Neocomian belemnites from the Bersek-hegy (Gerecse Mountains, Hungary), part I: Late Valanginian to earliest Barremian

by
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Abstract — Belemnites from Late Valanginian to earliest Barremian sedimentary rocks of the Bersek-hegy (Gerecse Mts, Hungary) are described and compared to faunas from other regions. Early Barremian to "Mid" Barremian faunas are briefly mentioned and will be published in more details in part II. Since the sampled sections also yielded rich ammonite assemblages, the belemnite stratigraphy can be evaluated within the well-studied Mediterranean ammonite zones.

The Upper Valanginian to Barremian *Hibolithes* are discussed, i.e. "Subfusiformi" of SHVETSOV, 1913. The status of *Mesohibolites* STOLLEY, 1919 is briefly discussed but will be described in detail in part II, as more research is needed to unravel the "*Mesohibolites*". A new genus will be introduced for the Upper Valanginian to lowermost Hauterivian part of *Mesohibolites* s. l. [= pars *Combemorelites* GAYTE, 1984 (MS)], i.e. *Adiakritobelus* n. gen.

The Early, "Mid" and Late Hauterivian are characterised by *Hibolithes* (gr.) *subfusiformis*, *Duvalia dilatata* spp., *Pseudoduvalia* spp. and *Pseudobelus brevis*.

Uppermost Hauterivian to lowermost Barremian belemnite genera and species are comparable to the Duvaliidae–*Hibolithes* association, characteristic for this stratigraphical interval in southeast France. "*Mesohibolites*" spp. and *Duvalia grasiana* (DUVAL–JOUVE, 1841) characterize the late Lower Barremian, while the "Mid" Barremian (latest Lower Barremian and earliest Upper Barremian) is characterised by *Curtohibolites* spp.

Faunal differences in various areas in the Tethys are believed to be the result of incompleteness of the published faunas and do generally not have a palaeobiogeographical background.

Lectotypes are indicated for *Belemnites josephinae* (HONNORAT–BASTIDE, 1889) and *Hibolites jaculiformis* SHVETSOV, 1913.

Keywords — Valanginian, Hauterivian, Barremian, belemnite, ammonite, stratigraphy.

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Introduction

The historical background of the Bersek-hegy (Bersek Hill) fossil collection (informally known also as FÜLÖP Collection) is described in FŐZY & FOGARASI (2002). In this paper the distribution of Late Valanginian to lowermost Barremian belemnites is discussed and compared to other regions. Recently a first impression of this belemnite material has been published in JANSSEN & FŐZY (2003). Several other groups of macro- and microfossils (FŐZY 1995; FŐZY & FOGARASI 2002) have been also studied or are just under study. These researches created an opportunity to place the investigated material in a biostratigraphical framework.

Geological setting

The belemnites were collected from several closely spaced sections (profiles "A", "B", "C", "D", "E") in the uppermost level of the Bersek-hegy quarry. The sampled sections are delimited either by minor faults or by a "slumped" layer. Their possible correlation is given by FŐZY & FOGARASI (2002: text-figure 4). Present study focuses on the belemnites association of Late Valanginian – Hauterivian – earliest Barremian section "C". (GPS data: 47° 43' 13", Y: 18° 31' 42", Z: 338) The geographical and geological setting of the studied locality and section(s) are given on Figure 1.

The material originates from the Bersek Marl Fm. (CSÁSZÁR & HAAS 1984). This formation consists of an alternation of grey/green and red argillaceous and calcareous marls (background sedimentation), intercalated with inter-bedded fine- to coarse-grained (micaceous) sandstones (ÁRGYELÁN et al. 1997). Occasionally siliceous pebbles occur (beds 217 and 227). Below bed 224 corals and echinoids occur regularly, while above this bed brachiopods (*Triangope* spp.) and fish-remains are found more abundant. Indications for some condensation might be found in the abundant occurrence of aptychi in bed 221.

The Bersek Marl Fm. is separated from the Lábatlan Sandstone Fm. (HANTKEN 1868; HOFMANN 1884) by a grey-greenish horizon (probably bed 200), the "graugrüne mergelige Sandsteinbank" of FÜLÖP (1958: p. 34, 79, text-figure 27), rich in coaly material. The section can be found in FÜLÖP (1958: text-figure 27 ("Abschnitt I" and basal part of "Abschnitt II") and plate VI, figure 2) and FŐZY (1995: text-figure 3). These beds most probably represent a channel, with an erosional contact, which cuts the succession below. The slumped layers can be followed throughout the quarry.

According to ÁRGYELÁN et al. (1997) the deposition took place in the relative distal part of a submarine slope environment as reflected by the presence of slump scars.

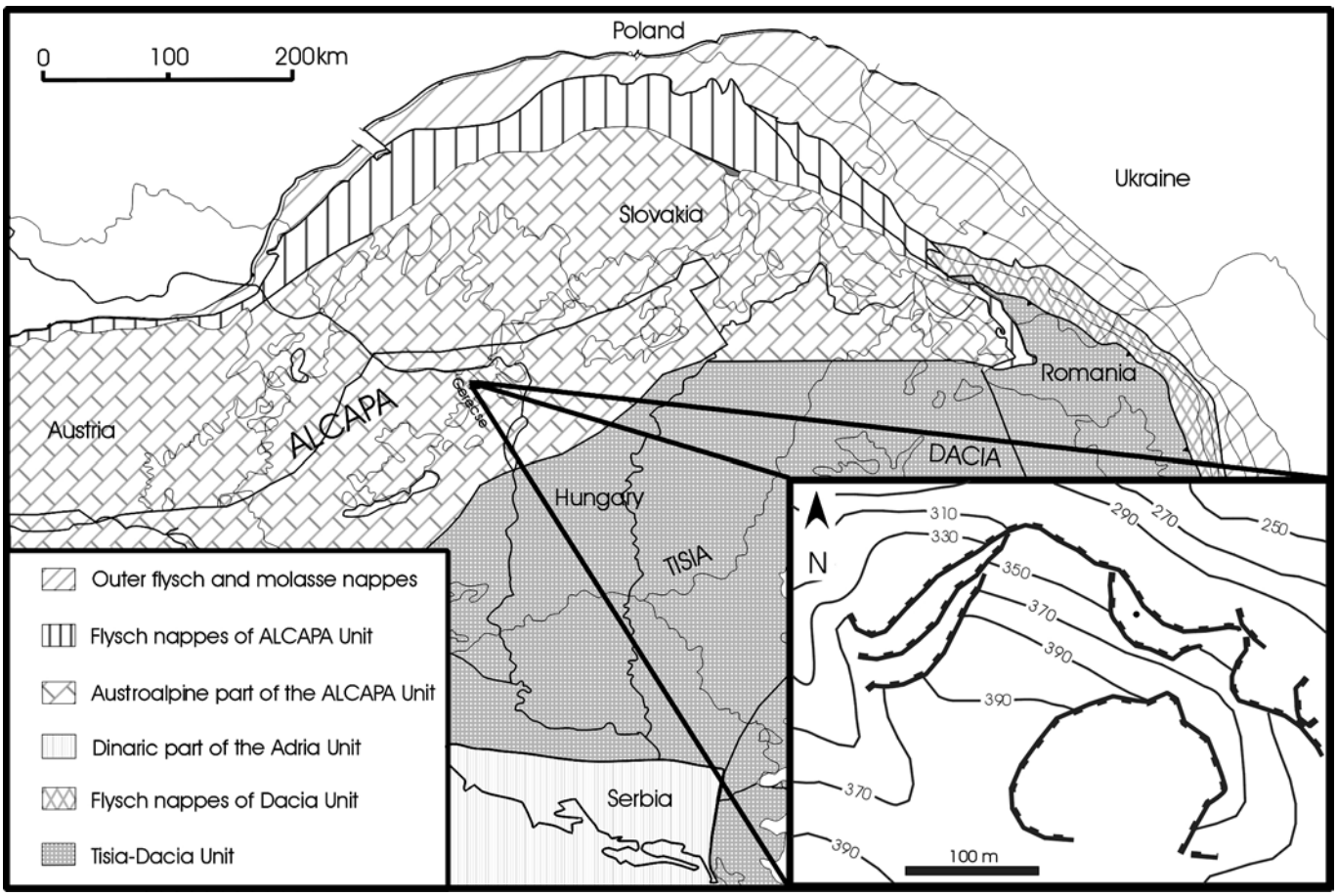

Figure 1. — Geographical and structural setting of the Gerecse Mts and its surroundings. — The position of the studied sections of the Bersek-hegy quarry, including the Late Valanginian–earliest Barremian Section "C" is marked by a dot (after FŐZY & FOGARASI 2002). For detailed stratigraphic position and correlation of the sampled sequences, see Figure 4 of the paper cited above.

Material

There is only limited information on Neocomian belemnites from the Gerecse Mountains or from Hungary in general. Collections of HANTKEN (1868, 1872), HOFMANN (1884), STAFF (1906), SOMOGYI (1914) and FÜLÖP (1958) contained belemnites from the Gerecse Mountains. The material described here has briefly been mentioned by JANSSEN & FŐZY (2003, p. 292–293), and indicated by corresponding bed numbers in the sections.

The larger part of the material consists of belemnites that belong to Mesohibolitidae NERODENKO, 1983 (here including *Hibolithes*, *Vaunagites*, *Mesohibolites* s.l., and *Curtohibolites*). The material is characterized by belemnites that belong to the "Subfusiformi" of SHVETSOV (1913: p. 51–54).

It is not always possible to determine the belemnites to any specific species or genus. This is explained by the extreme rarity of well-founded characteristics and the sparse or subjective differences that can exist between juvenile,

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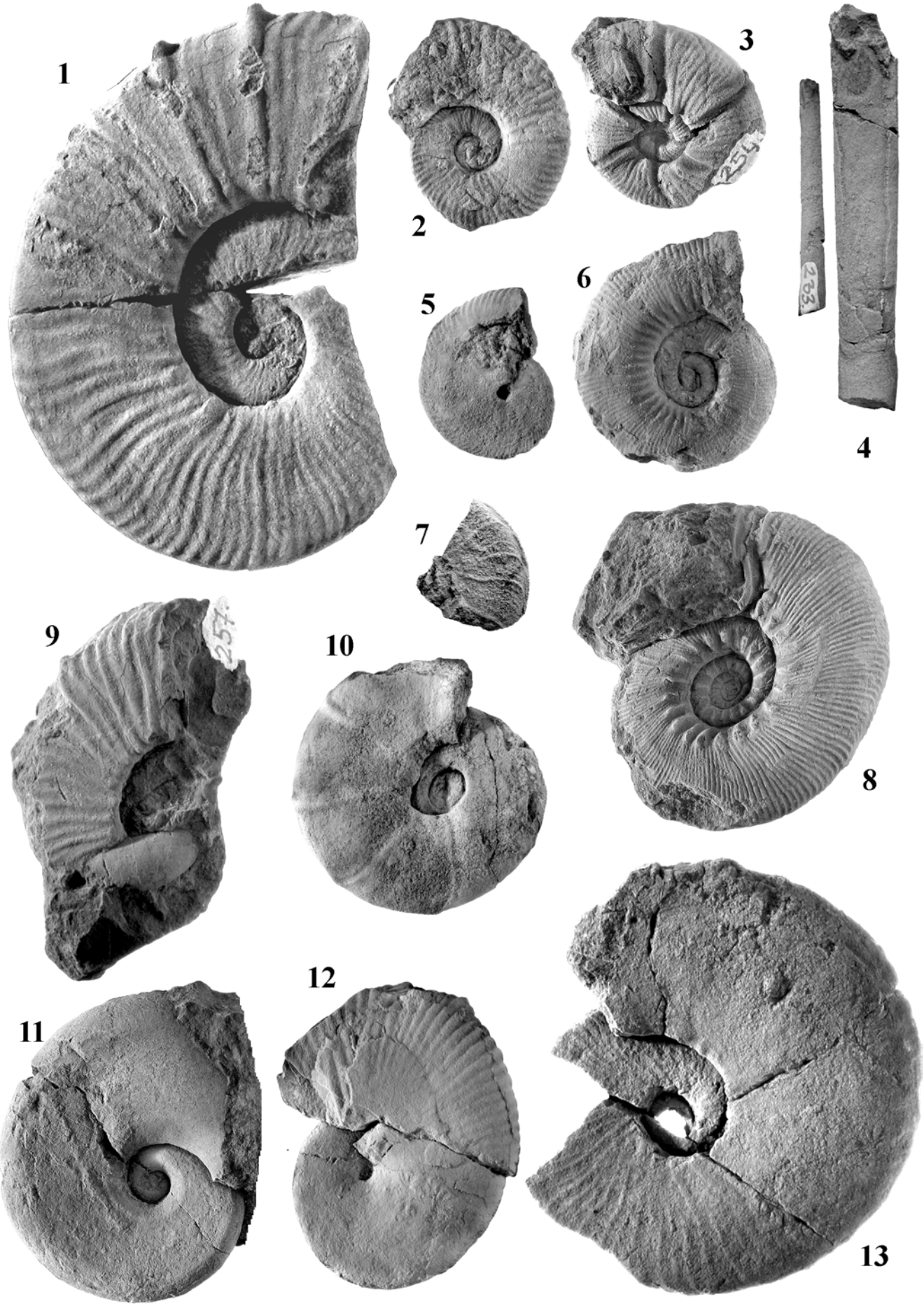
Explanation to Plate I

1 ***Neocomites peregrinus* (RAWSON & KEMPER, 1981)**; (M. 2002.309) — ×1; section C; bed 252; Peregrinus Zone.
2 ***Pseudothurmannia ohmi* (WINKLER, 1868)**; (M. 2002.133) — ×1; section C; bed 203; Ohmi Zone.
3 ***Jeanthieuloyites* cf. *quinquestriatus* (BESAIRE, 1936)**; (M. 2002.44) — ×1; section C; bed 254; Peregrinus Zone.
4 ***Bochianites neocomiensis* (D'ORBIGNY, 1841)**; (M. 2002.21) — ×1; section C; bed 233; ?Radiatus Zone.
5 ***Subsaynella mimica* THIEULOY & BULOT, 1992**; (M. 2002.171) — ×1; section C; bed 210; Sayni Zone.
6 ***Jeannoticeras jeannoti* (D'ORBIGNY, 1840)**; (M. 2002.157) — ×1; section C; bed 214; ?Nodosoplicatum Zone.
7 ***Subsaynella sayni* (PAQUIER, 1900)**; (M.2002.170) — ×1; section C; bed 213; Sayni Zone.
8 ***Olcostephanus* cf. *densicostatus* (WEGNER, 1909)**; (M.2002.136) — ×1; section C; bed 253; Peregrinus Zone.
9 ***Teschenites pachydicranus* THIEULOY, 1977**; (M.2002.310) — ×1; section C; bed 257; Peregrinus Zone.
10 ***Plesiospitidiscus* sp.**; (M.2002.490) — ×1; section C; bed 209; ?Ligatus Zone.
11 ***Neolissoceras grasianum* (D'ORBIGNY, 1841)**; (M. 2002.16) — ×1; section C; bed 236; Radiatus Zone.
12 ***Phyllopachyceras winkleri* (UHLIG, 1882)**; (M. 2002.183) — ×1; section C, bed 251; Peregrinus Zone.
13 ***Teschenites callidiscus* (THIEULOY, 1971)**; (M. 2002.317) — ×1; section C; bed 243; Furcillata Zone.

