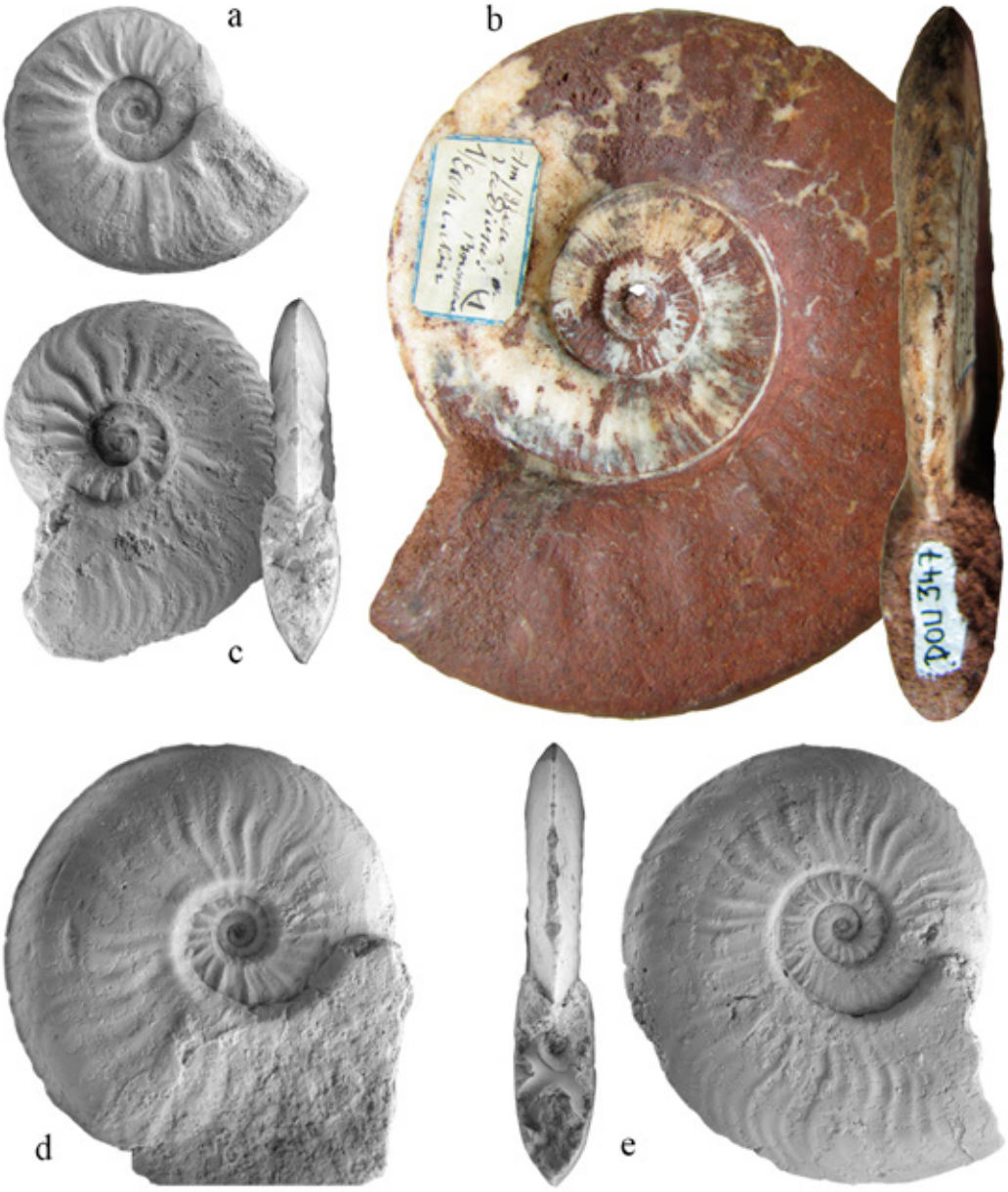
2001 *Pleydellia costulata* (Zieten 1830); Schulbert, p. 94; pl. 12, figs. 7-9; pl. 20, fig. 2.

2010 *Pleydellia costulata* (Zieten, 1830); Arp, p. 45; pl. 2, Fig. 29-32.

Material - Two specimens (MNHNL DOU510; DOU776) have been studied.

Diagnosis – Evolute ammonites with sub-oxycone section. Slightly rounded flanks. Wide and shallow umbilical area. Small periumbilical wall. Keeled. The body chamber is a quarter of the length of the last whorl. Strong, slightly sigmoid, slightly retroverse ribs. Obsolete ribs or growth lines on last whorl. Simple suture line with sub-rectangular lateral lobe L.

Description - Evolute shell with whorls that overlap one third. Sub-oxycone section with slighty



Pl. 10: a - *Cotteswoldia costulata* (Zieten, 1830), DOU510; b - *Cotteswoldia bifax* Buckman, 1904, DOU347; c - *Cotteswoldia angulata* Maubeuge, 1950, DOU204 holotype; d - *Cotteswoldia angulata* Maubeuge, 1950, DOT408; e - *Cotteswoldia angulata* Maubeuge, 1950, DOT409. Natural History Museum of Luxembourg. Scale 1:1.

rounded flanks between small periumbilical wall and sharp external area. Umbilical area is wide and relatively flat. A strong keel is developed on the external area. A quarter of the body chamber is preserved. The ornamentation is characterized by sigmoid, strong, slightly retroverse ribs and the presence of faded ribs along external whorls. The faded ribs are similar to growth lines. The suture

line is poorly preserved except a sub-rectangular shaped lateral lobe L.

Remarks - This species has been interpreted in the literature as either *Cotteswoldia* or *Pleydellia* (Bérnad 1993; Goy et al. 1994; Ureta et al. 1999; Schweigert et al. 2000; Schulbert 2001; Arp 2010). But the evolution and compression degree of whorls and the absence of a high periumbilical wall, which are typical characters for *Cotteswoldia*, are the motivation for the interpretation herein. *Cotteswoldia costulata* differs from *Cotteswoldia egena* in the evolution degree and the ornamentation on adult whorls. *Cotteswoldia costulata* differs from *Dumortieria costula*, in compression degree and height of keel.

Geographic and Stratigraphic distribution - The studied specimens lack the exact stratigraphic and geographic information. *Cotteswoldia costulata* belongs to the fauna of the Mactra Subzone, Aalensis Zone, upper Toarcian (Goy et al. 1994).

Cotteswoldia angulata Maubeuge, 1950
(Pl. 10, figs. c, d, e)

v. 1905 *Harpoceras lotharingicum* Branco; Benecke, pl. LI, fig. 1.

*v. 1950 *Cotteswoldia angulata* n.sp. Maubeuge, p. 367, pl. I, fig.1.

Holotype - *Cotteswoldia angulata* was established by Maubeuge (1950, p. 367, pl. I). The holotype (MNHNL DOU204) was found in "Couche grise", in a district of Dudelange called "Italie" and it previously was part of the Leesberg collection.

Material - The holotype (MNHNL DOU204) and four more specimens (MNHNL DOT406-409) have been studied.

Diagnosis - Involute shell with lanceolate section. Rounded flanks. Low periumbilical wall. Narrow umbilical area. Keeled and sharp external area. Sinous, overlapping ribs. Suture line with simple elements, L is narrow and sub-rectangular in shape.

Description - Moderately involute ammonites with high whorls that overlap slightly more than a half. The section is lanceolate in shape with rounded flanks. The external area is very sharp with a high keel. The umbilical area is relatively narrow, bound by low periumbilical walls. The ornamentation is characterized by an alternation of thick, and fading to obsolete sinuous ribs, in a ratio of 1 to 2. In some cases, thick and weak ribs are connected. On the outermost whorl, the ornamentation becomes more regular, loosing connection between ribs and alternation of obsolete and thick ribs. The suture line has simple elements. The E is flared and enriched with an accessory triangular saddle A. ES is globular and sub-divided by accessory lobe. L is narrow and indented on the bottom. Both sides of L seem to be diagnostic for the species. Flanks of L show two kinds of ornamentation, the motif to undulation is always the same but on the umbilical side they are thicker and more regular, while on the external side, they are more rough and also thinner. SL_1 is globular and sub-divided by accessory lobe. U_2 is similar to L.

Remarks - Maubeuge (1950) classified as *Cotteswoldia angulata* nov. sp. an ammonite formerly described as *Harpoceras lotharingicum* Branco (Benecke 1905: pl. LI, fig. 1). Although it shows little differences with typical features of *Cotteswoldia*, the differences are deemed sufficient to maintain Maubeuge's species. The suture line shows some interesting peculiarities. The lateral lobe L is sub-rectangular in shape and narrower as for the other species of *Cotteswoldia*. The only close species which has a similar feature of lateral lobe L is *Canavarina venustula*, which is different for all others characters.

Geographic and stratigraphic distribution - All specimens of *Cotteswoldia angulata* have been found in the upper part of the Couche grise cycle, nearby Dudelange, in the sub-basin of Esch-sur-Alzette (upper Toarcian, Aalensis Zone).

Cotteswoldia misera Buckman, 1902
(Pl. 11, figs. a, b; Pl. 12, fig. a)

*v. 1879 *Harpoceras subcomptum n.sp.* Branco, 90, pl. 5, fig. 3,4.

1885 *Ammonites* cf. *comptus* Quenstedt, 433; pl. 54, fig. 1-4.

1890 *Grammoceras subcomptum* (Branco); Buckman, p. 198, pl. 30, fig. 11-14.

1904 *Pleydellia? subcompta?* (Branco); Buckman, p. 138; pl. 30, figs. 13, 14; Suppl. p. 167, fig. 117.

1904 *Harpoceras (Grammoceras) subcomptum* (Branco); Prinz, 106; pl. 28, fig. 7.

v. 1905 *Harpoceras (Grammoceras) subcomptum* Branco; Benecke, 387; pl. 46, fig. 2, 3; pl. 48, figs. 1,3,4.

1927 *Grammoceras subcomptum* Branco; Schneider, p. 40.

v. 1940 *Pleydellia subcompta* Branco; Gérard & Bichelonne, p. 34; pl. 8, fig. 2.

v. 1961 *Pleydellia subcompta* Buckman; Maubeuge, pl. II, fig. 5.

1963 *Pleydellia subcompta* (Branco); Schindewolf, p.314, fig. 172.

1967 *Pleydellia* cf. *subcompta* (Branco, 1879); Géczy, pag. 150, fig. 151; pl. XXXIV, fig. 1.

1976 *Pleydellia subcompta* (Branco, 1879); Schlegelmilch, 108, pl. 51, fig. 11.

1983 *Pleydellia subcompta* (Bran.); Fauré & Cubaynes, pl. 2, fig. 2.

1983 *Pleydellia celtica n.sp.* Fauré & Cubaynes, 682, pl. 2, fig. 8–29.

1985 *Pleydellia subcompta* Branco; Caloo-Fortier, pl. 1, fig. 1d.

1985 *Pleydellia subcompta* (Branco); Seyed-Emami & Nabavi, p. 262, figs. 30, 31.

1985 *Pleydellia celtica* Fauré & Cubaynes; Seyed-Emami & Nabavi: 262–264, fig. 21.

1990 *Pleydellia subcompta* (Branco); Goy & Martinez, pl. 4, figs. 8, 9.

1992 *Pleydellia subcompta* (Branco); Schlegelmilch, pl. 51, fig. 11.

1995 *Pleydellia subcompta* (Branco); Rulleau, pl. 13, figs. 4-7.

1996 *Pleydellia subcompta* (Branco, 1879); Bernad & Martinez, p. 21; pl. 4, fig. 7.

1997 *Pleydellia subcompta* (Branco); Cariou & Hantzpergue, pl. 11, figs. 17,18.

1997 *Pleydellia subcompta* (Branco); Metodiev, p. 22; pl. 4, fig. 6.

2001 *Cotteswoldia subcompta* (Branco, 1879); Schulbert, pl. 11, fig. 1,2, 5, 9,10; pl. 30, fig. 1.

2002 *Pleydellia (P.?) celtica*; Fauré, 730, pl. 22, figs. 1, 2.

2002 *Pleydellia celtica*? Fauré & Cubaynes, 1983; Neige & Rouget, pag. 778, fig. 7I, J.

2004 *Pleydellia subcompta* (Branco, 1879); Myczynski, p. 66, fig. 25/4.

2004 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Pallini et al., pag. 10; pl. 4, fig. 7.

2004 *Pleydellia (Pleydellia) celtica* Fauré & Cubayne, 1983; Pallini et al., p. 10; pl. 4, fig. 11.

2005 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 360, figs. 6e, j.

2006 *Pleydellia subcompta* (Branco); Rulleau, pl. 55, fig. 2.

2006 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 265, fig. 5(13).

2008 *Pleydellia subcompta* (Branco); Metodiev, pag. 102, fig. 6r.

2008 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 251, fig. 5h.

2010 *Pleydellia subcompta* (Branco, 1879); Arp, p. 41; pl. 2, fig. 17,18.

Material - A set of 27 well preserved specimens (DOT391, 392, 394-405; DOT444; DOU197, 311, 391, 793, 980; EW114-01, 114-02; HO108, 130-01, 130-02; TO131, 137; 200) has been studied.

Diagnosis – Evolute ammonites with lanceolate whorlsection. Keeled and sharp external area. Wide umbilical area. Small periumbilical wall. Several sinous, proverse, fasciculate ribs with tendency to regularize over the ontogeny. Simple suture line with sub-rectangular L, indented to bottom.

Description - Moderately evolute shell with whorls that overlap in half. Section is lanceolate in shape with rounded flanks. The external area is sharp and keeled. The umbilical area is wide and bound by shallow periumbilical walls. The ornamentation is characterized by several, sinuous ribs. They are more or less fasciculate on inner whorls and become more regular along the outer whorls. The suture line has simple and globular elements. The E is wide and flared, enriched with a sub-triangular shaped accessory saddle A. ES is globular and crossed by a small accessory lobe. L is sub-rectangular in shape and its flanks are parallel to the coiling or just a bit flared. The bottom of L is indented and the central lobe is particularly deep. SL_1 is long and globular. U_2 is short and sub-triangular in shape.

Remarks –The studied specimens show several similarities with the type figured by Branco (1879) in terms of ornamentation, suture line, degree of growth of whorl, highness and roundness of flanks. Branco (1879) pictured two specimens with different evolution degree: 1) a specimen with whorls covering less than one third (pl. 5, fig. 3); 2) a specimen with

Pl. 11: a - *Cotteswoldia misera* Buckman, 1902, DOT432; b - *Cotteswoldia misera* Buckman, 1902, DOU418; c - *Cotteswoldia subcompta* (Branco, 1879), TO137. Natural History Museum of Luxembourg. Scale 1:1.

bends that overlap in half (pl. 5 fig. 4). Our specimens show more simila-rities with the more evolute type of Branco (2), but they have sharper external area. The external area illustrated by Branco and the higher degree of evolution are features of *Cotteswoldia mactra,* which is sometimes considered a morpho-type of *subcompta* (Rulleau 2006). However, *Cotteswoldia subcompta* differs from *Cotteswoldia mactra* by more distinct sharpness of the external area, ornamentation and the roundness of the flanks.

Pl. 12: a - *Cotteswoldia misera* Buckman, 1902, DOU135; b - *Cotteswoldia subcompta* (Branco, 1879), DOT394; c - *Cotteswoldia subcompta* (Branco, 1879), TO131. Natural History Museum of Luxembourg. Scale 1:1.

Cotteswoldia subcompta differs from *Cotteswoldia misera* by its lower number of ribs, sharper external area and higher evolution of whorls. *Pleydellia celtica* Fauré & Cubaynes, 1983 is considered synonymous of *Cotteswoldia subcompta* due to the similarities with Branco's type (1879, pl. 5 figs. 3) and the types described by Rulleau (2006). *Pleydellia celtica?* described by Neige & Rouget (2002) is similar to young specimen of Branco and it is detemined as *Cotteswoldia subcompta* (1879, pl. 5, fig. 4b-d).

Geographic and stratigraphic distribution - *Cotteswoldia subcompta* is found in sediments of the Mactra Sub-zone, in the lower part of the Aalensis Zone, upper Toarcian, in both North European and Mediterranean domains. Specimens from Luxembourg are reported from the "Grès supraliasique" and the Couche brune, Couche grise and Couche rouge cycles in the sub-basin of Esch-sur-Alzette.

Cotteswoldia subcompta (Branco, 1879) (Pl. 11, fig. c; Pl. 12, figs. b, c)

*v. 1879 *Harpoceras subcomptum n.sp.* Branco, 90, pl. 5, fig. 3,4.

1885 *Ammonites* cf. *comptus* Quenstedt, 433; pl. 54, fig. 1-4.

1890 *Grammoceras subcomptum* (Branco); Buckman, p. 198, pl. 30, fig. 11-14.

1904 *Pleydellia? subcompta?* (Branco); Buckman, p. 138; pl. 30, figs. 13, 14; Suppl. p. 167, fig.117.

1904 *Harpoceras (Grammoceras) subcomptum* (Branco); Prinz, 106; pl. 28, fig. 7.

v. 1905 *Harpoceras (Grammoceras) subcomptum* Branco; Benecke, 387; pl. 46, fig. 2, 3; pl. 48, figs. 1,3,4.

1927 *Grammoceras subcomptum* Branco; Schneider, p. 40.

v. 1940 *Pleydellia subcompta* Branco; Gérard & Bichelonne, p. 34; pl. 8, fig. 2.

v. 1961 *Pleydellia subcompta* Buckman; Maubeuge, pl. II, fig. 5.

1963 *Pleydellia subcompta* (Branco); Schindewolf, p.314, fig. 172.

1967 *Pleydellia* cf. *subcompta* (Branco, 1879); Géczy, pag. 150, fig. 151; pl. XXXIV, fig. 1.

1976 *Pleydellia subcompta* (Branco, 1879); Schlegelmilch, 108, pl. 51, fig. 11.

1983 *Pleydellia subcompta* (Bran.); Fauré & Cubaynes, pl. 2, fig. 2.

1983 *Pleydellia celtica n.sp.* Fauré & Cubaynes, 682, pl. 2, fig. 8–29.

1985 *Pleydellia subcompta* Branco; Caloo-Fortier, pl. 1, fig. 1d.

1985 *Pleydellia subcompta* (Branco); Seyed-Emami & Nabavi, p. 262, figs. 30, 31.

1985 *Pleydellia celtica* Fauré & Cubaynes; Seyed-Emami & Nabavi: 262–264, fig. 21.

1990 *Pleydellia subcompta* (Branco); Goy & Martinez, pl. 4, figs. 8, 9.

1992 *Pleydellia subcompta* (Branco); Schlegelmilch, pl. 51, fig. 11.

1995 *Pleydellia subcompta* (Branco); Rulleau, pl. 13, figs. 4-7.

1996 *Pleydellia subcompta* (Branco, 1879); Bernad & Martinez, p. 21; pl. 4, fig. 7.

1997 *Pleydellia subcompta* (Branco); Cariou & Hantzpergue, pl. 11, figs. 17,18.

1997 *Pleydellia subcompta* (Branco); Metodiev, p. 22; pl. 4, fig. 6.

2001 *Cotteswoldia subcompta* (Branco, 1879); Schulbert, pl. 11, fig. 1,2, 5, 9,10; pl. 30, fig. 1.

2002 *Pleydellia (P.?) celtica*; Fauré, 730, pl. 22, figs. 1, 2.

2002 *Pleydellia celtica*? Fauré & Cubaynes, 1983; Neige & Rouget, pag. 778, fig. 7I, J.

2004 *Pleydellia subcompta* (Branco, 1879); Myczynski, p. 66, fig. 25/4.

2004 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Pallini et al., pag. 10; pl. 4, fig. 7.

2004 *Pleydellia (Pleydellia) celtica* Fauré & Cubayne, 1983; Pallini et al., p. 10; pl. 4, fig. 11.

2005 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 360, figs. 6e, j.

2006 *Pleydellia subcompta* (Branco); Rulleau, pl. 55, fig. 2.

2006 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 265, fig. 5(13).

2008 *Pleydellia subcompta* (Branco); Metodiev, pag. 102, fig. 6r.

2008 *Pleydellia (Pleydellia) subcompta* (Branco, 1879); Seyed-Emami et al., p. 251, fig. 5h.

2010 *Pleydellia subcompta* (Branco, 1879); Arp, p. 41; pl. 2, fig. 17,18.

Material - A set of 27 well preserved specimens (DOT391, 392, 394-405; DOT444; DOU197, 311, 391, 793, 980; EW114-01, 114-02; HO108, 130-01, 130-02; TO131, 137; 200) have been studied.

Diagnosis - Evoluted, plane-spiraled shell. Lanceolate section. Keeled and sharp external area. Wide umbilical area. Small periumbilical wall. Several sinous, proverse, fasciculate ribs with tendency to regularize over its ontogeny. Simple sutural line with sub-rectangular in shape L, indented to bottom.

Description - Middle evoluted plane-spiraled shell with external whorl which covers half of the inner ones. Section is lanceolate in shape with rounded flanks. The external area is sharp and crossed by a distinct keel. The umbilical area is wide and bound by small periumbilical walls. The ornamentation is characterized by several, sinuous ribs. They are more or less fasciculate on inner whorls, and they become more regular along external ones. The sutural line has simple and globular elements. E is wide and flared, enriched by a sub-triangular shaped accessory saddle A. ES is globular and crossed by a small accessory lobe. L is sub-rectangular in shape and its flanks are parallel to the coiling or just a bit flared. The bottom of L is indented and the central lobe is particularly deep. SL_1 is long and globular. U_2 is short and sub-triangular in shape.

Remarks –The studied specimens show several similarities with the type figured by Branco (1879) for ornamentation, sutural line, degree of growth of whorl, highness and roundness of flanks. Branco (1879) pictured two specimens with different evolution degree (in pl. 5, fig.3 the whorls cover less than an external third of the inner coil, in pl. 5 fig. 4 the whorls cover half of the inner coil). Studied specimens show more similarities with the more evoluted type of Branco (fig. 4), while the external area of said specimen seem sharper than Branco's type. The external area illustrated by Branco and the higher degree of evolution are features of *Cotteswoldia mactra*, which is sometimes considered a morpho-type of *subcompta* (Rulleau 2006). However, *Cotteswoldia subcompta* differs from *Cotteswoldia mactra* by its more distinct sharpness of the external area, its ornamentation and the roundness of the flanks. *Cotteswoldia subcompta* differs from *Cotteswoldia misera* by its lower number of ribs, sharper external area and higher evolution of whorls. *Pleydellia celtica* Fauré & Cubaynes, 1983 is considered synonymous of *Cotteswoldia subcompta* due to the similarities with Branco's type (1879, pl. 5 figs. 3) and the types described by Rulleau (2006). *Pleydellia celtica?* described by Neige & Rouget (2002) is similar to young specimen of Branco and it is detemined as *Cotteswoldia subcompta* (1879, pl. 5, fig. 4b-d).

Geographic and stratigraphic distribution - *Cotteswoldia subcompta* is found in sediments of the Mactra Sub-zone, in the lower part of the Aalensis Zone, upper Toarcian, in both North European and Mediterranean domains. Specimens from Luxembourg are reported from the "Grès supraliasique" and the Couche brune, Couche grise and Couche rouge cycles in the sub-basin of Esch-sur-Alzette.

Cotteswoldia mactra (Dumortier, 1874) (Pls. 13, 14)

* 1874 *Ammonites mactra* nov. sp. Dumortier, pag. 251, pl. 50, figs. 4, 5.

1878 *Ludwigia mactra*; Bayle, pl. lxxx, figs. 2, 3.

v. 1879 *Harpoceras mactra* Dum. sp.; Branco: 88–90; pl. 1, fig. 10.

1883 *Harpoceras aalense*; Wright, pl. lxxv, fig. 10.

1885 *Ammonites* cf. *comptus* Quenstedt: 433, Taf. 54, Fig. 45, 46.

1886 *Harpoceras mactra*; Vacek, pl. ix, fig. 14.

1886b *Harpoceras mactra* (Dumortier) var. *intorgus* De Gregorio:, pag. 9; pl. 2, fig. 2.

1890 *Grammoceras mactra* (Dumortier); Buckman, pl. 30, figs. 3-7; pl. 31, figs. 1-4.

1904 *Pleydellia? mactra?* (Dumortier); Buckman, p. 139; pl. 30, figs. 3, 4; Suppl., p. 167, fig. 119.

v. 1905 *Harpoceras (Grammoceras) mactra* Dum.; Benecke: 380, pl. 45, fig. 3.

1927 *Grammoceras mactra* (Dumortier); Schneider, p. 34; pl. 3, figs. 3-5.

v. 1940 *Pleydellia mactra* (Dumortier); Gérard & Bichelonne, p. 34; pl. 9, fig. 3.

v. 1946 *Pleydellia mactra* Dumortier; Maubeuge, pl. XII, figs. 4, 5.

? 1959 *Pleydellia mactra* (Dumortier); Théobald & Moine: 28, Taf. 6, Fig. 9.

v. 1961 *Pleydellia mactra* Dumortier; Maubeuge, pl. IV, fig. 1.

1963 *Pleydellia mactra* (Dum.); Schindewolf, p. 316, 317, figs. 174, 175.

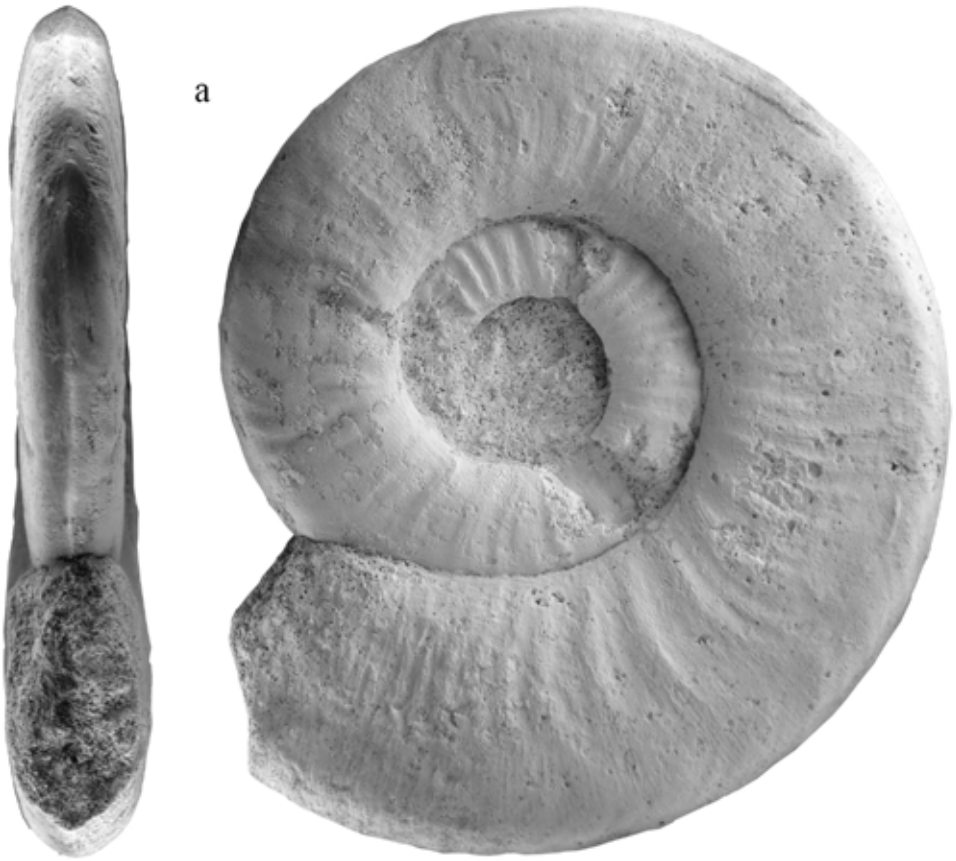
1967 *Dumortieria mactra evoluta* nov. subsp. Géczy, pag. 149, fig. 150; pl. 32, fig. 3.

