Neocomian belemnites and ammonites from the Bersek-hegy (Gerecse Mountains, Hungary), part II: Barremian

by
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Abstract — The belemnite faunas from the Lower and lower Upper Barremian sedimentary rocks of the Bersek-hegy (Gerecse Mts, Hungary) are described within the framework of a precise ammonite stratigraphy and compared to faunas from other regions. A new genus (*Conohibolites*) is introduced for *Belemnites* gr. *platyurus* DUVAL-JOUVE, 1841.

In the previous part, *Adiakritobelus* was introduced for the Valanginian – lowermost Hauterivian part of the "*Mesohibolites*" auct. This genus includes the species *Belemnites minaret* RASPAIL, 1829 (former genotype of *Mesohibolites* STOLLEY, 1919). However, the generic name "*Mesohibolites*" auct. pl., generally used for a group of late Barremian to early Aptian belemnites, is proposed as a *nomen conservandum*, with *Mesohibolites uhligi* (SHVETSOV, 1913) as a new genotype (proposal forwarded; pending validation of the ICZN).

A zonation based on the distribution of belemnites is proposed for the Lower to lower Upper Barremian. At least two different belemnite associations characterize the sediments under investigation. One characteristic for the lowermost Barremian, with *D. gagrica* SHVETSOV, 1913, *D. silesiaca* UHLIG, 1902 (Duvaliidae), *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829), and *Hibolithes jaculiformis* SHVETSOV, 1913 (Mesohibolitidae). These belemnites occur in the Hugii, Nicklesi, and probably the Pulchella Zone of the Mediterranean Tethys. Around the boundary between the Pulchella and the Compressissima Zone these belemnites are replaced by *Duvalia* gr. *grasiana* (DUVAL-JOUVE, 1841) (Duvaliidae) and new genera of Mesohibolitidae, i.e. *Curtohibolites*, *Conohibolites* and "*Mesohibolites*". This new fauna association characterizes the sediments, which are herein called "mid"-Barremian, being approximately equivalent of the top of the Lower Barremian and the base of the Upper Barremian. Not until the Upper Barremian Feraudianus/Giraudi Zones, a complete different association of belemnites (*Mesohibolites* sensu stricto) is found. These belemnites make a diverse and characteristic faunal-component of the uppermost Barremian and Lower Aptian (Bedoulian).

Keywords — Barremian, belemnites, ammonites, Tethys, *Conohibolites* n. gen., *Curtohibolites*, *Mesohibolites*.

JANSSEN, N. M. M. & FŐZY, I.: Neocomian belemnites from the Bersek-hegy (Gerecse Mountains, Hungary), part II: Barremian — *Fragmenta Palaeontologica Hungarica*, **23**: 59–86.

Introduction

In this paper the distribution of belemnites from a part of the Barremian sedimentary rocks of the Bersek-hegy (Bersek Hill, Gerecse Mts, Hungary) is discussed and compared to other regions. A first review of the belemnite material from the Bersek-hegy was published by JANSSEN & FŐZY (2003). Later a detailed description of the Late Valanginian – Hauterivian – earliest Barremian belemnite fauna of the same locality was given (JANSSEN & FŐZY 2004). The present paper focuses on the Lower to "mid" Barremian (from Pulchella to Vandenheckii Zones) fauna of the succession. Many of the earlier identifications are revised.

Especially in the south-eastern region of Europe many belemnites are described from the Barremian. Unfortunately, it is not always possible to tell the exact stratigraphic position of the investigated material but for a sub-stage. As a consequence, together with the lack of characteristic diagnostic features and the lack in knowledge of the ontogeny, it is momentarily difficult to use belemnites in stratigraphy. On the other hand, the well-preserved and rich ammonite fauna collected from the Bersek-hegy allows precise biostratigraphic subdivision on zonal level. Therefore the Gerecse cephalopod assemblage (ammonites and belemnites together) have a special importance from the point of view of Tethyan Barremian stratigraphy. Ammonites were identified and evaluated by I. F., while N. J. is responsible for belemnite studies.

Geological setting and previous works

The material used herein was collected from four closely situated sections in the uppermost level of the Bersek-hegy quarry (see part I for geographical position), from the lower part of the Lábatlan Sandstone Formation (HANTKEN 1868; HOFMANN 1884; FÜLÖP 1958). The sediments mainly consist of marly, grey to green or red-coloured beds with intercalations of sandy calcareous beds. This lithological aspect shows similarities to the so-called "Rossfeld Schichten" of the Eastern Alps. The sampled sections (Sections A, B, D and E) are delimited by minor faults.