Plate I



immature and mature specimens of the various species. In most of these belemnites there is only limited information on the variation of the species, let alone detailed stratigraphical information.

The Hungarian material is stored in the Geological and Palaeontological Department of the Hungarian Natural History Museum (Budapest), under the inventory numbers from 2004.57.1 to 2004.156.1. All other belemnites mentioned are stored in the collection of the National Museum of Natural History (Leiden, The Netherlands).

Stratigraphical notes

Due to the intensive biostratigraphic work carried out mainly on Spanish and French sequences, the Late Valanginian ammonite zonal scheme suffered several modifications during the past decade. Many of the changes were taken into consideration by revision work of the "KILIAN Group" (HOEDEMAEKER et al. 2003).

In contrast, the (Early and Mid-) Hauterivian ammonite zonations remained rather unchanged over the past years. This is largely the result of the sporadic research that has been done over the past years in these deposits. It seems fairly clear that the association of ammonites in the lowermost Hauterivian, i.e. Radiatus Zone, shows close affinity with the uppermost Valanginian ammonite association. Many genera show their last occurrence within this stratigraphical interval (*Acanthodiscus*, *Breistrofferella*, *Leopoldia*, *Oosterella*, *Teschenites*). Others (e.g. *Crioceratites*, *Jeannoticeras*, *Spitidiscus*) become abundant and stratigraphically important, from the top of the Radiatus Zone, or base of the Loryi

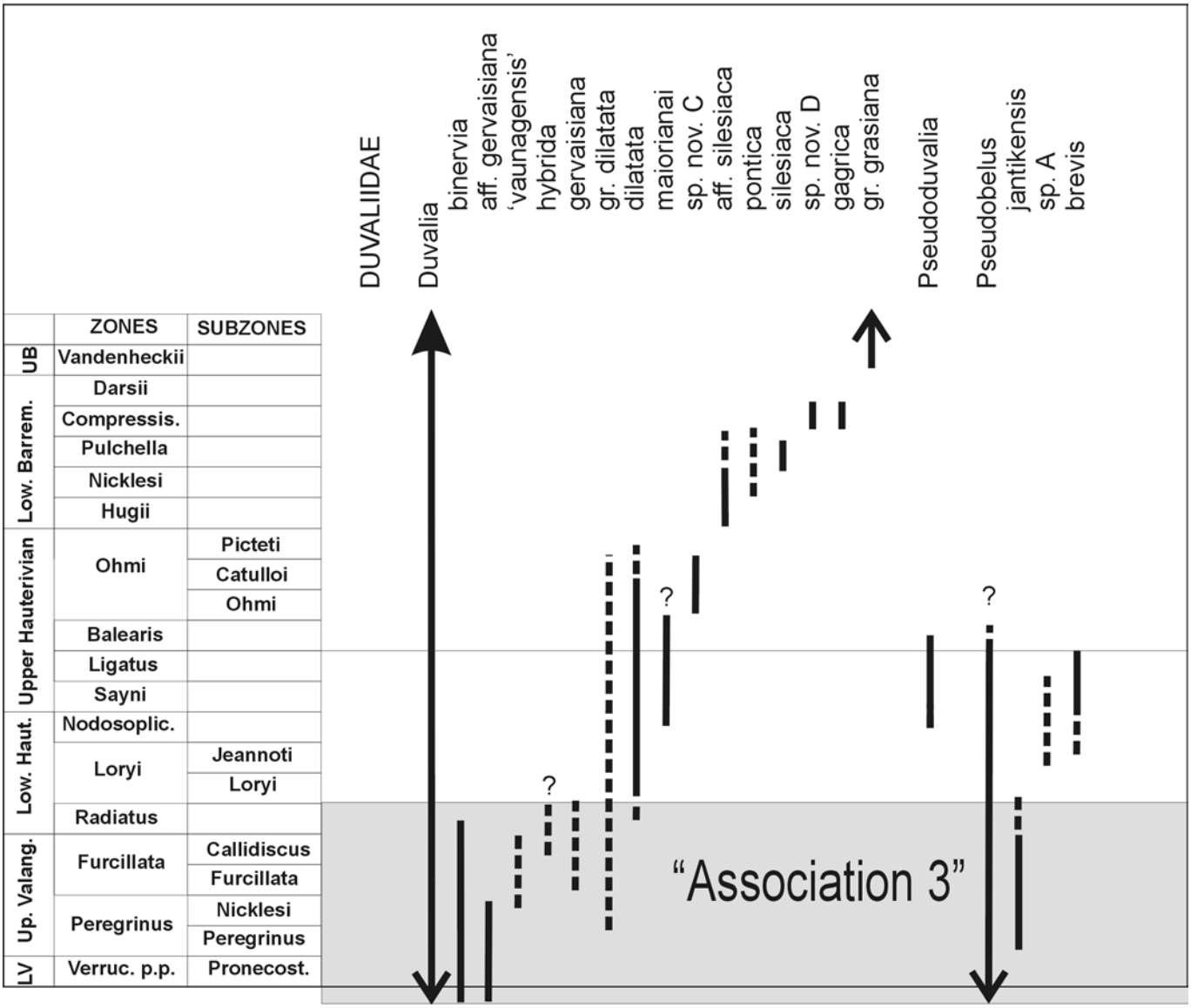


Figure 2 — Ranges of Tethyan Duvaliidae mentioned in the text. — Stratigraphical data after MICHALÍK & VAŠIČEK (1989), KAKABADZE & KELEPTRISHVILI (1991), VAŠIČEK et al. (1994), JANSSEN (1997), CLÉMENT (2000), JANSSEN & CLÉMENT (2002) and, unpublished pers. obs. in southeastern France (Angles, Chamateuil, Cheiron, Clos de Barral, Col de Rousset, Collet des Boules, La Lagne) and Spain (Río Argos, Tornajo). Ammonite zones after HOEDEMAEKER et al. 2003). — **Key**: **?** extension uncertain; ▪▪▪▪▪▪▪ exact stratigraphical range uncertain; ▬▬ range certain.

Zone. Moreover, the index-ammonites might not always be present. From the available data in platform deposits in southeast France it seems likely that the Loryi Zone and the Jeannoti Subzone equal each other almost. It is apparent that more research is badly needed.

Recently the ammonite-zonation of the Upper Hauterivian was revised by VERMEULEN (2002) based on material from sections in southeast France. COMPANY et al. (2003), based on several sections in southeast Spain, revised the uppermost Hauterivian interval. Based on ammonites from the Barremian stratotype section at Angles (southeast France), a revised stratigraphical scheme for the Lower Barremian was recently proposed by VERMEULEN (2002).

In the Bersek-hegy, the whole Late Valanginian – early Late Barremian ammonite succession is dominated by representatives of the suborder Phylloceratina and Lytoceratina. Altogether, about 11 thousands ammonites were collected from sections "A"–"E" (FŐZY & FOGARASI 2002).

The Late Valanginian – Hauterivian – (earliest Barremian) part of the profile (section "C"), which is in the focus of the present paper, yielded about 2750, moderately well preserved internal moulds of ammonites.

Regarding the suborder Ammonitina *N. grasianum* (D'ORBIGNY) (Plate I: 11) is common throughout the section (up to the Balearis Zone.) The lower (Late Valanginian) part of section "C" is dominated by *Jeanthieuloyites* spp., (including *J. quinquestriatus* (BESAIRE, 1936)), (Plate I: 3) and representatives of Oosterellidae and Neocomitidae. *Oosterella* species recognised in the Bersek-hegy (including *O. cultrata, O. cultrataeformis, O. gaudryi, O. ondulata* and *O. fascigera*) are described and figured by FŐZY (2004, in this volume).

The oldest recognised biostratigraphic unit in the section "C" is the Peregrinus Zone. (The thick, grey marl below, rather poor in cephalopod remains, was not sampled.) *Neocomites peregrinus* (RAWSON & KEMPER, 1981),

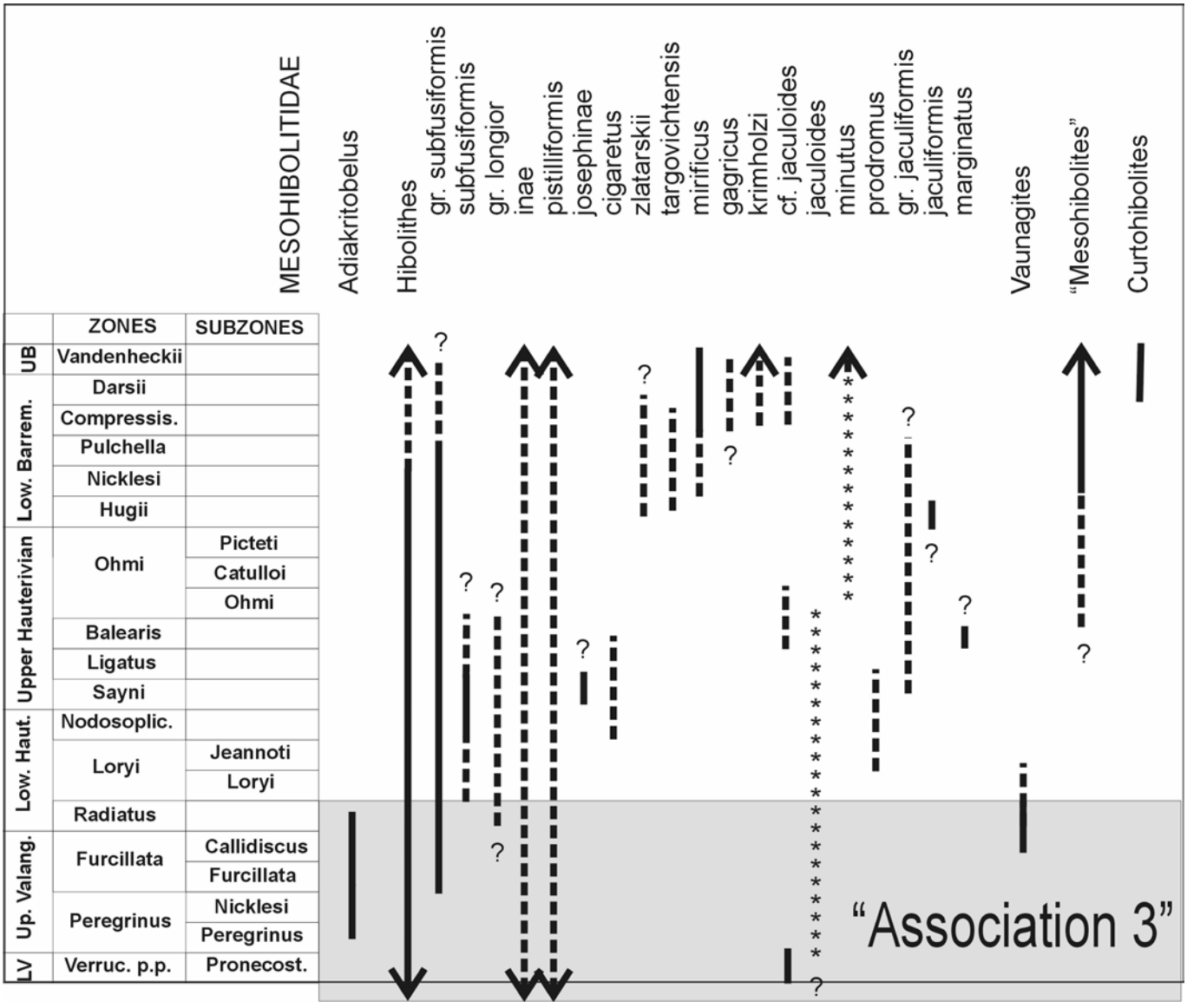


Figure 3 — Ranges of Tethyan Mesohibolitidae mentioned in the text. — Data obtained as for Figure 2. — **Key**: as in Figure 2; ranges of *Hibolithes* spp. (*jaculoides* and *minutus*) in the Boreal Realm are indicated by asterisks (****) [after MUTTERLOSE (1978, 1989), KEUPP & MUTTERLOSE (1984), IMMEL & MUTTERLOSE (1980)].

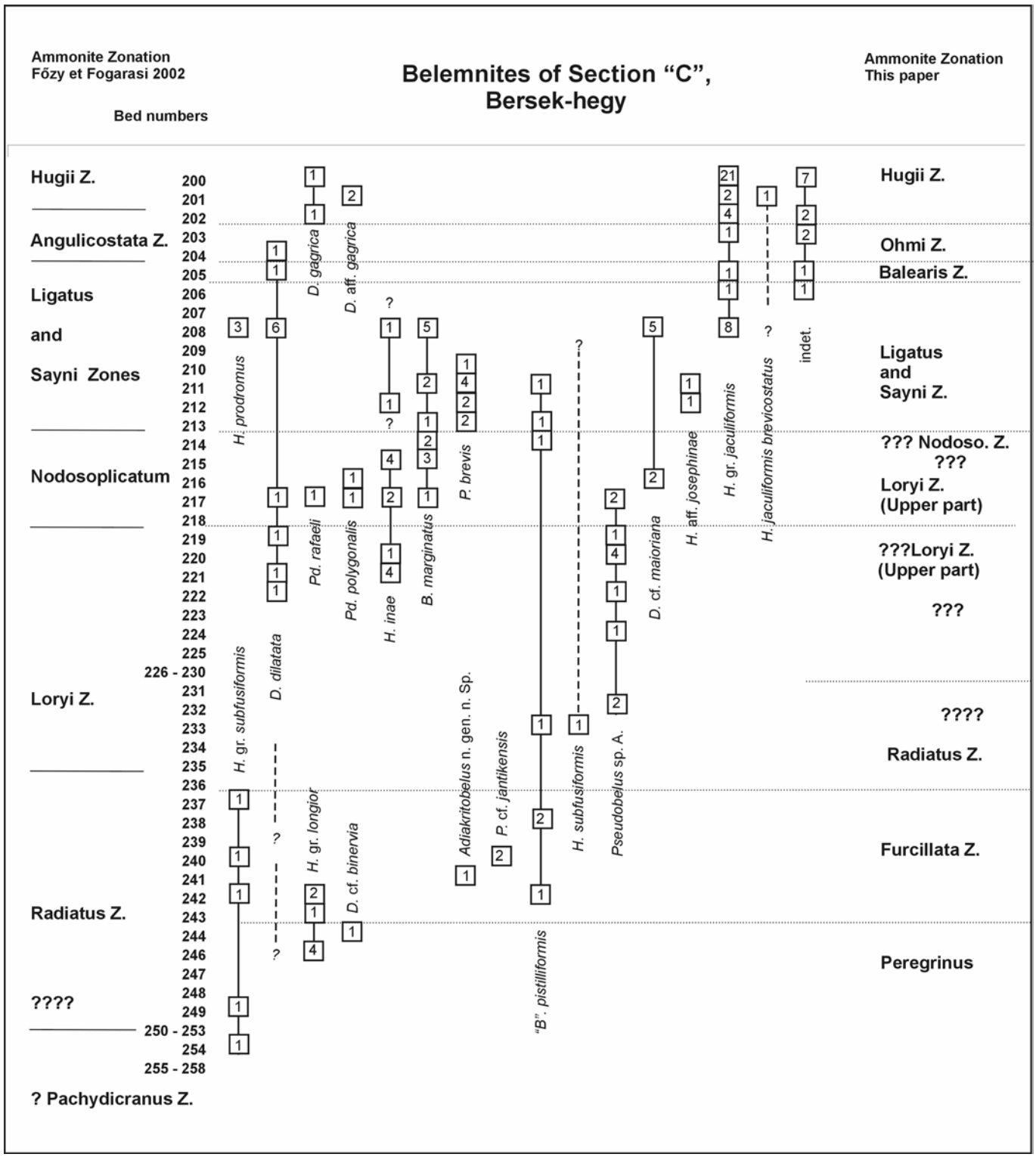


Figure 4 — Revised data set of Bersek-hegy belemnites for the Late Valanginian–lowermost Barremian (section "C").