1976 *Pleydellia mactra* (Dumortier); Schegelmilch, pl. 51, fig.12.

1983 *Pleydellia mactra* (Dum.) Fauré & Cubayne, pl. 2, fig. 1.

1985 *Pleydellia mactra* Dumortier; Caloo-Fortier, p. 244, pl. I, fig. 1e; p. 246, pl. II, fig. 2k.

1985 *Pleydellia* gr. *mactra* Dumortier; Caloo-Fortier, p. 244, pl. I fig. 1a.



Pl. 13: a - *Cotteswoldia mactra* (Dumortier, 1874), DOU400. Natural History Museum of Luxembourg. Scale 1:1.

1985 *Pleydellia mactra* (Dumortier); Seyed-Emami & Nabavi, p. 260, figs. 22, 25.

1985 *Pleydellia* aff. *mactra* (Dumortier); Seyed-Emami & Nabavi, p. 260, fig. 23.

1990 *Pleydellia mactra* (Dumortier); Goy & Martinez, pl. 4, figs. 6, 7.

1992 *Pleydellia mactra* (Dum. 1874); Schlegelmilch: 108, Taf. 51, Fig. 12.

1995 *Pleydellia mactra* (Dumortier); Rulleau, pl. 13, figs. 1-3.

1997 *Pleydellia mactra* (Dumortier); Cariou & Hantzpergue, p. 34, fig. 4.

1997 *Pleydellia mactra* (Dumortier, 1874); Metodiev, p. 22; pl. 4 fig. 9.

1998 *Pleydellia mactra* (Dumortier); Almeras et al., pag. 109; pl. 17, fig. 8.

2001 *Pleydellia (Pleydellia) mactra* (Dumortier); Rulleau et al., pl. 17, figs. 7,8.

2001 *Cotteswoldia mactra* (Dumortier 1874); Schulbert: 83, pl. 9, figs. 14, 15, pl. 25, fig. 1.

2002 *Pleydellia (P.?) mactra* (Dumortier); Fauré, pag. 730; pl. 22, fig. 8.

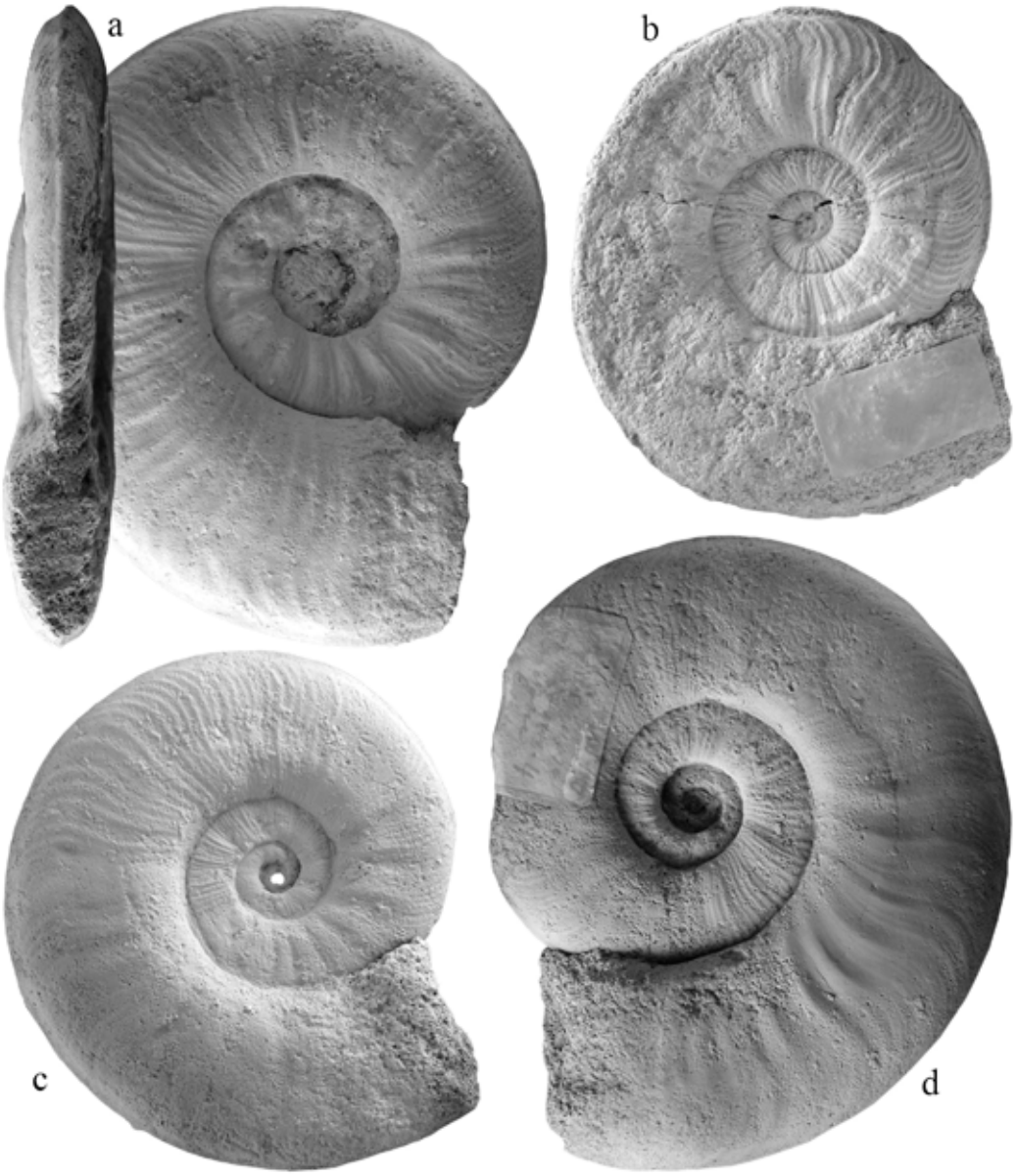
2003 *Pleydellia mactra* (Dumortier); Floquet et al., pag. 166, fig. 5d.

2004 *Pleydellia (Pleydellia) mactra* (Dumortier, 1874); Pallini et al., pag. 10; pl. 4 figs. 4, 10, 11; pl. 15, fig. 10.

2006 *Pleydellia (Pleydellia) mactra* (Dumortier); Rulleau, pl. 55, fig. 1.

2007 *Pleydellia mactra* (Dumortier); Floquet et al., pag. 26, fig. 21d.

2008 *Pleydellia mactra* (Dumortier); Metodiev, pag. 102, fig. 6t.



Pl. 14: a - *Cotteswoldia mactra* (Dumortier, 1874), DOU426; b - *Cotteswoldia mactra* (Dumortier, 1874), DOU744; c - *Cotteswoldia mactra* (Dumortier, 1874), DOU745; d - *Cotteswoldia mactra* (Dumortier, 1874), DOU746. Natural History Museum of Luxembourg. Scale 1:1.

2010 *Cotteswoldia mactra* (Dumortier, 1874); Arp pl. 2, figs. 9-14.

2010 *Cotteswoldia* cf *mactra* (Dumortier, 1874); Arp, pl. 2 figs. 15-16.

Material - A set of 14 specimens (MNHNL DOU400, 426, 543, 744, 745, 746, 751, 787, 949; DOT335; HO104, 116, 132; TO116) has been studied.

Diagnosis – Evolute ammonites with sub-rectangular section. Sub-flat flanks. Small periumbilical wall. Wide umbilical area. Keeled, sub-triangular external area. Body chamber at half whorl. Simple peristome. Several sinuous, proverse and fasciculate ribs. Fasciculation shows bulges. Simple suture line.

Description – Evolute shell with whorls that overlap less than a third of the flanks The section is sub-rectangular in shape with sub-rounded flanks. The flanks are flat on the middle and become rounded close to both external and umbilical area. The external area is sub-triangular in shape and has a distinct keel. The umbilical area is wide and bounded by a shallow periumbilical wall. The body chamber is half a whorl and it shows a simple peristome. The ornamentation consists of several sinuous, proverse, more or less regularly fasciculate ribs. Fasciculation shows bulges on the periumbilical edge. Along the external whorl, where the costulation tends to fade, the bulges are the only visible elements of the ornamentation. The suture line has globular and large, simple elements. The E is wide, flared and enriched by an accessory saddle A. ES is globular and crossed by an accessory lobe. L is wide and sub-rectangular in shape, deeply indented on bottom. SL_1 is long, globular and crossed by an accessory median lobe. U_2 is triangular, short and deeply indented on bottom.

Remarks - *Cotteswoldia mactra* is an older species of *Cotteswoldia*, from the lower Aalensis Zone where it is considered an important marker (Mactra Subzone, Gabilly et al., 1974). *Cotteswoldia mactra* differs from the other species of *Cotteswoldia* by its strong evolution, the shape of the flanks and the sub-triangular shape of the external area. These features allow to consider *Cotteswoldia mactra* closely related to species of ancestor *Dumortieria*. *Cotteswoldia mactra* differs from *Dumortieria* in its number of ribs, as well as the shape of ribs and their tendency to fasciculate. Rulleau (2006) considers *Cotteswoldia mactra* a morphotype of *Cotteswoldia subcompta,* but the first species differs from the last one in its external area, ornamentation and degree of evolution of whorls.

Geographic and stratigraphic distribution - Studied specimens from Luxembourg are collected in the Couche brune and the Couche rouge cycles of the sub-basin of Esch-sur-Alzette. *Cotteswoldia mactra* is a cosmopolitan species found in all the tethyan domains in the lower part of the Aalensis Zone (Mactra subzone), upper Toarcian.

Cotteswoldia aalensis (Zieten, 1830) (Pl. 15, figs. a, b, c, d, e)

* 1830 *Ammonites Aalensis* Zieten, p. 25; pl. xxviii, fig. 3.

1842 *Ammonites Aalensis* (Zieten); d'Orbigny, p. 238; pl. 63, fig. 3.

1846 *Ammonites aalensis* Zieten; Quenstedt, S. 114, Taf. 7, Fig. 7.

1874 *Ammonites Aalensis* (Zieten); Dumortier, p. 250; pl. 50, fig. 1-3.

1879 *Ludwigia Aalensis*; Bayle, pl. 79, figs. 1-3.

1885 *Ammonites aalensis* Zieten; Quenstedt, p. 424, pl. 54, fig. 1.

1885 *Ammonites* cf. *Aalensis*; Quenstedt, 433, pl. 54, fig. 51, 52.

1886 *Harpoceras aalense* Zieten; Vacek, p. 76; pl. 7, figs. 11, 12.

1890 *Grammoceras aalense* (Zieten); Buckman, p. 192, ; pl. 31, figs. 15, 16; pl. 32, Fig. 1-10.

1894 *Harpoceras aalense* Zieten; Bose, p. 766; pl. 55, fig. 2.

1900 *Harpoceras aalense* Zieten; Burckhardt, p. 27; pl. 20, figs. 9-11; pl. 29, figs. 1, 2.

1904 *Pleydellia aalensis* (Zieten); Buckman, p. 137; pl. 32, figs. 3-6; Suppl. p. 165, figs. 112, 113.

v. 1905 *Harpoceras (Grammoceras) aalense* Zieten; Benecke, p. 389; pl. 47, figs. 2-6; pl. 48, figs. 5, 6; pl. 50, figs. 1,3,5,6.

1906 *Harpoceras aalense* Zieten; Renz, p. 273; pl. 13, fig. 5.

1927 *Grammoceras aalense* Zieten; Scheneider, p. 32; pl. 3, figs. 1, 2.

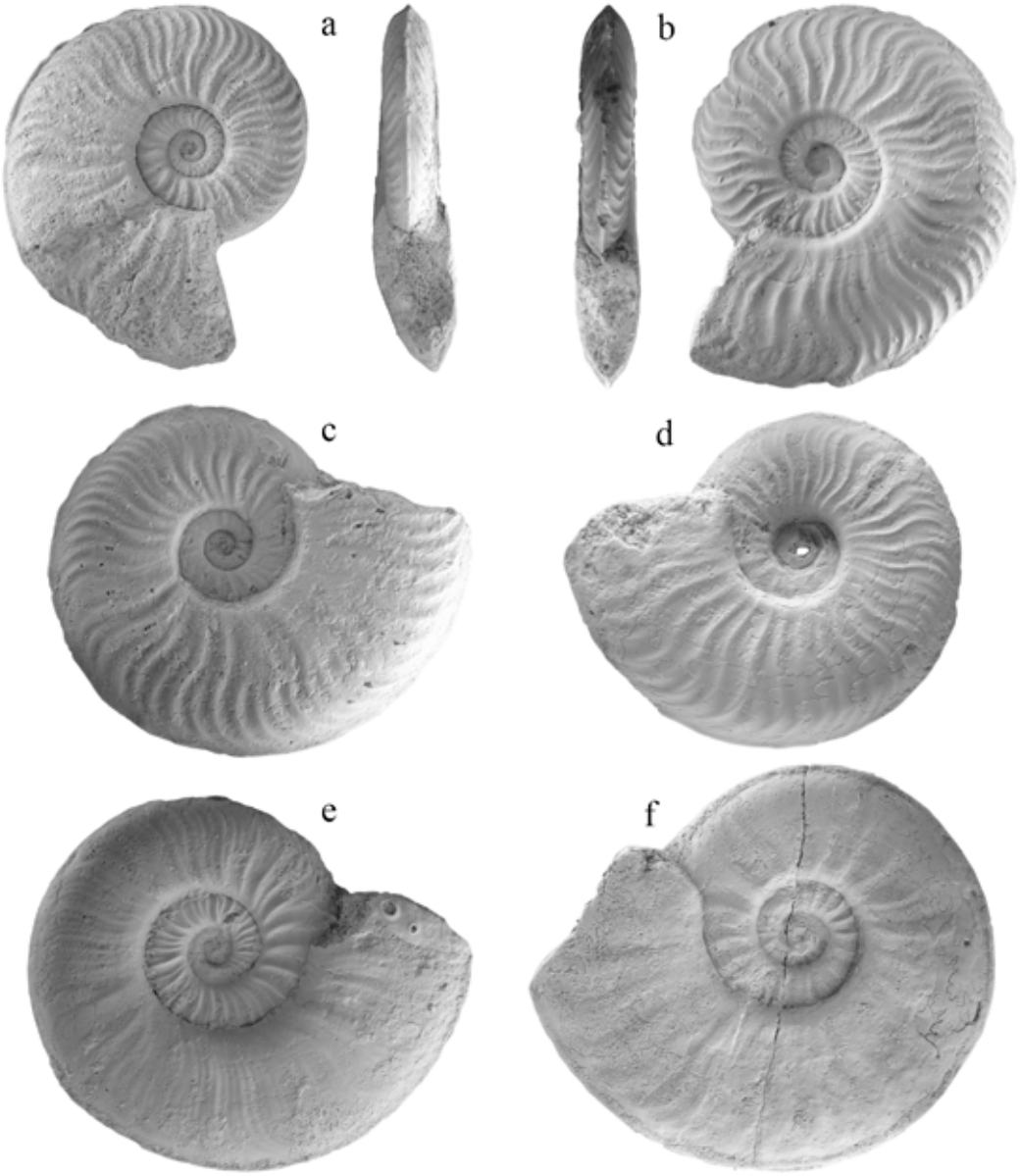
v. 1940 *Pleydellia Aalensis* Zieten; Gérard & Bichelonne, pl. 34; pl. 8, fig. 3.

v. 1950 *Pleydellia aalense* Zieten (Buckman); Maubeuge, pl. 7.

1959 *Pleydellia Aalensis* Zieten; Théobald & Moine, p. 19 pl. n. t. 1, fig. 1; pl. 3, fig. 1-8; pl. 4, fig. 1-7.

1959 *Pleydellia aalensis* (Zieten); Brockert, S. 40, Taf. 6, Fig. 1; pl. 21, figs. 3-8

1961 *Harpoceras (Pleydellia) aalense* Zieten; Vlahinic & Dekic, p. 100; pl. 1, fig. 1.



Pl. 15: a - *Cotteswoldia aalensis* (Zieten, 1830), TO123; b - *Cotteswoldia aalensis* (Zieten, 1830), DOT346; c - *Cotteswoldia aalensis* (Zieten, 1830), DOT305; d - *Cotteswoldia aalensis*, DOU348 (Zieten, 1830); e - *Cotteswoldia aalensis* (Zieten, 1830), DOT367; f - *Cotteswoldia paucicostata* Buckman, 1904, DOU525. Natural History Museum of Luxembourg. Scale 1:1.

v. 1961 *Pleydellia Aalensis* Zieten; Maubeuge, pl. 2, fig. 3.

1961 *Pleydellia aalensis* Zieten; Dean *et alii*, pl. 74, fig. 4a, b.

1967 *Pleydellia aalensis* Zieten; Colacicchi, p. 799; pl. 65, fig. 1.

1967 *Pleydellia aalensis* (Zieten); Géczy, p. 152, fig. 153; pl. XXXIV, fig. 7, 9.

1967 *Pleydellia aalensis ovalis nov. subsp*. Géczy, pag. 154; pl. 34, fig. 5.

1967 *Pleydellia aalensis inaequicostata nov. subsp*. Géczy, pag. 154; pl. 34, figs. 4, 11.

1967 *Pleydellia aalensis* (Zieten); Klöcker, p. 87, figs. 12-14.

1968 *Pleydellia aalensis* (Zieten); Sapunov, pl. 3, fig. 5.

1976 *Pleydellia aalensis* (Zieten); Schlegelmilch, pag. 108; pl. 51, fig. 8, 9.

1976 *Pleydellia aalensis tenuilobatus* Theobald & Moine; Schlegelmilch, pag. 108; pl. 51, fig. 10.

1977 *Pleydellia aalensis* (Zieten); Urlichs, pl. 6, fig. 5.

1982 *Pleydellia aalensis* Zieten, 1832; Venturi, pag. 83, fig. 129.

1983 *Pleydellia* cf. *aalensis* (Ziet.); Fauré & Cubayne, pl. 2, figs. 32-34.

1985 *Pleydellia* gr. *aalensis* Zieten; Caloo-Fortier, pl. I, figs. 1a-c, f-i; pl. II, figs. 2l-n; pl. V, figs. 5a-c.

1985 *Pleydellia aalensis* (Zieten); Seyed-Emami & Nabavi, p. 266, figs. 34, 38.

1985 *Pleydellia* cf. *aalensis* (Zieten); Seyed-Emami & Nabavi, p. 266, figs. 35.

1985 *Pleydellia* aff. *aalensis* (Zieten); Seyed-Emami & Nabavi, p. 266, figs. 36.

1985 *Pleydellia aalensis* Zieten, 1832; Venturi, p. 83, fig. 129.

1990 *Pleydellia aalensis* (Zieten); Goy & Martinez, pl. 4, fig. 10.

1992 *Pleydellia aalensis* (Zieten); Schlegelmilch, S. 108, Taf. 51, Fig. 8, 9.

1992 *Pleydellia aalensis tenuicostata* Theobald & Moine; Schlegelmilch, p. 108, pl. 51, fig. 10.

1993 *Cotteswoldia aalensis* (Zieten); Ohmert, p. 146; figs. 3,6; pl. 14, Fig. 1, 2

1994 *Cotteswoldia aalensis* (Zieten); Ohmert & Prauss, Taf. 1, Fig. 3,4.

1995 *Pleydellia aalensis* (Zieten); Rulleau, pl. 13, figs. 8, 9.

1996 *Pleydellia aalensis* (Zieten, 1830); Bernad & Martinez, p. 21; pl. 4, fig. 8.

1996 *Pleydellia* cf. *aalensis* (Zieten, 1830); Bernad & Martinez, p. 21.

1997 *Pleydellia aalensis* (Ziet); Cariou & Hantzpergue, pl. 11, fig. 15, 16.

1997 *Pleydellia aalensis* (Zieten); Metodiev, p. 23; pl. IV, fig. 8.

2001 *Pleydellia (Pleydellia) aalensis* (Zieten); Rulleau *et alii*, p. 53, fig. 18/5, pl. 18, fig. 7.

2001 *Cotteswoldia aalensis* (Zieten, 1832); Schulbert, p. 87; pl. 11, fig. 8; pl. 12, figs. 2, 4; pl. 20, figs. 1, 3.

2001 *Cotteswoldia aalensis distans* (Buckman); Schulbert, pl. 9, figs. 10, 13.

2001 *Cotteswoldia aalensis tenuicostata* (Théobald & Moine, 1959); Schulbert, p. 91; pl. 11, fig. 6.

2002 *Pleydellia aalensis* (Zieten); Enriques & Ureta in Cecca *et al*.: 150, Figs. 93 a-h.

2004 *Pleydellia (Pleydellia) aalensis* (Zieten, 1830); Pallini et al., pag. 10; pl. 4, figs. 1-3, 8, 9, 12-14; pl. 15, fig. 9

2004 *Pleydellia (Pleydellia) aalensis ovalis* Geczy, 1967; Pallini et al., pag. 10.

2004 *Pleydellia aalensis* (Zieten, 1830); Myczynski, p. 64, fig. 26/3.

2005 *Pleydellia (Pleydellia) aalensis* (Zieten, 1830); Seyed-Emami et al., p. 360, figs. 6c, d, f.

2006 *Pleydellia (Pleydellia) aalensis* (Zieten); Rulleau, p. 94; p. 92, fig. 24/11; pl. 55, fig. 6.

v. 2007 *Pleydellia (Pleydellia) aalensis* (Zieten, 1830); Di Cencio, p. 322; pl. 33, figs. 1, 6, 9.

2008 *Pleydellia aalensis* Zieten; El Hammichi et al., pl. II, fig. 7.

2008 *Pleydellia aalensis* (Zieten); Metodiev, pag. 102, fig. 6q.

2008 *Pleydellia (Pleydellia) aalensis* (Zieten, 1830); Seyed-Emami et al., p. 251, fig. 5e.

2010 *Cotteswoldia aalensis* (Zieten, 1832); Arp, 41, pl. 2, Fig. 23-28.

Material – A set of 54 specimens (MNHNL DOU195, 202, 348, 383, 397, 779; DOT305, 336-367, 442, 447; EW105, 106; 108; 116; HO156; LO135, 136-01, 136-02, 149; TO122, 123, 124, 223, 224) has been studied.

Diagnosis - Moderately evolute shell. Oxycone section. Rounded flanks. Wide and keeled external area. Wide umbilical area. Small periumbilical wall. Sinuous, prominent, overlapped and fasciculated ribs. Simple suture line with a sub-rectangular lateral lobe L.

Description - Moderately evolute ammonites with whorls that overlap by a third of the whorl height. The section is oxycone with slightly rounded flanks. The external area is relatively wide and keeled. The umbilical area is wide and flat, and it is bounded by small rounded periumbilical walls. The ornamentation is characterized by single, well-spaced, sinuous ribs. They are proverse on the umbilical side and tend to become radial towards the external area. Alternation between strong and fading ribs is observed. Frequent phenomena of fasciculation, connecting and overlapping are also observable. The number of ribs increases with ontogenesis. This kind of ornamentation gives the impression of an irregular ornamentation, which is a typical feature for this species. The suture line is quite simple. The E is wide and flared, indented and enriched with a short accessory saddle A. ES is long and globular, it tends to develop towards the middle side of flank and it is enriched by an accessory median lobe. L is wide, sub-rectangular in shape and indented towards the bottom. SL_1 is long and sub-rectangular in shape. U_2 and U_3 are wide and parallel to coiling.

Remarks – Historically, the species *aalensis* has commonly been assigned to the genus *Pleydellia*, but other species belonging to this genus differ from *aalensis* in evolution degree and ornamentation. In this paper, we believe that our specimens belong to *Cotteswoldia*, following Ohmert (1993), Schulbert (2001) and Arp (2010). In the studied collection, two morphotypes of *Cotteswoldia aalensis* can be recognized: (a) an evoluted and compressed morph; (b) a more involuted and stout morph. In our opinion, an intraspecific variability of compression and evolution features exists in case of the species *Cotteswoldia aalensis*, while the typical not regular ornamentation is diagnostic for this species . Sometimes, in case of more involuted specimens, an increasing number of ribs can be observed, but those are always dispersal ribs.

Geographic and stratigraphic distribution – The studied specimens were found in the "Grès supraliasique" and the Couche grise cycle in the sub-basin of Esch-sur-Alzette. *Cotteswoldia aalensis* is a cosmopolitan species, found and studied virtually worldwide (Di Cencio, 2007, cum bibl.). *Cotteswoldia aalensis* is a marker of the Aalensis Zone, upper Toarcian.

Cotteswoldia paucicostata Buckman, 1904 (Pl. 15, fig. f)

* 1904 *Cotteswoldia paucicostata* n. sp. Buckman, pl. XXIII, figs. 1-3.

v. 1940 *Cotteswoldia paucicostata* Buckman; Gérard & Bichelonne, p. 36; pl. 8, fig. 1.

v. 1961 *Cotteswoldia paucicostata* Buckman; Maubeuge, pl. IV, fig. 2.

1993 *Cotteswoldia paucicostata* Buckman; Ohmert, pl. 14, fig. 3.

1995 *Pleydellia (Cotteswoldia) paucicostata* Buckman; Rulleau, pl. 11, figs. 1, 2; pl. 12, fi. 4.

2001 *Pleydellia (Cotteswoldia) paucicostata* (Buckman); Rulleau et al., pl. 17, figs. 1, 2.

2004 *Cotteswoldia paucicostata* Buckman, 1902; Pallini et al., p. 10; pl. 5, fig. 8.

2005 *Pleydellia (Cotteswoldia) paucicostata* Buckman, 1904; Seyed-Emami et al., p. 363, figs. 6h, i.

2006 *Pleydellia (Cotteswoldia) paucicostata* (Buckman); Rulleau, pl. 53, figs. 1, 2.