The turbidite (mass flow) origin for the upward coarsening-thickening series was recognised by CSÁSZÁR & HAAS (1984) and KÁZMÉR (1987). The sequence was placed onto the distal part of a submarine fan (SZTANÓ 1991) and, after discrimination of the specific lithofacies, onto a fine clastics dominated submarine slope, characterized by slump scars and multidirectional debris flows and turbidites (FOGARASI 1995a). According to FOGARASI (1995b), the background sediment, was deposited between the ACD and the CCD tuned by Milankovic-scale cyclicity.

The petrographical and micromineralogical aspects of the Lower Cretaceous formations of the Gerecse Mts were intensively discussed by ÁRGYELÁN (1996, 1997) and CSÁSZÁR & ÁRGYELÁN (1994). The dominant heavy mineral assemblage of the clastic succession was derived from an obducted and eroded ophiolitic sequence that was formed in the Tethys–Vardar Ocean. The island-arc-type andesitic–rhyolitic material in the underlying biancone limestone (Szentivánhegy Limestone Fm.) indicates the initial subduction of this ocean. The similarity to the "Rossfeld Schichten" was micromineralogically confirmed. Attempts to set up magnetostratigraphic sequences were unsuccessful due to serious secondary remagnetization.

Recent palaeontological and stratigraphical studies of the Cretaceous in the Gerecse Mts are related to the investigations based on the huge fossil material (about 11 thousands specimens), collected bed-by-bed in the early 60s under the supervision of late Prof. FÜLÖP. Ammonites are by far the most abundant fossils. Subordinated belemnites occur, and eventually bivalves, gastropods, brachiopods, crinoids, rhyncholites, echinoids and corals can be found. Plant-remains and bioturbation traces are quite common, especially in section "A", while fish-remains occur mainly in the lower part of section "D". The first results on the different fossil groups of this collection (ammonites, belemnites, bivalves and nannofossils) were already published (COMPANY et al. 2005; FŐZY 2004; FŐZY & FOGARASI 2002; JANSSEN & FŐZY 2003, 2004; SZENTE 2003).

In this paper the Lower to lower Upper Barremian belemnites from the sections, in stratigraphic order: B (beds 139–101), A (beds 44–1), and D (beds 411–301) are discussed. Section E (beds 300/45–1) is a parallel section that overlaps with sections A and D. The correlation and the approximate relative position of the mentioned sections are given on Figure 1. Since the original field notes are not available, the exact position of the sections and the rate of the possible overlap of the sections are unknown.