(Plate I: 1), zonal index of the Late Valanginian Peregrinus Zone was discovered in bed 252. The presence of the zone is also confirmed, by the rich *Oosterella* fauna and by olcostephanids in the beds between 248–253, determined as *O. nicklesi* WIEDMANN et DIENI, 1968 and *O. densicostatus* (WEGNER, 1909) (Plate I: 8). Within Olcostephanidae microconchs and macronconchs were recognised. The first appearance of the extremely uncoiled *Himantoceras* sp. in bed 256, precedes slightly the appearance of *O. nicklesi. T. pachydicranus* (THIEULOY, 1977) (Plate I: 9), the zonal index of the former, long ranged Late Valanginian Pachydicranus Zone, was found in bed 250. It is also worth mentioning, that *T.* cf. *flucticulus* (THIEULOY, 1977) and *T. callidiscus* (THIEULOY, 1977) (Plate I: 13) were found together in and around bed 243. The latter possibly represents the higher level of the latest Valanginian Furcillata Zone. It is somehow contradictory, that *T.* cf. *flucticulus* was reported from the Radiatus Zone in Spain (HOEDEMAEKER & LEEREVELD 1995). The genus *Criosarasinella* was not recognised in the Hungarian fauna.

As a conclusion we can say, that however the latest Valanginian age of the lowermost part of the section "C" is confirmed by the appearance of several species, it is impossible to follow the precise succession of the numerous horizons, described from France and Spain.

The zonal index of the basal Hauterivian Radiatus Zone is missing from the Bersek-hegy succession. Because of this, the Valanginian/Hauterivian boundary was tentatively drawn in the section "C" on the basis of the contemporary appearance of the genus *Saynella*, (represented, by a big, smooth specimen) and an ammonite, very close to *O. hispanicus* (MALLADA, 1887). These occurrences and also the bloom of the genus *Crioceratites* in the bed 236 suggest that the boundary can be placed possibly between beds 236 and 237. The last appearance of *O. densicostatus* (bed 232) is also within this interval.

Throughout the whole Hauterivian, phylloceratids, lytoceratids and representatives of the genus *Crioceratites* and related forms are abundant. Beds, representing the lower part of the stage, are rich in *Neolissoceras* and *Bochianites neocomiensis* (D'ORBIGNY, 1841) (Plate I: 4). Many ammonites, belonging to the family Holcodiscidae, with a narrow, smooth band on the ventral side, were referred as *Jeanthieuloyites* close to the *rossfeldensismeneghini* group. *Jeannoticeras jeannoti* (D'ORBIGNY, 1840) (Plate I: 6) was found in bed 214, representing probably the highest appearance of this species and the upper part (Jeannoti Subzone) of the Loryi Zone. Beds below this level yielded no characteristic ammonites, thus the lower part of the zone (Loryi Subzone) can not be inferred. In the following bed (213) *Subsaynella sayni* (PAQUIER, 1900) (Plate I: 7), was found, representing possibly the Late Hauterivian already. It also means that there is no evidence for the presence of the Nodosoplicatum Zone in the section. (The characteristic taxon of the zone, the genus *Lyticoceras* has not been found yet in Hungary.)

There is a noteworthy concentration of *Plesiospitidiscus* spp. (Plate I: 10) between beds 200–212, which could mean the presence of the Ligatus Zone. This interval also yielded the first ptychoceratids. On the other hand, the separation of the Sayni and Ligatus Zones seems to be impossible at the moment. Only elements of the *Pseudothurmannia* succession (Plate I: 2), carefully described from the latest Hauterivian by COMPANY et al. (2003) were recognized in the upper part of the Bersek-hegy section (Balearis and Ohmi Zones). The topmost beds of the section, yielded *Discoidella favrei* (OOSTER, 1860) and also *Taveradiscus hugii* (OOSTER, 1860), the zonal index of the basal Barremian Hugii Zone. These beds possibly represented by the base of the greenish slump layer of the quarry.

The Upper Valanginian to lowermost Hauterivian belemnites

The belemnites from this stratigraphical interval are mentioned in JANSSEN & CLÉMENT (2002) as "Association 3". Apparently the top of the Radiatus Zone separates this association from the one above. The faunal differences between these two associations might be caused by a minor extinction event. An impoverished ammonite association is known from the Loryi Zone in southeast France (REBOULET & ATROPS 1999: p. 192). Belemnite data suggest the same (Figures 2–3), but already from the top of the Radiatus Zone on.

In the Hungarian material the "Association 3" includes the following Duvaliidae: *Duvalia* cf. *binervia* (RASPAIL, 1829) an alveolar part, *D.* gr. *dilatata* (DE BLAINVILLE) (beds 246 and 239) and, *Pseudobelus* sp. (bed 240: probably *P.* cf. *jantikensis* NERODENKO, 1986). Note that specimens from beds 246 and 239 are indicated by JANSSEN & FŐZY (2003) to be the morph *binervioides*. However, these specimens could possibly belong to *Duvalia hybrida* (DUVAL–JOUVE, 1841: Pl. 3, fig. 2 = ?*Belemnites variegatus* RASPAIL, 1829; or *D. gervaisiana* (DE ROUVILLE, 1872). The ontogeny of these belemnites is unknown and more research is necessary to distinguish between genuine *D. dilatata* morph. div. and these specimens.

The following Mesohibolitidae are included: "*Belemnites pistilliformis*" RASPAIL, 1829 (Plate II: 8, Plate III: 3), *Hibolithes longior* SHVETSOV, 1913 (Plate II: 20, 21), *H.* gr. *subfusiformis* (RASPAIL, 1829) (Plate II: 24, Plate III: 10), and, *Adiakritobelus* sp. nov. (Plate II: 11, 12).

GAYTE (1984) introduced in her manuscript a new genus (*Combemorelites*) for a group of belemnites with taxonomical characteristics intermediate between *Hibolithes* DENYS DE MONTFORT, 1808 and *Mesohibolites* STOLLEY, 1919. Unfortunately, this genus was never introduced properly although used throughout the following years. It contained several species, both from Valanginian–Hauterivian as well from Barremian sedimentary deposits. Here a new name will be introduced for this peculiar group of Upper Valanginian to lowermost Hauterivian belemnites.

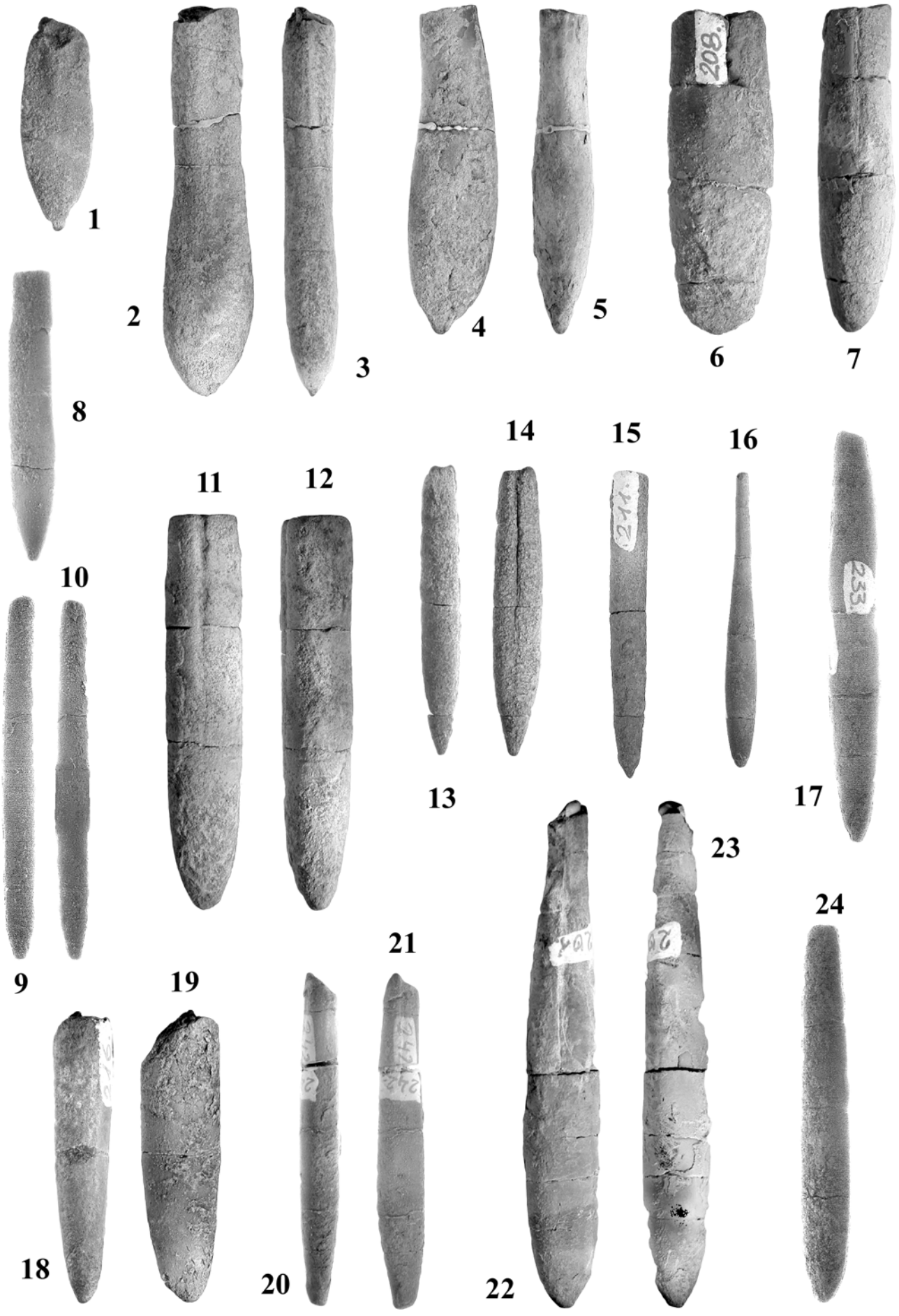
Taxonomical notes

Abbreviations in the text and plate explanations — **LT** = lectotype, **MT** = monotypic, **HT** = holotype, **+** = lapsus calami (spelling error), **MS** = manuscript, **auct. pl.** = many authors (but not necessarily all) excluding the first, **imm.** = immature, **juv.** = juvenile, **L** = length of rostrum, **H** = maximal height, **W** = maximal width, **h** = height in alveolar part, **w** = width in alveolar part.

Taxonomical indications in genera and species to be described are in accordance with RIEGRAF (1995), or RIEGRAF et al. (1998). Note that citations placed between angle brackets are personal views of one of the authors (N. J.). Citations between round brackets are from various other sources (indicated by "*fide*"), but not always followed.

Among the "Subfusiformi" there are some species that are actually collective species, i.e. *Belemnites pistilliformis* auct. pl. and *Hibolithes inae* auct. pl. They contain homeomorphic juvenile and immature specimen of various species, ranging from the Jurassic to the Neocomian. Also some Duvaliidae are subject to this phenomenon, i.e. *Duvalia* gr. *binervia* (RASPAIL, 1829). Morphologically very close specimens occur in the Upper Valanginian, lowermost Barremian and at the boundary of the Upper Barremian – Lower Aptian. Without specific stratigraphical data it seems impossible to separate these species.

Plate II



Family Mesohibolitidae NERODENKO, 1983

Genus *Adiakritobelus* n. gen.

(Plate II: 11, 12)

pars? 1829: *Belemnitae Chamateulii* (= *B. sordidii*) — RASPAIL, pp. 317 (47)–320 (50).
pars 1829: *Belemnitae pelorii* — RASPAIL, pp. 320 (50)–323 (53).
pars 1829: *Belemnitae claviformes* RASPAIL, pp. 323 (53)–328 (58).
pars 1913: *B. depressi* — SHVETSOV, pp. 54, 66.
pars 1919: *Mesohibolites* — STOLLEY, p. 45.
pars 1984: *Combemorelites* n. gen. — GAYTE, pp. 98–100.
1990: *Combemorelites* GAYTE — MUTTERLOSE, pp. 1, 3.
pars 1995: *Mesohibolites* STOLLEY — RIEGRAF, pp. 89–92.
pars 1995: *Pseudohibolites* BLÜTHGEN — RIEGRAF, pp. 97–107.
2002: *Combemorelites* GAYTE — JANSSEN & CLÉMENT, pp. 514, 515, 521.
2003: Mesohibolitidae n. gen. — JANSSEN & FŐZY, p. 293.

Derivation of name — name based on the Greek word for undistinguishable, mixed (adiakritobelos) (i.e. being a morphological mixture between *Hibolithes* and *Mesohibolites*).

Type species — *Hibolites rogeri* DELATTRE (1952: Pl. II, Figs 1–2). The other figure is a rostrum of intermediate age.

Type stratum — The basal layer, a phosphatic conglomerate, of the glauconitic deposits in Collet des Boules (Peyroules, southeast of France). This deposit contains fossils of the Upper Valanginian and lowermost Hauterivian (Furcillata to base of Radiatus Zone).

Diagnosis — The genus is characterized by medium sized rostrum (generally less than 14 cm) with characteristic rounded to compressed dorso-ventral section in the rostrum cavum, and with increasing dorso-ventral flattening in the rostrum sollidum towards the apical area. The apex might be blunt to very pointed, or elongated. The ventral aspect of the rostrum is subcylindroconical to cylindroconical. In lateral view the rostrum appears to be (sub)conical with the ventral side generally straight (except for the apical part), and the dorsal side being slightly curved towards the apical area. The depth of the alveolus may vary, as does the length of the alveolar groove.