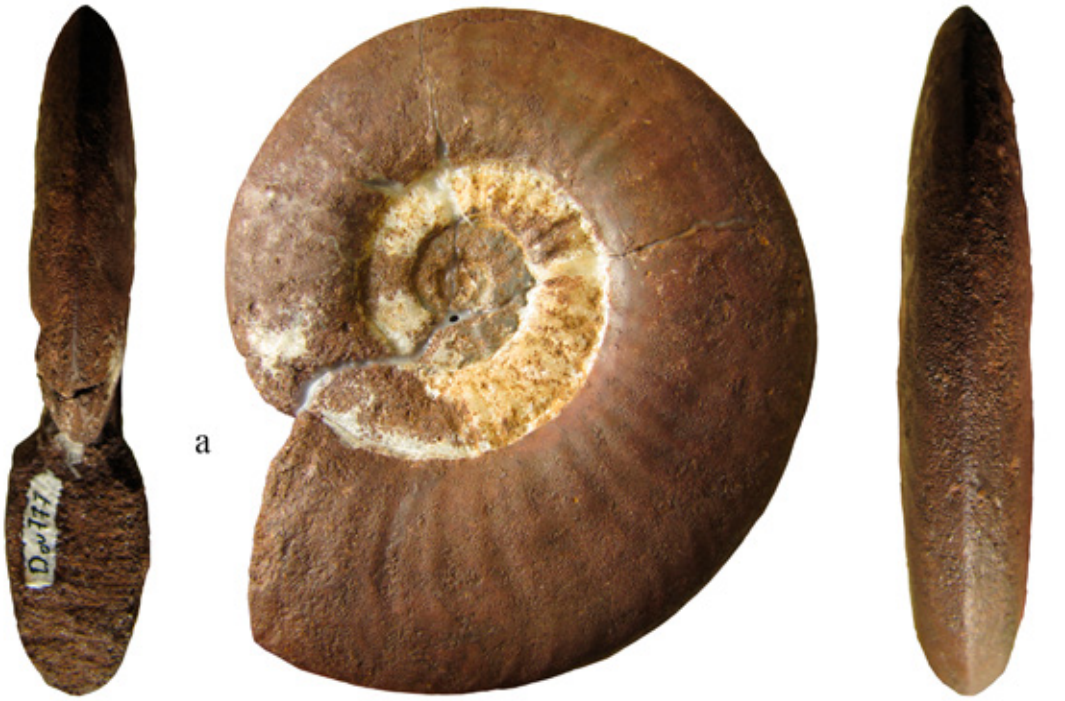
2008 *Pleydellia (Cotteswoldia)* cf. *paucicostata* (Buckman); Ippolitov et al., pl. 1, fig. 2.

2008 *Pleydellia (Cotteswoldia) paucicostata* Buckman; Metodiev, p. 102, fig 6y.

Material - Two specimens (MNHNL DOU525; 766) have been studied.

Diagnosis - Evolute shell. Oxycone section. Sub-rounded flanks. Wide umbilical area. Rounded periumbilical wall. Keeled external area. Half a whorl long body chamber. Strong, sinuous, spaced ribs. Simple suture line, L is sub-rectangular in shape.

Description - Moderately evolute ammonites with external whorls that overlap less than a half. The section is oxycone with sub-rounded flanks. The umbilical area is wide and bounded by a small and rounded periumbilical wall. External area is keeled. The body chamber corresponds to a half whorl. The ornamentation consists of sparse, large and strong ribs. They show a progressive attenuation with coiling. The suture line is simple and has globular elements. The E is rectangular with an accessory triangular saddle A. ES is narrow and slim, indented by a median lobe. L is deep and sub-rectangular in shape. SL_1 is short.



Pl. 16: a - *Cotteswoldia grandjeani* (Benecke, 1905), DOU777. Natural History Museum of Luxembourg. Scale 1:1.

Remarks - *Cotteswoldia paucicostata* is considered by Buckman (1904) as type for the genus *Cotteswoldia*. Studied specimens show some difference with the type displayed by Rulleau (2006), but this is due to its bad preservation.

Geographic and stratigraphic distribution – The studied specimens lack more precise stratigraphic and geographic information. According to the synonymy list, the species is cosmopolitan and distributed in the lower part of the Aalensis Zone.

Cotteswoldia grandjeani (Benecke, 1905) (Pls. 16, 17)

*v. 1905 *Harpoceras Grandjeani* n. f. Benecke, pag. 375; pl. L, figs. 7, 7a.

v. 1940 *Cotteswoldia Grandjeani* Benecke; Gérard & Bichelonne, p. 36; pl. 10, fig. 4.

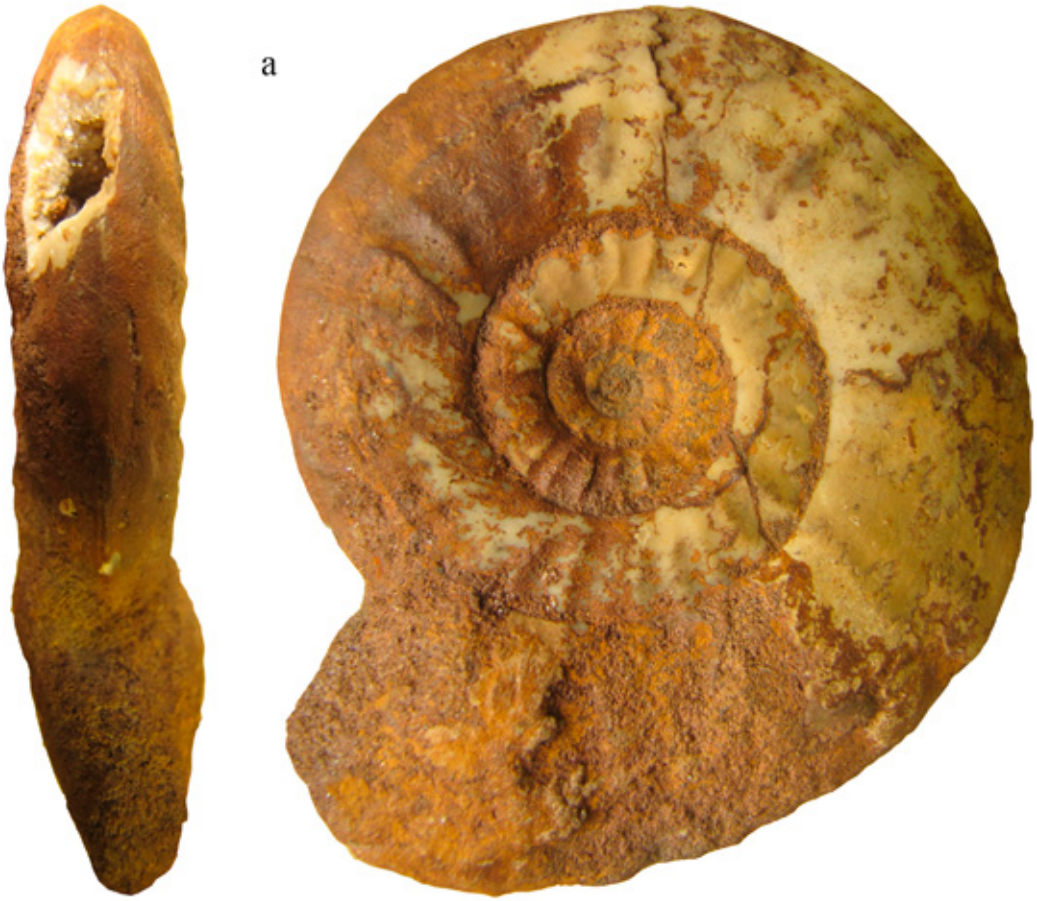
v. 2001 *Pleydellia (Cotteswoldia)* aff. *grandjeani* (Benecke); Rulleau et al., pl. 16, fig. 9.

v. 2006 *Pleydellia (Cotteswoldia)* aff. *grandjeani* (Benecke); Rulleau, pl. 54, fig. 6.

Material - A set of 7 specimens (MNHNL DOU317, 387, 738, 777; HO121, 146, 162) has been studied.

Diagnosis – Evolute shell with oxycone section. Rounded flanks. Wide umbilical area. Small periumbilical wall. Keeled, sub-triangular external area. Single sinuous, well-spaced ribs. Simple suture line with sub-rectangular shaped L.

Description - Moderately evolute ammonites with external whorls that overlap less than a half. The section is oxycone with rounded flanks. The external area is triangular and keeled. The umbilical area is wide, relatively flat and bounded by a barely distinct periumbilical wall. The ribbing is progressively fading with the growth. The suture line has simple and globular elements. E is sub-rectangular in shape and flared, with a big accessory saddle A. ES is wide, globular and it shows a median accessory lobe. L is deep and sub-rectangular in shape, it is indented on the bottom. SL_1 is long and narrow on the bottom, it has an accessory median lobe. U_2 is triangular and it is slightly centrifugal. U_3 is barely visible.



Pl. 17: a - *Cotteswoldia grandjeani* (Benecke, 1905), DOU317. Natural History Museum of Luxembourg. Scale 1:1.

Remarks - *Cotteswoldia grandjeani* is very similar to *Dumortieria kocki* Benecke, 1905, but it differs by its more acute external area, higher keel and thinner section. Another difference may be found in the shape of umbilical elements of the sutural line, which are parallel to the coiling in *Cotteswoldia grandjeani*, while they tend to be centrifugal in *Dumortieria kochi*. The studied specimens are very similar to the type published by Rulleau et al. (2001). The specimen that Rulleau (2000, 2006, 2007) considered affine ("aff.") to the species of Benecke, is considered by us as belonging to *Cotteswoldia grandjeani*.

Geographic and stratigraphic distribution - Studied specimens were collected in the Couche noire and Couche brune cycles in the sub-basin of Esch-sur-Alzette.

Genus *Walkericeras* Buckman, 1913

Walkeria Buckman 1904; Buckman, p. 139.

Type species - *Walkeria delicata* Buckman (Buckman 1904, Mon. I.O.Amm., 1904 Suppl., p. cxl, fig. 122).

Diagnosis - Evolute to moderately involute shell. Sub-oxycone to sub-rectangular section. Flat flanks. Sub-triangular to sharp and keeled external area. Wide to narrow umbilical area, bounded by high, sloping and strong periumbilical wall. Sinuous, thick to weak, joined and fasciculate ribs. Two-thirds of whorl length body chamber. Simple peristome. Simple suture line with flared and wide L.

Remarks - *Walkericeras* has been considered (Rulleau 1995b, 2000, 2006; Rulleau et al. 2001) a sub-genus of *Pleydellia* due to their similar

appearance, but the high periumbilical wall, sub-triangular external area and flared lateral lobe L of the sutural line, together with the inner flank being parallel to tho coiling, allow to separate these two genera. Only *Pleydellia spathi* has an element L, which is similar to *Walkericeras* and because of this, its phyletic position is disputable. Schulbert (2001) considered all species of *Walkericeras* belonging to *Cotteswoldia*, but there are too many differences between these two genera to accept this view. *Walkericeras* differs from *Canavarina* for the height of flanks in *Canavarina* and the sutural line.

Geographic and stratigraphic distribution - *Walkericeras* is a cosmopolitan genus found in the Aalensis Zone of each paleogeographic domain (Di Cencio 2007).

Walkericeras pseudolotharingicum (Maubeuge, 1950) (Pl. 18)

? 1890 *Walkericeras* sp.; Buckman, pl. XXX, fig. 10.

v. 1905 *Harpoceras* cf. *lotharingicum* Branco; Benecke, pl. LI, fig. 4.

v. 1905 *Harpoceras lotharingicum* Branco; Benecke, pl. LII, fig. 5.

*v. 1950 *Pleydellia (Walkericeras) pseudolotharingica* n.sp. Maubeuge: p. 383, pl. XIII, fig. 2.

1995 *Pleydellia (Walkericerras) lugdunensis* Elmi & Rulleau; Rulleau, pl. 13, figs. 10-14; pl. 14, fig. 3.

1995 *Pleydellia (Walkericeras)* gr. *lugdunensis* Elmi & Rulleau; Rulleau, pl. 14, figs. 6, 7; pl. 15, figs. 3-6.

1997 *Pleydellia (Walkericeras) lugdunensis* nom. nov., Elmi & Rulleau in Cariou & Hantzpergue, p. 35 fig. 5; pl. 11, fig. 19.

2001 *Pleydellia (Walkericeras) lugdunensis* Elmi & Rulleau morph. *delicata* Buckman; Rulleau et al., pl. 18, fig. 6.

2001 *Pleydellia (Walkericeras) lugdunensis* Elmi & Rulleau; Rulleau et al., pl. 19, figs. 1, 2.

2004 *Pleydellia (Walkericeras) lugdunensis* Elmi & Rulleau, 1997; Myczynski, p. 68, fig. 26/1, 2.

2004 *Pleydellia (Walkericeras)* cf. *lugdunensis* Elmi & Rulleau, 1997; Seyed-Emami et al., p. 84; pl. 1, Fig. 8a, b.

2006 *Pleydellia (Walkericeras) lugdunensis* Elmi & Rulleau; Rulleau, pl. 55, figs. 7, 8.

2006 *Pleydellia (Walkericeras)* gr. *lugdunensis* Elmi & Rulleau; Rulleau, pl. 56, fig. 4.

2008 *Pleydellia (Walkericeras) lugdunensis* Elmi *et alii*; El Hammichi et al.; pl. II, fig. 8.

2008 *Pleydellia (Walkericeras) lugdunensis* Elmi & Rulleau; Metodiev, pag. 102, fig. 6v.

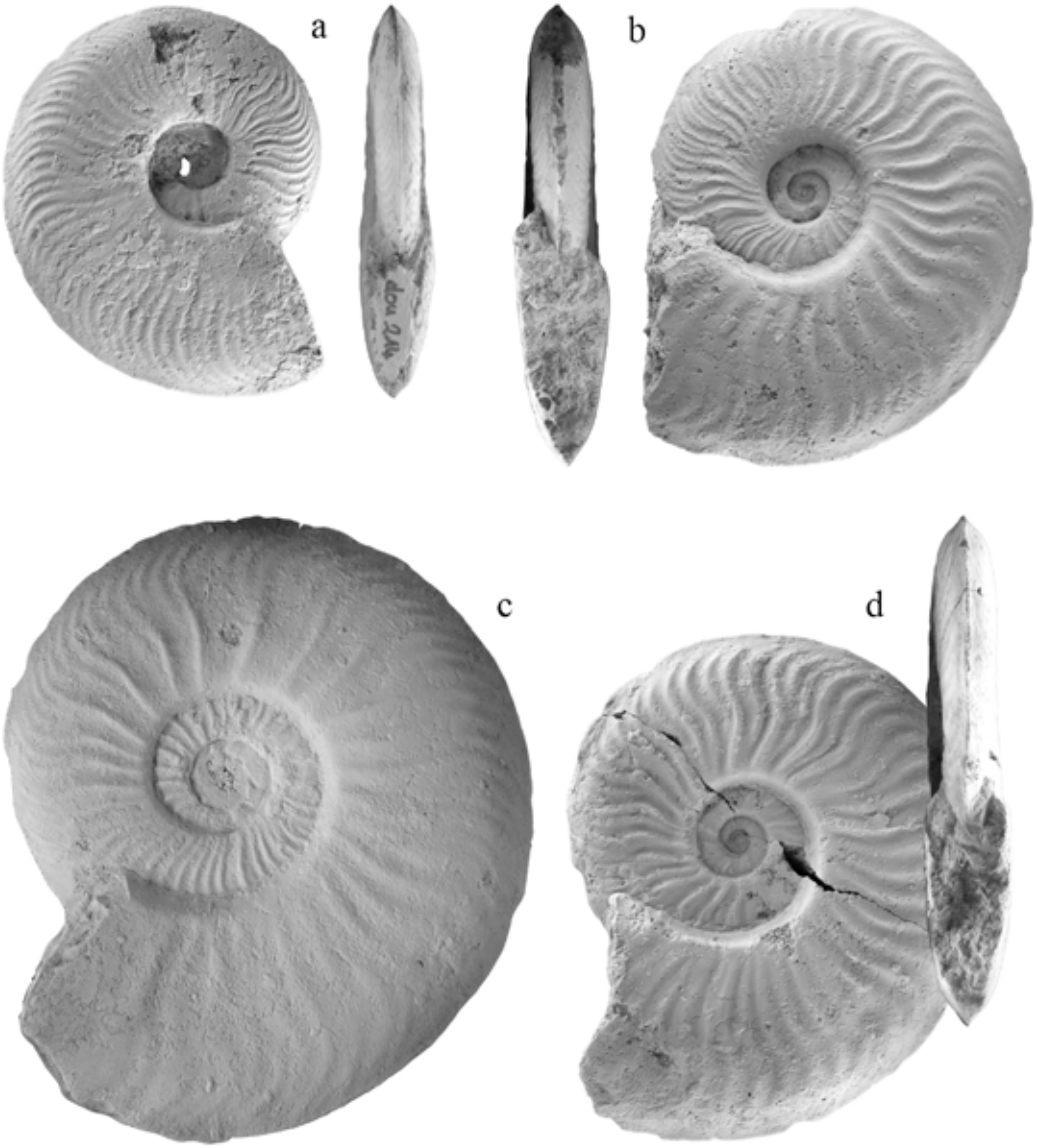
Holotype - Maubeuge 1950 (p. 383, pl. XIII, fig. 2), refigured herein (Pl. 18, fig. a).

Material - A set of ten specimens (DOU214 holotype; DOU338, 339, 340, 553-01, 731, 765; DOT435, 436; EW109) has been studied.

Diagnosis – Moderately involute ammonites. Sub-oxycone section. Slightly rounded flanks. High and sloping periumbilical wall. Narrow and deep umbilical area. Sharp and keeled external area. Single, sinuous, proverse, joined ribs. Simple suture line with flared lateral lobe L.

Description - Moderately involute shell with whorls that overlap slightly more than a half. The section is sub-oxycone with almost flat flanks. The umbilical area is narrow and quite shallow; it is bounded by a high and sloping periumbilical wall. The external area is sharp and keeled. The ornamentation consists of single, proverse, and sinuous ribs on inner whorls. They become joined towards the external whorls, showing also an alternation between thick and attenuate ribs. The suture line has wide and rough elements. The E is wide and flared, enriched by a sub-triangular accessory saddle A. ES is wide, rough and crossed by a small median accessory lobe. L is sub-rectangular and flared. SL_1 is globular, rough and crossed by a small median accessory lobe. U_2 is small and sub-triangular in shape.

Remarks - The holotype of *Walkericeras pseudolotharingicum* is involute, with low periumbilical wall and sharp external area. These features suggest to exclude the species *pseudolotharingicum* from *Walkericeras*. However, *W. pseudolotharingicum* shows the typical lateral lobe L of *Walkericeras* and it allows to distinguish this genus from *Cotteswoldia*, *Pleydellia* and *Canavarina*. *Walkericeras pseudolotharingicum* differs from *W. lotharingicum* for its proverse ribs, especially on the inner whorls. *Walkericeras pseudolotharingicum* and *Pleydellia* (*Walkericercas) lugdunensis* Elmi & Rulleau, 1997 are very similar in morphology (e.g. the evolution degree of whorls, ornamentation, periumbilical wall). Therefore, following the rule of Priority of the



Pl. 18: a - *Walkericeras peudolotharingicum* (Maubeuge, 1950), DOU214 holotype; b - *Walkericeras peudolotharingicum* (Maubeuge, 1950), DOU338; c - *Walkericeras peudolotharingicum* (Maubeuge, 1950), DOU339; d - *Walkericeras peudolotharingicum* (Maubeuge, 1950), DOU340. Natural History Museum of Luxembourg. Scale 1:1.

Code of Zoological Nomenclature (ICZN, 1999, art. 32), *Walkericeras lugdunensis* should be considered a junior synonym of *Walkericeras pseudolotharingicum*. Accordingly, the name of both the Lugdunensis sub-biozone and biohorizon of the Aalensis Zone should be replaced. (fig. 6).

Geographic and stratigraphic distribution - The studied specimens were collected in the upper part of the "Couche Grise", nearby Dudelange and Kayl, in the sub-basin of Esch-sur-Alzette. *Walkericeras pseudolotharingicum* is a marker in the upper part of the Aalensis Zone (Pseudolotharin-

gicum Subzone and Biohorizon, ex Lugdunensis Subzone and Biohorizon *sensu* Rulleau et al. 2001), upper Toarcian.

Walkericeras lotharingicum (Branco, 1879) (Pl. 19, figs. b, d; Pl. 20, fig. a; Pl. 21; Pl.. 24, fig. c)

*v. 1879 *Harpoceras lotharingicum* Branco: pl. 2, fig. 6.

1890 *Grammoceras lotharingicum*; Buckman, p. 199; pl. 30, fig. 8, 9.

1904 *Walkeria? lotharingica?* (Branco); Buckman, p. 140; pl. 30, figs. 8, 9; Suppl. p. 167, fig. 123.

v. 1905 *Harpoceras lotharingicum* Branco; Benecke, p. 399; pl. 51, figs. 1-4; pl. 52, figs. 1-3, 5.

1927 *Grammoceras lotharingicum* Branco; Schneider, p. 37.

v. 1940 *Walkeria lotharingica* Branco; Gérard & Bichelonne, p. 34; pl. 8, fig. 4.

v. 1950 *Pleydellia (Walkericeras) lotharingica* Branco; Maubeuge, p. 384, pl. XIII, fig. 1.

v. 1961 *Walkericeras lotharingicum* Branco; Maubeuge, pl. II, fig. 4.

1985 *Pleydellia lotharingica* (Branco); Seyed-Emami & Nabavi, p. 260, fig. 26.

2001 *Pleydellia (Walkericeras) lotharingica* (Branco); Rulleau et al., pl. 18, fig. 3.

2001 *Cotteswoldia lotharingica* (Branco); Schulbert, p. 81, pl. 10, figs. 1-5.

2006 *Pleydellia (Walkericeras) lotharingica* (Branco); Rulleau, pl. 54, fig. 7.

2008a *Pleydellia* cf. *lotharingica* (Branco); Riccardi, p. 631, fig. 5/31.

2008b *Pleydellia* cf. *lotharingica* (Branco); Riccardi, pag. 328, fig. 4/30.

2010 *Cotteswoldia* cf *lotharingica* (Branco, 1879); Arp. p. 44; pl. 3, figs. 8, 9.

Material - A collection of seventeen specimen (MNHNL DOU130, 131, 176, 208, 290, 344, 512, 552, 763, 769, 790; EW110, 115; HO126, 158; LG103; TO127) has been studied.

Diagnosis - Moderately evolute shell. Flat flanks. High and sharp periumbilical wall. Wide umbilical area. Triangular keeled external area. Body chamber corresponds to two-thirds of the outermost whorl. Simple peristome. Single, sinuous, proverse ribs. Simple suture line with flared L.

Description – Moderately evolute shell with whorls that overlap in half in the earlier ontogenetic stages. The shell becomes more evolute with growth and the whorls overlap by a third. The section is lanceolate in shape, with flat flanks. The umbilical area is wide, relatively flat and it is bounded by high and strong periumbilical walls. On the smaller specimens, the external area is sharp, while it becomes sub-triangular on bigger ones. The external area is always keeled. The body chamber comprises two-third of the last whorl and ends with a simple peristome. The ornamentation is characterized by widely spaced, sinuous and slightly proverse ribs. Sometimes, the phenomenon of capture of ribs is observable, as the phenomenon of fading ribs. Suture line has short, globular, and rough elements. The E is wide,flared, and enriched with an accessory saddle A. ES is globular, indented and crossed by a small accessory lobe. L is wide and flared with an inner flank parallel to the coiling and deep indentation on the bottom. SL_1 is a bit longer than ES. U_2 is similar to L.

Remarks - *Walkericeras lotharingicum* differs from *Walkericeras pseudolotharingicum* by the radial start of ribs on the umbilical side of the flanks and the lack of connecting ribs.

Geographic and stratigraphic distribution - The studied specimens were collected in the Couche grise and Couche rouge cycles, in the sub-basin of Esch-sur-Alzette and in the Couche grise cycle of the sub-basin of Differdange. It is a cosmopolitan species, found in Germany (Schulbert 2001; Arp 2010), France (Rulleau 1995, 2000, 2006; Rulleau et al. 2001) and South America (Riccardi 2008). *Walkericeras lotharingicum* characterizes the Pseudolotharingicum Subzone, upper Aalensis Zone, upper Toarcian (Rulleau et al. 2001).

Walkericeras fluitans (Dumortier, 1874) (Pl. 19, figs. a, c; Pl. 22)

* 1874 *Ammonites fluitans* Dumortier: p. 253, pl. 51, Figs. 7-8.

1878 *Ludwigia Aalensis*; Bayle, pl. lxxix, fig. 4.

v. 1879 *Harpoceras* cf. *fluitans* Dumortier; Branco, pl. ii, fig. 5.

1885 *Ammonites* cf. *radians*; Quenstedt, pl. liv, fig. 21.

1886 *Harpoceras fluitans* (Dumortier); Vacek: pl. 9, Figs. 6-7.

1890 *Grammoceras fluitans* (Dumortier); Buckman, p. 190; pl. XXX, fig. 1, 2.

1890 *Grammoceras* sp.; Buckman, p. 191; pl. XXXII, figs. 11, 12.

v. 1905 *Harpoceras* cf. *fluitans* Dum.; Benecke, p. 385; pl. XLVII, fig. 1; pl. XLVIII, fig. 2.

1927 *Grammoceras fluitans* Dumortier; Schneider, p. 31.

1976 *Pleydellia fluitans* (Dumortier); Schlegelmilch, pag. 108; pl. 51, fig. 14.

1992 *Pleydellia fluitans* (Dumortier); Schlegelmilch, pag. 108; pl. 51, fig. 14.

1993 *Cotteswoldia fluitans* (Dumortier); Ohmert, pl. 14, fig. 6.

1995 *Pleydellia (Cotteswoldia?) fluitans* (Dumortier); Rulleau, pl. 15, figs. 10, 11.

1997 *Pleydellia (Walkericeras) fluitans* (Dum.); Cariou & Hantzpergue, pl. 11, figs. 20, 21.

2000 *Pleydellia (Cotteswoldia) ?fluitans* (Dumortier); Rulleau, pl. 16, fig. 3a,b.

2000 *Pleydellia (C.?)* aff. *fluitans* (Dumortier); Rulleau, pl. 16 fig. 4a,b.

2001 *Pleydellia (Pleydellia) fluitans* (Dumortier); Rulleau et al., p. 53, fig. 18/6; p. 55, pl. 17, fig. 5.

2001 *Pleydellia (Pleydellia)* aff. *fluitans* (Dumortier); Rulleau et al., pl. 18, fig. 2.

2001 *Cotteswoldia fluitans* (Dumortier, 1874); Schulbert, p. 92; pl. 11, figs. 3, 7; pl. 23, fig. 1.

2006 *Pleydellia (Pleydellia) fluitans* (Dumortier); Rulleau, p. 94; pl. 55, fig. 5.

v. 2007 *Pleydellia (Pleydellia) fluitans* (Dumortier, 1874); Di Cencio, p. 324; pl. 33, fig. 13.

2010 *Cotteswoldia fluitans* (Dumortier, 1874); Arp, p. 44; pl. 2 figs. 36, 37.

Material - A set of 13 specimens (MNHNL DOT441, 450, 485, DOU136, 252, 273, 759, 760, 761, 772, 791, 804, 965) has been studied.

Diagnosis – Evolute shell with sub-rectangular section. Flat flanks. High and sharp periumbilical walls. Wide and relatively deep umbilical area. Sub-triangular keeled external area. Thick, sinuous, proverse and rarely joined ribs. Half a whorl long body chamber. Simple suture line with slightly centrifugal and flared L.