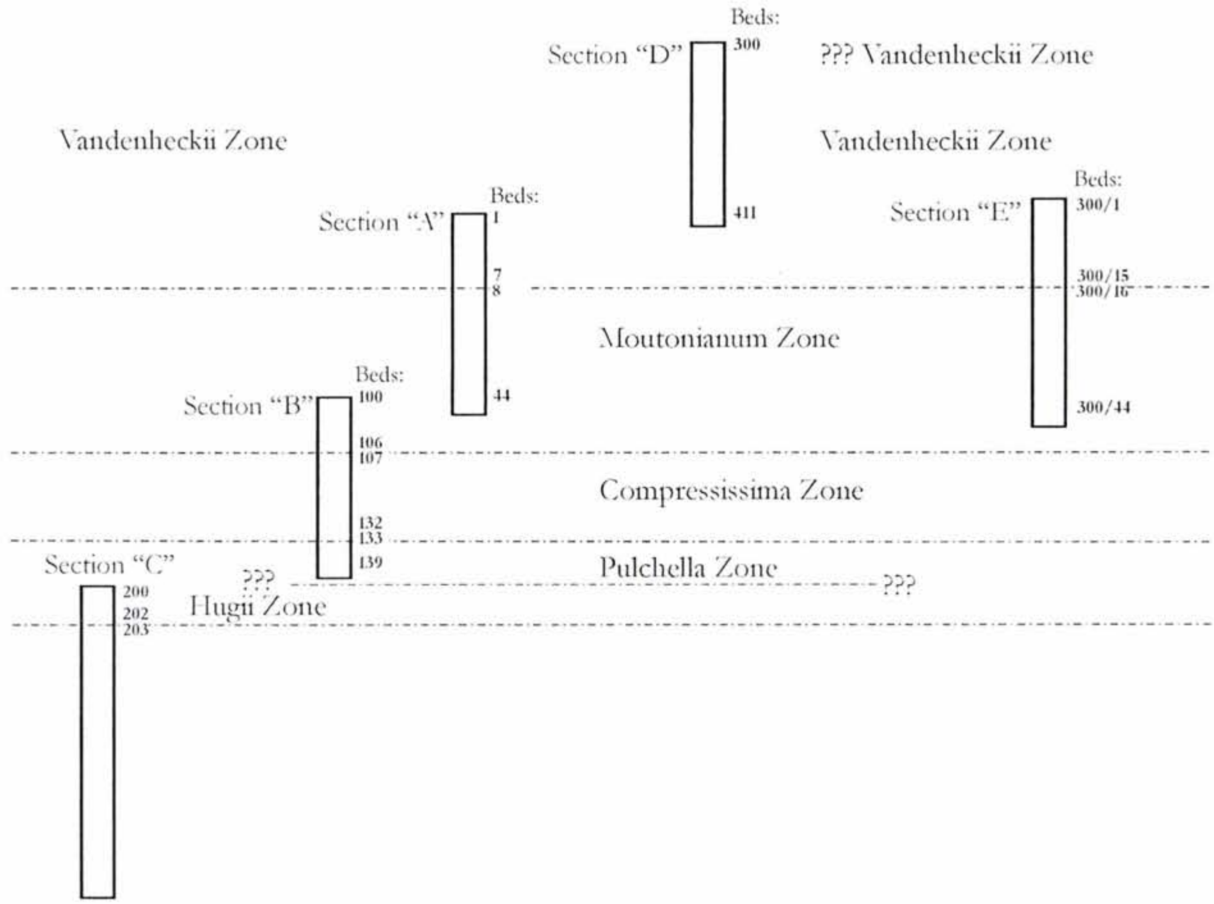


Figure 1 — Correlation and biostratigraphy of the studied sections at the Bersek-hegy. — The name of the sections (A, B, C, D) reflects the possible original order of sampling. Selected, successive field numbers are shown. Sections "A", "B", "C" and "D", latter penetrated into the overlying soilified, clastic layer, situated a few meters far from each other. Section "E" is a parallel section sampled a few ten meters far away. Possibly all the sections are delimited by minor faults. The rate of the overlap between the section is unknown. The Moutonianum Zone roughly covers VERMEULEN's Darsi and Uhligi Zones. The Vandenheckii Zone can be correlated, more or less, with the Sayni Zone of VERMEULEN (2002).

Stratigraphy

During the last decade, the ammonite fauna of many Spanish and French Barremian sections were intensively studied. The results published by COMPANY et al. (1995) provided a good frame toward a standard Tethyan zonation scheme, which was summarised by HOEDEMAEKER & RAWSON (2000), and later by HOEDEMAEKER et al. (2003). More recently, VERMEULEN (2002) introduced a new scheme for the Barremian. This was largely a revision, and continuation of previous results (see KLEIN & HOEDEMAEKER 1999, and publications mentioned herein). The scheme was principally established in the Barremian stratotype of Angles (ABST). Additional data were obtained from several palaeogeographically close sections. Figures 1–5 show the zonation as used herein, being a mixture of the "standard" ammonite zonation and the zonation sensu VERMEULEN (2002). Some horizons of VERMEULEN (2002), are only known (at the moment) from the ABST, or in palaeogeographically close sections (Clos de Barral). The ammonite zones from the latter are indicated in Figure 2, as some are potentially interesting with respect to the Hungarian material.

COMPANY et al. (1995) listed the problems that existed concerning the Barremian stratigraphy. They figured three profiles that are of interest for the discussion, from the pelagic domain of the southern palaeo-margin of Iberia (Subbetic Zone). These three profiles are correlated by us, to get insight in the distribution of the index species (cf. Figure 2); and compared to the distribution of these species, as far as possible, in the ABST.

In many cases, the scientific dispute concerns the alleged potential possibility of misidentifications as a result of incomplete type material. This was a problem when specialists had to choose a substitute zonal candidate for the Moutonianum Zone. It resulted in the incorporation of the Darsi Zone, to replace the Moutonianum Zone (HOEDEMAEKER et al. 2003), which apparently covers more or less a comparable stratigraphic interval, but see Figure 2 (our interpretation). The so-called advantage of the Darsi Zone in respect to the Moutonianum Zone, which was defined in south-east Spain, is that it is defined in the ABST, but until this moment the index species is only known from sections in south-east France (ABST; Clos de Barral).