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Explanation to Plate II

1 ***Pseudoduvalia rafaeli* (STOYANOVA-VERGILOVA, 1965)**; (2004.79.1) — ×1; section C; bed 217; top Loryi Zone. (L = 40.8 mm; H = 14.0 mm; W = 6.2 mm; h = 11.1 mm; w = 5.0 mm). Lateral view.

2–3 ***Duvalia gagrica* SHVETSOV, 1913**; (2004.78.1) — ×1; section C; bed 202; Hugii Zone. (L = 74.8; H = 17.6 mm; W = 10.3 mm; h = 13.2 mm; w = 10.6 mm). Lateral and dorsal views.

4–5 ***Duvalia* aff. *gagrica* SHVETSOV, 1913**; (2004.85.1) — ×1; section C; bed 201; Hugii Zone. (L = 62.2 mm; H =17.0 mm; W = 11.6 mm; h = 11.5 mm; w = 10 mm). Lateral and dorsal views.

6–7 ***Duvalia* cf. *maioriana* STOYANOVA–VERGILOVA, 1965**; (2004.86.1) — ×1; section C; bed 208; ?Ligatus Zone. (L = 60.3; H = 19 mm; W = 14 mm). Lateral and ventral views.

8 **"*Belemnites*" *pistilliformis* RASPAIL, 1829**; (2004.133.1) — ×1; section C; bed 214; ?Nodosoplicatum Zone. (L= 54 mm; H=W= 9 mm). Lateral view.

9–10 ***Hibolithes inae* ERISTAVI, 1955**; (2004.90.1) — ×1; section C; bed 220; ?Loryi Zone. (L = 69 mm; H = 6.3 mm; W = 7 mm). Lateral and ventral views.

11–12 ***Adiakritobelus* n. gen., n. sp.**; (= *Combemorelites mariae* GAYTE, 1984 [MS]); (2004.80.1) — ×1; section C; bed 241; Furcillata Zone. (L = 76 mm; H = 13.3 mm; W = 15.4 mm). Ventral and lateral views.

13–14 ***Hibolithes prodromus* SHVETSOV, 1913**; (2004.83.3) — ×1; section C; bed 208; ?Ligatus Zone. (L = 55.1 mm; H = 7.5 mm; W = 9.3 mm) Lateral and ventral views.

15 ***Hibolithes* cf. *josephinae* (HONNORAT-BASTIDE, 1889)**; (2004.76.1) — ×1; section C; bed 211; Sayni Zone. (L = 58 mm; H = W = 5.8 mm). Ventral view.

16 **"*Belemnites*" *pistilliformis* RASPAIL, 1829**; (2004.81.1) — ×1; section C; bed 242; Furcillata Zone. (L = 56 mm; H = W = 5.8 mm). Ventral view.

17 ***Hibolithes subfusiformis* (RASPAIL, 1829)**; (2004.98.1) — ×1; section C; bed 233; ?Radiatus Zone. (L = 78 mm; H = 9.4 mm; W = 10.2 mm). Lateral view.

18–19 ***Duvalia* cf. *maioriana* STOYANOVA–VERGILOVA, 1965**; (2004.77.1) — ×1; section C; bed 216; top Loryi Zone. (L = 55 mm; H = 14.9 mm; W = 10.9 mm). Dorsal and lateral views.

20–21 ***Hibolithes longior* SHVETSOV, 1913**; (2004.82.1) — ×1; section C; bed 242; Furcillata Zone. (L = 64 mm; H = 9 mm; W = 7.3 mm). Lateral and ventral views.

22–23 ***Hibolithes jaculiformis* SHVETSOV, 1913**; (2004.84.1) — ×1; section C; bed 201; Hugii Zone. (L = 97.5 mm; H = 13.0 mm; W = 14.8 mm). Ventral and lateral views.

24 ***Hibolithes* gr. *subfusiformis* (RASPAIL, 1829)**; (2004.149.1) — ×1; section C; bed 237; Furcillata Zone. (L = 73 mm; H = 9.4 mm; W = 10.5 mm). Lateral view.

Differential diagnosis — The growth is more irregular as compared to *Hibolithes*. While the latter is hastate to fusiform, full-grown *Adiakritobelus* can become (sub)cylindrical to (sub)cylindroconical. The onset of the alveolus is to the dorsal side, in exceptional cases central. The latter is however common in *Hibolithes*. As compared to the morphological close *Mesohibolites*, the only obvious difference is the different stratigraphical distribution. Full-grown "*Mesohibolites*" show a near straight ventral side, while *Adiakritobelus* is curved, although sometimes hardly visible. As compared to "*Mesohibolites*" the dorso-ventral flattening is much less well pronounced in full-grown specimen.

Species included — *Belemnites brevirostris* [nov.] RASPAIL, 1829; *B. fusus* [nov.] RASPAIL, 1829; *B. minaret* nov. RASPAIL, 1829; *B. navicula* [nov.] RASPAIL, 1829; *B. rugosus* [nov.] RASPAIL, 1829; and probably *Belemnites gemmatus* RASPAIL, 1829; *B. incurvatus* RASPAIL, 1829; and *B. oblongus* RASPAIL, 1829. Furthermore *Belemnites subfusiformis* var. *robustus* DUVAL–JOUVE, 1841; *Belemnites subfusiformis* var. "*gamma*" DUVAL–JOUVE, 1841 (Pl. 9, Figs 10–11); *Hibolites rogeri* DELATTRE, 1952 and *Combemorelites mariae* GAYTE, 1984 [MS]. Some typical Barremian species are partially included. They are described from Valanginian–Hauterivian strata, i.e.: *Belemnites semicanaliculatus* auct. non DE BLAINVILLE, 1827; *Belemnites beskidensis* auct. non UHLIG, 1883; *Belemnites minaretiformis* auct. non SHVETSOV, 1913.

Remarks — The original concept of *Combemorelites* as used by GAYTE (1984) was wider as compared to the concept used here. Originally it includes also some Barremian species.

Belemnites minaret RASPAIL, 1829 fulfils the characteristics ascribed to the new genus. Moreover it originates from La Lagne (near Castellane, France) and thus in all probability collected from the condensed Valanginian–Hauterivian glauconitic deposits, as Barremian deposits are largely absent from this area (COTILLON 1971: text-figures 40–41).

Stratigraphical distribution — Peregrinus Zone to Radiatus Zone.

Geographical distribution — France, Hungary, Romania, Switzerland, and probably also in Austria and Bulgaria.

The Lower Hauterivian belemnites

The belemnites from this interval (Loryi to Nodosoplicatum Zone) are poorly known. Personal observations in deposits in southeastern France and Spain suggest an association dominated by *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829), *Pseudobelus* spp. and subspecies of *Duvalia dilatata* (DE BLAINVILLE, 1827). *Duvalia dilatata* (DE BLAINVILLE, 1827) is apparently common in Hungary by HANTKEN (1872), STAFF (1906), SOMOGYI (1914), FÜLÖP (1958, 1964) and NAGY (1981). However, JEKELIUS's specimen (1915: p. 117, plate X, figure 4: *Belemnites dilatatus* DE BLAINVILLE (?) var. n.) from Romania, seems to be a complete *Duvalia binervia* (RASPAIL, 1829).

Family Duvaliidae PAVLOV, 1914

Genus *Duvalia* BAYLE & ZEILLER, 1878

Duvalia dilatata (DE BLAINVILLE, 1827) morph. div.

(Plate III: 1, 2, 7, 8, 23, 31, 32)

Material — Juvenile specimens from beds 222 and 221 (cf. BOGDANOVICHA, 1906: pp. 124–125, Pl. VII, Fig. 20).

The morph *binervioides* STOYANOVA–VERGILOVA, 1965b from beds 217, 208(3), 205 and 204.

The morph *dilatata* (DE BLAINVILLE, 1827) from beds 219 and 208(2) (of which one is complete and shows remains of the phragmocone).

Stratigraphical distribution — Hauterivian (Radiatus (?)/Loryi–base Ohmi Zone). The Hungarian material originates from sediments attributed to the Loryi, up to the Balearis Zone.

Type — The type is depicted on plate 5, figure 18 of de BLAINVILLE (1827). It apparently originates from Mende, Departement Lozere (south of the Massif Central). The other specimen is a deformed one and thus of no taxonomical value.

Genus *Pseudobelus* DE BLAINVILLE, 1827

Pseudobelus sp.

(Plate III: 16–19)

	1841: *Belemnites bipartitus* DE BLAINVILLE — DUVAL–JOUVE, pl. 1, figs. 1, 4.
?	1861: *Belemnites bipartitus* (CATULLO) BLAINVILLE — DE LORIOL, p. 20, pl. I, fig. 4.
non	1900: *Pseudobelus bipartitus* BLAINVILLE mut. *brevis* — PAQUIER, pp. 486, 487, II (cs).
	1913: *Duvalia bipartita* BLAINVILLE — SHVETSOV, pp. 45, 66, pl. II, figs. 2a–b.
	1994: *Pseudobelus brevis* PAQUIER — VAŠIČEK et al., pl. 27, figs. 5–6.
pars	2003: *Pseudobelus* spp. — JANSSEN & FŐZY , p. 293 [not bed 240].

Material — These specimens belong to the smaller *Pseudobelus* of *P.* gr. *brevis* PAQUIER, 1900. The Hungarian material includes: bed 232 (two incomplete specimens), one complete specimen from bed 225, one specimen from bed 222 (incomplete), four specimens from bed 221 (incomplete), one specimen from bed 219 (apical part), and from bed 217 two specimens, among which is one complete and one fragmented.

Taxonomical remarks — The specimens differ from *P. brevis* PAQUIER, 1900 due to a generally more elongated, and more compressed, faint appearance. *P. brevis* appears more robust as compared to these fairly elegant

specimens. It clearly is a new species, but as we do not know all of the new species of NERODENKO (cf. RIEGRAF, 1995: p. 113–115, 301), open nomenclature is used.

Stratigraphical distribution — This species precedes the genuine *P. brevis* PAQUIER, 1900. It is found in beds attributed to the Radiatus/Loryi Zones (Figure 4).

Genus *Hibolithes* DENYS DE MONTFORT, 1808

Hibolithes longior SHVETSOV, 1913

(Plate II: 20, 21)

1913: *Hibolites longior* n. sp. — SHVETSOV, pp. 51–52, 68, pl. III, fig. 2a–g.
1939: *Hibolites longior* SCHWETZOFF — KRYMGOL'TS, pp. 10–11, pl. I, fig. 7 [Lower Hauterivian, coll. RENGARTEN].
1952: *Hibolites longior* SCHWETZOFF — KHECHINASHVILI, pl. I, figs. 2–4.
1970: *Hibolites longior* SCHWETZOFF — STOYANOVA–VERGILOVA, pp. 13–14, pl. III, figs. 1–3.
? 1973: *Hibolites longior* SCHWETZOFF — NAZARISHVILI, pp. 16–17, pl. 1, figs. 5–6 [= *inae*?].
? 1973: *Hibolites longior* SCHWETZOFF — NAZARISHVILI, pl. 8, fig. 1 [= *inae*?].
1994: *Hibolites longior* SCHWETZOFF — VAŠIČEK et al., p. 80, pl. 25, figs. 7–8 [Hauterivian–Barremian boundary].
2002: *Hibolites longior* SCHWETZOFF — TOPCHISHVILI et al., pp. 64–65, pl. VI, figs. 1–2 [Late Hauterivian].

Material — 7 specimen from beds 246 to 242.

Taxonomical remarks — Elongated rostrum with typical dorsoventral compression in (im)mature specimens. The alveolar groove is typically long, up to about two third of the rostrum. Juvenile specimens are rounded, with a faint, but well developed alveolar groove.

Stratigraphical distribution — Apparently from Late Valanginian to Hauterivian–Barremian boundary. The Hungarian material is from Late Valanginian sedimentary deposits. In the Vocontian platform sedimentary environments (surrounding of Peyroules, les Allaves, etc.) this species is present in the sedimentary rocks that span the Valanginian–Hauterivian boundary.

Type — Lectotype (SHVETSOV, 1913: plate III, figure 2a) indicated by STOYANOVA–VERGILOVA (1970: p. 14).

The late Early or early Late (= "Mid") Hauterivian belemnites

The ammonite *Jeannoticeras jeanoti* (cf. FŐZY & FOGARASY 2002: Table III), (Plate I, Figure 6); a thick morph (? var. c*rassismus* WEGNER, 1909), in beds 218 and 214 suggest these beds to belong the top of the Loryi (Jeannoti Subzone) and/or the base of the Nodosoplicatum (Variegatus Subzone). The belemnites from this interval indicate it to be typical Late Hauterivian (JANSSEN & FŐZY 2003: p. 293). Apparently these data contradict, but the stratigraphical information based on belemnites is much more scarse for this interval, as compared to the ammonites. From the above stratigraphical information it seems that *Pseudoduvalia* is already present in the top of the Lower Hauterivian ("Mid" Hauterivian), together with *Duvalia* cf. *maioriana* STOYANOVA–VERGILOVA, 1965b.

The following belemnites are first found in this interval.

"*Belemnites*" *marginatus* RASPAIL, 1829

(Plate III: 9, 12)

pars 1829: *Belemnites marginatus* [nov.] — RASPAIL, pl. 8, fig. 74.

Material — Several strong depressed immature, or juvenile (?) specimens show no trace of an alveolar groove, and possess an apex which is centrally placed. At first glance they appear like juvenile Duvaliidae, but these are depressed, and have an excentric apex. These specimens are characterized by an extreme dorso-ventral flattening over the total length of the shell. No trace of an alveolar groove could be detected. Whether this flatness could be the result of corrosion could not be detected, but some specimens show signs of weathering (borings and corrosion). They are elongated, slightly pointed towards the apex, and with a broader alveolar side as compared to the apical side.

Remarks — Belemnites of unknown affinity, most probably related to *Hibolithes jaculiformis* SHVETSOV, 1913; possibly also partially *H. prodromus* SHVETSOV, 1913.

Stratigraphical remarks — Similair forms were collected in the glauconitic Upper Hauterivian and lowermost Barremian deposits of Chamateuil (topotypes) and Clos de Barral (cf. VERMEULEN 1980a, 1980b, 2002 for location) (unpublished, personal observations).

The Hungarian material originates from the "Mid" Hauterivian to Ligatus Zone.

"*Belemnites*" *pistilliformis* RASPAIL, 1829

(= *Belemnites pistilliformis* auct. pl.)
(Plate II: 8, 16, Plate III: 3)

pars 1827: *Belemnites pistilliformis* DE BLAINVILLE, pp. 98–99, pl. 5, figs. 14–15.
1829: *Belemnites pistilliformis* [nov., non: DE BLAINVILLE] — RASPAIL, p. 327, figs. 95–97.
1913: *Hibolithes* sp. — SHVETSOV, pl. III, fig. 3 (= *H. inae* nov. sp. *fide* ERISTAVI 1955: p. 26; = *H. secretus* sp. nov. *fide* GUSTOMESOV 1967: pp. 125–128).
? 2003: *Vaunagites pistilliformis* COMBÉMOREL & GAYTE — JANSSEN & FŐZY, p. 293.