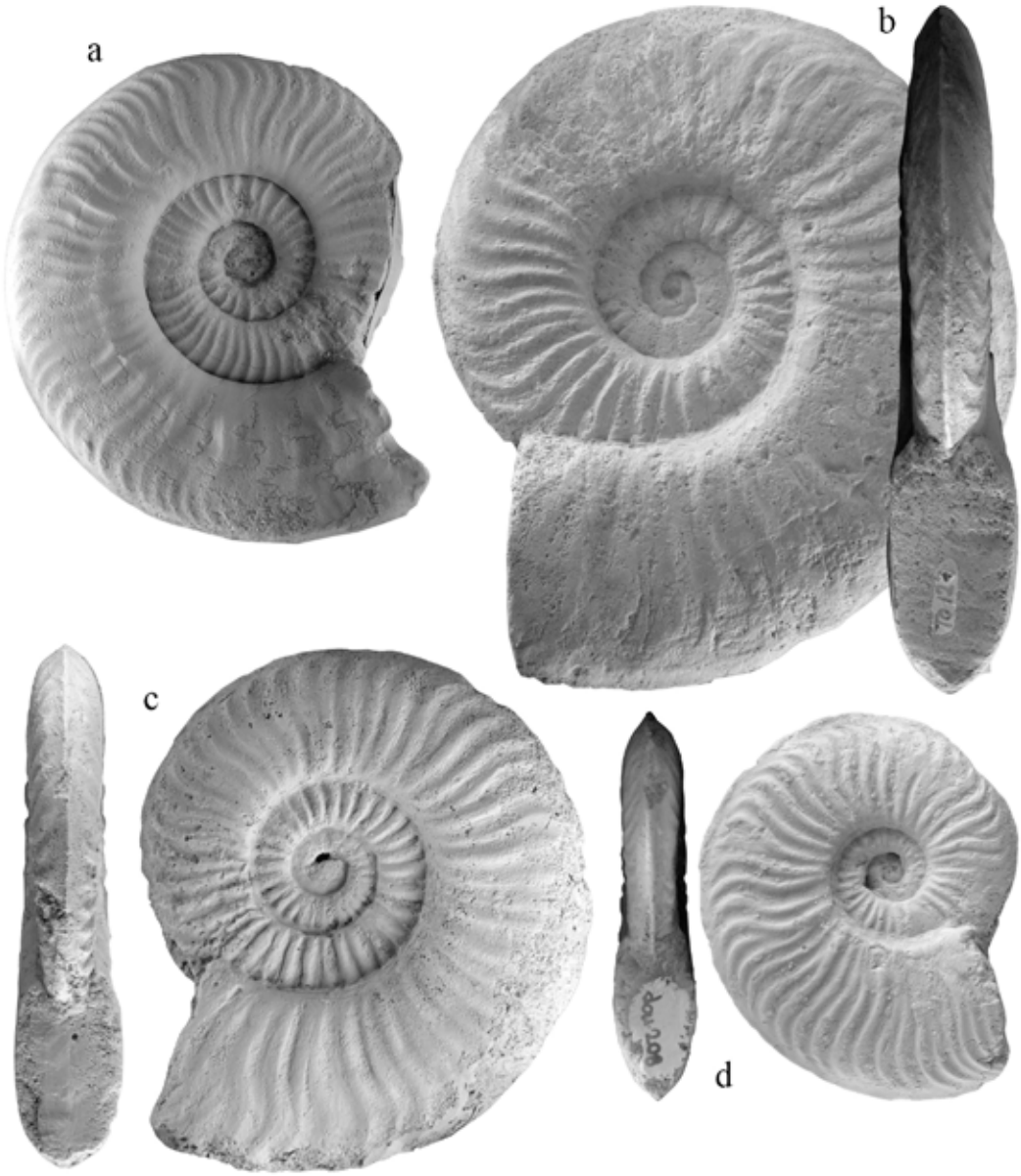
Description - Evolute shell with whorls that overlap by a third. The section is sub-rectangular with flat flanks. The umbilical area is wide and relatively deep and it is bounded by high and sharp periumbilical walls. The external area is sub-triangular, bearing a strong keel. The body chamber measures two-thirds of a whorl. The ornamentation is characterized by thick, sinuous, generally separate, but sometimes connected, ribs. The suture line has short, rough and globular elements. E is wide and flared, it is enriched by a triangular accessory saddle A. ES is wide and rough, crossed by a small accessory median lobe. L is wide and flared with an inner flank which is parallel to the coiling and an external one, which iscentrifugal. SL_1 is narrow, globular and longer than ES. U_2 is similar to but less deep than L. U_1 is barely visible.

Remarks - Two of the studied specimens (DOU252 and DOU136) were figured by Benecke (1905: pl. 47, fig. 1; pl. 48, fig. 2). This author identified both specimen as *Harpoceras* cf. *fluitans*. Confronting both specimens with other published types it appears evident that they can be identified as *Walkericeras fluitans*. The taxonomic position of *Walkericeras fluitans* has always been quite controverse. Schulbert (2001) considers *Cotteswoldia fluitans*, while Rulleau et al. (2001) assigns it to *Pleydellia (Pleydellia) fluitans*. In this paper, owing to the height of the periumbilical wall and the flareness of element L of the sutural line, we prefer the combination *Walkericeras fluitans*. The similarities to both *Cotteswoldia* and *Walkericeras*, would indicate that this species represents a transitional morphology between the two mentioned genera. The stratigraphic position of *Walkericas fluitans* seems to reinforce this idea. The species differs from all other species of *Walkericeras* by its lack of constant interaction between ribs.

Geographic and stratigraphic distribution - The studied specimens were collected in the Couche noire, Couche grise and Couche brune cycles in the sub-basin of Esch-sur-Alzette. *Walkericeras fluitans* is found in Mactra Sub-zone, lower Aalensis Zone, upper Toarcian (Rulleau et al., 2001) of Italy (Pallini *et al*. 2003-2004; Di Cencio 2007), France (Rulleau et al. 2001) and Germany (Schulbert 2001).

Walkericeras arcuatum (Buckman, 1902) (Pl. 20, fig. b)

1890 *Grammoceras* sp.; Buckman, pl. xxxii, figs. 11, 12; p. 191.



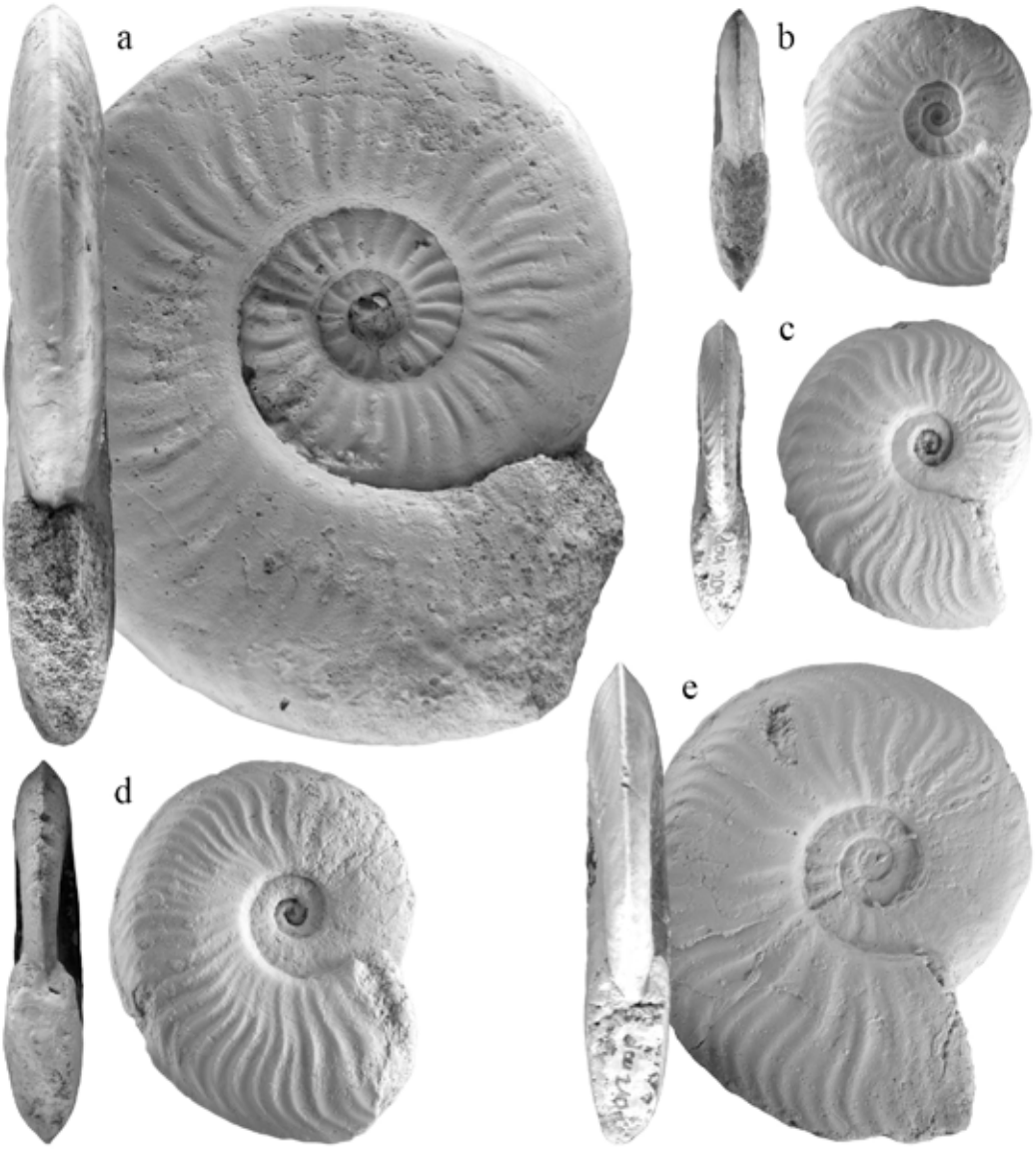
Pl. 19: a - *Walkericeras fluitans* (Dumortier, 1874), DOU121; b - *Walkericeras lotharingicum* (Branco, 1879), TO127; c - *Walkericeras fluitans* (Dumortier, 1874), DOU252; d - *Walkericeras lotharingicum* (Branco, 1879), DOU208. Natural History Museum of Luxembourg. Scale 1:1.

* 1902 *Walkeria arcuata*, emend. amm. nov., Buckman, p.5

1904 *Walkeria acuata* Buckman; Buckman, pl. XXXII, figs. 11, 12; Suppl., fig. 121, p. 167.

v. 1950 *Pleydellia (Walkericeras) arcuata* Buckm.; Maubeuge, p. 381, pl. XI, fig. 2

v. 1961 *Walkericeras arcuata* Buckman; Maubeuge, pl. IV, fig. 4.



Pl. 20: a - *Walkericeras lotharingicum* (Branco, 1879), DOU131; b - *Walkericeras arcuatum* (Buckman, 1902), DOU182; c - *Walkericeras pseudoarcuatum* (Maubeuge, 1950), DOU209 holotype; d - *Walkericeras pseudoarcuatum* (Maubeuge, 1950), DOU211; e - *Walkericeras pseudoarcuatum* (Maubeuge, 1950), DOU210. Natural History Museum of Luxembourg. Scale 1:1.

Material - Only one specimen (MNHNL DOU182) has been studied.

Diagnosis - Moderately evolute shell, with lanceolate section. Flat flanks. High periumbilical wall. Wide and deep umbilical area. Sharp and keeled external area. Single, fasciculate and joined ribs. Simple suture line with slightly flared L.

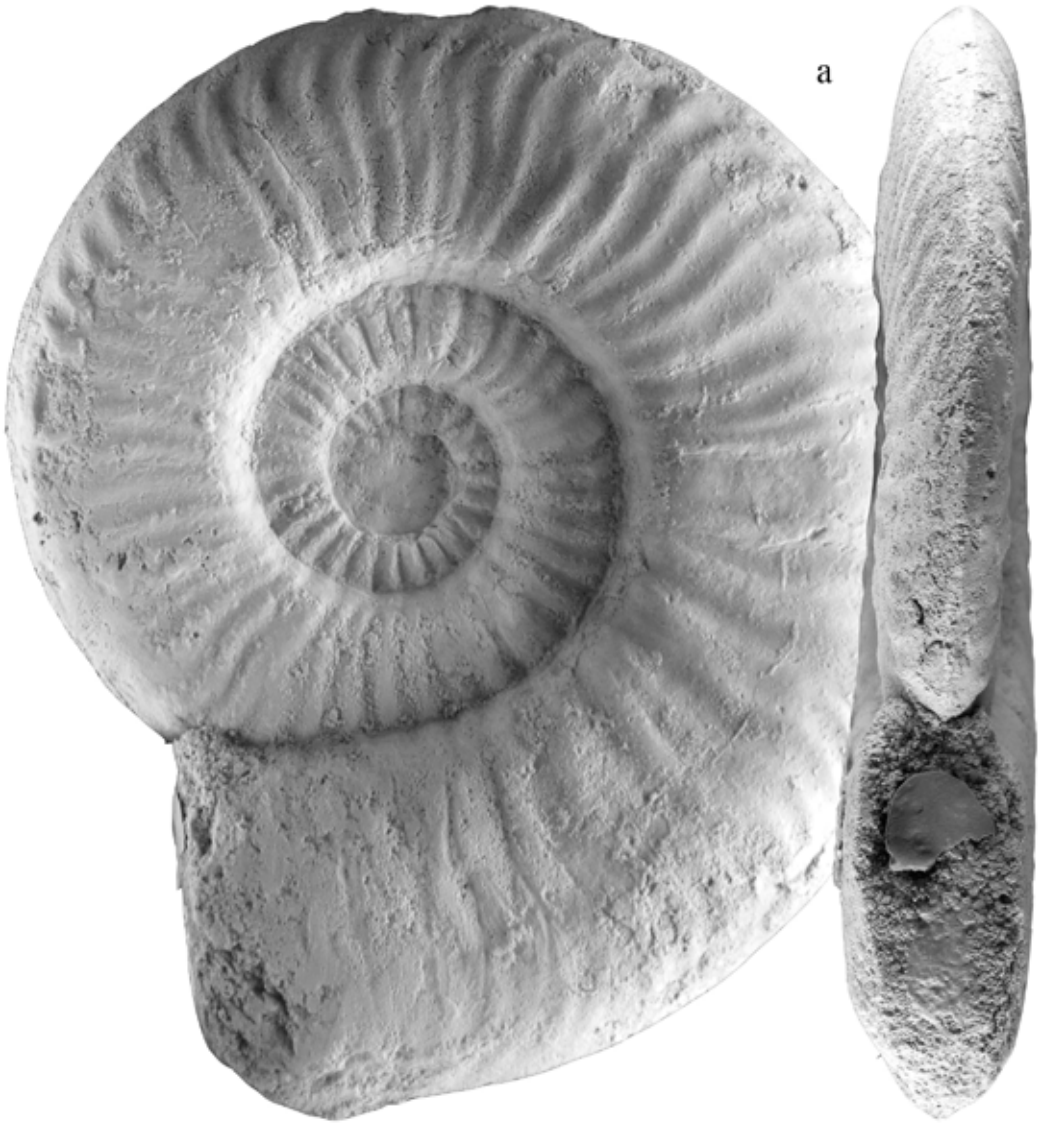
Description - Moderately evolute, plane-spiraled shell with external whorls covering half of the inner ones. The section is lanceolate, with flat flanks. The

Pl. 21: a - *Walkericeras lotharingicum* (Branco, 1879), DOU344. Natural History Museum of Luxembourg. Scale 1:1.

umbilical area is relatively narrow and deep and it is bounded by a low periumbilical wall. The external area is sharp and keeled. The ornamentation is characterized by separate, sinuous, proverse ribs with a tendency to fasciculation and joining on the outer whorls. The suture line has simple and globular elements. E is sub-rectangular in shape and it is enriched by a triangular accessory saddle A. ES is wide, globular and crossed by a small accessory lobe. L slightly flared and indented on the bottom.

Remarks - *Walkericeras arcuatum* differs from *Walkericeras pseudoarcuatum* in ornamentation and in the element L of the suture line.

Geographic and stratigraphic distribution – The studied specimen originates from the Couche grise cycle nearby Dudelange, sub-basin of Esch-sur-Alzette, in rocks dated from the Aalensis Zone, upper Toarcian.



Pl. 22: a - *Walkericeras fluitans* (Dumortier, 1874), DOU136. Natural History Museum of Luxembourg. Scale 1:1.

***Walkericeras pseudoarcuatum* (Maubeuge, 1950) (Pl. 20, figs. c, d, e)**

1905 *Harpoceras lotharingicum* Branco; Benecke, pl. LI, fig. 5.

*v. 1950 *Pleydellia (Walkericeras) pseudoarcuata* n.sp. Maubeuge, p. 382, pl. XII, figs. 1-2.

1993 *Pleydellia pseudoarcuata* Maubeuge; Ohmert, pag. 151, fig. 9; pl. 14, fig. 10; pl. 15, fig. 1.

1996 *Pleydellia pseudoarcuata* Maubeuge; Ohmert, p. 26. Fig. 22c.

Holotype - *Pleydellia (Walkericeras) pseudoarcuata* Maubeuge (1950, p. 382, pl. XII, figs. 1-2). The holotype is preserved in the collection of the natural History Museum in Luxembourg (MNHNL DOU209).

Material - A set of six specimens (MNHNL DOU183, 194, 209 holotype, 210, 211, 246) has been studied.

Diagnosis – Moderately evolute shell, with lanceolatesection. Flat flanks. High periumbilical wall. Narrow and deep umbilical area. Sharp and keeled external area. The body chamber has a length of a quarter whorl. Sinuous, proverse, strong, fasciculate and joined ribs. Simple suture line with flared L.

Description - Moderately evolute ammoniteswith whorls that overlap in half. The section is lanceolate with flat or slightly rounded flanks. The umbilical area is wide, shallow, and bounded by high and slightly sloping periumbilical walls. The external area is sharp and keeled. The ornamentation is characterized by thick, sinuous and proverse ribs. They tend to fasciculate on the inner third; here, an alternation between thick and attenuate ribs together with connecting ribs can be observed. On the studied specimens, the body chamber is only preserved for one quarter of a whorl. The suture line is globular with rough and wide elements. The E is quite shallow, flared and enriched by an accessory saddle A. The ES is rough, slightly globular and crossed by a small accessory lobe. THe L is wide, flared and shallow. Its inner flank is parallel to the coiling and indented on the bottom. SL_1 is sub-rectangular in shape, globular and crossed by a small accessory median lobe. U_2 is similar to L. U_3 is barely visible.

Remarks - *Walkericeras pseudoarcuatum* differs from *Walkericeras arcuatum* by its flared lateral lobe L and its ornamentation.

Geographic and stratigraphic distribution – The studied specimens were collected in the upper part of the "Couche Grise" cycle, nearby Dudelange, in the sub-basin of Esch-sur-Alzette. *Walkericeras pseudoarcuatum* was also found in Germany (Schweigert et al. 2000). *Walkericeras pseudoarcuatum* is typical of the Aalensis Zone, upper Toarcian.

Walkericeras hinsbergi (Benecke, 1905) (PL. 23; Pl. 24, fig. b)

*v. 1905 *Harpoceras Hinsbergi* n. sp. Benecke: p. 373, pl. XLVI, fig. 1a.

v. 1940 *Cotteswoldia Hinsbergi* Benecke; Gérard & Bichelonne, p. 36; pl. 10, fig. 1.

2001 *Pleydellia (Cotteswoldia) hinsbergi* (Benecke); Rulleau et al., pl. 16, fig. 6.

2006 *Pleydellia (Cotteswoldia) hinsbergi* (Benecke); Rulleau, pl. 54, fig. 2.

Holotype - *Harpoceras Hinsbergi* Benecke (1905, pl. XLVI, fig. 1a). The holotype is preserved in the collections of the National Museum of Natural History Luxembourg (MNHNL DOU345).

Material - A set of seven specimens (coded DOU121, 345 holotype, 773; HO144; LO183; TO133, 138) has been studied.

Diagnosis - Moderately evolute shell. Sub-rectangular to sub-oxycone section. Flat flanks. High and strong periumbilical wall. Wide and relatively deep umbilical area. Sub-triangular keeled external area. Body chamber longer than half of a whorl. Thick, sinuous, slightly retroverse, joined and fasciculate ribs. Simple suture line with flared and wide L.

Description - Moderately evolute ammonites with whorls that overlap by a third of the whorl height. The section is sub-oxycone with flat flanks. The umbilical area is wide, relatively deep, and bounded by high and sharp periumbilical walls. The external area is sub-triangular and keeled. The body chamber corresponds to almost half a whorl. The ornamentation is characterized by strong, sinuous, retroverse, fasciculate to joined connecting ribs. On the body chamber, ribs attenuate, but the fasciculation and joining become more visible. The suture line has big and rough elements. E is wide and flared. It is enriched by an accessory, triangular saddle A. ES is wide, indented and crossed by a small accessory median lobe. L is deep, flared, indented with an inner flank parallel to the coiling. SL_1 is similar to ES and it is crossed by a median accessory lobe. U_2 is wide and quite deep.

Remarks - *Walkericeras hinsbergi* is similar to *Cotteswoldia grandjeani* but it differs in height of the periumbilical wall and morphology of the lateral lobe L. *Walkericeras hinsbergi* differs from the other species of *Walkericeras* by the retroverse tendancy of the ribs.

Geographic and Stratigraphic distribution - The studied specimens were collected in the Couche noire, Couche grise and Couche brune cycles in the sub-basin of Esch-sur-Alzette. *Walkericeras hinsbergi* is also known in France (Rulleau et al. 2001). It is found in the Aalensis Zone, upper Toarcian.

Pl. 23: a - *Walkericeras hinsbergi* (Benecke, 1905), DOU345 holotype. Natural History Museum of Luxembourg. Scale 1:1.

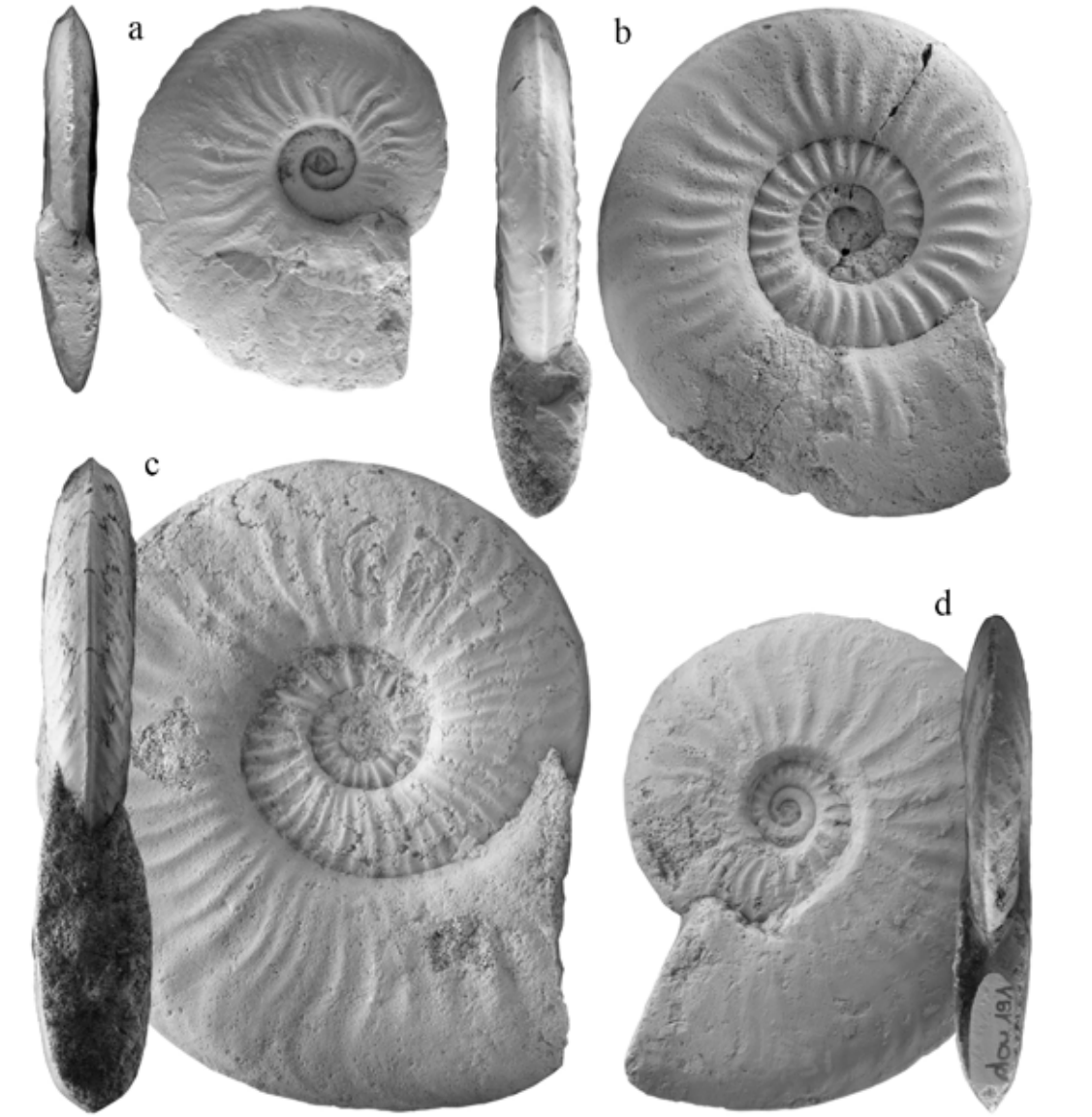
Walkericeras pseudograndjeani (Maubeuge, 1950) (Pl. 24, figs. a, d)

*v. 1950 *Cotteswoldia pseudogranjeani* n.sp., Maubeuge: p. 369, pl. II, fig. 1.

Holotype - *Walkericeras pseudograndjeani* was established by Maubeuge (1950, p. 369, pl. II, fig. 1). The holotype is preserved in the collections of the Natural History Museum Luxembourg (MNHNL DOU191).

Material - Only 2 well preserved specimens (DOU191 holotype, DOU215) have been studied.

Diagnosis - Moderately involute shell. Lanceolate section. Flat flanks. High and thick periumbilical wall. Narrow and quite deep periumbilical wall. Sharp and keeled external area. Sinuous, radial, fasciculate to joined ribs. Simple sutural line, flared L.



Pl. 24: a - *Walkericeras pseudograndjeani* (Maubeuge, 1950), DOU215; b - *Walkericeras hinsbergi* (Benecke, 1905), DOU773; c - *Walkericeras lotharingicum* (Branco, 1879), DOU176; d - *Walkericeras pseudograndjeani* (Maubeuge, 1950), DOU191, holotype. Natural History Museum of Luxembourg. Scale 1:1.