Material — These include juvenile and immature hastate, lanceolate or fusiform specimens of rounded to very slightly depressed belemnites without the trace of an alveolar groove. The material of RASPAIL can be attributed to *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829 = *Belemnites symmetricus* RASPAIL, 1829). The original material was collected from La Lagne (southeast of Castellane, France) and might actually include juvenile material that belongs to *Vaunagites* COMBÉMOREL & GAYTE, 1981, and even "*Combemorelites*" GAYTE, 1984 [MS]. However, these juvenile, immature or apical parts are virtually undistinguishable. The material from DE BLAINVILLE originates from the Castellane area without further geographical precision.

Stratigraphical remarks — The Hungarian material ranges from the Late Valanginian (bed 242), Lower Barremian (bed 122; erroneously as 212 in JANSSEN & FŐZY 2003) to the "Mid" Barremian (beds 410 and 399). The latter specimens might be juvenile specimen of *Hibolithes mirificus* STOYANOVA–VERGILOVA, 1965a or juvenile "*Mesohibolites*".

Genus *Duvalia* BAYLE & ZEILLER, 1878

Duvalia cf. *maioriana* STOYANOVA–VERGILOVA, 1965b

(Plate II: 6, 7, 18, 19)

	1930: *Duvalia binervia* RASPAIL — TSANKOV, pp. 64–65, pl. IV, fig. 18 [imm.].
	1946: *Duvalia lata* (BLAINVILLE) — TSANKOV, pl. XVII, fig. 7.
non	1965: *Duvalia binervia* (RASPAIL) — STOYANOVA–VERGILOVA, pl. V, fig. 2 [= *Duvalia* sp. nov. (indicated 'C' in Fig. 2)].
pars?	1965: *Pseudoduvalia polygonalis* (BLAINVILLE) — STOYANOVA–VERGILOVA, pl. III, fig. 1.
?	1965: *Duvalia dilatata majoriana* subsp. nov. — STOYANOVA–VERGILOVA, pp. 196–197, pl. VI, figs. 1–2.
?	1976: *Duvalia dilatata majoriana* STOYANOVA–VERGILOVA — AVRAM, p. 60(8).
	1980: *Duvalia dilatata* var. *majoriana* STOYANOVA–VERGILOVA — JELETZKY, p. 8, pl. V, figs. 1A–B.
	1989: *Duvalia dilatata majoriana* STOYANOVA–VERGILOVA — MICHALÍK & VAŠIČEK, pl. 3, fig. 2.
	1995: *Duvalia dilatata maioriana* STOYANOVA–VERGILOVA — RIEGRAF, p. 111.
non	1997: *Duvalia hybrida* (DUVAL-JOUVE) — JANSSEN, pp. 20–21, pl. 4, fig. 5 [= *Duvalia* sp. nov. (indicated 'D' in Fig. 2)].
	1998: *Duvalia dilatata majoriana* STOYANOVA–VERGILOVA — RIEGRAF et al., p. 263.
	2002: *Duvalia maioriana* STOYANOVA–VERGILOVA — JANSSEN & CLÉMENT, p. 515.
pars	2003: *Duvalia* gr. *dilatata* (DE BLAINVILLE) — JANSSEN & CLÉMENT, p. 520.
	2002: *Duvalia* sp. nov. aff. *hybrida* (DUVAL–JOUVE) — JANSSEN & FŐZY, p. 293.

Material — One complete immature (?) specimen and an apical part from bed 216, and one mature specimen from bed 208.

Remarks — The specimens can be best described as being morphologically somewhere between *D. hybrida* (DUVAL–JOUVE, 1841) and *D. lata* (DE BLAINVILLE, 1827). They differ mainly from *D.* gr. *lata* (DE BLAINVILLE) because they show a much shorter alveolar groove, besides a different stratigraphical range. Whether or not this material equals *D. dilatata majoriana* STOYANOVA–VERGILOVA, 1965b is uncertain. In our opinion it is most certainly not a subspecies of *D. dilatata* (DE BLAINVILLE, 1827).

Stratigraphical remarks — The Hungarian material originates from the "Mid" Hauterivian to Ligatus Zone. One juvenile to immature specimens, comparable to TSANKOV (1930: plate IV, figure 18), is found in the Río Argos (Spain) section, bed A43–44 (cf. HOEDEMAEKER & LEEREVELD 1995), and one fragment in A62, in the top of the Nodosoplicatum Zone.

It occurs in Bulgaria, Carpathian (Balearis Zone; cf. MICHALÍK & VAŠIČEK 1989), France, Hungary, Morocco, Romania (?) and Spain.

Genus *Pseudoduvalia* NAEF, 1922

Pseudoduvalia polygonalis (DE BLAINVILLE, 1827)

(Plate III: 27, 28)

	1827: *Belemnites polygonalis* — DE BLAINVILLE, pp. 121–122, pl. 5, fig. 11 [HT].
non	1913: *Duvalia polygonalis* BLAINVILLE — SHVETSOV, p. 67, pl. II, figs. 1a–c.
non	1962: *Duvalia* (*Polygonalia*) *polygonalis* BLAINVILLE — ALIEV, pp. 43, 44, 45.
non	1964: *Duvalia polygonalis* (DE BLAINVILLE) — CHINCHUROVA, pp. 24–25, text-fig. 10, pl. 1, fig. 10.
pars	1965: *Polygonalia polygonalis* (BLAINVILLE) — ALI-ZADE, text-figs. h–k, l–t.
pars	1965: *Duvalia polygonalis* (BLAINVILLE) — STOYANOVA-VERGILOVA, pp. 197–199, pl. III, fig. 2–11.
	1972: *Pseudoduvalia polygonalis* (BLAINVILLE) — ALI-ZADE, pp. 135–137, pl. II, figs. 1–2, 5.
non	1997: *Pseudoduvalia poligonalis* [sic!] (BLAINVILLE) — KRYMGOL'TS, pp. 150–151, pl. 59, fig. 6.

Material — One specimen from bed 217 and, one mature specimen, from bed 216.

Stratigraphical remarks — Supposed to be characteristic Upper Hauterivian specimens. In southeast France they disappear either in the top of the Ligatus Zone or at the base of the Balearis Zone, and in the Río Argos (Spain) the last *Pseudoduvalia* was found in bed A128 (base Balearis Zone; cf. HOEDEMAEKER & LEEREVELD 1995).

The Hungarian material is restricted to the "Mid" Hauterivian, and probably represents the top of the Nodosoplicatum Zone.

Type — Monotypical.

Pseudoduvalia rafaeli (STOYANOVA–VERGILOVA, 1965b)

(Plate II: 1)

1965: *Duvalia rafaeli* sp. nov. — STOYANOVA–VERGILOVA, pp. 201–202, pl. II, figs. 3, 4 [HT], 5–6.

non 1973: *Duvalia* cf. *rafaeli* STOYANOVA–VERGILOVA — NAZARISHVILI, pp. 85–86, pl. 7, figs. 27–28 [Lower Aptian; =? *Duvalia* gr. *grasiana* (DUVAL–JOUVE)].

pars 2000: *Pseudoduvalia rafaeli* (STOYANOVA–VERGILOVA) — KELEPTRISHVILI, pp. 134, 135, 136.

non 2002: *Pseudoduvalia rafaeli* (STOYANOVA–VERGILOVA) — TOPCHISHVILI et al., pp. 164–165, pl. XXIII, fig. 6 [Early Aptian; =? *D.* gr. *grasiana* (DUVAL–JOUVE)].

Material — One mature specimen from bed 217.

Stratigraphical remarks — Late Hauterivian (no specification on ammonite zones). The Hungarian specimen originates from the "Mid" Hauterivian (probably top Nodosoplicatm Zone) and occurs together with *P. polygonalis*.

Type — Holotype indicated by STOYANOVA–VERGILOVA, 1965b.

The Upper Hauterivian to lowermost Barremian belemnites

In the Hungarian material this interval is represented from bed 213 on. This bed contains the stratigraphically important ammonite *Subsaynella sayni* (PAQUIER) (Plate I: 7). Bed 210 contains *Subsaynella mimica* THIEULOY & BULOT (Plate I: 5). The latter is found in the top of the Sayni Zone and the base of the Ligatus Zone. These beds are in south-east France characterised by the occurrence of *Pseudobelus brevis* PAQUIER, 1900 with *Pseudoduvalia* spp., *Duvalia dilatata* (DE BLAINVILLE, 1827), *Hibolithes subfusiformis* (RASPAIL, 1829), *H. josephinae* (HONNORAT–BASTIDE, 1889), *H.* gr. *subfusiformis* (RASPAIL, 1829) and "*Belemnites marginatus*" RASPAIL, 1829. A more or less comparable fauna is found in Hungary (beds 213 to 209).

Bed 208 is exceptionally rich in belemnites and contains *H. prodromus* SHVETSOV, 1913 (Plate II: 13, 14), the last(?) *H. subfusiformis* (RASPAIL, 1829), juvenile or immature specimens of *Duvalia* cf. *maioriana* STOYANOVA–VERGILOVA, 1965b, and the first *H.* gr. *jaculiformis* SHVETSOV, 1913.

The belemnites from the upper part (after the last *Pseudoduvalia*) of the Upper Hauterivian (Balearis to Ohmi Zones) are mainly characterised by *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829), *H.* gr. *jaculiformis* SHVETSOV, 1913 and with subordinated Duvaliidae (mainly *D. dilatata* spp.). This interval is in the Hungarian material represented by beds 204 to 203, as bed 202 contains already Duvaliidae (supposed to be) characteristic for the Early Barremian.

CLÉMENT (2000) deals with the belemnites from the Barremian stratotype of Angles. The belemnites above the Hauterivian–Barremian boundary are characterised as "faune à *Duvalia*" (various new species and species related to *D. silesiaca* UHLIG, 1901 and *D. gagrica* SHVETSOV, 1913) with *Hibolithes* spp.

Family Mesohibolitidae NERODENKO, 1983

Genus *Hibolithes* DENYS DE MONTFORT, 1808

The oldest representatives of this genus occur in the Bajocian (RIEGRAF 1981; DOYLE 1987; DOYLE & BENNETT 1995) and the last representatives are to be found in the "Mid"/Upper Barremian to earliest Aptian (NAZARISHVILI 1968, 1973; MUTTERLOSE 1988a, 1998). It is a "conservative" genus that, with exceptions, seems to be composed of many homoeomorphic species or groups of species without much trait. Detailed investigations might reveal some groups of closely related species to be restricted to certain stratigraphical intervals. The Late Valanginian–Hauterivian–Early Barremian species here discussed, Subfusiformi of SHVETSOV, 1913, can be divided into two (or three?) morph-groups.

One group consists of belemnites that are rounded to slightly depressed in the stem region and compressed, depressed or rounded in the alveolar area. The alveolar groove when preserved (often these species do show exfoliation of the alveolar area) can be very long. This seems to be the most common form in the western Tethyan Hauterivian and Lower Barremian, and can best be characterised as *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829). The juvenile or immature specimens tend to be well-rounded, like: *Belemnites pistilliformis* auct. pl.; "*B." pistilliformis* RASPAIL, 1829 and juvenile *H. jaculoides* ssp. SWINNERTON, 1937.

A second group (*Hibolithes* gr. *jaculiformis* SHVETSOV, 1913) consists of hastate, depressed to well-depressed rostra. Sometimes mature specimens are less depressed but juvenile specimens seem always to be depressed. Mature specimens can be depressed to rounded in the alveolar area.

Eventually a third group consists of well-rounded, elongated to slightly hastate (im)mature species, with no or a (very) faint alveolar groove (*Belemnites* gr. *josephinae* HONNORAT-BASTIDE, 1889). They occur in different stratigraphical levels as compared to *Vaunagites* COMBÉMOREL & GAYTE, 1981. Compared to the latter genus they differ in form (less elongated) and development of the alveolar area (with well-defined but faint alveolar groove).

The first group of *Hibolithes* [*H.* gr. *subfusiformis* (RASPAIL, 1829)] includes partially: *Hibolithes* DENYS DE MONTFORT, 1808, the Subfusiformi of SHVETSOV, 1913 and *Hibolites* auct. pl. The most typical member would be *Belemnites symmetricus* RASPAIL, 1829. This species occurs in the "marnes à bélemnites" (Upper Hauterivian; cf. COTILLON 1971), a characteristic package of outer-platform deposits ("hemi-pelagic"), with marl dominated rocks. The following species would be included in this group: *Belemnites symmetricus* RASPAIL, 1829; *B. praemorsus* RASPAIL, 1829; *B. subfusiformis* RASPAIL, 1829; partially *B. pistilliformis* RASPAIL, 1829; and probably *B. hastatus* RASPAIL, 1829; furthermore *Hibolites longior* SHVETSOV, 1913; *Hibolites cigaretus* STOYANOVA–VERGILOVA, 1965a; *B. mirificus* STOYANOVA–VERGILOVA, 1965a; *B. zlatarskii* STOYANOVA–

VERGILOVA, 1965a; *B. krimholzi* STOYANOVA–VERGILOVA, 1970; *B. targovichtensis* STOYANOVA–VERGILOVA, 1979; *Hibolites stoyanovae* COMBÉMOREL, 1988; *Hibolithes gamtaensis* CHALLINOR, 1989; *B. miosensis* CHALLINOR, 1989.

Not to be included are the Late Tithonian–Berriasian and Lower Valanginian Mesohibolitidae, like: *Hibolithes laryi* (MAYER, 1866), *H.* aff. *pistilliformis* (DE BLAINVILLE, 1827), etc. Also, the typical Jurassic belemnites around *Belemnites wuerttembergicus* OPPEL, 1857, *B. semihastatus* DE BLAINVILLE and *B. hastatus* DE BLAINVILLE, are not to be included.

Actually the status of the genotype (*Hibolithes hastatus* DENYS DE MONTFORT, 1808) is controversial as indicated by RIEGRAF (1995: 98–99) and authors mentioned there. It originates from the surroundings of Gap. It is generally supposed to be of Upper Jurassic origin, as this is the most common strata in the Gap area. However, it strongly resembles *Belemnites hastatus* [nov.] RASPAIL 1829: Pl. 8, Fig. 91; from La Lagne (near Castellane, southeast of France). Most probably this specimen is from the Valanginian–Hauterivian boundary sediments or from the Upper Hauterivian.

Hibolithes is highly variable concerning the length of the alveolar groove, the shape of the various cross-sections and, the position of the maximum outline with respect to the apex. Cross-sections are in general rounded to depressed in stem region, but can be compressed in the alveolar region. The maximum diameter is in general situated near the apical part of the rostrum but can shift to the middle part of the rostrum, as in the type of *Belemnites subfusiformis* RASPAIL (1829: Pl. 8, fig. 93).