Description – Moderately involute ammonites with whorls that overlap by more than a half. The section is lanceolate with slightly flat flanks. The umbilical area is narrow and quite deep and it is bounded by high and sharp periumbilical walls. The external area is sharp and bears a very distinct keel. The ornamentation is characterized by sinuous and radial ribs, which tend to fasciculate and to join. The suture line has wide and rough elements. E is flared and enriched by an accessory saddle A. ES is wide and slightly indented, it is crossed by a large median accessory lobe. L is sub-squared, flared and indented on bottom. SL_1 is short, sub-rectangular and crossed by an accessory lobe. U_2 is small in size.

Remarks - *Walkericeras pseudograndjeani* differs from all species of *Walkericeras* and from all other species of *Pleydellia, Cotteswoldia* and *Canavarina* by its radial ribs.

Geographic and stratigraphic distribution - The studied specimens were collected in the upper part of the "Couche Grise" cycle, nearby Dudelange, sub-basin of Esch-sur-Alzette (Aalensis Zone, upper Toarcian).

Walkericeras dudelangense (Maubeuge, 1950) (Pl. 25, fig. b)

*v. 1950 *Pleydellia (Walkericeras) dudelangense* n.sp.; Maubeuge, p. 385, pl. XIV, fig. 1.

1967 *Pleydellia dudelangensis* (Maubeuge, 1950); Géczy, p. 155; pl. 34, fig. 2; pl. 44, fig. 68.

1997 *Pleydellia dudelangensis* (Maubeuge, 1950); Metodiev, p. 22; pl. 4, fig. 7.

Holotype - *Pleydellia (Walkericeras) dudelangense* Maubeuge (1950, p. 385, pl. XIV, fig. 1). The holotype is preserved in the collections of the Natural History Museum Luxembourg (MNHNL DOU216).

Material - Only the holotype (MNHNL DOU216) has been studied.

Diagnosis - Moderately involute shell. Lanceolate section. Sub-flat flanks. High and sub-rounded periumbilical wall. Narrow and relatively deep umbilical area. Sub-triangular, keeled external area. Sinuous, spaced ribs. Simple suture line, flared and rough L.

Description - Moderately involute ammonites with whorls that overlap by two-thirds of the whorl height. The section is lanceolate, with sub-flat flanks. The umbilical area is narrow and relatively deep, bounded by high and sloping periumbilical walls. The external area is triangular and keeled. The ornamentation consists of single, sinuous, strong and spaced ribs. Weak ribs may also be present between two stronger ribs, especially on the outer whorls. The suture line has wide and rough elements. The E is wide, flared and it is enriched by an accessory saddle A. The ES is wide, globular, rough and crossed by a little accessory lobe. The L is wide, rough, short and indented on the bottom. The SL_1 is long, narrow and crossed by an accessory lobe. The U_2 is sub-rectangular in shape. The U_3 is barely visible.

Remarks - The ornamentation of the species *dudelangense* is typical for the genus *Walkericeras*, but there are some other features which do not match the typical features of this genus. In particular, the lack of a flared L element raises some doubt concerning the generic attribution. It cannot be excluded that *Walkericeras dudelangense* is a juvenile specimen of another species of *Walkericeras*.

Geographic and stratigraphic distribution - The studied specimen was collected in the upper part of the "Couche Grise" cycle, near the district "Italie", Dudelange, in the sub-basin of Esch-sur-Alzette (Aalensis Zone, upper Toarcian).

Genus *Pleydellia* Buckman, 1899

Type Species - *Pleydellia comata* Buckman, 1899 (suppl. pl. x, figs.11-13). In 1904, Buckman subsequently erroneously designated *Pleydellia aalensis* as type for the genus *Pleydellia*. In 1923, Buckman used again *Pleydellia comata* as type for *Pleydellia*.

Diagnosis - More or less involuted shell. Oxycone section. Slightly rounded flanks. Sharp and keeled external area. Narrow umbilical area. Rounded periumbilical wall. Sinuous and more or less fasciculated ribs. The body chamber comprises a third of a whorl. Simple suture line with sub-rectangular L.

Remarks - *Pleydellia* has always been considered a 'bucket' genus that includes an entire group of *Cotteswoldia*, *Walkericeras Pleydellia* and *Canavarina*. There is still no consensus in literature on the species composition of the genus. Based on several well-preserved specimens of the collections of the Natural History Museum Luxembourg, a revision and better classification of species referred to *Pleydellia* can be made. It has been found that *Walkericeras* and *Canavarina* are closer to *Pleydellia*, than *Cotteswoldia*. As a matter of fact, *Cotteswoldia* does not seem to be connected to *Pleydellia* in a phyletic lineage (Rulleau *et al*. 2001), but they are separated by the evolution of *Walkericeras*. *Pleydellia* differs from *Cotteswoldia* in several features, namely, the periumbilical wall, degree of whorl overlapping, external area, highness of flanks and wideness of the lateral lobe L. Similarities between *Cotteswoldia* and *Pleydellia* are expressed in ornamentation, in some species. *Pleydellia* differs from *Walkericeras* by the rounded, flared and not too high periumbilical wall, roundness of flanks, sharpness of external

Pl. 25: a - *Pleydellia falcifer* Maubeuge, 1950, DOU180 holotype; b - *Walkericeras dudelangense* (Maubeuge, 1950), DOU216 holotype; c - *Pleydellia falcifer* Maubeuge, 1950, DOU122; d - *Pleydellia falcifer* Maubeuge, 1950, DOU806. Natural History Museum of Luxembourg. Scale 1:1.

area and rectangularity of lateral lobe L. *Pleydellia* differs from *Canavarina* in roundness of flanks and wideness of lateral lobe L.

Geographic and stratigraphic distribution - *Pleydellia* is a cosmopolitan genus which has been discovered in rocks dated to the uppermost Toarcian (Aalensis Zone) in every paleogeographic domain.

Pleydellia falcifer Maubeuge, 1950

(Pl. 25, figs. a, c, d)

v. 1905 *Harpoceras plicatellum* Buckman; Benecke, pl. LV, fig. 2.

*v. 1950 *Pleydellia falcifer* n.sp. Maubeuge: p. 379, pl. IX, fig. 2.

1990 *Pleydellia falcifer* Maubeuge; Goy & Martinez, pl. 4; figs. 11, 12.

1995 *Pleydellia (Walkericeras) falcifer* Maubeuge; Rulleau, pl. 15, fig. 7.

2001 *Pleydellia falcifer* Maubeuge; Schulbert, p. 101, pl. 13, fig. 1; pl. 22, fig. 2.

2005 *Pleydellia* cf. *falcifer* Maubeuge; Seyed-Emami *et al*., p. 362, fig. 6m.

Holotype - *Pleydellia falcifer* Maubeuge (1950, p. 379, pl. IX, fig. 2 (3737). It is kept in the collections of the Natural History Museum Luxembourg (MNHNL DOU180).

Material - A set of seventeen specimens (MNHNL DOU122, 177, 180 holotype, 196, 281, 399, 486, 747, 748, 749, 752, 755, 758, 806; DOT446, 448; TO132) has been studied.

Diagnosis - Moderately involute shell. The section is lanceolate. Slightly rounded flanks. Narrow and flat umbilical area. Distinct periumbilical wall. Sharp and keeled external area. Sinuous and fasciculate to joined ribs. Simple suture line with wide and sub-rectangular L.

Description - Moderately involute ammonites with whorls that overlap by a half of the whorl height. The section is lanceolate with slightly rounded flanks. The umbilical area is narrow, flat, and bounded by a distinct periumbilical wall. The external area is sharp and keeled. The ornamentation is characterized by sigmoid, proverse ribs. They are fasciculated on the inner whorls and connected on the outer whorls. The suture line has rough and simple elements. E is flared, shallow and enriched by an accessory triangular saddle A. ES is rough and wide, slightly intended and sub-divided by accessory lobe. L is wide, sub-rectangular and indented on the bottom. SL_1 is long, globular and crossed by an accessory lobe. U_2 is short and triangular.

Remarks - On the outer whorls, *Pleydellia falcifer* shows similar ornamentation to *Walkericeras* species. However, this species shows low periumbilical wall, moderate involution, rounded flanks and sub-rectangular L elements, which are *Pleydellia*-like features. Typical *Pleydellia*-like ribs are present on inner whorls.

Geographic and stratigraphic distribution - The studied specimens were collected in the upper part of the "Couche Grise" cycle, nearby the localities of Dudelange and Kayl, in the sub-basin of Esch-sur-Alzette. *Pleydellia falcifer* is found in outcrops of the Aalensis Zone, upper Toarcian of Iran (Seyed-Emami et al. 2005) and Morocco (El Hammichi et al. 2008).

Pleydellia pseudoaalense Maubeuge, 1950 (Pl. 26; Pl. 27, figs. a, b, d)

1890 *Walkericeras* ?*lotharingica* Branco; Buckman, pl. XXX, figs. 8-9.

*v. 1950 *Pleydellia pseudoaalense* n.sp.Maubeuge, p. 378, pl. IX, fig. 1.

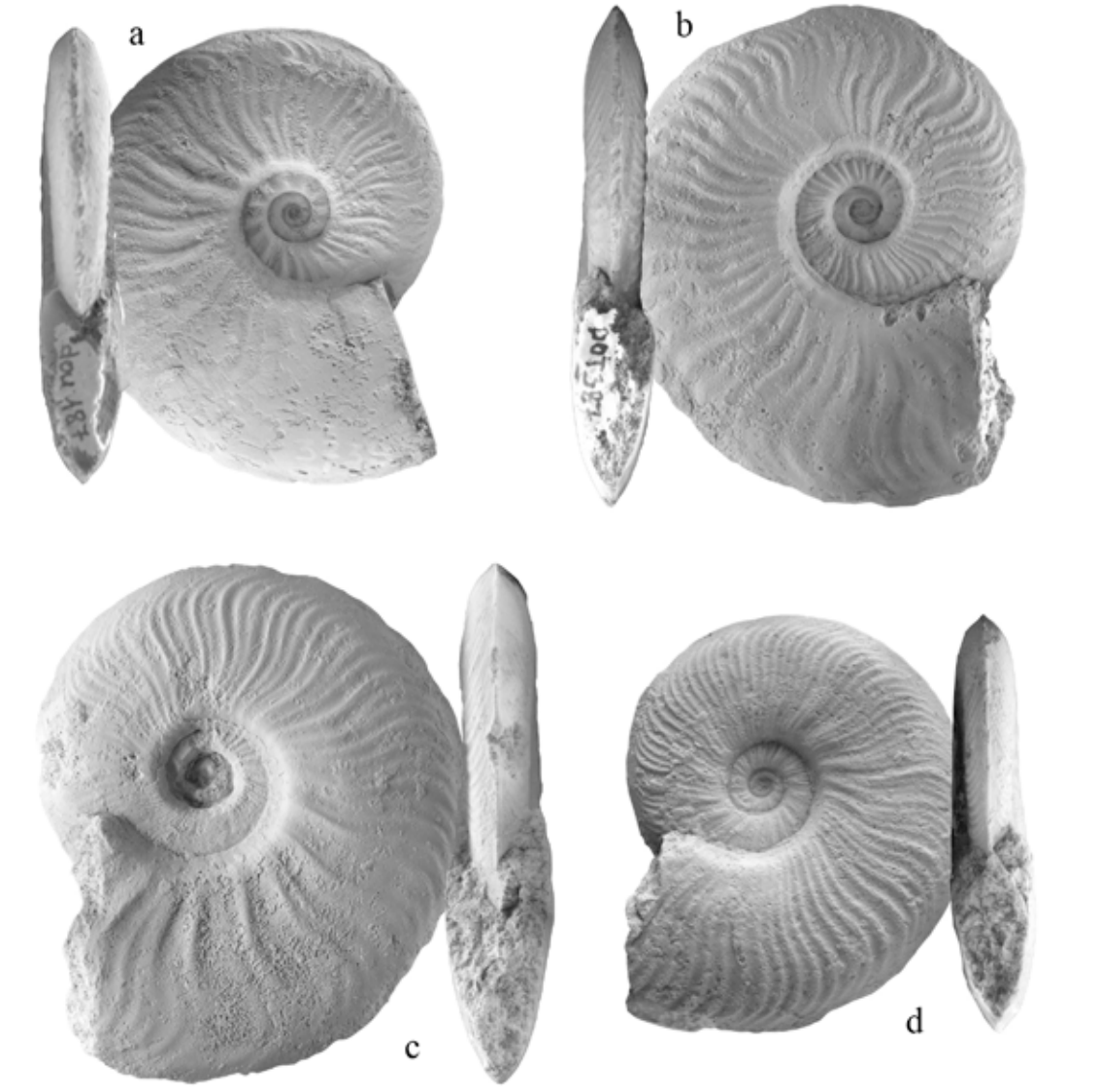
Holotype - *Pleydellia pseudoaalense* Maubeuge (1950, p. 378, pl. IX, fig. 1). The holotype is preserved in the collections of the Natural History Museum Luxembourg (MNHNL DOU187).

Material - A set of 43 specimens (MNHNL DOT368-390, 393, 437; DOU132, 187 holotype, 203, 269, 279, 342, 511, 733, 750, 754, 785, 952, 966; EW103, 104; LO183; TO151, 222) has been studied.

Diagnosis - Moderately involute shell with lanceolate section. Sub-rounded flanks. Narrow and flat umbilical area. Sloping periumbilical wall. Keeled, sharp and sub-triangular external area. Several proverse, sinuous, fasciculate ribs. Simple suture line with narrow, indented and sub-rectangular L.

Description - Moderately involute ammonites with whorls that overlap. The section is lanceolate, with sub-rounded flanks. The umbilical area is narrow, and bounded by sloping periumbilical walls. The external area is sharp, sub-triangular, and keeled. The ornamentation is characterized by proverse and fasciculate ribs, which tend to bifurcate. The suture line has rough and simple elements. The E is wide and flared, enriched with an accessory saddle A. The ES is rough and globular, crossed by a small accessory lobe. The L is narrow and deep, sub-rectangular in shape with both flanks parallel to coiling or moderately flared. Its bottom is deeply indented. The SL_1 is large and rough, crossed by an accessory lobe. The U_2 is similar to L. The U_3 is barely visible.

Remarks - *Pleydellia pseudoaalense* resembles in some features *Cotteswoldia* spp. (e.g., narrow and indented on the bottom L, rounded flanks), but differs in the consistent presence of a distinct periumbilical wall. The latter, together with the rounded flanks are morphological features typical



Pl. 26: a - *Pleydellia pseudaalense* Maubeuge, 1950, DOU187 holotype; b - *Pleydellia pseudaalense* Maubeuge, 1950, DOT387; c- *Pleydellia pseudaalense* Maubeuge, 1950, DOT380; d - *Pleydellia pseudaalense* Maubeuge, 1950 DOT393. Natural History Museum of Luxembourg. Scale 1:1.

for *Pleydellia*. The rib bifurcation is an interesting and defining feature of *Pleydellia pseudoaalense*. It is more common among the genus *Walkericeras,* but *Pleydellia pseudoaalense* differs from it in having less high periumbilical wall and rounded flanks.

Geographic and stratigraphic distribution -The studied specimens were collected in the "Grès supraliasique" and the Couche grise cycle, in the sub-basin of Esch-sur-Alzette. *Pleydellia pseudoaalense* is distributed in the Aalensis Zone, upper Toarcian.

Pleydellia funcki Maubeuge, 1950 (Pl. 27, fig. c)

v. 1905 *Harpoceras* sp.; Benecke, pl. LII, fig. 4.

*v. 1950 *Pleydellia funcki* n.sp., Maubeuge, p. 379, pl. X, fig. 1.

Holotype - *Pleydellia funcki* Maubeuge (1950, p. 379, pl. X, fig. 1). The holotype is preserved at the collections of the Natural History Museum Luxembourg (MNHNL DOU193).

Material - Only one specimen, the holotype (DOU193), has been studied.

Diagnosis - Moderately involute shell. Oxycone section. Rounded flanks. Flared and rounded periumbilical wall. Narrow and flat umbilical area. Sharp and keeled external area. Body chamber corresponds to two-thirds of the outermost whorl. Sinous, proverse, irregularly fasciculate ribs. Simple suture line. Sub-rectangular shaped L.

Description - Moderately involute ammonites with whorls that overlap by two-thirds. The section is oxycone, with sub-rounded flanks. The umbilical area is narrow and flat, bounded by a sloping and rounded periumbilical wall. The external area is sharp and keeled. The body chamber is two-thirds of the outer whorl. The ornamentation is characterized by sigmoid, proverse and irregularly fasciculate ribs. The suture line has short and rough elements. E is wide and sub-rectangular. It is enriched by an accessory saddle A. ES is sub-rectangular, globular and crossed by a small accessory lobe. L is sub-rectangular. SL_1 is long and crossed by a smallaccessory lobe. U_2 is wide, but barely visible.

Remarks - *Pleydellia funcki* is the most involute amongst other *Pleydellia*. It has a similar style of coiling as *Pleydellia arkelli* and the differences are in the roundness of the flanks and the ornamentation. We can not rule out the possibility that the single studied specimen might be a juvenile of some other species of *Pleydellia*.

Geographic and stratigraphic distribution – The studied specimen has been collected in the upper part of the "Couche Grise" cycle, near the district "Italie", Dudelange, in the sub-basin of Esch-sur-Alzette. *Pleydellia funcki* comes from the Aalensis Zone, upper Toarcian.

Pleydellia arkelli Maubeuge, 1950 (Pl. 28, fig. c)

? 1890 *Pleydellia* sp. A, Buckman, pl. XXX, figs. 11-12.

*v. 1950 *Pleydellia arkelli* n.sp. Maubeuge, p. 380, pl. X, fig. 2.

1985 *Pleydellia arkelli* Maubeuge; Seyad-Emami & Nabavi, p. 266, figg. 41.

2001 *Pleydellia* cf. *arkelli* Maubeuge; Schulbert, p. 102, pl. 12, fig. 6.

Holotype - *Pleydellia arkelli* Maubeuge (1950, p. 380, pl. X, fig. 2). The holotype is preserved in the collections of the Natural History Museum Luxembourg (MNHNL DOU189).

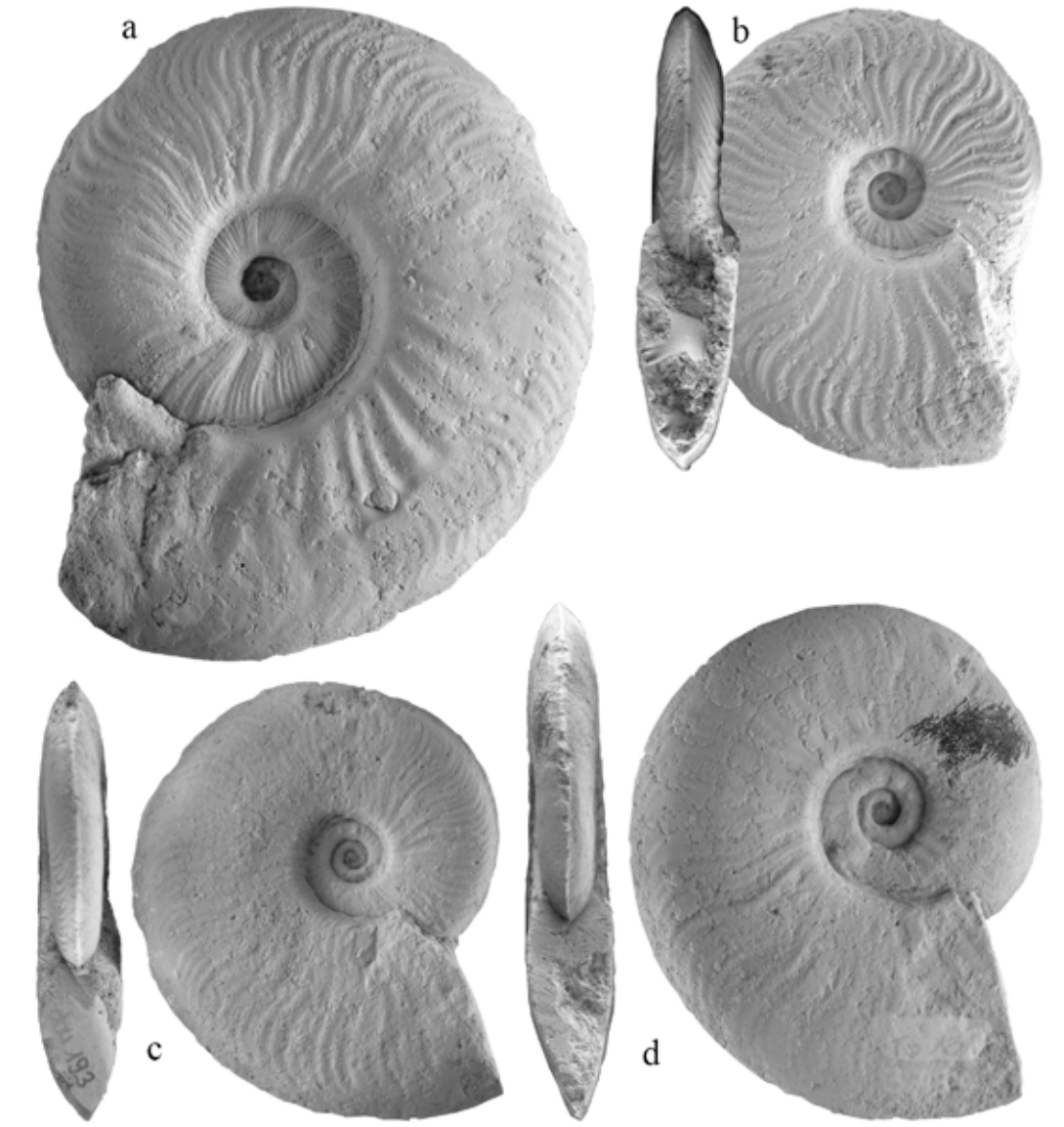
Material - Only one well-preserved specimen (DOU189, holotype) has been studied.

Diagnosis – Moderately involute shell. Oxycone section. Sub-rounded flanks. Sub-rounded periumbilical wall. Narrow and flat umbilical area. Sharp and keeled external area. Proverse, sinuous, fasciculate and bifurcate ribs.

Description - Moderately involute ammonites that overlap by two thirds. The section is oxycone with sub-rounded flanks. The umbilical area is narrow, relatively deep, and bounded by a rounded periumbilical wall. The external area is sharp and bears a distinct keel. The ornamentation consists of sinuous and proverse ribs. They are strong on the inner whorls and become fine and fasciculate on the outer whorls. A tendency of dividing into two or three secondary ribs is observable. The branching is between one or two weak ribs and the next strong ones. The suture line is not preserved.

Remarks - The holotype of *Pleydellia arkelli*, the only known specimen of species, shows the typical features to be included in the genus *Pleydellia*. The only difference is the phenomenon of cpturing of ribs, unique feature between the several species of *Pleydellia*.

Geographic and stratigraphic distribution – The studied specimen was collected in the upper part of the "Couche Grise" cycle, near the district "Italie", Dudelange, in the sub-basin of Esch-sur-Alzette. *Pleydellia arkelli* has also been reported from Germany (Schulbert 2001) and Iran (Seyed-Emami & Nabavi 1985), in the upper part of the Aalensis zone (Schulbert 2001).



Pl. 27: a - *Pleydellia pseudaalense* Maubeuge, 1950 DOU342; b - *Pleydellia pseudaalense* Maubeuge, 1950 DOU750; c - *Pleydellia funcki* Maubeuge, 1950 DOU193 holotype; d - *Pleydellia pseudaalense* Maubeuge, 1950 TO151. Natural History Museum of Luxembourg. Scale 1:1.

Pleydellia leura (Buckman, 1890)
(Pl. 28, figs. b, d)

1885 *Ammonites* cf. *Lythensis*, Quenstedt, pl. liv, figs. 54, 55.

* 1890 *Grammoceras leurum* Buckman, p. 195; pl. 33, figs. 5-10.

1904 *Pleydellia leura* (Buckman); Buckman, p. 138; pl. 33, figs. 5-10; Suppl.,pp. 165, 167; figs. 116, 117.

v. 1905 *Harpoceras* (Grammoceras) cf. *leurum* (Buckman); Benecke, p. 402; pl. 53, figs. 7, 8.

1927 *Grammoceras leurum* Buckman; Schneider, p. 35.

v. 1940 *Pleydellia leura* Buckman; Gérard & Bichelonne, p. 34; pl. 8, fig. 5.

1976 *Pleydellia leura* (Buckman); Schlegelmilch, p. 108; pl. 51, figs. 13, 14.

1992 *Pleydellia leura* (Buckman); Schlegelmilch, p. 108; pl. 51, figs. 13, 15.

1995 *Pleydellia leura* (Buckman); Rulleau, pl. 12, figs. 13, 14.

2001 *Pleydellia (Pleydellia) leura* Buckman; Rulleau et al., pl. 18, fig. 1.

2001 *Pleydellia leura* (Buckman, 1890); Schulbert, p. 96; pl. 13, figs. 6, 7, 10, 11, pl. 14, fig. 1.

2001 *Pleydellia* aff. *leura* (Buckman, 1890); Schulbert, pl. 13, fig. 9.

2006 *Pleydellia (Pleydellia) leura* Buckman; Rulleau, pl. 55, fig. 4.

v. 2007 *Pleydellia (Pleydellia) leura* Buckman, 1890; Di Cencio, p. 323; pl. 33, fig. 2.

2008 *Pleydellia leura* Buckman; Metodiev, pag. 102, fig. 6w.

2010 *Pleydellia leura* (Buckman, 1890); Arp, p. 46; pl. 2, figs. 33-35.

Material - Two well preserved specimens (MNHNL DOU181, 763) have been studied.

Diagnosis - Moderately involuteshell. Lanceolate section. Slightly rounded flanks. Sub-rounded periumbilical wall. Narrow and flat umbilical area. Sharp and keeled external area. Multiple, closely spaced to more distant, sinuous ribs. Simple suture line, sub-rectangular shaped L and short SL_1.

Description – Moderately involute ammonites that overlap by two thirds. The section is lanceolate in shape, with slightly rounded flanks. The umbilical area is narrow, flat, and bounded by rounded periumbilical walls. The external area is sharp and keeled. The ornamentation consists of alternating closely spaced to distant, weak and strong ribs. Irregular fasciculation occurs every 4 or 5 ribs on inner whorls, every 2 or 3 ribs on external whorls. Sometimes smooth but large constriction is observable, after an enforced rib. Rarely phenomenon of capture between ribs is observable. The capture, fasciculation, connecting and alternating are irregular phenomena. The suture line has rough, simple elements. E is wide, flared and enriched by an accessory triangular saddle A. ES is globular, short and slightly rearward confronting the entire line, it is enriched by a small accessory lobe. L is wide, sub-squared and indented on bottom and the umbilical indentation is very deep and indented again. SL_1 is longer than ES, slightly globular and enriched by an accssory lobe. U_2 is small and slightly centrifugal. SL_2 is rough.