Sometimes but not always this variability is related to ontogeny. Juvenile and (very) immature specimens tend to have no trace of an alveolar groove, are less hastate, show round(ed) cross-sections, and thus become virtually impossible to distinguish from *Vaunagites* and "*Belemnites*" *pistilliformis* auct. pl.

⇒

Explanation to Plate III

1–2 ***Duvalia dilatata* (DE BLAINVILLE, 1827) morhpe *dilatata* (DE BLAINVILLE, 1827);** (2004.69.1) — ×1; section C; bed 208; Ligatus Zone. (L = 101 mm; H = 28 mm; W = 15.4 mm). Lateral and dorsal views.

3 **"*Belemnites*" *pistilliformis* RASPAIL, 1829**; (2004.74.1) — ×1; section C; bed 236; ?Radiatus Zone. (L = 83 mm; H = 8 mm; W = 9 mm). Lateral view.

4–5 ***Hibolithes inae* ERISTAVI, 1955**; (2004.131.1) — ×1; section C; bed 215; ?Nodosoplicatum Zone. (L = 49 mm; H = 8.5 mm; W = 10 mm). Ventral and lateral views.

6 ***Hibolithes* gr. *jaculiformis* SHVETSOV, 1913**; (2004.73.1) — ×1; section C; bed 202; Hugii Zone. (L = 80.5 mm; H = 12 mm; W = 11 mm). Lateral view.

7–8 ***Duvalia dilatata* (DE BLAINVILLE, 1827) morph *binervioides* STOYANOVA-VERGILOVA, 1965**; (2004.63.1) — ×1; section C; bed 208; Ligatus Zone. (L= 100 mm; H= 22 mm; W= 9 mm). Dorsal and lateral views, ×1

9 **"*Belemnites*"*marginatus* RASPAIL, 1829**; (2004.136.1) — ×1; section C; bed 213; ?Nodosoplicatum Zone. (L = 63 mm; H = 7 mm; W = 8.5 mm). Dorsal view.

10 ***Hibolithes* gr. *subfusiformis* (RASPAIL, 1829)**; (2004.66.1) — ×1; section C; bed 200; Hugii Zone. (L = 66 mm; H = 9 mm; W = 9.5 mm). Dorsal view.

11 ***Hibolithes inae* ERISTAVI, 1955**; (2004.64.1) — ×1; section C; bed 212; Sayni Zone. (L = 67 mm; H = 8 mm; W = 9 mm). Lateral view.

12 **"*Belemnites*" *marginatus* RASPAIL, 1829**; (2004.136.1) — ×1; section C; bed 215; ?Nodosoplicatum Zone. (L = 62 mm; H = 6 mm; W = 7 mm). Lateral view.

13–14 ***Pseudobelus brevis* PAQUIER, 1900**; (2004.103.2) — ×1; section C; bed 210; ?Sayni Zone. (L = 47 mm; H = 5 mm; W = 6 mm). Lateral and ventral views.

15 ***Pseudobelus brevis* PAQUIER, 1900**; (2004.71.1) — ×1; section C; bed 212; ?Sayni Zone. (L = 26 mm). Lateral view.

16 ***Pseudobelus* sp. A**; (2004.140.1) — ×1; section C; bed 232; ?Radiatus Zone. (L = 24 mm; H = 4 mm; W = 4.9 mm). Lateral view.

17–19 ***Pseudobelus* sp. A**; (2004.75.1) — ×1; section C; bed 225; ?Loryi Zone. (L = 46 mm, H= 3mm, W = 4 mm). Ventral and lateral (left and right) views.

20 ***Pseudobelus brevis* PAQUIER, 1900**; (2004.104.1) — ×1; section C; bed 213; ?Sayni Zone. (L = 32 mm; H = 5 mm; W = 6 mm). Lateral view.

21 ***Pseudobelus brevis* PAQUIER, 1900**; (2004.104.2) — ×1; section C; bed 213; ?Sayni Zone. (L = 30 mm; H = 5 mm; W = 5.5 mm). Lateral view.

22 ***Hibolithes inae* ERISTAVI, 1955**; (2004.135.1) — ×1; section C; bed 215; ?Nodosoplicatum Zone. (L = 59 mm; H = 7 mm; W = 7,2 mm). Lateral view.

23 ***Duvalia dilatata* (DE BLAINVILLE, 1827) morph *binervioides* STOYANOVA-VERGILOVA, 1965**; (2004.68.1) — ×1; section C; bed 204; Ohmi Zone. (L = 76 mm; H = 19 mm; W = 8 mm). Lateral view.

24–25 ***Hibolithes* gr. *jaculiformis* SHVETSOV, 1913**; (2004.72.1) — ×1; section C; bed 206; ?Ligatus Zone. (L= 53 mm; H= 10 mm; W= 9 mm). Dorsal and lateral views.

26 ***Duvalia silesiaca* UHLIG, 1902**; (2004.62.1) — ×1; section C; bed 200; Hugii Zone. (L = 45 mm; H = 10,5 mm; W = 16 mm). Lateral view.

27–28 ***Pseudoduvalia polygonalis* (DE BLAINVILLE, 1827)**; (2004.70.1) — ×1; section C; bed 216; Loryi or Nodosoplicatum Zone. (L = 37 mm; H = 7.2 mm; W = 12.5 mm). Dorsal and lateral views.

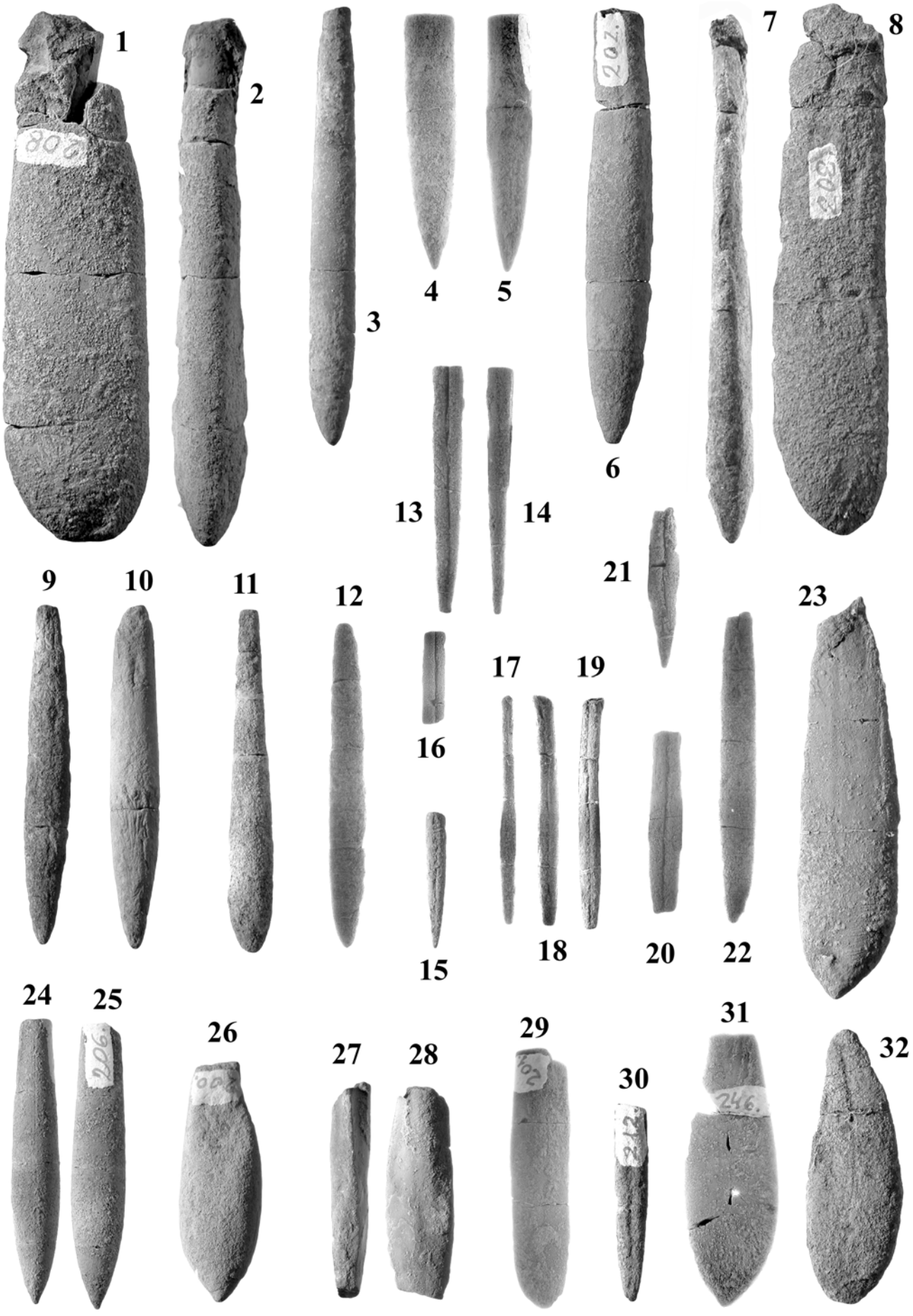
29 ***Duvalia gagrica* SHVETSOV, 1913**; (2004.88.1) — ×1; section C; bed 201; Hugii Zone. (L = 49 mm; H =11 mm; W = 8 mm). Lateral view.

30 ***Pseudobelus brevis* PAQUIER, 1900**; (2004.71.2) — ×1; section C; bed 212; ?Sayni Zone. (L = 39 mm; H = 3 mm; W = 6.4 mm). Lateral view.

31 ***Duvalia* gr. *dilatata* (DE BLAINVILLE, 1827)**; (2004.143.1) — ×1; section C; bed 246; Peregrinus Zone. (L = 52 mm; H = 18 mm; W= 6.9 mm). Lateral view.

32 ***Duvalia dilatata* (DE BLAINVILLE, 1827) morph *binervioides* STOYANOVA-VERGILOVA, 1965**; (2004.63.2) — ×1; section C; bed 208; Ligatus Zone. (L = 52 mm, H = 18.2 mm, W = 6.8 mm). Lateral views.

Plate III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Complete specimens are (very) rare due to the rather extreme fragility of the alveolar region, or to exfoliation in the alveolar part of the stem-region (*Actinocamax*-effect). This effect is often observed among the Mesohibolitidae but is not characteristic. Some Duvaliidae tend to show the same phenomenon.

Generally restricted to the Tethyan Realm, but with exceptions. Most probably *Hibolithes jaculoides* SWINNERTON, 1937 and connected species (*Pseudohibolites* BLÜTHGEN, 1936; cf. DOYLE, 1987; DOYLE & KELLY, 1988) should be included. They are virtually undistinguishable from the variation that is shown by *H.* gr. *subfusiformis* (RASPAIL, 1829) or *H.* gr. *jaculiformis* SHVETSOV, 1913, besides they show more or less the same stratigraphical range.

H. jaculoides occurs in the Valanginian and Hauterivian (cf. MUTTERLOSE, 1978: p. 60–61; KEUPP & MUTTERLOSE, 1984: p. 166). As far as we could detect the oldest stratigraphically controlled specimens in northwestern Europe are found in the *Dichotomites crassus* Zone to base of the *Dichotomites triptychoides* Zone of the "Varlheide Profil" (MUTTERLOSE et al. 2000: p. 28–34), but cf. MUTTERLOSE (1988b: p. 79, text-figure II. 2/1). It becomes abundant in the Lower Hauterivian, and is replaced by *H. minutus* SWINNERTON, 1952 in the upper part of the Upper Hauterivian (cf. MUTTERLOSE, 1989: p. 704, 706).

IMMEL & MUTTERLOSE (1980) mention isolated occurrences of *H. jaculoides* SWINNERTON, 1937 from the Lower Barremian Fissicostatus Zone of the Subboreal Province. This interval corresponds approximately to the middle of the Caillaudianus Zone (= Darsi Zone) in the Mediterranean Tethys, and corresponds to the stratigraphical interval in which the last belemnites of the *H.* gr. *subfusiformis* (i.e. *Hibolithes gagricus* SHVETSOV, 1913, *Hibolithes krimholzi* STOYANOVA–VERGILOVA, 1970 and *H. targovichtensis* STOYANOVA–VERGILOVA, 1979) are to be found in the Tethys.

Most likely many citations of *H. jaculum* auct. pl. in the Tethys area are to be traced back to *H.* (gr.) *subfusiformis* (RASPAIL, 1829). However, recently JANSSEN & CLÉMENT (2002: p. 514) have found evidence for *H.* cf. *jaculoides* SWINNERTON, 1937 to be present in the lower part of the Upper Valanginian of SE France (notably the Pronecostatum Zone and base of the Peregrinus Zone and probably also in the top of the Verrucosum Subzone (the former "Neocomiensis" Subzone). *H.* cf. *jaculoides* is also present in comparable sedimentary rocks in SE Spain (Tornajo, prov. of Murcia, Spain; pers. obs.). Thus it seems to precede the well-known mixed Tethyan\Boreal fauna of the Peregrinus Zone. If this might be a consisted pattern, it might appear that *H. jaculoides* SWINNERTON appears only in specific intervals in the northern margin of the Tethyan area.

Hibolithes subfusiformis (RASPAIL, 1829)

(Plate II: 17)

+	1822: *Belemnites fusoides* — LAMARCK, p. 592 [nom. nud.].
	1829: *Belemnites subfusiformis* [nov.] — RASPAIL, p. 325, pl. 8, fig. 93[MT].
pars	1840: *Belemnites subfusiformis* RASPAIL — D'ORBIGNY, pp. 50–53, pl. 4, fig. 13.
pars	1841: *Belemnites subfusiformis* RASPAIL — DUVAL–JOUVE, pp. 66–72, pl. 9, figs. 3, 7, 11.
	1913: un rostre du gr. s*ubfusiformis* — SHVETSOV, pl. III, fig. 7.
	1918: *Belemnites fusoides* (LAMARCK) — FAVRE, p. 6, pl. 1, figs. 6a–b.
pars	1952: *Hibolites subfusiformis* RASPAIL — KHECHINASHVILI, pl. II, figs. 2–3, non fig. 4 [= *jaculiformis* SHVETSOV].
	1967: *Hibolites subfusiformis* RASPAIL — GUSTOMESOV, pl. II, fig. 1 [= RASPAIL, 1829: fig. 93].
	1970: *Hibolites subfusiformis* (RASPAIL) — STOYANOVA–VERGILOVA, pp. 14–15 (cs).
+	1970: *Hibolites subfusifomis* (RASPAIL) — STOYANOVA–VERGILOVA, pl. IV, figs. 1–3.
?	1970: *Hibolithes* cf. *subfusiformis* (RASPAIL) — STOYANOVA–VERGILOVA, pl. IV, fig. 4.
	1995: *Neohibolites subfusiformis* (RASPAIL) — RIEGRAF, p. 95.
	2003: *Hibolithes subfusiformis* (RASPAIL) — JANSSEN & FŐZY, p. 293.

Material — One complete specimen from bed 233 and one doubtful fragment from bed 208.

Stratigraphical distribution — Hauterivian (top of Radiatus Zone to Ligatus Zone, confirmed by the Hungarian material.

Type — *Hibolithes subfusiformis* (RASPAIL, 1829) is monotypic, and originates from La Lagne (southeast of Castellane, France). As indicated in GAYTE (1984: p. 87–88) the original specimen of RASPAIL is most probably lost. GAYTE (1984: Pl 1, Fig. 1) indicated a specimen (with atypical morphology) from the collection of Lioure as a neotype; probably from the Radiatus Zone of St. Théodorit (Gard, France).

Hibolithes gr. *subfusiformis* (RASPAIL, 1829)

(Plate II: 24)

?	1808: *Hibolithes hastatus* — DENYS DE MONTFORT, pp. 386–388, (with text-fig.).
+	1829: *Belemnites praemorsus* [nov.] — RASPAIL, p. 325, pl. 6, fig. 27 [nom. dub.].
+	1829: *Belemnites contortus* [nov.] — RASPAIL, p. 326, pl. 6, figs. 28–29 [nom. dub.]
	1829: *Belemnites symmetricus* [nov.] — RASPAIL, pp. 324–325, pl. 8, fig. 90 [most common morph; = *Hibolites dumasi* n. sp. GAYTE, 1984 [MS]].
?	1829: *Belemnites hastatus* [nov.] — RASPAIL, p. 324, pl. 8, fig. 91.
+pars	1829: *Belemnites pistilliformis* [nov. non: DE BLAINVILLE] — RASPAIL, p. 327, pl. 8, figs. 95, 96–97 [comparable to SHVETSOV, 1913: pl. III, fig. 3 ⇒ synonym with *Hibolites inae* n. sp. ERISTAVI, 1955 which is a senior synonym for *Hibolites secretus* GUSTOMESOV, 1967; note that the species *inae* ERISTAVI is most probabaly a collection of juv.\imm. morphs of belemnites that belong to *Hibolithes* gr. *subfusiformis* (RASPAIL)], 98–102 [La Lagne; most probably juvenile\immature specimen but could also partially belong to *Vaunagites* COMBÉMOREL & GAYTE, 1981 ⇒ "*Belemnites pistilliformis*" auct.; nom. dub.].

pars 1840: *Belemnites subfusiformis* RASPAIL — D'ORBIGNY, pp. 50–53, pl. 4, figs. 9–12 [= *symmetricus* RASPAIL; most common morph], 14–16 [specimen virtually not separable from *Vaunagites* ⇒ "*Belemnites pistilliformis*" auct.].

pars 1841: *Belemnites subfusiformis* RASPAIL — DUVAL–JOUVE, pp. 66–72, pl. 9, figs. 1 ["forme type" of DUVAL–JOUVE (= *jaculoides* SWINNERTON *fide* MUTTERLOSE, 1978); = *Hibolithes dumasi* n. sp. GAYTE, 1984 [MS]], 2 [juv. ⇒ "*Belemnites pistilliformis*" auct.], 4 [(var. *claviforme* DUVAL–JOUVE, 1841); this could be *Hibolithes hastatus* DENYS de MONTFORT, 1808], 6 (= *jaculoides* SWINNERTON *fide* MUTTERLOSE, 1978), 8–9, 10–11 [probably *Adiakri tobelus*], 12–14 ["*Belemnites pistilliformis*" auct.], 15 [possibly an exfoliated alveolar part], pl. 10, figs. 1–26 [different teratological and deformed species; cf. SHVETSOV, 1913: pl. II, figs. 3, 9].

non 1841: *Belemnites subfusiformis* RASPAIL var. *robustus* — DUVAL–JOUVE, pp. 69, 71["...dans la couche de calcaire chloriteux..."], pl. 9, fig. 5 [= *Adiakri tobelus*].

1857: *Belemnites pistilliformis* BLAINVILLE — OOSTER, pp. 21–23 [Neocomian], pl. 2, figs. 9–10 (non *fide* NAZARISHVILI, 1973), 11 [cf. JEKELIUS, 1915: pl. X, fig. 3; possibly comparable? to *H. jaculoides* SWINNERTON (= nov. subsp. *fide* PATRULIUS & AVRAM, 1976: 147)].

? 1907: *Hibolites subfusiformis* RASPAIL — KARAKASH, p. 21, pl. I, figs. 9–10, 15 [from "calcaire barrémien du Biassala"].

non 1913: *Hibolites longior* n. sp. — SHVETSOV, pp. 51–52, 68, pl. III, figs. 2a–g, 5.

non 1913: *Hibolithes jaculiformis* n. sp. — SHVETSOV, pp. 52–53, pl. III, figs. 4a–l [(= *subfusiformis* RASPAIL *fide* KRYMGOL'TS 1939; ALI-ZADE, 1972; pars *fide* NAZARISHVILI, 1973: figs. 4a–c, h–i)], 6, 11–14 (= *jaculoides* SWINNERTON *fide* MUTTERLOSE, 1978).

non 1937: *Hibolites jaculum* PHILLIPS — KUZNETSOVA, p. 40 [Early Aptian *fide* KRYMGOL'TS, 1939: p. 12, pl. I, fig. 8; (= *H. krimholzi* n. sp. *fide* STOYANOVA–VERGILOVA, 1970); = imm? *Mesohibolites renngarteni*, 1939].

? 1937: *Hibolites jaculoides* — SWINNERTON, p. xxv (pro *Belemnites jaculum* (auct. non FAURE–BIGUET)).

? 1939: *Oxyteuthis* cf. *jasikowi* LAHUSEN — KRYMGOL'TS, pl. I, fig. 3 [with parallel lateral lines!?].

non 1939: *Hibolites jaculum* PHILLIPS — KRYMGOL'TS, pp. 11–12, pl. I, figs. 8 [(= *H. krimholzi* nov. sp. *fide* STOYANOVA-VERGILOVA, 1970); coll. KUZNETSOVA (№ 5), from Lower Aptian marls ⇒ imm? *M. renngarteni* KRYMGOL'TS, 1939], 9 a–b [coll. RENNGARTEN (№ 12), appa rently from Aptian deposits], 10 (figs. 8–10 ⇒ *H. krimholzi* n. sp. *fide* STOYANOVA–VERGILOVA, 1970).

1960: *Hibolites subfusiformis* RASPAIL — KABANOV, p. 358, pl. I, fig. 13 [Hauterivian; (= *secretus* n. sp. GUSTOMESOV, 1967: 127)].

1970: *Hibolites* sp. — No 2, STOYANOVA–VERGILOVA, p. 22, pl. IV, fig. 6 [Lower Barremian].

pars? 1972: Hibolites subfusiformis (RASPAIL) — ALI–ZADE, pp. 138–139, pl. IV, figs. 1, 3 [Lower Barremian; = *jaculiformis* SHVETSOV], 4 [Hauterivian; = gr. subfusiformis RASPAIL].

non 1973: *Hibolites subfusiformis* (RASPAIL) — NAZARISHVILI, pp. 17–19 [Lower Barremian–Lower Aptian; ep? *Parahibolites*], pl. 1, figs. 7–8 [= *jaculiformis* SHVETSOV].

1984: *Hibolites subfusiformis* (RASPAIL) — GAYTE, pp. 87–90, pl. 1, figs. 1[NT], 2, 3 [typical morph].

? 1990: *Hibolites subfusiformis* (RASPAIL) — KELEPTRISHVILI, p. 15 [Upper Barremian, cf. TOPCHISHVILI et al., 2002: pl. VI, fig. 3; ⇒ imm? *H. krimholzi*?].

1991: *Hibolites jaculoides* SWINNERTON — KAKABADZE & KELEPTRISHVILI, pp. 33–34, pl. I, fig. 1.

pars? 1998: *Hibolites subfusiformis* (RASPAIL) — KELEPTRISHVILI, pp. 443 [Lower Barremian], 445 [Upper Barremian ⇒ *H. krimholzi*?].

2000: *Hibolithes* aff. *subfusiformis* (RASPAIL) — CLÉMENT, pl. 3, fig. 4 [Mazuca].

? 2002: *Hibolithes subfusiformis* (RASPAIL) — TOPCHISHVILI et al., pp. 65–67, pl. VI, fig. 3 [Upper Barremian; ⇒ ?*inae* NAZARISHVILI non SHVETSOV].

2003: *Hibolithes* gr. *subfusiformis* (RASPAIL) — JANSSEN & FŐZY, p. 293.

non 2003: *Hibolithes* gr. *subfusiformis*? (RASPAIL) — JANSSEN & FŐZY, p. 293 [pars *H.* gr. *jaculiformis* SHVETSOV (bed 200), *H. targovichtensis* STOYANOVA–VERGILOVA (beds 135 and 134) and *H. krimholzi* STOYANOVA–VERGILOVA (bed 131)].

Material — An alveolar part from bed 254 and 248, a part from bed 242, a stem-fragment from bed 240 and, one nearly complete specimen from bed 237.

Stratigraphical remarks — Upper Valanginian–Hauterivian–"Mid" Barremian; Furcillata (?) Zone to Darsi Zone. Note that *Hibolithes* cf. *jaculoides* SWINNERTON, 1937 and "*B. pistilliformis*" auct. is already present in the Pronecostatum Zone.

Remarks — Various more or less complete fragments are identified as *H.* gr. *subfusiformis* (RASPAIL, 1829) in the material from Hungary. Most show the more common hastate morphology, indicating some of the variation possible in the *subfusiformis*-stock. RASPAIL's specimen originates from La Lagne (near Castellane, SE France). They appear to be especially abundant in the "marnes à Bélemnites".

Hibolithes inae ERISTAVI, 1955

(Plate II: 9, 10, Plate III: 4, 5, 11, 22)

non 1902: *Belemnites subfusiformis* RASPAIL — NOETLING, pp. 4–5, pl. I, figs. 4–5 [the exact age is unclear and might be Tithonian to Barremian] (pars = *H. secretus* n. sp. *fide* GUSTOMESOV, 1967; = *H. inae* ERISTAVI *fide* NAZARISHVILI, 1973; = *H. jiabulensis* n. sp. *fide* YIN, 1975).

? 1913: *Hibolites* sp. — SHVETSOV, pp. 52, 68, pl. III, fig. 3 [Upper Hauterivian; (*fide* ERISTASVI 1955; = *H. secretus* nov. sp. *fide* GUSTOMESOV 1967) ⇒ could be a juv. or imm. specimen of *H.* gr. *subfusiformis* (RASPAIL, 1829)].

1955: *Hibolites inae* nov. sp. ERISTAVI, p. 26, pl. I, fig. 15 [MT; Lower Barremian].

non 1967: *Hibolites secretus* sp. nov. — GUSTOMESOV, pp. 125, 127–128, pl. II, fig. 2 ["Lower Hauterivian"⇒ most probably Valanginian, on the same plate typical uppermost Lower Valanginian belemnites are figured from the same locality] (*fide* STOYANOVA-VERGILOVA, 1970; NAZARISHVILI, 1973).

non 1970: *Hibolites inae* ERISTAVI — STOYANOVA-VERGILOVA, p. 16, pl. III, figs. 4 [Lower Hauterivian] – 5 [Hauterivian] [= *H. symmetricus* (RASPAIL, 1829)].

non 1973: *Hibolites innae* [sic] ERISTAVI — NAZARISHVILI, pp. 22–23, pl. 1, figs. 14–15 ["Mid"– Upper Barremian; ⇒ juv? close to ?*Belemnites gladiiformis* UHLIG, 1883].

1990: *Hibolites inae* ERISTAVI — KELEPTRISHVILI, p. 14 [Upper Hauterivian].

\+ 1995: *Pseudohibolites innae* (ERISTAVI) — RIEGRAF, p. 102.

pars 1998: *Hibolites inae* ERISTAVI — KELEPTRISHVILI, p. 443 [Upper Hauterivian], non p. 445 [Upper Barremian; ⇒ juv? close to ?*Belemnites gladiiformis* UHLIG, 1883].

2003: *Hibolithes inae* ERISTAVI — JANSSEN & FŐZY, p. 292.

Material — Some fragments show slightly depressed cross-sections with no trace of an alveolar groove. They are included in this species, i.e.: one specimen and three fragments from bed 221, one specimen from bed 220, two specimens from bed 217, four from bed 215, two specimens from bed 214, one from bed 212, one from bed 208, and some fragments from beds 213, 207 and 206.

Stratigraphical remarks — (Upper) Hauterivian–Lower Barremian, but no specification on ammonite zones is known. The Hungarian material originates from the Hauterivian (Nodosoplicatum to Ligatus Zone).

Type — ERISTAVI (1955: Pl. I, Fig. 15) by monotypy.

General remarks — These specimens probably could be grouped within "*Belemnites pistilliformis* RASPAIL", but they differ due to the fact that they are slightly depressed. They could be grouped within the original concept of *Vaunagites*. However, the latter genus is most probably restricted to the Upper Valanginian and lowermost Hauterivian. It is virtually impossible to recognise any member of this genus when dealing with juvenile or not fully-grown specimens.

Hibolithes cf. *josephinae* (HONNORAT–BASTIDE, 1889)

(Plate II: 15)

? 1889: *Belemnites Josephinae* nov. sp. — HONNORAT–BASTIDE, pp. 465–466, text-figs. 1[LT]–5.
2003: *Hibolithes* aff. *josephinae* (HONNORAT–BASTIDE) — JANSSEN & FŐZY, p. 292.

Material — One specimen from bed 212 and one from bed 211.

Stratigraphical remarks — The Hungarian material originates from the Sayni–Ligatus Zones. In the "marnes á Bélemnites" of southeast France *H. josephinae* is found in the top of the Sayni Zone and in the Ligatus Zone but not in the Balearis Zone anymore.

Type — HONNORAT-BASTIDE (1889) depicts five specimens. Text-figure 5 is a juvenile specimen, while the text-figures 1–4 show elongated (im)mature specimens. Text-figure 1 would be considered mature. It shows the general rounded, elongated rostrum with a faint alveolar groove. This specimen is choosen to be the lectotype.