Remarks - *Pleydellia leura* has always been described as an ammonite with well spaced, sinuous and fading ribs, but but possibly those specimen reported in literature were juveniles. On the adult stage, the ornamentation becomes more regular. But the ribbing is a less important diagnostic feature for the classification of *Pleydellia leura*, than the sutural line. For each studied specimen, the suture line has a typical little step between ES and SL_1 which is a distinctive feature of *Pleydellia leura*, together with the ornamentation of L. The same suture line has been observed on the specimens studied by Schulbert (2001, pl. 14, fig. 1).

Geographic and stratigraphic distribution - The studied specimens were collected in the upper part of the "Couche Grise", near the district "Italie", Dudelange. *Pleydellia leura* is a cosmopolitan species found in France (Rulleau et al. 2001), Germany (Schulbert 2001) and Italy (Di Cencio 2007), during the Aalensis Zone, upper Toarcian.

Pleydellia spathi (Maubeuge, 1947) (Pl. 28, fig. a)

1904 *Cotteswoldia* sp.; Buckman, fig.13; pl. 31.

*v. 1947 *Cotteswoldia spathi* n.sp.; Maubeuge: p. 78, pl. II, figs. 4-6.

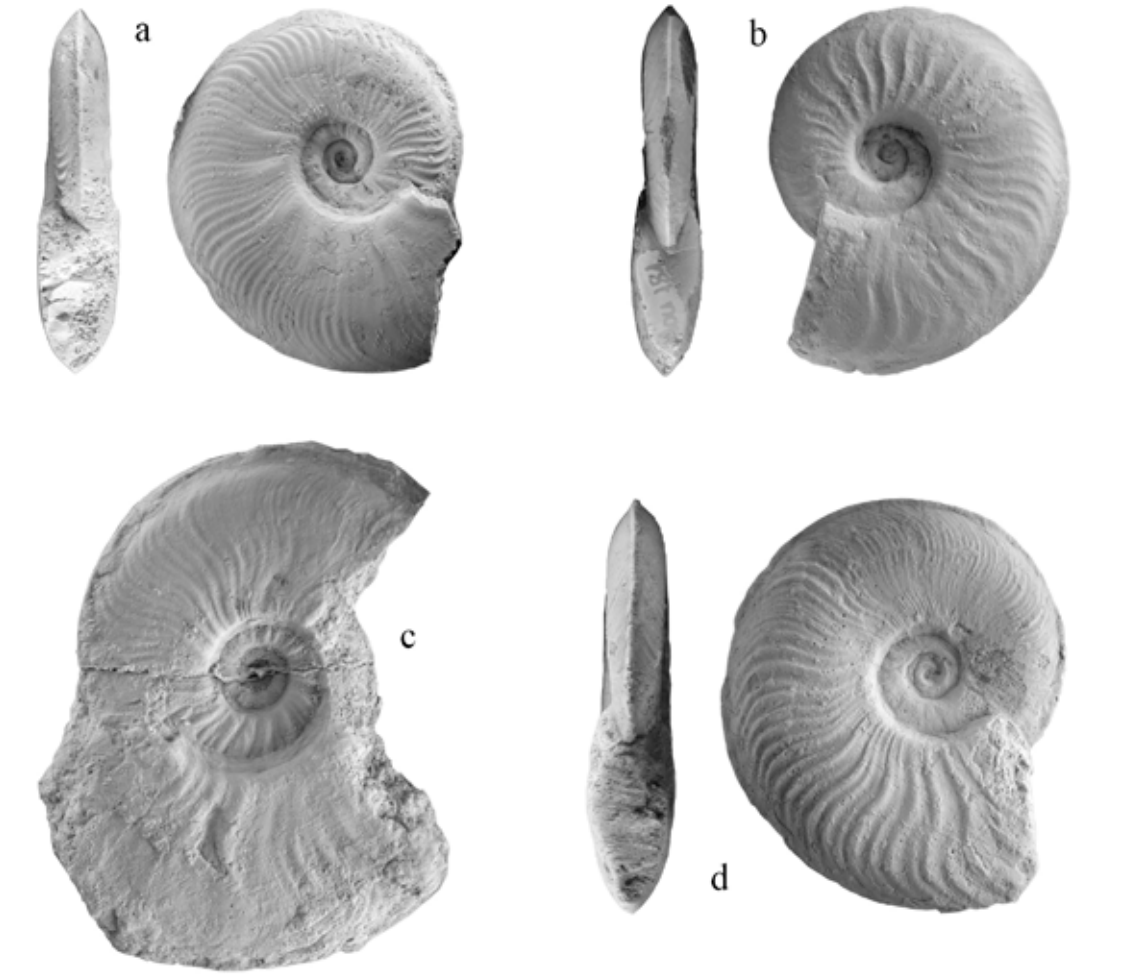
v. 1961 *Cotteswoldia spathi* Maubeuge; Maubeuge, pl. III, fig. 4.

Holotype - *Pleydellia spathi* was established by Maubeuge, (1947, p. 78, pl. II, figs. 4-6). The holotype, by monotypy, is preserved in the collections of the Natural History Museum Luxembourg (MNHNL TO121).

Material - Only one specimen, coded TO121 (holotype), has been studied.

Diagnosis - Moderately involute shell. Oxycone section. Slightly rounded flanks. Sharp and keeled external area. Narrow and flat umbilical area. Rounded periumbilical wall. Sinuous and fasciculated ribs. Suture line with simple and short elements. L is wide and flared.

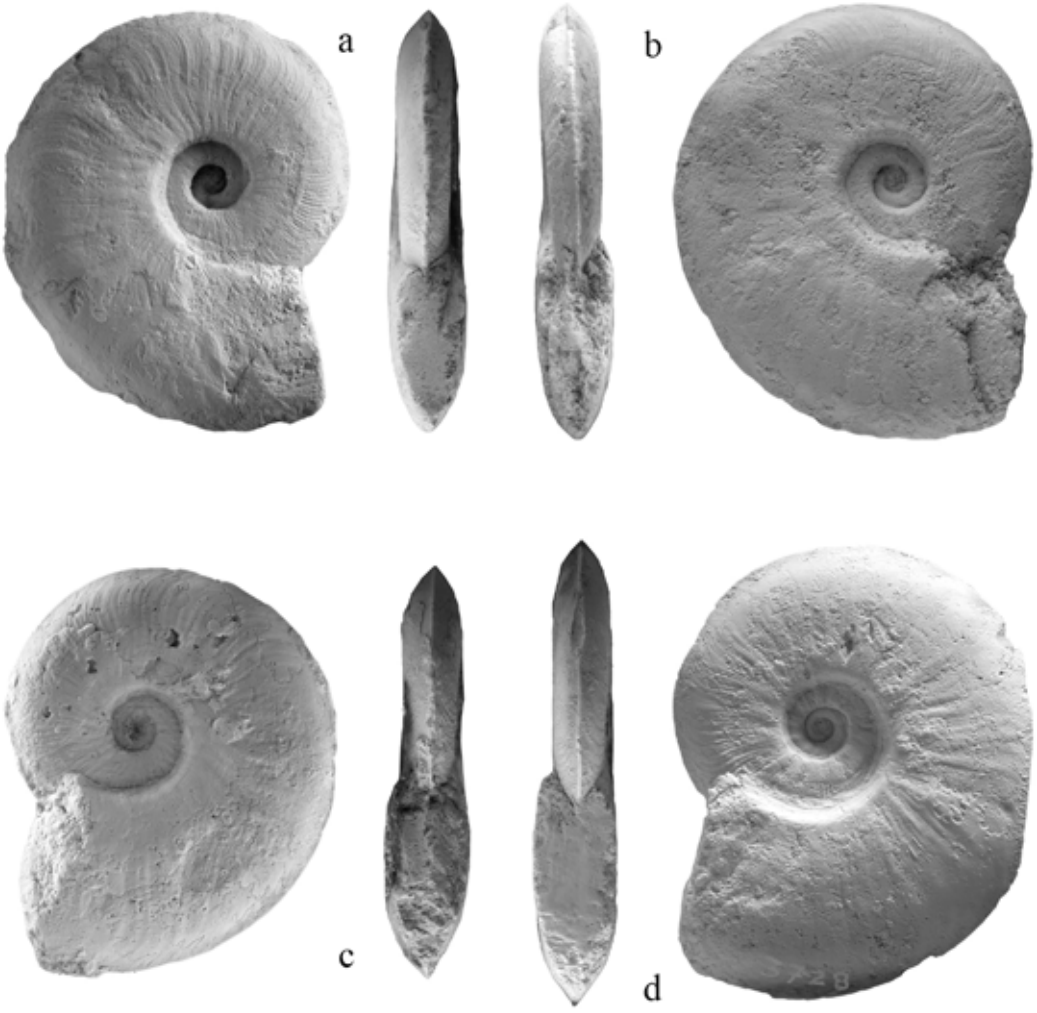
Description - Moderately involute ammonites that overlap more than a half of the flanks. The



Pl. 28: a - *Pleydellia spathi* (Maubeuge, 1947), TO121 Holotype; b - *Pleydellia leura* (Buckman, 1890), DOU181; c- *Pleydellia arkelli* Maubeuge, 1950, DOU189 holotype; b - *Pleydellia leura* (Buckman, 1890), DOU763. Natural History Museum of Luxembourg. Scale 1:1.

section is oxycone with slightly rounded flanks. The umbilical area is narrow, flat and bounded by a rounded periumbilical wall. The external area is sharp and bears a distinct keel. The ornamentation is characterized by numerous sinuous, proverse, irregularly fasciculated ribs. The suture line has rough and simple elements. E is narrow, indented and enriched by a short accessory saddle A. ES is wide and globular, it shows a small median accessory lobe. L is very wide and flared, indented on the bottom. SL_1 is sub-rectangular in shape and it shows a small median accessory lobe. U_2 is similar to L, U_3 is barely visible.

Remarks - *Pleydellia spathi* has been classified as *Cotteswoldia spathi*, by Maubeuge (1947) for its periumbilical wall, typical for *Cotteswoldia*. But *Pleydellia spathi* differs from every other species of *Cotteswoldia* for its element L of suture line, too much flared. Similar L element are often found on *Walkericeras* and not on *Pleydellia*. But the ornamentation, evolution degree and external area are typical only for *Pleydellia*. In only one specimen, three genus are represented. The species *spathi* shows simultaneously the same ornamentation, evolution degree and external area than *Pleydellia*, the same periumbilical wall as *Cotteswoldia* and



Pl. 29: a - *Pleydellia buckmani* Maubeuge, 1947, DOU184; b - *Pleydellia buckmani* Maubeuge, 1947, DOU185; c - *Pleydellia buckmani* Maubeuge, 1947, DOU206; d - *Pleydellia buckmani* Maubeuge, 1947, DOU201. Natural History Museum of Luxembourg. Scale 1:1.

the same L elements of the sutural line as *Walkericeras*. The presence of all those characters together suggests that this specimen is only a juvenile. The presence of *Cotteswoldia*-, *Walkericeras*- and *Pleydellia*-like features justifies the attribution of this species to *Pleydellia*, because latter genus is at the end on the phyletic lineage that connects *Cotteswoldia*, *Walkericeras* and *Pleydellia*. *Cotteswoldia* and *Walkericeras* are ancestors of *Pleydellia* and it is possible that juvenile specimens of *Pleydellia* share some characters with them. Further work is necessary, but at the moment, the attribution of the species *spathi* to the genus *Pleydellia* seems most appropriated.

Geographic and stratigraphy distribution – The studied specimen was collected in the upper part of the "Couche Grise" layer, near the district "Italie", Dudelange, in the sub-basin of Esch-sur-Alzette. Stratigraphically, it was found over the first local occurrence of *Pleydellia buckmani*, but below *Canavarina venustula*, in the Buckmani Bio-horizon, uppermost Aalensis Zone, Upper Toarcian. Maubeuge (1947) considered the Buckmani Bio-horizon as Spathi-Buckmani

bio-horizon. Fernandez-Lopez & Suares-Vega (1979) reported its presence in sediments around the Toarcian-Aalenian boundary of Asturia. Mouterde & Elmi (1991) suggested a local distribution of *Pleydellia spathi*.

Pleydellia buckmani Maubeuge, 1947 (Pl. 29; Pl. 30, figs. a, d)

1890 *Pleydellia* sp.; Buckman, Pl. XXXI, fig. 7.

v. 1905 *Harpoceras opalinum* Rein. var. *comptum* Buckm.; Benecke, p. xx, pl. L, fig. 4.

v. 1905 *Harpoceras partitum* Buckman; Benecke, pl. LIV, figs. 6-7.

*v. 1947 *Pleydellia buckmani* n.sp., Maubeuge, p. 76, Pl. II, figs. 1-3.

v. 1949 *Pleydellia buckmani* Maubeuge; Maubeuge, Pl. XVII, fig. 1.

v. 1950 *Pleydellia buckmani* Maubeuge; Maubeuge, p. 370, pl. 3- 4.

v. 1950 *Pleydellia* aff. *buckmani* Maubeuge; Maubeuge, p. 373, Pl. VII, fig. 1.

v. 1961 *Pleydellia buckmani* Maubeuge; Maubeuge, pl. III, fig. 3.

1964 *Pleydellia buckmani* (Maubeuge); Holder, fig. 20.1.

1985 *Pleydellia buckmani* Maubeuge; Seyed-Emami & Nabavi, p. 262, figs. 27-29.

1990 *Pleydellia buckmani* Maubeuge; Goy & Martinez, pl. 4, fig. 13.

1993 *Pleydellia buckmani* Maubeuge; Ohmert, pag. 151, fig. 10.

2001 *Pleydellia (Pleydellia) buckmani* Maubeuge; Rulleau et al., pl. 18, fig. 4; pl. 19, fig. 3.

2001 *Pleydellia buckmani* Maubeuge; Schulbert, p. 99, pl. 14, figs. 2,3,5-9; pl. 21, fig. 1.

2003-2004 *Pleydellia (Pleydellia)* gr. *buckmani* (Maubeuge 1947); Pallini et al., p.10; pl. 4, Fig. 5.

2005 *Pleydellia (Pleydellia) buckmani* Maubeuge, 1947; Seyed-Emami et al., p. 362, figs 6a, b, g.

2006 *Pleydellia (Pleydellia) buckmani* Maubeuge; Rulleau, pl. 56, figs. 6, 7.

2008 *Pleydellia buckmani* Maubeuge; Metodiev, p. 102, fig. 6y.

2008 *Pleydellia (Pleydellia) buckmani* Maubeuge, 1947; Seyed-Emami et al., p. 251, figs 5f, g.

2010 *Pleydellia buckmani* Maubeuge, 1947; Arp, p. 48; pl. 3, fig. 1-7.

v. 2017 *Pleydellia buckmani* Maubeuge, 1947; Di Cencio & Doria, fig. 1a, 2.

v. 2018 *Pleydellia buckmani* Maubeuge, 1947; Weis *et al*., p. 99, fig. 9c.

v. 2019 *Pleydellia buckmani* Maubeuge, 1947; Di Cencio *et al*., p. 21, fig. 1d.

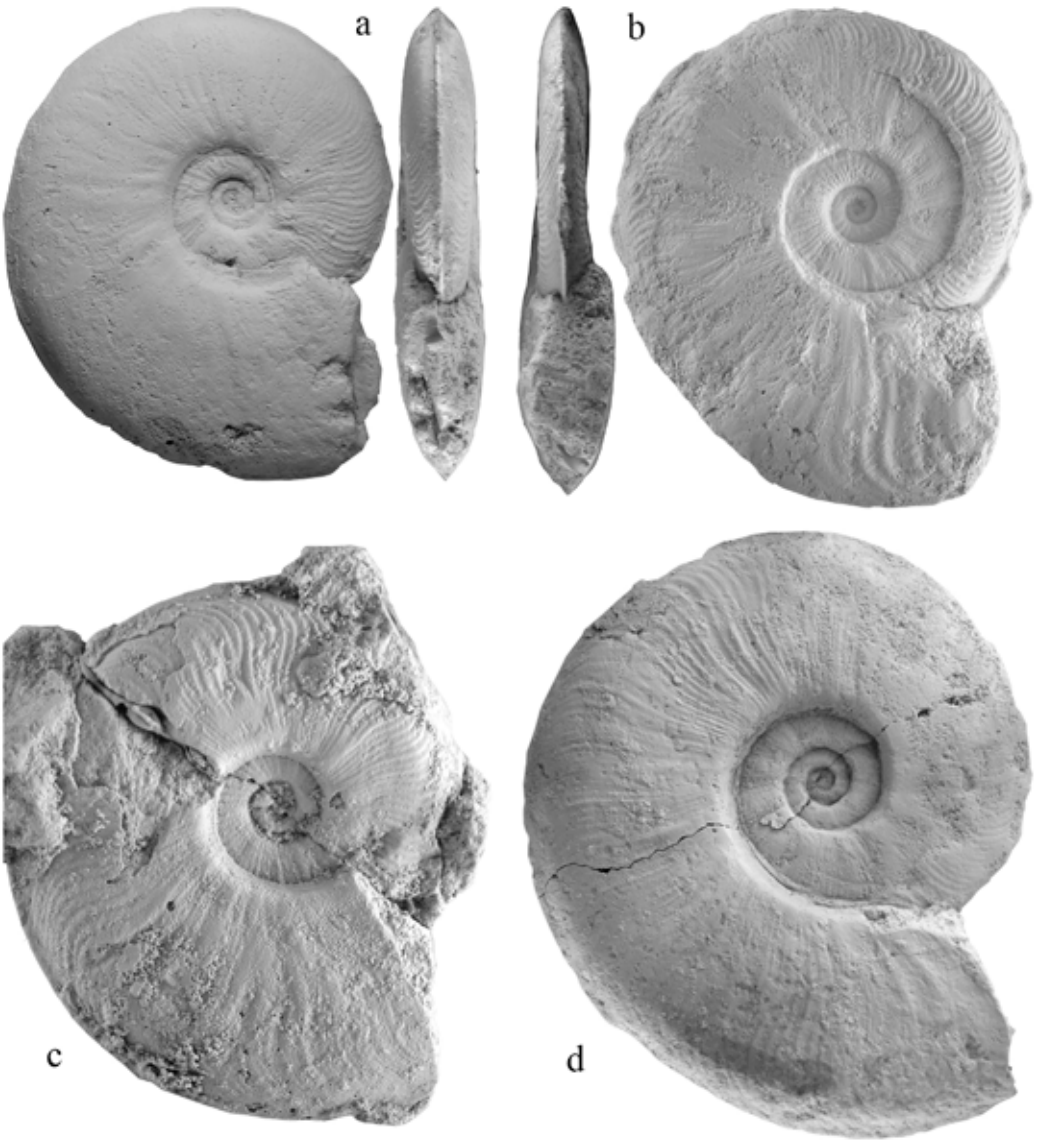
Holotype - *Pleydellia buckmani* was established by Maubeuge (1947, p. 76, Pl. II, figs. 1-3). The holotype is preserved in the collections of the Natural History Museum Luxembourg (MNHNL TO120).

Material - A set of 27 specimens (MNHNL DOT193, 410-416, 449; DOU137, 184, 185, 186, 190, 192, 199, 201, 205, 206, 213, 743; TO120 [holotype], 160, 196-01, 196-02, 196-03, 196-04) has been studied.

Diagnosis - Moderately involute shell. Oxycone section. Slightly rounded flanks. Sharp and keeled external area. Narrow and flat umbilical area. Rounded small periumbilical wall. Numerous sinuous and fasciculated ribs. Half a whorl-long body chamber. Simple peristome. Simple and rough suture line.

Description - Moderately involute ammonites with half overlapping whorls.The section is oxycone with slightly rounded flanks. The umbilical area is narrow and quite flat, bounded by rounded periumbilical walls. The external area is sharp and bears a very distinct keel. The body chamber is half a whorl and the peristome is simple. The ornamentation is characterized by numerous sinuous, proverse, strong and weak ribs. Fasciculation is present and creates a regular bulging along the flanks. Towards the body chamber, the ornamentation fades and only fasciculation is visible. The suture line has rough, simple elements. E is narrow, indented and enriched by an accessory sub-triangular saddle A. ES is wide and globular with a small median accessory lobe. L is relatively narrow, sub-rectangular in shape and indented on the bottom. SL_1 is globular, sub-rectangular in shape and crossed by a small median accessory lobe. U_2 is slightly centrifugal, while U_3 is parallel to the coiling.

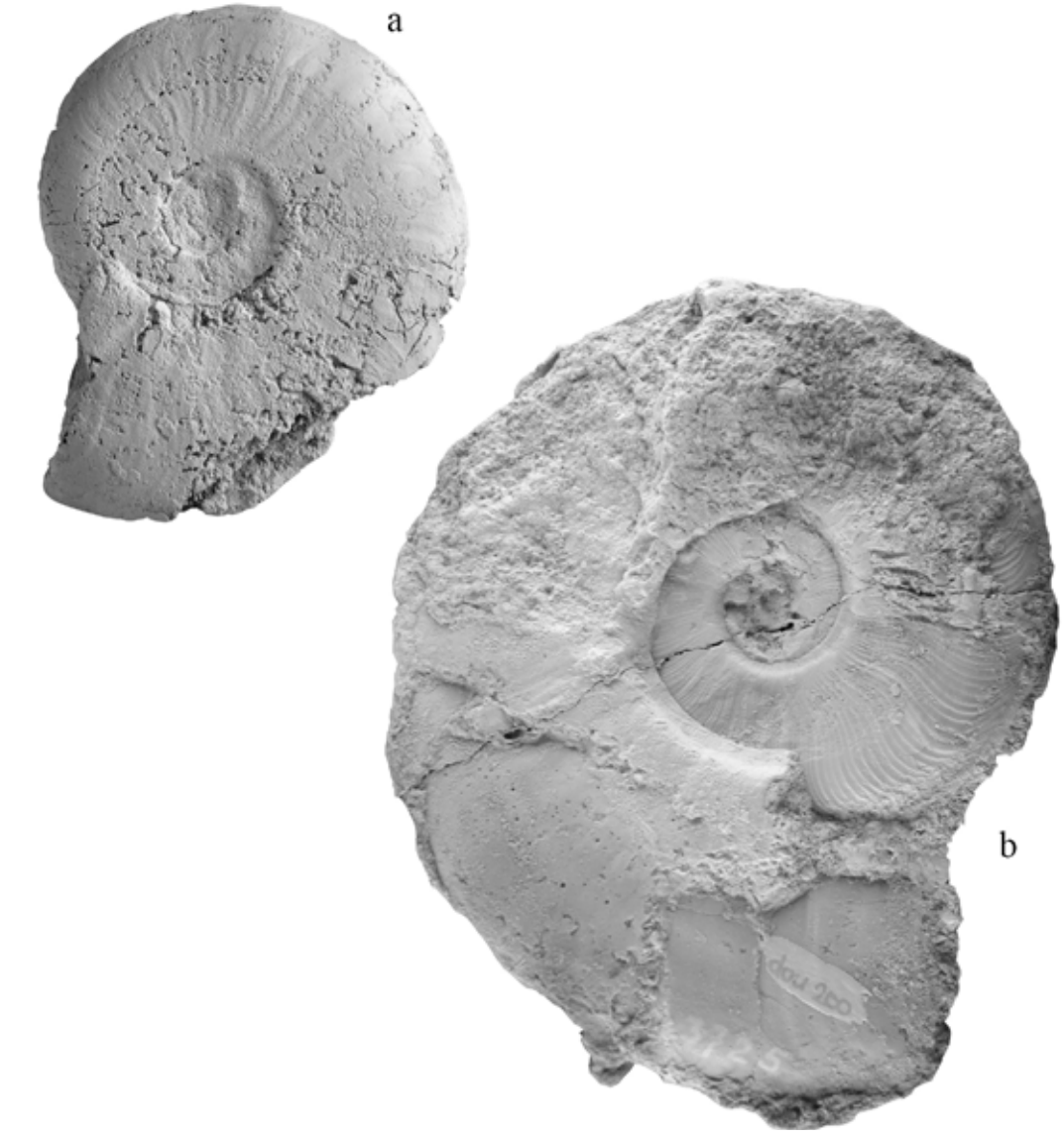
Remarks - *Pleydellia buckmanni* is an easily recognizable species since it differs from all the other species of *Pleydellia* by its numerous sinous and fasciculated ribs. It is the latest species of *Pleydellia* and the affinities with the Aalenian genus *Leioceras* are obvious. But *Pleydellia buckmanni* differs from *Leioceras* by the covering degree of whorls,



Pl. 30: a . *Pleydellia buckmani* Maubeuge, 1947, TO120 holotype; b - *Canavarina venustula* (Buckman, 1902), DOT434; c - *Canavarina venustula* (Buckman, 1902), DOU198; d - *Pleydellia buckmani* Maubeuge, 1947, TO160. Natural History Museum of Luxembourg. Scale 1:1.

fasciculation of ribs and sutural line, which has less elements than the latter. *Pleydellia buckmani* differs from *Canavarina venustula* by its small and rounded periumbilical wall, evolution degree and roundness of flanks.

Geographic and stratigraphic distribution – The studied specimens were collected in the Couche grise and Couche jaune cycles in the sub-basin of Esch-sur-Alzette. This species has been found in France (Rulleau 1995b, 2000, 2006; Rulleau et al. 2001), Iran (Seyed-Emami et al. 2004, 2005, 2006, 2008), Germany (Schulbert 2001; Arp 2010), Bulgaria (Metodiev 2008) and Italy (Pallini et al. 2004). *Pleydellia buckmani* is the marker of the Buckmani Bio-horizon, uppermost Aalensis zone, upper Toarcian.



Pl. 31: a - *Canavarina venustula* (Buckman, 1902), DOU329; b - *Canavarina venustula* (Buckman, 1902), DOU200. Natural History Museum of Luxembourg. Scale 1:1.

Genus *Canavarina* Buckman, 1904

1904 *Canavaria* Buckman, 1902; Buckman.

Type species - *Canavarina digna* Buckman, 1904 (Suppl. p. clxvii, fig. 127; pag. cxlii, fig. 129).

Diagnosis – Moderately involute shell. Lanceolate section. Slightly compressed to sub-flat flanks. Sharp, sub-triangular and keeled external area. Narrow and relatively deep umbilical area. High and rounded periumbilical wall. Numerous sinuous, fasciculate ribs. One third-whorl long body chamber. Simple peristome. Simple suture line. Sub-rectangular shaped L.

Remarks - *Canavarina* is a controversial genus and its position in the *Pleydellia s.l.* group has always been disputed. Arkell et al. (1957) and Howarth (2013) consider *Canavarina* synonymous of *Pleydellia*, while Rulleau et al. (2001) consider *Canavarina* a sub-genus of *Pleydellia*. *Canavarina* differs from *Pleydellia* by the high periumbilical wall, flat flanks, triangular external area and small lateral lobe L. *Canavarina* differs from *Walkericeras* by the small and narrow lateral lobe L, the involution degree and its thick ornamentation. *Canavarina* differs from *Leioceras* by the higher evolution of the whorls and the lower number of elements of the sutural line.

Geographic and stratigraphic distribution - *Canavarina* is often found together with *Pleydellia buckmani*. *Canavarina* is distributed in the North European palaeogeographic domain (Maubeuge 1947; Rulleau 1995, 1996, 2000, 2006; Cariou & Hantzpergue 1997; Rulleau et al. 2001; Fuchs & Weis 2010), Buckmani Bio-horizon, Pseudolotharingicum Sub-zone, upper Aalensis Zone, upper Toarcian.

Canavarina venustula (Buckman, 1902) (Pl. 30, figs. b, c; Pl. 31)

1879 *Amaltheus subserrodens*, Branco: pl. iii, fig. 2.

1890 *Grammoceras suberrondens*; Buckman, pl.XXXI, figs. 5, 6; 10-12?, p. 179.

* 1902 *Canavaria venustula*, emend Amm. nov. Buckman, p. 3.

1904 *Canavarina venustula* (Buckman); Buckman, pl. XXXI, figs. 5, 6, 10-12?; suppl. figs 131, 132, p. clxvii.

v. 1947 *Canavarina venustula* Buckm.; Maubeuge, p. 76, Pl. I, fig. 1

v. 1950 *Canavarina venustula* Buckm.; Maubeuge, pl. 8.

v. 2010 *Canavarina venustula*; Fuchs & Weis, p. 66, fig. 3c.

Material - A set of 11 specimens (MNHNL DOT192, 433, 434, 438, 456; DOU106, 198, 200, 212, 329; TO105) has been studied.

Diagnosis – Moderately involute shell. Lanceolate section. Slightly compressed to sub-flat flanks. Sharp, sub-triangular and keeled external area. Narrow and deep umbilical area. High and rounded periumbilical wall. Numerous sinuous, fasciculate ribs. One third whorl-long body chamber. Simple peristome. Simple suture line. Sub-rectangular shaped L.

Description - Moderately involute ammonites with whorls that overlap by half to two-thirds The section is lanceolate, with sub-flat to slightly compressed flanks. The umbilical area is narrow and relatively deep, bounded by high and rounded periumbilical walls. The external area is triangular to sharp and keeled. The body chamber consists of one third of a whorl and ends with a simple peristome. The ornamentation is characterized by numerous thin, sinuous, proverse and fasciculate ribs. On the external whorls, the ribs tend to attenuate, but fasciculation is always visible. The suture line has rough, globular elements. E is wide and flared and it is enriched by an accessory saddle A. ES is wide, globular and crossed by an accessory lobe. L is narrow, sub-rectangular and slightly flared. SL_1 is long, globular and crossed by an accessory lobe. U_2 is small and sub-rectangular in shape.

Remarks - *Canavarina venustula* seem to derive from *Pleydellia buckmani*; both species have an overlapping stratigraphic distribution. *Canavarina venustula* differs from *Pleydellia buckmani* for major involution degree, sharper periumbilical wall and higher flanks. *Canavarina venustula* differs from every other species of *Pleydellia* by its high periumbilical wall, flat to compressed flanks, thin proverse ribbed ornamentation and sub-triangular to acute external area. *Canavarina venustula* differs from *Canavarina steinmanni* Haug, 1855 in roundness of flanks and fasciculation of ribs.

Geographic and stratigraphic distribution – The studied specimens were collected in the Couche grise and Couche jaune cycles in the sub-basin of Esch-sur-Alzette. *Canavarina venustula* is found in the Buckmani bio-horizon, Pseudolotharingicum Sub-zone, Aalensis Zone, upper Toarcian. Maubeuge (1963) assumed a Venustula bio-horizon over the Buckmani bio-horizon, to be the last bio-horizon of the Toarcian.

Superfamily Hammatoceratoidea Schindewolf, 1964

Family Hammatoceratidae Buckman, 1887

Subfamily Hammatoceratinae Buckman, 1887

Genus *Bredyia* Buckman, 1910

1910 *Burtonia* Buckman.

1963 *Pseudammatoceras* Elmi.

Type species - The genus *Bredyia* was established by Buckman on the type species *Burtonia crassornata* Buckman 1910, alrready known as *Ammonites subinsignis* Oppel, 1856

Diagnosis – Involute shell. Sub-trapezoidal to sub-ogival section. Flat, converging flanks. Narrow and keeled external area. Wide to narrow, deep umbilical area. Rounded periumbilical walls. One whorl-long body chamber. Primary ribs dubdivided in secondary ribs. Hammatoceratid suture line with simple elements.

Remarks - The genus *Bredyia* has been considered by Arkell *et al*. (1957). Elmi (1963) used the species *subinsignis* as type species of the genus *Planammatoceras*. Senior (1977) considers *Planammatoceras* synonymous of *Bredyia* for nomenclatural reasons. Donovan *et al*. (1981) considered Elmi's genus as a junior synonym of *Bredyia*. Kovacs (2009) affirms the validity of the the genus, following the classification of Senior (1977), Martinez (1992) and Cresta (1997).

Stratigraphic and geographic distribution - *Bredyia* appears in the Aalensis Zone in both the Mediterranean and North-Western European domains and becomes cosmopolitan during the Aalenian (Kovacs, 2009).

***Bredyia subinsignis* (Oppel, 1856)**
(Pls. 32, 33, 34)

* 1856 *Ammonites subinsignis* Oppel, p. 367.

1874 *Ammonites alleoni*; Dumortier, p. 259; pl. 52, figs. 3, 4.

1874 *Ammonites subinsignis* (Oppel); Dumortier, p. 261, pl. 53, figs 3-5.

1883 *Harpoceras insigne* Schubler; Wright, p. 453, pl. 75, figs. 1-3.

v. 1905 *Hammatoceras subinsigne* Oppel; Benecke, p. 331, pl. 32, figs 2–3, pl. 33.

1910a *Burtonia crassornata*; Buckman, p. 97, pl. 9, fig. 1, pl. 10, fig. 1.

1925 *Hammatoceras subinsigne* Oppel; Renz, p. 10, pl. 1, fig. 5.

1927 *Hammatoceras subinsigne* Oppel; Schröder, p. 12, pl. 1, fig. 5.

1940 *Hammatoceras subinsigne* Oppel; Gérard & Bichelonne, p. 41, pl. 17, fig. 2.

1961 *Hammatoceras (Hammatoceras) subinsigne* Oppel; Krymholts, p. 99, pl. 6, figs 4, 6.

1962 *Hammatoceras alleoni* Dumortier; Migacheva, p. 82; pl. 8, figs. 1, 3.

1962 *Hammatoceras subinsignis* Oppel; Migacheva, p. 82; pl. 8, fig. 8.

1963 *Pseudammatoceras subinsigne* (Oppel); Elmi, p. 15, pl. 1, figs 1–2.

1963 *Pseudammatoceras dumortieri dumortieri* (Prinz); Elmi, p. 23, pl. 1, fig. 4.

1963 *Pseudammatoceras dumortieri crassum* n. subsp. Elmi, p. 25, pl. 3, figs 1–3.

1963 *Parammatoceras alleoni* (Dumortier); Elmi, p. 55; pl. 8, fig. 1.

1963 *Parammatoceras suballeoni* Elmi, p. 57; pl. 8, fig. 4.

1966 *Hammatoceras subinsigne* (Oppel); Nutsubidze, p. 145, pl. 32, fig. 1, pl. 33, fig. 1.

1966 *Hammatoceras vighi* n. sp. Géczy, p. 39, fig. 27, pl. 5, fig. 3, pl. 37, fig. 18.

1967 *Pseudammatoceras cf. subinsigne* (Oppel); Seyed–Emami, p. 77, pl. 10, fig. 2.

1967 *Pseudammatoceras dumortieri dumortieri* (Prinz); Seyed–Emami, p. 78, pl. 2, fig. 19, pl. 8, figs 8–9.

1976 *Hammatoceras subinsigne* (Dumortier); Schlegelmilch, p. 91, pl. 48, fig. 5.

1977 *Bredyia subinsignis* (Oppel); Senior, p. 682, pl. 81, figs 1–4, pl. 82, figs 1–5, pl. 83, figs 1–2, 5–6, pl. 84, figs 1–24.

1992 *Bredyia subinsignis* (Oppel); Martínez, p. 140, fig. 26, pl. 29, fig. 1, pl. 30, figs 1–2, 4, pl. 31, figs 1, 3–8, pl. 32, figs 1–4.

1993 *Bredyia crassornata* (Buckman); Elmi & Rulleau, p. 153, fig. 8.

1994 *Bredyia subinsignis* (Oppel); Goy et al., pl. 1, fig. 13, pl. 2, figs 9–10.

1996 *Bredyia subinsignis* (Oppel); Schweigert, p. 2, pl. 1, figs 1, 2, pl. 2, figs 1–2.

Pl. 32: a - *Bredyia subinsignis* (Oppel, 1856), DOU650. Natural History Museum of Luxembourg. Scale-bar 1 cm.

1996 *Pseudammatoceras subinsigne* (Oppel); Rulleau, p.8, pl. 28, figs 1–2, pl. 29, figs 3–6.

1996 *Bredyia crassornata* Buckman; Rulleau, p. 8, pl. 27, figs 1–2.

2001 *Pseudammatoceras subinsigne* (Oppel); Metodiev & Sapunov, p. 62, pl. 1, figs 1–2.

2001 *Pseudammatoceras subinsigne* (Opp.); Rulleau et al., pl. 24, figs 3-5, pl. 25, fig. 3, pl. 30, fig. 4.

2005 *Bredyia subinsignis* (Oppel); García & Frank, pl. 3, figs 1–2.

2007 *Pseudammatoceras subinsigne* (Oppel); Rulleau, p. 102, fig. 28/7, pl. 76, fig. 7.

2007 *Bredyia crassornata* Buckman; Rulleau, p. 104, pl. 77, fig. 1.

2009 *Bredyia subinsignis* (Oppel, 1856); Kovacs, p. , figs. 33, 34.

Pl. 33: a - *Bredyia subinsignis* (Oppel, 1856), DOU833. Natural History Museum of Luxembourg. Scale-bar 1 cm.

2009 *Pseudammatoceras subinsignis* (Oppel); Rulleau, p. 51, fig. 15/8-10; pl. 36, fig. 4; pl. 38, figs. 2-3; pl. 39; pl. 40, figs. 1, 3; pl. 41, fig. 2.

2009 *Bredyia crassornata* Buckman; Rulleau, p. 55, figs. 15/13; figs., 16/2-3; pl. 44, figs. 2-3; pl. 45, fig. 1-2; pl. 46; pl. 47, fig. 2; pl. 48, fig. 1, 3, 4; pl. 49, fig. 3, 5.

Material – A set of seven specimens (MNHNL DOU650, 833, 838; HO152; LO238; TO102, 139) has been studied.

Diagnosis – Involute shell. Sub-trapezoidal section. Convergent, flat flanks. Narrow and keeled external area. Wide and deep umbilical area. Rounded periumbilical walls. One whorl-

Pl. 34: a - *Bredyia subinsignis* (Oppel, 1856), TO102. Natural History Museum of Luxembourg. Scale-bar 1 cm.

long body chamber. Strong and slightly retroverse primary ribs. Proverse secondary ribs. Tubercles on forked ribs. Multiple simple elements on hammatoceratid suture line.

Description - Moderately involute ammonites with whorls that overlap in half. The section is sub-trapezoidal with rounded external third. The flanks are flat but they become convex towards the external area. The external area is narrow and keeled. The umbilical area is rather wide, moderately deep and bounded by a rounded periumbilical wall. The body chamber is about one whorl. The ornamentation is characterized by very strong, slightly retroverse primary ribs. Every primary rib branches into three secondary ribs, over the half of flank of shell. On juvenile

Pl. 35: a - *Bredyia brancoi* (Prinz, 1904), DOU330. Natural History Museum of Luxembourg. Scale-bar 1 cm.

stages, tubercles give rise to secondary ribs. The secondary ribs are proverse and the entire system of primary and secondary ribs forms proverse, C-shaped ribs. The ornamentation fades towards the body chamber on the mature shell. The suture line is hammatoceratid and shows several simple elements. The external lobe E is very large, with flanks on the shoulder of the flanks of the shell. It is indented and enriched by a large (one third of E), triangular accessory saddle. ES is narrow and crossed by several deep accessory lobes. L is sub-rectangular in shape, indented and has a bottom enriched by three deep indentetion. SL_1 is narrow and very indented, showing a design similar to a hand with several indented fingers. U_2 is narrow indented and centrifugal. The umbilical

elements are centrifugal. SL_2 has its "fingers" directed towards the umbilicus. The last umbilical elements are very indented.

Remarks - *Bredyia subinsignis* differs from *Bredyia brancoi* in evolution degree, highness of section, coarser ornamentation, as well as suture line, which has less indented elements. *Bredyia subinsignis* differs from *Planammatoceras sieboldi* in thickness of whorls, shape of section, evolution degree, sharpness of the external area and suture line.

Geographic and Stratigraphic Distribution – According to Kovacs (2009), *Bredyia subinsignis* occurrs between the upper Aalensis zone, Upper Toarcian, and the middle Aalenian. The specimens studied in this paper originate from the Couche grise cycle in the sub-basin of Esch-sur-Alzette (Aalensis Zone, upper Toarcian) and not precisely identified upper Toarcian rocks of the sub-basin of Differdange.

Bredyia brancoi (Prinz, 1904) (Pls. 35, 36, 37, 38)

v. 1879 *Ammonites aff. Sieboldi* Oppel; Branco, p. 97, pl. 5, fig. 5.

* 1904 *Hammatoceras Sieboldi* Oppel nov. var. *Brancoi*, Prinz, p. 77, pl. 38, fig. 1.

v. 1905 *Hammatoceras lotharingicum* n. n. Benecke, p. 335, pl. 30, fig. 7, pl. 32, fig. 1, pl. 34.

v. 1940 *Hammatoceras lotharingicum* Benecke; Gérard & Bichelonne, p. 40, pl. 21, fig. 1.

v. 1952 *Hammatoceras ferruginense* nov. sp. Maubeuge, p. 154, fig. 2.

1963 *Parammatoceras boyeri* nov. sp. Elmi, p. 49, fig. 20, pl. 7, figs 1–2.

1966 *Hammatoceras brancoi* Prinz; Géczy, p. 34, fig. 21, pl. 3, fig. 2, pl. 4, fig. 3(?), pl. 37, fig. 13.

1967 *Pseudammatoceras boyeri* (Elmi); Seyed–Emami, p. 83, pl. 3, fig. 1, pl. 10, fig. 1.

1992 *Bredyia brancoi* (Prinz); Martínez, p. 151, pl. 33, fig. 1.

1996 *Pseudammatoceras boyeri* (Elmi); Rulleau, p. 6, pl. 24, figs 1–2.

2001 *Pseudammatoceras boyeri* (Elmi); Rulleau *et al*., p. 56, fig. 4, pl. 24, figs 1–2, pl. 25, fig. 8.

2001 *Parammatoceras boyeri* Elmi; Metodiev & Sapunov, p. 66, figs 2/4–5, pl. 1, fig. 4.

2003-2004 *Pseudammatoceras cfr. brancoi* (Prinz); Pallini *et al*., p. 15, pl. 12, fig. 4.

2007 *Pseudammatoceras boyeri* (Elmi); Rulleau, p. 102, fig. 28/6, pl. 75, figs 1–2.

2009 *Bredyia brancoi* (Prinz, 1904); Kovacs, p. 48, fig. 35.

2009 *Pseudammatoceras boyeri* Elmi; Rulleau, p. 50, fig. 15/14; pl. 35; pl. 36, figs. 1-3; pl. 37; pl. 38, fig. 1.

Material - A set of 7 specimens (MNHNL DOU330, 648, 653, 951; LO197; TO128, 130) has been studied.

Diagnosis – Involute shell with sub-ogival section. Flat, slopped flank. Narrow and keeled external area. Narrow and deep umbilical area. High and rounded periumbilical walls. Primary ribs subdivided in secondary ribs. One-whorl-long body chamber. Hammatoceratid suture line with simple elements.

Description - Moderately involute ammonites with whorls that overlap about two-thirds. The section is sub-ogival with flat flanks converging towards the external area. Close to the external area, the flanks tend to be convex. Flanks become flatter on the body chamber on mature shell. The external area is narrow and keeled. The umbilical area is relatively narrow and deep, bounded by high and rounded periumbilical walls. The ornamentation is characterized by very strong, spaced, slightly retroverse to radial primary ribs, which are branching into two or three secondaries at the inner third of the flanks. The secondary ribs are proverse and projected forward. They are fading on the body chamber. The overall rib trajectory is characterized by a proverse "C" shape. The body chamber is almost one whorl long. The suture line is hammatoceratid, with simple elements. E is very large, with flanks on the shoulder of the flanks of the shell. It is indented and enriched by a large (one third of E), triangular accessory saddle. ES is narrow and crossed by several deep accessory lobes. L is sub-rectangular in shape, indented and enriched on bottom by three deep accessory lobes. SL_1 is narrow, indented and tilted around U_2. U_2 is narrow, indented and centrifugal. The umbilical elements are centrifugal.

Remarks - *Bredyia brancoi* differs from *Bredyia subinsignis* in having more evoute and higher whorls, a coarser ornamentation and simpler suture line. *Hammatoceras ferruginense* Maubeuge is considered herein synonymous of *Bredyia brancoi*.

Geographic and Stratigraphic Distribution - *Bredyia brancoi* is distributed from the uppermost

Pl. 36: a - *Bredyia brancoi* (Prinz, 1904), LO197. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Pl. 37: a - *Bredyia brancoi* (Prinz, 1904), DOU951. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Pl. 38: a - *Bredyia brancoi* (Prinz, 1904), TO128. Natural History Museum of Luxembourg. Scale-bar 1 cm.

Toarcian to the lower Aalenian in Europe (Kovacs, 2009). The studied specimens originate from not precisely identified rocks of upper Toarcian age, in the sub-basins of Esch-sur-Alzette and Differdange.

Planammatoceras Buckman, 1922

Type species – *Planammatoceras planiforme* (Buckman, 1922, p. 356), by original designation.

Remarks - *Planammatoceras* is a debatable genus. Kovacs (2009) revised it and discussed its taxonomic position. This author proved the validity of *Planammatoceras*, separating it from the other closely related genera, such as *Pseudaptetoceras* Géczy, 1966, *Eudmetoceras* Buckman, 1920 and *Ceccaites* Cresta, 1997.

Stratigraphic and geographic distribution - The earliest representatives of *Planammatoceras* appear in the uppermost Toarcian of the Mediterranean domain and the genus becomes cosmopolitan during the Aalenian (Kovacs, 2009).

***Planammatoceras sieboldi* (Oppel, 1862)**
(Pl. 39)

* 1862 *Ammonites Sieboldi* Oppel, p. 144, pl. 46, fig. 1.

1886 *Hammatoceras Sieboldi* Oppel, Vacek, p. 87, pl. 11, fig. 6, pl. 12, figs. 1-3.

1904 *Hammatoceras halavatsi* nov. sp. Prinz, p. 84; pl. 32; pl. 33, fig. 3; pl. 38, pl. 7.

1904 *Hammatoceras stenomphalum* (*angusto-umbilicatum*) Hantk msc. nov. sp. Prinz, p. 79; pl. 19, fig. 2.

1935 *Hammatoceras sieboldi* (Oppel); Dorn, p. 18; pl. 1, fig. 1.

1960 *Parammatoceras sieboldi* Vacek non Oppel; Lelievre, p. 29; pl. 5, fig. 16.

1963 *Parammatoceras sieboldi* (Oppel); Elmi, p. 95, fig. 35.

1966 *Hammatoceras sieboldi halavitsi* (Prinz); Geczy, p. 71; pl. 15, fig. 1; pl. 40, fig. 5.

1966 *Hammatoceras sieboldi lelievrae* n. subsp. Geczy, p. 71; pl. 17, fig. 1; pl. 40, fig. 6.

1966 *Hammatoceras sieboldi stenomphalum* (Prinz); Geczy, p. 70; pl. 14, figs 1-3, 5; pl. 11, figs 1-4.

1992 *Parammatoceras sieboldi* (Oppel); Martinez, p. 190, fig. 39; pl. 35. fig. 3, 4; pl. 36, fig. 1.

1997 *Ceccaites sieboldi* (Oppel, 1862); Cresta, p. 40, fig. 10.

2006 *Pseudaptetoceras* aff. *sieboldi* (Oppel); Rulleau, p. 108; pl. 83, fig. 6.

2006 *Ceccaites* cf. *sieboldi* (Oppel, 1862); Seyed-Emami *et al*., p. 269, fig. 6/17a, b).

2009 *Planammatoceras sieboldi* (Oppel); Rulleau, p. 69; fig. 16/9; pl. 62; fig. 3; pl. 64; pl. 70, fig. 3.

Material - Four poorly preserved ammonites (MNHNL DOU412; HO159; TO129, 180) have been studied.

Diagnosis – Involute shell. Sub-triangular section. Slightly flat flanks. Narrow and keeled external area. Narrow and deep umbilical area. High and rounded periumbilical walls. Proverse primary and secondary ribs. Tubercles on the points of rib branching. Simple hammatoceratid suture line.

Description - Moderately involute ammonites that overlap more than two-thirds. The section is sub-triangular, with slightly flat flanks that converge towards the external area, starting from high periumbilical wall. The external area is narrow and keeled. The umbilical area is narrow and deep. It is bounded by high and rounded periumbilical walls. The ornamentation consists of short, thick primary ribs. Two or three thick and proverse secondary ribs. Tubercles are visible on each point of branching. The suture line is characterized by several simple hammatoceratid elements. E is narrow and enriched by a triangular accessory saddle A. ES is narrow, indented and enriched by two important and three less important accessory lobes. L is very large and deep, it is subrectangular in shape and it has a symmetric system of indentation. On its bottom, three deep terminations are visible. SL_1 is narrow and particularly indented. U_2 is short, indented and centrifugal. That way, it takes off space to SL_1. The umbilical elements are centrifugal.

Remarks - Geczy (1966) established several sub-species for *Planammatoceras sieboldi*, thus showing its strong morphological variability. Kovacs (2009) included those subspecies in the synonymy of *P. sieboldi*.

Geographic and Stratigraphic Distribution - *Planammatoceras sieboldi* is found worldwide in the rocks from the upper Toarcian to the Aalenian (Geczy, 1966, Seyed-Emami *et al*., 2006). The studied specimens originate from the upper part of the Pseudoradiosa Zone in the sub-basins of Esch-sur-Alzette and Differdange.

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Pl. 39: a - *Planammatoceras sieboldi* (Oppel, 1862), HO159. Natural History Museum of Luxembourg. Scale-bar 1 cm.

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Appendix - Measurements of specimens

A major part of specimens studied have been measured. The most important measurements that support the taxonomic subdivision are the "degree of evolution along the whorl", obtained by the ratio between inner diameter (or umbilical diameter, so-called "u") and external diameter (named "d"): (u/d); and the ratio between height of the external-most part of the shell (called "h") and its thickness (called "t"): (t/h). On the first column the collection number (called simply "n") of each measured and studied specimen is indicated. For some specimens a partial set of measurements only, or no measurements at all are given, due to insufficient preservation or recovering matrix. The holotypes are highlighted by bold characters.

Pleurolytoceras wrighti (Buckman, 1888)

n	d	u	h	t	u/d	t/h
DOT320	227,50	48,25	116,75	74,45	0,212	0,638
DOU230	253,00	62,50	122,00	93,55	0,247	0,767
DOU232	137,20	36,05	65,30	44,20	0,263	0,677
DOU258	257,00	53,00	134,00	96,25	0,206	0,718
DOU265	209,00	47,75	104,65	68,20	0,228	0,652
DOU274	219,00	51,10	110,90	51,30	0,233	0,463
DOU280	144,40	48,35	67,50	51,00	0,335	0,756
DOU363	172,00	36,15	89,95	52,70	0,210	0,586
DOU368	372,20	94,35	173,00	90,00	0,253	0,520
DOU389	199,00	41,70	101,50	70,70	0,210	0,697
DOU390	163,00	39,65	80,75	63,75	0,243	0,789
DOU647	198,50	46,20	91,00	63,90	0,233	0,702
DOU680	253,00	55,65	119,10	58,70	0,220	0,493
DOU710	535,00	129,40	252,00	133,00	0,242	0,528
DOU827	334,00	100,20	145,00	95,50	0,300	0,659
DOU945	213,00	48,85	110,65	64,80	0,229	0,586
TO118	122,20	27,90	61,00	42,25	0,228	0,693
TO159	185,00	46,00	88,05	65,70	0,249	0,746

Hudlestonia affinis (von Seebach, 1864)

n	d	u	h	t	u/d	t/h
DOU651	217,00	63,30	87,90	50,50	0,292	0,575
DOU652	199,00	41,35	87,50	50,15	0,208	0,573
DOU961	173,00	35,00	80,85	39,00	0,202	0,482
TO125	129,70	22,65	61,05	30,50	0,175	0,500

Hudlestonia compressum (Benecke, 1905)

n	d	u	h	t	u/d	t/h
DOU275	144,00	33,55	62,55	27,95	0,233	0,447
DOU393	182,00	45,55	79,10	31,75	0,250	0,401
DOU764	132,30	29,75	61,80	20,90	0,225	0,338
DOU768	123,85	28,20	58,20	26,55	0,228	0,456
LO193	126,00	25,85	59,30	29,65	0,205	0,500
TO221	108,20	19,50	53,30	23,00	0,180	0,432
TO243	185,50	39,30	81,70	32,40	0,212	0,397
TO245	-	-	76,30	26,60	-	0,349

Hudlestonia serrodens (Quenstedt, 1846)

n	d	u	h	t	u/d	t/h
DOU133	90,00	18,85	43,70	19,50	0,209	0,446
DOU134	118,50	31,95	49,70	20,90	0,270	0,421
DOU237	174,00	40,95	73,50	37,15	0,235	0,505
DOU261	180,00	43,05	84,40	39,60	0,239	0,469
DOU289	101,00	24,20	45,30	21,05	0,240	0,465
DOU513	108,95	37,30	43,80	17,55	0,342	0,401
DOU645	160,00	37,40	72,40	34,55	0,234	0,477
DOU669	167,00	36,30	76,55	36,30	0,217	0,474
DOU670	144,00	35,75	65,50	29,80	0,248	0,455
DOU739	192,50	41,10	90,30	45,70	0,214	0,506
HO127	104,20	23,85	48,25	19,10	0,229	0,396
KA108	119,50	23,55	57,90	24,60	0,197	0,425
TO114	109,95	20,90	50,90	22,90	0,190	0,450
TO156	196,00	31,95	92,85	42,55	0,163	0,458

Dumortieria kochi Benecke 1905

n	d	u	h	t	u/d	t/h
DOU317	75,15	32,60	24,40	15,40	0,434	0,631
DOU387	111,55	47,90	36,25	21,85	0,429	0,603
DOU401	117,10	45,20	34,10	19,50	0,386	0,572
DOU528	107,50	48,30	32,80	17,00	0,449	0,518
HO110	114,10	49,70	37,20	22,00	0,436	0,591
HO135	**93,60**	**40,90**	**29,50**	**16,60**	**0,437**	**0,563**
HO141	112,10	48,10	34,90	20,90	0,429	0,599
TO135	124,00	55,50	39,90	21,80	0,448	0,546
TO136	128,00	57,90	41,90	21,50	0,452	0,513