Hibolithes gr. *jaculiformis* SHVETSOV, 1913

(Plate III: 6, 24, 25)

pars 1829: *Belemnites subfusiformis* — RASPAIL, p. 325.
1913: *Hibolites jaculiformis* n. sp. — SHVETSOV, pp. 52–53, 68, pl. II, figs. 5 (var. *inflata*) – 6 (var. *brevisulcata*), pl. III, figs. 4a–c (var. *brevisulcata*), d (var. *inflata*), e–g (immature), h–i (var. *brevisulcata*), j (var. *inflata*), k–l (immature), 11–12 (juvenile).
1937: *Hibolites jaculum* PHILLIPS — MORDVILKO, p. 18.
pars 1939: *Hibolites jaculum* PHILLIPS — KRYMGOL'TS, pp. 11–12 [coll. MORDVILKO no. 1093, 1111].
1955: *Hibolites Jaculiformis* SCHWETZOFF var. *inflata* SHVETSOV — ERISTAVI, pp. 27–28.
1955: *Hibalites* [sic] *subfusiformis* RASPAIL var. *inflata* SCHWETZOFF — ERISTAVI, pl. II, fig. 1.
? 1970: *Hibolites subfusiformis inflata* SCHWETZOFF — KOTETISHVILI, p. 105, pl. XX, figs. 1a–b [apparently from Giraudi Zone => ?*H. krimholzi* STOYANOVA–VERGILOVA].
pars 1972: *Hibolites subfusiformis* (RASPAIL) — ALI–ZADE, pl. IV, figs. 1, 3, non fig. 4.
1973: *Hibolites jaculiformis* SCHWETZOFF — NAZARISHVILI, pp. 19–21, pl. I, figs. 9–11.
? 1994: *Hibolites jaculoides depressirostris* SWINNERTON — VAŠIČEK et al., p. 80, pl. 25, figs. 1–2.
? 1994: *Hibolites jaculoides* cf. *torpedinus* SWINNERTON — VAŠIČEK et al., pp. 80–81, pl. 25, figs. 5–6.
1995: *Parahibolites jaculiformis* var. *inflatus* (SCHWETZOFF) — RIEGRAF, p. 97.
1995: *Pseudohibolites jaculiformis* var. *brevisulcatus* (SCHWETZOFF) — RIEGRAF, p. 110.
2003: *Hibolithes jaculiformis* var. *brevisulcatus* SHVETSOV — JANSSEN & FŐZY, p. 292.
pars 2003: *Hibolithes* gr. *jaculiformis* SHVETSOV — JANSSEN &, FŐZY p. 293 [three specimens from bed 208 are now considered to be *Hibolithes prodromus* SHVETSOV, 1913].
pars 2003: *Hibolithes* gr. *subfusiformis*? (RASPAIL) — JANSSEN & FŐZY, p. 293 [bed 200 only].

Material — One immature rostrum from bed 208, and one mature rostrum from bed 201 (var. *brevisulcatus* SHVETSOV, 1913). Also immature moderately flattened rostra from beds: 208(7), 206, 205, 203(13), 202(4), 201(2) and 200(21).

Stratigraphical remarks — (uppermost Hauterivian?)/Lower Barremian to "Mid" Barremian, apparently also in the Upper Barremian. The latter specimens might belong to *Hibolithes krimholzi* STOYANOVA-VERGILOVA, 1970.

The Hungarian material originates from the Ligatus Zone up to the ?Hugii Zone. Eventually (if the specimens in section B are correctly labelled) up to the base of the "Caillaudianus Zone" (= Pulchella Zone).

General remarks — This is a species that is very close to a group of cylindrical belemnites that are generally indicated to belong to *Hibolites jaculoides* SWINNERTON and its variations (cf. MUTTERLOSE, 1978: p. 100). The main difference in these particulair specimens seems to be the moderate to strong depression of the rostrum solidum in *jaculiformis*-type of belemnites. Moreover, the length of the alveolar groove, as compared to the *jaculoides*-type, is much longer. However, as demonstrated by the material here available, the length of the alveolar groove depends most probably on the age of the animal. Only in mature specimens, a clear alveolar groove can be observed, comparable to specimens as depicted in VAŠIČEK et al. (1994: Pl. 25, figs 5–6).

Type — No type was indicated thus as a lectotype is chosen *H. jaculiformis* var. *inflata* SHVETSOV, 1913 (Pl. III, figs 4d, 4j).

Hibolithes prodromus SHVETSOV, 1913
(Plate II: 13, 14)

? 1829: *Belemnites marginatus* [nov.] — RASPAIL, p. 319, pl. 8, fig. 70.
1913: *Hibolites prodromus* n. sp. — SHVETSOV, pp. 51, 68, pl. III, figs. 1a [LT]–d, 1b, 1c–e.
1937: *Hibolites prodromus* SCHWETZOFF — MORDVILKO, p. 18.
non 1972: *Hibolites prodromus* SCHWETZOFF — ALI–ZADE, p. 139, pl. IV, fig. 5 [= *Hibolithes inae* (auct. non ERISTAVI, 1955) NAZARISHVILI, 1973].
1973: *Hibolites prodromus* SCHWETZOFF — NAZARISHVILI, pp. 15–16, pl. 1, figs. 3–4.
1995: *Pseudohibolites prodromus* (SCHWETZOFF) — RIEGRAF, p. 105.
? 1999: *Hibolites* cf. *prodromus* (SCHWETZOFF) — KVANTALIANI, p. 42.
pars 2003: *Hibolithes* gr. *jaculiformis* SHVETSOV — JANSSEN & FŐZY, p. 293.

Material — Three well-depressed spindle-like specimens (bed 208). One shows an alveolar groove, up to the middle of the rostrum.

Stratigraphical remarks — Upper Valanginian?–Hauterivian (without specification of any ammonite zone). The Hungarian belemnites are derived from a bed in the Ligatus? Zone.

Type — Lectotype indicated by ALI-ZADE (1972: p. 139).

Family Duvaliidae PAVLOV, 1914
Genus *Pseudobelus* DE BLAINVILLE, 1827

Pseudobelus brevis PAQUIER, 1900
(Plate III: 13–15, 20, 21, 30)

1830: bélemnitae bisulci — RASPAIL, p. 88, pl. 4, figs. 20–21.
pro 1841: *Belemnites bipartitus* BLAINVILLE — DUVAL–JOUVE, pl. 1, figs. 3, 5 [LT]–6.
1900: *Pseudobelus bipartitus* BLAINVILLE mut. *brevis* — PAQUIER, pp. 486, 487, II (cs).
pars 1914: *Belemnites* (*Duvalia*) *bipartitus* BLAINVILLE — SOMOGYI, pp. 344 (50), 356 (62), 360 (66).
pars 1914: *Belemnites bipartitus* BLAINVILLE — SOMOGYI, pp. 310 (16), 353 (59).
non 1915: *Pseudobelus bipartitus* D'ORBIGNY — JEKELIUS, p. 117, pl. VIII, fig. 6.
pars 1958: *Pseudobelus bipartitus* BLAINVILLE — FÜLÖP, p. 29.
pars 1964: *Pseudobelus bipartitus* BLAINVILLE — FÜLÖP, p. 98.
pars? 1972: *Pseudobelus bipartitus* BLAINVILLE — ALI–ZADE, pp. 128–129, pl. I, fig. 6.
non 1994: *Pseudobelus brevis* PAQUIER — VAŠIČEK et al., pl. 27, figs. 5–6.
1997: *Pseudobelus brevis* PAQUIER — JANSSEN, pp. 28–29, pl. 6, figs. 3–4.
2003: *Pseudobelus brevis* PAQUIER — JANSSEN & FŐZY, p. 293.

Material — Two specimens from bed 213, two specimens from bed 212, four specimens from bed 211, and one from bed 210.

Stratigraphical remarks — Occurs in the upper part of the "Mid" to early Late Hauterivian (top Nodosoplicatum–Ligatus).

Type — Lectotype indicated by VAŠIČEK (1978: p. 11). This specimen demonstrates the short, rather thick (slightly compressed) and rougged shell very well.

Genus *Duvalia* BAYLE & ZEILLER, 1878

Duvalia gagrica SHVETSOV, 1913
(Plate II: 2–5, Plate III: 29)

1913: *Duvalia gagrica* — SHVETSOV, pp. 47, 67, pl. II, figs. 4a–e [MT].
1965: ?*Polygonalia gagrica* (SCHWETZOFF) — ALI–ZADE, p. 142.
1965: *Duvalia gagrica* SCHWETZOFF — STOYANOVA–VERGILOVA, pp. 204–205, pl. I, fig. 4.
1990: *Pseudoduvalia gagrica* (SCHWETZOFF) — KELEPTRISHVILI, p. 15.
? 2002: *Duvalia gagrica* SCHWETZOFF — MOOSLEITNER, pl. 57, fig. 4.
2002: *Pseudoduvalia gagrica* (SCHWETZOFF) — TOPCHISHVILI et al., pp. 165–166, pl. XXIV, fig. 4.
pars 2003: *Duvalia gagrica* SHVETSOV — JANSSEN & FŐZY, p. 293.

Material — Two immature specimens from bed 201. Apparently immature specimens show a less pronounced dorsal knick in the alveolar area.

Stratigraphical remarks — Lower Barremian, probably Hugii (Mazuca) to Caillaudianus (Pulchella) Zones.

Remarks — JANSSEN & FŐZY (2003) mention four specimens of this species. However, on second thought, two specimens (from beds 200 and 202; Plate I: 4–5), are probably better characterised as *Duvalia* aff. *gagrica* SHVETSOV, 1913 (= CLÉMENT, 2000: *Duvalia* nov. sp. 3 on Pl. 4, fig. 5). They show a (much) smaller, less compressed alveolar part and the dorsal alveolar knick is less developed. One specimen from the Barremian stratotype near Angles was found in the middle of the Nicklesi Zone (beds 104–106), and one specimen from the Tornajo (southeast Spain) is most probably found in sediments that can be attributed to the top of the Hugii Zone or base of the Colombiana Zone.

The Hungarian material originates from beds that are indicated by FŐZY & FOGARASI (2002: Table III) to be equivalent of the top of the Angulicostatus Zone (bed 202) and base of the Hugii Zone (beds 201, 200). It is here believed that all these beds should belong to the lower part of the Lower Barremian.

Duvalia silesiaca UHLIG, 1902

(Plate III: 26)

	1902: *Belemnites* (*Duvalia*) *dilatatus* BLAINVILLE forma *silesiaca* — UHLIG, p. 64, pl. I, figs. 5 [LT]–6.
?	1906: *Duvalia* cf. *silesiaca* UHLIG — LEMOINE, pp. 185–186, pl. I, figs. 7–8 (cs).
?	1906: *Pseudobelus Rodoi* n. sp. — LEMOINE, pp. 183–184, pl. I, figs. 5–5b [juv? specimen], 6.
	1913: *Duvalia binervia* RASPAIL — SHVETSOV, pp. 47–48, 67, pl. II, figs. 10a–l.
pars	1965: *Duvalia binervia* (RASPAIL) — STOYANOVA–VERGILOVA, pp. 187–190, pl. V, figs. 1, 3–9.
	1972: *Duvalia binervia* (RASPAIL) — ALI–ZADE, pp. 131–132, pl. II, figs. 6–9, 13.
	1978: *Duvalia silesiaca* UHLIG — VAŠIČEK, pp. 8–9, pl. II, fig. 1 [= UHLIG, 1902: pl. I, fig. 5].
pars?	1988: *Duvalia silesiaca* UHLIG — COMBÉMOREL, pp. 132–133, pl. 22, figs. 17–18, 19[?].
	1989: *Duvalia binervia* (RASPAIL) — MICHALÍK & VAŠIČEK, pl. 2, fig. 2.
?	1991: *Duvalia* cf. *silesiaca* UHLIG — CIVITELLI et al., pp. 164–165, pl. 1, fig. 10.
	1997: *Duvalia* sp. — A. JANSSEN, pp. 24–25, pl. 4, figs. 1–2.

Material — Five specimens from bed 200.

Stratigraphical remarks — In the Barremian stratotype section this species is found from the Hugii Horizon (bed 73, 74) on, up to the top of the Mazuca Zone (bed 85). Apart from the specimen figured in JANSSEN (1997; bed Q41–50 (= A192–198)), additional specimens were collected from beds A188 to A198 in the Río Argos succession. This interval corresponds to the Colombiana Zone and the base of the Nicklesi Zone.

Type — Lectotype indicated by VAŠIČEK (1978).

Remarks — Variable species homeomorphic with *Duvalia binervia* (RASPAIL, 1829). With strong constriction in and dorsally bended, alveolar part. Lateral lines are often difficult to discern, but see the lectotype. Specimens are virtually undistinguishable, except for the different intervals in which they occur; i.e. *D. binervia* is found in the Upper Valanginian to lowermost Hauterivian (Radiatus Zone). Also, at the boundary between the Upper Barremian and the Lower Aptian, comparable morphs exist.

The "Mid" Barremian belemnites

This association is characterised by *Curtohibolites* STOYANOVA–VERGILOVA, 1963, *Duvalia grasiana* (DUVAL–JOUVE, 1841) and, some "*Mesohibolites*" spp. (this fauna will extensively be dealed with in part II of the Gerecse belemnites).

Curtohibolites occurs sporadically in the Barremian stratotype profile of Angles from bed 129 (Lower middle of Darsi Zone) on, and occurs in the Clos de Barral section (cf. VERMEULEN, 1980a, b) rather abundant in the Barremian Sayni Zone.

The Hungarian material includes *C. trubatchensis* STOYANOVA–VERGILOVA, 1963, *Curtohibolites* sp. and, *Curtohibolites*? *pinguis* (SHVETSOV, 1913) and originates from beds most probably to be correlated with the lower middle Darsi Zone ("*C. heinzi* and *P. caicedi* Horizons" of VERMEULEN, 2002).

Conclusions

The belemnites from the Gerecse Mountains (Hungary) are comparable to associations of belemnites characteristic for Upper Valanginian to Barremian stratigraphical interval (Figures 2–4). Belemnites from the oldest investigated beds fit into Association 3 (JANSSEN & CLÉMENT, 2003). This association covers the interval from the Upper Valanginian (without the Verrucosum Subzone) to the lowermost Hauterivian (Radiatus Zone).

"Association 3" is followed by a short impoverished interval (low diversity, high frequency) approximately around the boundary of the Radiatus/Loryi Zones. This short interval is succeeded by sediments characterised by the classical Hauterivian belemnites, as there are *Duvalia dilatata* (DE BLAINVILLE), *Pseudobelus* gr. *brevis* PAQUIER, *Pseudoduvalia* spp. and *Hibolithes* (gr.) *subfusiformis* (RASPAIL). The upper part of this interval is characterised by the disappearance of the genera *Pseudobelus* (but cf. PAQUIER, 1900: 555, most probably not related to this genus however) and *Pseudoduvalia* NAEF, 1922; and the occurrence of *Hibolithes* gr. *jaculiformis* SHVETSOV.

The Hauterivian–Barremian boundary sediments show the last *Duvalia dilatata* (DE BLAINVILLE) and some related specimens. Mesohibolitidae are rather abundant. The lowermost Barremian sediments are again characterised by various Duvaliidae (*D. silesiaca* UHLIG, *D.* (aff.) *gagrica* SHVETSOV) and the last representatives of *H.* gr. *subfusiformis* (RASPAIL) and *H.* gr. *jaculiformis* SHVETSOV.

The "mid" Barremian shows the first classical Barremian elements with *Mesohibolites* auct. pl. and *Duvalia grasiana*. Characteristic elements are the peculair *Curtohibolites* and elongated belemnites around *Belemnites gladiiformis* UHLIG.

* * *

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