Dumortieria sparsicosta Haug, 1887

n	d	u	h	t	u/d	t/h
DOT445	30,65	11,60	11,80	8,00	0,378	0,678
TO249	19,10	8,00	6,90	-	0,419	-

Dumortieria suevica Haug, 1887

n	d	u	h	t	u/d	t/h
DOU343	137,50	66,10	40,80	21,50	0,481	0,527
DOU432	132,00	63,20	38,50	24,10	0,479	0,626
TO136	84,40	35,00	27,70	16,00	0,415	0,578
TO253	124,00	55,10	37,80	16,80	0,444	0,444
TO255	87,70	36,90	27,80	11,70	0,421	0,421
TO257	-	-	-	-	-	-

Dumortieria levesquei (d'Orbigny, 1844)

n	d	u	h	t	u/d	t/h
DOU527	77,10	36,00	25,00	15,20	0,467	0,608
TO115	96,00	49,00	25,00	13,50	0,510	0,540
TO154	60,00	28,80	16,30	8,90	0,480	0,546

Dumortieria leesbergi (Branco, 1879)

n	d	u	h	t	u/d	t/h
DOU588	45,10	18,95	16,60	12,00	0,420	0,723
DOU775	85,20	38,90	25,70	11,25	0,457	0,438
LO191	68,25	30,75	23,85	12,80	0,451	0,537
TO254	93,70	42,80	26,60	15,30	0,457	0,575

Dumortieria pseudoradiosa (Branco, 1879)

n	d	u	h	t	u/d	t/h
DOU432	132,00	63,20	38,50	24,10	0,479	0,626
DOU611	115,00	54,10	34,50	20,20	0,470	0,586
DOU781	54,60	21,60	20,00	13,90	0,396	0,695
DOU947	114,90	50,70	29,30	17,10	0,441	0,584
HO133	91,00	43,70	27,30	17,60	0,480	0,645
HO140	125,50	58,60	38,90	22,40	0,467	0,576
TO136	84,40	35,00	27,70	16,00	0,415	0,578
TO244	77,00	29,60	27,10	15,50	0,384	0,572
TO246	44,60	14,60	17,40	9,40	0,327	0,540
TO247	51,60	19,90	18,10	-	0,386	-

Dumortieria costula (Reinecke, 1818)

n	d	u	h	t	u/d	t/h
DOU346	58,70	24,90	19,80	11,70	0,424	0,591
HO117	90,50	39,50	29,10	12,40	0,436	0,426
TO251	42,20	17,20	14,10	10,70	0,408	0,759

Dumortieria moorei (Lycett, 1857)

n	d	u	h	t	u/d	t/h
TO252	78,80	33,90	25,50	15,00	0,430	0,588
TO256	88,70	39,40	28,40	12,90	0,444	0,454

Cotteswoldia bifax Buckman, 1904

n	d	u	h	t	u/d	t/h
DOU347	97,10	41,90	31,50	16,40	0,432	0,521
DOU417	86,60	36,80	27,30	13,30	0,425	0,487

Cotteswoldia costulata (Zieten, 1830)

n	d	u	h	t	u/d	t/h
DOU510	40,00	12,75	17,95	8,20	0,319	0,457
DOU776	54,10	13,85	23,80	9,60	0,256	0,403

Cotteswoldia angulata Maubeuge, 1950

n	d	u	h	t	u/d	t/h
DOU204	**52,30**	**15,20**	**22,85**	**10,00**	**0,291**	**0,438**
DOT406	65,95	22,15	25,30	11,20	0,336	0,443
DOT407	39,60	9,45	18,50	8,45	0,239	0,457
DOT408	58,35	13,25	26,40	10,75	0,227	0,407
DOT409	58,50	17,00	24,90	10,75	0,291	0,432

Cotteswoldia misera Buckman, 1902

n	d	u	h	t	u/d	t/h
DOT417	54,80	12,90	24,15	10,85	0,235	0,449
DOT418	56,00	12,85	22,50	10,50	0,229	0,467
DOT419	52,30	14,00	23,00	9,80	0,268	0,426
DOT420	51,60	12,90	22,40	10,85	0,250	0,484
DOT421	49,85	12,25	22,35	10,20	0,246	0,456
DOT422	54,95	11,40	25,60	9,40	0,207	0,367
DOT423	54,70	15,60	22,85	9,65	0,285	0,422
DOT424	34,10	7,95	16,25	8,10	0,233	0,498

n	d	u	h	t	u/d	t/h
DOT425	40,35	9,10	18,70	8,20	0,226	0,439
DOT426	40,50	9,90	18,25	8,60	0,244	0,471
DOT427	71,20	21,35	28,80	11,45	0,300	0,398
DOT428	38,05	8,75	17,35	8,20	0,230	0,473
DOT429	62,40	16,00	24,80	11,20	0,256	0,452
DOT430	51,15	12,20	23,30	9,95	0,239	0,427
DOT431	52,10	14,30	21,95	9,25	0,274	0,421
DOT432	62,20	12,95	25,55	11,85	0,208	0,464
DOT433	67,10	18,40	26,80	10,85	0,274	0,405
DOU135	58,60	15,50	23,50	10,80	0,265	0,460
DOU971	38,05	9,30	17,95	7,50	0,244	0,418
HO153	65,20	22,30	23,00	11,60	0,342	0,504

Cotteswoldia subcompta (Branco, 1879)

n	d	u	h	t	u/d	t/h
DOT392	64,65	18,50	27,30	10,75	0,286	0,394
DOT394	60,55	17,35	26,45	11,50	0,287	0,435
DOT395	67,65	18,00	28,85	12,50	0,266	0,433
DOT396	49,75	11,85	22,30	6,60	0,238	0,296
DOT397	55,00	14,00	25,35	10,00	0,255	0,394
DOT398	48,50	13,00	21,60	10,50	0,268	0,486
DOT399	33,45	9,50	14,40	6,30	0,284	0,438
DOT400	31,30	8,90	13,70	6,15	0,284	0,449
DOT401	39,50	11,60	15,85	6,40	0,294	0,404
DOT402	55,40	18,35	22,50	9,60	0,331	0,427
DOT403	36,00	13,90	12,90	6,80	0,386	0,527
DOT404	79,90	24,80	30,30	11,80	0,310	0,389
DOT405	48,40	13,65	20,45	8,35	0,282	0,408
DOT444	70,00	21,10	28,30	12,00	0,301	0,424
DOU197	47,00	12,35	20,85	9,45	0,263	0,453
DOU311	105,10	47,30	31,20	14,10	0,450	0,452
DOU391	82,05	30,00	29,00	13,30	0,366	0,459
DOU793	37,40	13,60	14,15	8,20	0,364	0,580
DOU980	92,05	33,40	33,35	15,70	0,363	0,471
EW114-01	36,20	13,60	13,50	6,30	0,376	0,467
EW114-02	61,00	18,70	23,70	9,60	0,307	0,405
HO108	61,20	23,40	22,30	10,30	0,382	0,462
HO130-01	45,90	15,30	17,60	8,00	0,333	0,455
HO130-02	32,50	11,30	11,60	5,90	0,348	0,509
HO131	83,00	30,30	28,70	13,65	0,365	0,476
HO137	112,35	38,75	33,80	18,00	0,345	0,533
TO200	-	-	-	-	-	-

Cotteswoldia mactra (Dumortier, 1874)

n	d	u	h	t	u/d	t/h
DOT335	-	-	-	-	-	-
DOU400	113,90	49,80	35,10	19,30	0,437	0,550
DOU426	86,10	32,15	28,75	14,10	0,373	0,490
DOU543	65,00	25,30	22,70	10,90	0,389	0,480
DOU744	70,10	26,85	24,40	10,05	0,383	0,412
DOU745	74,10	27,85	24,85	12,10	0,376	0,487
DOU746	87,10	36,50	27,10	15,65	0,419	0,577
DOU751	51,25	16,50	20,20	8,90	0,322	0,441
DOU787	71,65	29,00	24,05	12,70	0,405	0,528
DOU949	86,50	32,30	28,70	15,10	0,373	0,526
HO104	92,00	35,20	30,30	15,10	0,383	0,498
HO116	82,80	28,50	29,00	13,50	0,344	0,466
HO122	71,30	26,30	25,40	13,00	0,369	0,512
TO116	66,95	23,50	25,55	11,80	0,351	0,462

Cotteswoldia aalensis (Zieten, 1830)

n	d	u	h	t	u/d	t/h
DOU195	-	-	-	-	-	-
DOU202	30,00	8,30	13,25	7,50	0,277	0,566
DOU348	53,50	21,60	20,15	9,60	0,404	0,476
DOU383	63,40	17,70	27,00	12,55	0,279	0,465
DOT305	42,50	13,55	16,85	8,30	0,319	0,493
DOT336	38,75	13,40	15,10	6,85	0,346	0,454
DOT337	36,55	12,85	14,65	8,10	0,352	0,553
DOT338	25,70	8,95	8,45	5,35	0,348	0,633
DOT339	52,75	16,30	20,35	9,40	0,309	0,462
DOU674	38,90	9,20	17,70	11,40	0,237	0,644
DOU779	64,00	21,00	25,30	9,90	0,328	0,391
DOT340	73,00	20,00	29,40	12,55	0,274	0,427
DOT341	62,00	16,70	27,05	11,20	0,269	0,414
DOT342	62,30	17,70	26,30	10,30	0,284	0,392
DOT343	62,90	23,35	24,40	5,60	0,371	0,230
DOT344	46,05	12,00	19,60	8,85	0,261	0,452
DOT345	59,80	16,25	25,30	10,00	0,272	0,395
DOT346	58,60	16,10	25,00	10,70	0,275	0,428
DOT347	54,75	16,00	22,95	12,35	0,292	0,538
DOT348	40,45	13,50	16,50	7,20	0,334	0,436
DOT349	51,10	13,00	22,20	10,25	0,254	0,462

n	d	u	h	t	u/d	t/h
DOT350	50,40	14,70	21,15	9,65	0,292	0,456
DOT351	45,50	15,00	18,20	9,95	0,330	0,547
DOT352	42,65	11,90	16,90	8,60	0,279	0,509
DOT353	72,45	25,30	27,00	12,30	0,349	0,456
DOT354	66,15	22,80	24,45	12,40	0,345	0,507
DOT355	59,95	14,65	26,50	11,50	0,244	0,434
DOT356	57,00	16,50	24,00	10,95	0,289	0,456
DOT357	49,00	14,90	19,85	10,00	0,304	0,504
DOT358	57,70	16,60	24,35	-	0,288	-
DOT359	53,35	13,70	22,75	10,35	0,257	0,455
DOT360	33,90	9,95	14,50	6,50	0,294	0,448
DOT361	35,30	11,70	15,00	6,70	0,331	0,447
DOT362	55,70	15,75	23,65	11,30	0,283	0,478
DOT363	55,65	13,20	25,00	10,60	0,237	0,424
DOT364	50,00	14,75	21,55	10,75	0,295	0,499
DOT365	44,60	12,45	19,40	10,00	0,279	0,515
DOT366	38,75	10,45	17,40	7,40	0,270	0,425
DOT367	55,35	15,30	22,35	8,85	0,276	0,396
DOT442	55,40	17,10	22,40	8,85	0,309	0,395
DOT447	-	-	29,25	12,60	-	0,431
EW105	42,70	15,80	17,50	10,50	0,370	0,600
EW106	-	-	-	-	-	-
EW108	77,50	29,80	28,00	12,80	0,385	0,457
EW116	60,20	18,20	24,60	11,80	0,302	0,480
HO156	67,00	20,20	22,30	5,60	0,301	0,251
LO135	26,25	8,05	10,90	6,90	0,307	0,633
LO136-01	46,70	14,20	19,50	8,60	0,304	0,441
LO136-02	87,90	27,00	34,80	16,10	0,307	0,463
LO149	31,40	10,25	12,10	8,70	0,326	0,719
TO122	40,00	11,10	17,85	8,25	0,278	0,462
TO123	49,70	14,10	21,70	10,40	0,284	0,479
TO124	30,25	9,95	11,55	5,55	0,329	0,481
TO223	-	-	-	-	-	-
TO224	96,30	39,10	32,00	14,80	0,406	0,463

Cotteswoldia paucicostata Buckman, 1904

n	d	u	h	t	u/d	t/h
DOU525	61,60	20,80	23,50	10,60	0,338	0,451
DOU766	91,55	28,70	36,40	16,20	0,313	0,445

Cotteswoldia grandjeani (Benecke, 1905)

n	d	u	h	t	u/d	t/h
DOU317	-	-	-	-	-	-
DOU387	-	-	-	-	-	-
DOU738	112,05	48,40	34,60	18,00	0,432	0,520
DOU777	115,90	42,40	35,90	19,25	0,366	0,536
HO121	95,00	47,90	31,10	16,90	0,504	0,543
HO146	114,30	46,90	36,80	19,30	0,410	0,524
HO162	-	-	-	-	-	-

Walkericeras pseudolotharingicum (Maubeuge, 1950)

n	d	u	h	t	u/d	t/h
DOT435	81,80	30,90	29,75	11,60	0,378	0,390
DOT436	77,00	19,60	31,70	13,65	0,255	0,431
DOU214	**54,85**	**14,85**	**23,15**	**10,15**	**0,271**	**0,438**
DOU338	70,45	21,05	27,40	11,30	0,299	0,412
DOU339	64,60	19,20	25,70	11,40	0,297	0,444
DOU340	71,80	25,50	30,00	12,00	0,355	0,400
DOU553-01	83,10	24,45	34,00	13,80	0,294	0,406
DOU731	70,40	27,75	27,65	14,40	0,394	0,521
DOU765	81,55	29,20	30,55	12,40	0,358	0,406
EW109	47,10	14,60	19,50	7,40	0,310	0,379

Walkericeras lotharingicum (Branco, 1879)

n	d	u	h	t	u/d	t/h
DOU130	101,55	33,70	35,05	18,15	0,332	0,518
DOU131	96,60	36,75	34,00	15,00	0,380	0,441
DOU176	89,00	31,85	32,50	15,00	0,358	0,462
DOU208	53,80	15,95	22,75	11,30	0,296	0,497
DOU290	101,50	37,40	35,15	18,20	0,368	0,518
DOU344	99,50	34,50	35,30	16,40	0,347	0,465
DOU512	83,40	32,10	29,50	13,80	0,385	0,468
DOU552	97,30	33,60	36,50	18,25	0,345	0,500
DOU763	122,50	56,75	35,35	17,80	0,463	0,504
DOU769	77,60	28,55	27,75	12,60	0,368	0,454
DOU790	99,40	35,75	35,95	12,50	0,360	0,348
EW110	111,00	34,90	42,60	9,60	0,314	0,225
EW115	92,60	33,60	32,50	11,10	0,363	0,342
HO126	92,00	34,60	31,40	13,60	0,376	0,433
HO158	81,30	27,00	30,20	11,60	0,332	0,384
LG103	87,20	36,70	29,20	14,30	0,421	0,490
TO127	93,50	35,00	32,00	17,10	0,374	0,534

Walkericeras fluitans (Dumortier, 1874)

n	d	u	h	t	u/d	t/h
DOT441	89,00	33,40	31,05	18,10	0,375	0,583
DOT450	66,05	23,65	25,00	11,60	0,358	0,464
DOT485	76,10	28,40	26,25	10,85	0,373	0,413
DOU136	114,10	47,60	42,20	19,00	0,417	0,450
DOU252	83,20	34,80	28,85	16,35	0,418	0,567
DOU273	-	-	-	-	-	-
DOU759	62,90	23,55	23,30	11,75	0,374	0,504
DOU760	83,75	27,80	31,60	16,90	0,332	0,535
DOU761	80,00	30,90	29,25	13,25	0,386	0,453
DOU772	93,45	38,70	36,95	13,50	0,414	0,365
DOU791	72,50	29,50	23,40	11,80	0,407	0,504
DOU804	87,90	32,50	30,20	12,80	0,370	0,424
DOU965	107,50	48,20	34,20	17,80	0,448	0,520

Walkericeras arcuatum (Buckman, 1902)

n	d	u	h	t	u/d	t/h
DOU182	49,10	13,65	20,70	9,45	0,278	0,457

Walkericeras pseudoarcuatum (Maubeuge, 1950)

n	d	u	h	t	u/d	t/h
DOU183	51,50	14,00	22,90	9,30	0,272	0,406
DOU194	44,05	12,70	19,70	10,20	0,288	0,518
DOU209	**55,20**	**14,10**	**23,00**	**10,35**	**0,255**	**0,450**
DOU210	61,60	19,30	23,80	11,15	0,313	0,468
DOU211	46,10	13,30	20,15	9,05	0,289	0,449
DOU246	65,50	19,30	25,50	12,20	0,295	0,478

Walkericeras hinsbergi (Benecke, 1905)

n	d	u	h	t	u/d	t/h
DOU121	72,35	30,65	23,70	13,35	0,424	0,563
DOU345	**118,90**	**43,45**	**43,20**	**21,40**	**0,365**	**0,495**
DOU773	70,15	29,30	23,65	13,15	0,418	0,556
HO144	99,90	41,90	36,20	13,30	0,419	0,367
LO183	-	-	-	-	-	-
TO133	77,70	31,50	24,85	13,40	0,405	0,539
TO138	70,00	26,65	22,50	13,00	0,381	0,578

Walkericeras pseudograndjeani (Maubeuge, 1950)

n	d	u	h	s	o/d	s/h
DOU191	**68,40**	**19,50**	**28,70**	**10,20**	**0,285**	**0,355**
DOU215	52,60	13,00	23,90	8,10	0,247	0,339

Walkericeras dudelangense (Maubeuge, 1950)

n	d	u	h	t	u/d	t/h
DOU216	**-**	**-**	**-**	**-**	**-**	**-**

Pleydellia falcifer Maubeuge, 1950

n	d	u	h	t	u/d	t/h
DOU122	61,40	20,00	26,00	8,30	0,326	0,319
DOU177	56,90	15,80	24,55	11,70	0,278	0,477
DOU180	**54,70**	**12,90**	**23,20**	**10,85**	**0,236**	**0,468**
DOU196	68,40	18,25	30,20	11,90	0,267	0,394
DOU281	71,15	18,20	31,15	14,00	0,256	0,449
DOU399	45,35	11,35	20,80	9,90	0,250	0,476
DOU486	45,10	11,40	20,15	9,70	0,253	0,481
DOU747	65,50	14,90	28,80	11,40	0,227	0,396
DOU748	69,00	18,55	28,90	12,15	0,269	0,420
DOU749	77,35	22,15	31,85	9,95	0,286	0,312
DOU752	60,95	17,00	25,15	12,35	0,279	0,491
DOU755	58,50	14,00	26,80	11,95	0,239	0,446
DOU758	67,60	23,60	25,80	11,25	0,349	0,436
DOU806	69,85	23,70	25,80	10,10	0,339	0,391
DOT446	43,40	10,75	18,85	8,25	0,248	0,438
DOT448	69,05	18,60	28,70	12,70	0,269	0,443
TO132	70,00	20,75	28,00	13,40	0,296	0,479

Pleydellia pseudoaalense Maubeuge, 1950

n	d	u	h	t	u/d	t/h
DOU132	96,00	27,75	33,70	14,40	0,289	0,427
DOU187	**63,50**	**15,00**	**28,75**	**11,60**	**0,236**	**0,403**
DOU203	73,35	19,35	31,90	14,30	0,264	0,448
DOU269	79,20	25,70	31,35	14,80	0,324	0,472
DOU279	90,40	30,10	32,90	12,80	0,333	0,389
DOU342	89,60	28,65	32,55	13,20	0,320	0,406
DOU511	67,10	19,25	27,70	12,60	0,287	0,455
DOU733	63,70	17,05	27,15	10,90	0,268	0,401
DOU750	62,90	14,35	28,80	12,65	0,228	0,439

n	d	u	h	t	u/d	t/h
DOU754	56,95	16,65	24,00	10,15	0,292	0,423
DOU785	92,95	37,65	26,85	15,15	0,405	0,564
DOT368	71,50	20,70	30,15	12,45	0,290	0,413
DOT369	68,70	17,95	29,30	12,80	0,261	0,437
DOT370	61,90	14,10	29,10	11,50	0,228	0,395
DOT371	53,50	14,75	22,70	10,90	0,276	0,480
DOT372	70,30	21,00	28,10	10,75	0,299	0,383
DOT373	60,40	16,00	26,70	10,60	0,265	0,397
DOT374	43,30	10,10	20,30	7,95	0,233	0,392
DOT375	63,95	15,30	28,50	10,90	0,239	0,382
DOT376	57,55	14,20	26,50	11,50	0,247	0,434
DOT377	42,30	12,00	20,85	10,05	0,284	0,482
DOT378	51,70	12,45	23,50	12,50	0,241	0,532
DOT379	34,45	10,30	14,60	5,40	0,299	0,370
DOT380	46,15	11,50	21,40	10,45	0,249	0,488
DOT381	49,20	11,30	23,10	11,00	0,230	0,476
DOT382	46,40	11,70	20,40	10,05	0,252	0,493
DOT383	42,40	10,30	19,85	9,50	0,243	0,479
DOT384	55,30	12,90	15,20	11,40	0,233	0,750
DOT385	69,05	18,00	29,50	13,05	0,261	0,442
DOT386	71,00	17,15	30,95	13,50	0,242	0,436
DOT387	79,35	25,30	31,15	12,10	0,319	0,388
DOT388	70,10	19,00	29,25	12,40	0,271	0,424
DOT390	70,50	16,95	30,80	11,65	0,240	0,378
DOT393	65,50	16,60	28,70	12,50	0,253	0,436
DOT437	-	-	-	-	-	-
DOU952	128,60	44,00	48,85	19,35	0,342	0,396
DOU966	77,50	21,30	33,20	12,10	0,275	0,364
EW103	54,90	16,10	23,70	10,10	0,293	0,426
EW104	63,40	19,20	25,80	10,70	0,303	0,415
LO183	-	-	-	-	-	-
TO151	72,60	19,85	30,25	12,20	0,273	0,403
TO222	-	-	-	-	-	-

Pleydellia funcki Maubeuge, 1950

n	d	u	h	t	u/d	t/h
DOU193	**-**	**-**	**-**	**-**	**-**	**-**

Pleydellia arkelli Maubeuge, 1950

n	d	u	h	t	u/d	t/h
DOU189	**-**	**-**	**-**	**-**	**-**	**-**

Pleydellia leura (Buckman, 1890)

n	d	u	h	t	u/d	t/h
DOU181	48,80	13,30	21,20	9,50	0,273	0,448
DOU763	54,65	13,55	23,20	10,90	0,248	0,470

Pleydellia spathi (Maubeuge, 1947)

n	d	u	h	t	u/d	t/h
TO121	**42,00**	**10,75**	**17,45**	**8,55**	**0,256**	**0,490**

Pleydellia buckmani Maubeuge, 1947

n	d	u	h	t	u/d	t/h
DOT193	55,90	13,95	24,30	10,50	0,250	0,432
DOT410	51,70	11,40	24,55	9,95	0,221	0,405
DOT411	44,05	11,95	19,90	9,80	0,271	0,492
DOT412	66,60	18,00	28,50	11,85	0,270	0,416
DOT413	53,45	12,65	24,80	12,10	0,237	0,488
DOT414	54,75	11,85	25,00	11,15	0,216	0,446
DOT415	51,90	13,10	22,70	9,85	0,252	0,434
DOT416	47,40	12,70	21,65	10,05	0,268	0,464
DOT449	56,40	15,20	22,85	10,35	0,270	0,453
DOU137	56,25	13,00	25,45	11,65	0,231	0,458
DOU184	58,10	14,50	23,60	9,60	0,250	0,407
DOU185	58,30	14,40	24,40	9,80	0,247	0,402
DOU186	61,10	14,65	27,75	12,10	0,240	0,436
DOU190	65,85	14,15	30,80	11,00	0,215	0,357
DOU192	66,00	17,00	26,80	11,75	0,258	0,438
DOU199	34,70	9,60	14,30	6,60	0,277	0,462
DOU201	62,00	12,90	25,40	10,50	0,208	0,413
DOU205	33,80	10,70	13,80	7,20	0,317	0,522
DOU206	52,60	13,35	22,85	10,75	0,254	0,470
DOU213	55,55	14,50	24,35	10,00	0,261	0,411
DOU743	58,30	15,00	25,15	11,10	0,257	0,441
TO120	**61,90**	**18,90**	**19,55**	**11,20**	**0,305**	**0,573**
TO160	83,40	27,00	30,50	13,60	0,324	0,446
TO196-01	53,70	12,20	24,30	11,00	0,227	0,453
TO196-02	42,70	12,20	21,55	9,50	0,286	0,441
TO196-03	26,70	8,95	10,40	4,90	0,335	0,471
TO196-04	34,55	8,90	15,55	7,30	0,258	0,469

Canavarina venustula (Buckman, 1902)

n	d	u	h	t	u/d	t/h
DOT192	80,70	23,95	31,55	10,80	0,297	0,342
DOT433	67,00	21,20	28,20	12,25	0,316	0,434
DOT434	45,15	11,40	23,15	10,05	0,252	0,434
DOT438	53,00	13,40	25,10	11,35	0,253	0,452
DOT456	-	-	-	-	-	-
DOU106	91,10	25,70	37,25	11,30	0,282	0,303
DOU198	62,50	15,00	25,85	11,85	0,240	0,458
DOU200	96,40	29,30	36,35	13,60	0,304	0,374
DOU212	69,85	16,55	30,85	12,20	0,237	0,395
DOU329	65,80	14,30	21,60	8,45	0,217	0,391
TO105	112,90	32,85	43,50	20,95	0,291	0,482

Bredyia subinsignis (Oppel, 1856)

n	d	u	h	t	u/d	t/h
DOU650	246,00	88,80	89,55	45,55	0,361	0,509
DOU833	261,00	99,75	89,05	46,65	0,382	0,524
DOU838	209,00	75,75	74,85	49,00	0,362	0,655
HO152	159,00	61,70	51,00	32,00	0,388	0,627
LO238	134,15	51,00	50,30	42,50	0,380	0,845
TO102	315,30	128,70	106,90	54,30	0,408	0,508
TO139	168,00	60,00	63,05	42,55	0,357	0,675

Bredyia brancoi (Prinz, 1904)

n	d	u	h	t	u/d	t/h
DOU330	162,50	49,80	62,75	40,00	0,306	0,637
DOU648	201,50	58,90	83,10	40,95	0,292	0,493
DOU653	275,00	101,55	100,80	49,80	0,369	0,494
DOU951	164,50	59,85	61,95	42,35	0,364	0,684
LO197	205,50	70,40	78,05	53,25	0,343	0,682
TO128	137,25	42,85	53,95	32,20	0,312	0,597
TO130	123,80	34,05	51,70	31,25	0,275	0,604

Planammatoceras sieboldi (Oppel, 1862)

n	d	u	h	t	u/d	t/h
DOU412	194,00	64,40	82,85	59,35	0,332	0,716
HO159	133,90	52,25	48,95	46,95	0,390	0,959
TO129	95,15	24,70	42,00	23,00	0,260	0,548
TO180	127,95	34,40	54,95	41,15	0,269	0,749