The Sayni or Vandenheckii Zone (base of the Upper Barremian) appears to be rather stable, with respect to its position. However, the index species of the Sayni Zone apparently first occurs in (slightly) younger sediments; as compared to *Toxancyloceras* gr. *vandenheckii* (ASTIER, 1851) (cf. Figure 2; KLEIN & HOEDEMAEKER 1999, p. 116; VERMEULEN 2002, p. 44), i.e. in the Uhligi Zone.

The studied sections from the Bersek-hegy yielded a rich and diverse ammonite fauna with a typical Mediterranean impression. Representatives of the suborder Phylloceratina and Lytoceratina are common. *Phyllopachyceras infundibulum* (D'ORBIGNY, 1841) (Plate I: 10) is especially common.

The ammonites are well or moderately well preserved, in most cases as internal moulds. The number of the collected Barremian specimens is over 8000. Therefore it was relatively easy to follow the ammonite zones as recognised in Spain, and later correlated with the French zones and horizons. All of the characteristic index species of the Hugii, Pulchella, Compressissima, Moutonianum and Vandenheckii Zones were recognised. Former biostratigraphical studies of the same succession were based on fewer specimens, not collected bed-by-bed, (FÜLÖP 1958, NAGY 1967, 1968) and resulted a subdivision on substage level only.

The stratigraphically deepest section (section C), yielded mostly Late Valanginian – Hauterivian ammonites, but the topmost three layers (beds 200, 201 and 202) based on the occurrence of *Discoidella favrei* (OOSTER, 1860) (Plate II: 16) and *Taveradiscus hugii* (OOSTER, 1860) were ranged into the lowermost Barremian Hugii Zone. Beds above are disturbed by a slump; their ammonites are poorly preserved and scarce.

The next, documented biostratigraphic unit is the Pulchella Zone in the lower part of the section B (beds from 139 to 133). Two incomplete specimens from bed 135 represent the zonal index. *Deitanites labatlanensis* (COMPANY et al. 2005) a minute representative of the family Holcodiscidae was described from the upper part of the Pulchella Zone and from the lower part of the subsequent Compressissima Zone.

The latter unit is well documented in the section B (beds 132–107). The first representative of the zonal index (a small, nearly smooth form) appears in the bed 13; upwards in the profile dozens of *Subpulchellia compressissima* (D'ORBIGNY, 1841) (Plate II: 5–6) were found. The species show a large intraspecific variability from the point of view of the ribbing. Specimens with very fine and very coarse ribbing coexist in the same levels. Other pulchelliids like *Subpulchellia didayana* (D'ORBIGNY, 1841) (Plate I: 8–9) and *Subpulchellia changarnieri* (SAYN, 1890) (Plate II: 14) occur, in the upper part of the zone. Some of the characteristic holcodiscids have index value, like *Holcodiscus caillaudianus* (D'ORBIGNY, 1850) (Plate II: 10–11), *Holcodiscus gastaldianus* (D'ORBIGNY, 1850) (Plate I: 6–7), *Holcodiscus fallax* (COQUAND, 1860) (Plate II: 15). On the other hand, many other species of the family, are not really known at the moment, and need further studies – like e.g. "*Metahoplites*" cf. *henoni* (COQUAND 1880) (Plate II: 9). *Moutoniceras nodosum* (D'ORBIGNY, 1850) another species of index value for the zone, is represented by six specimens, of which some are well preserved, showing the small lateral nodules, which appear only on certain phase of development of the shell.

The subsequent Moutonianum Zone was recognised in the upper part of section B (beds 106–100) and above it, at the lower part of section A (beds 44–8). Parallel section E, which was excavated a few ten meters farther away from the other sampled sections, yielded also ammonites characteristic for the Moutonianum Zone (in beds 300/44 – 300/16). The index species is represented by numerous fragments (Plate I:

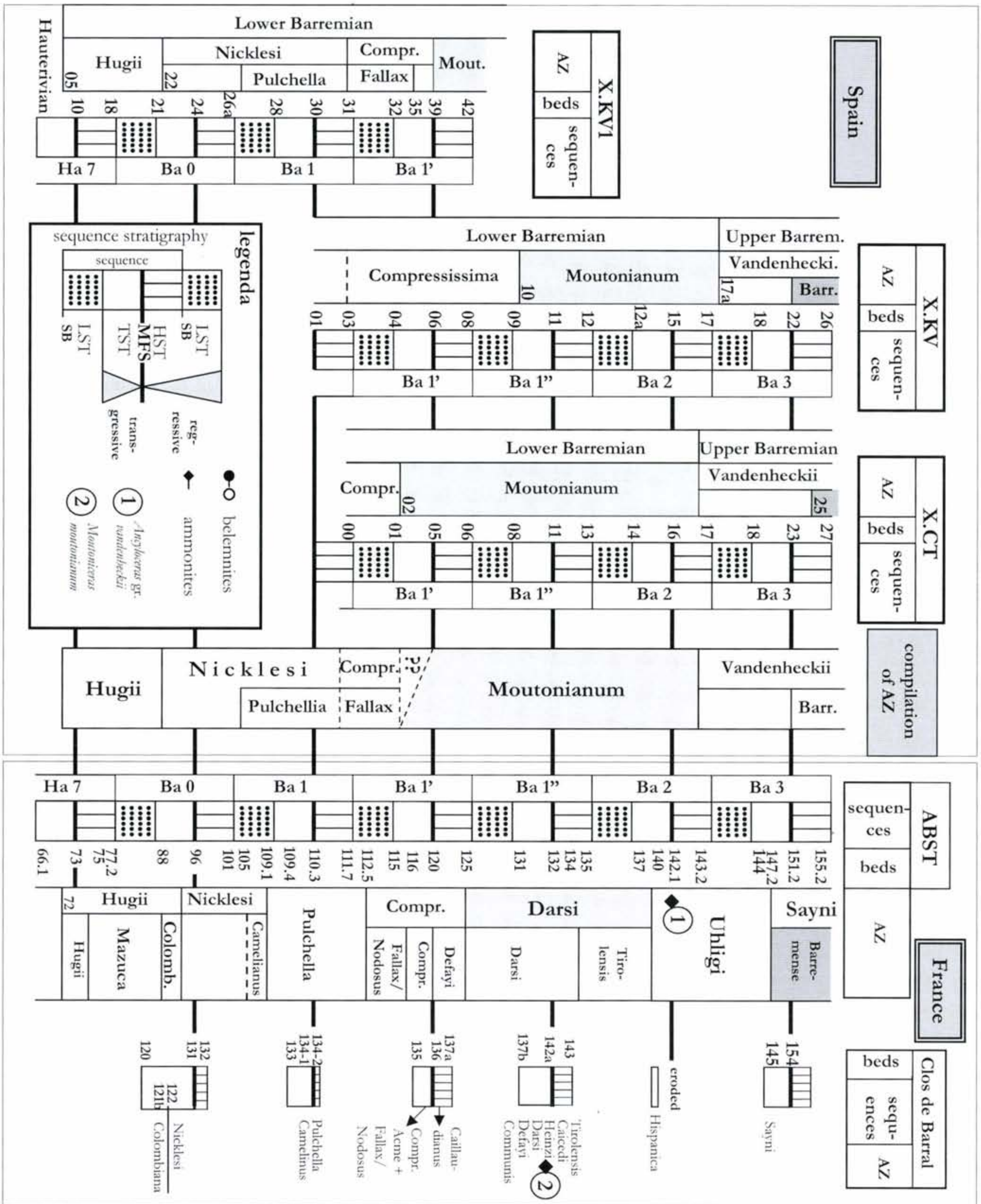


Figure 2 — Showing the (approximate) correlation between Spain (cf. COMPANY et al. 1995) and France (cf. VERMEULEN 2002). — To the right the approximate position of the Horizons (cf. VERMEULEN 2002) defined in the condensed platform deposits of the Clos de Barral section are shown. The sequences in the ABST are modified after HOEDEMAEKER & HERNGREEN (2003). Legend to be used in all other figures. Note that the only time-equivalent correlation points are the maximum flooding surfaces (indicated by thick horizontal lines). Also, the FO of the index species of the Hugii (Kiliani) and Nicklesi Zones are concrete. **ABST** = Angles Barremian Strato-Type; **AZ** = ammonite zonation; **Barr.** = Barremense; **Compr.** = Compressissima; **Mout.** = Moutonianum.

11–12). The initial spiral, the inner- and mid-whorls, and also the straight shaft and parts of the final hook are represented among the broken specimens. Pulchelliids are still common. Numerous *Subpulchellia caicedi* (KARSTEN, 1856) (Plate II: 1–2) were found in bed 25, and *Subpulchellia changarnieri* (SAYN, 1890) ranges through the zone. The latter includes many transitional forms towards the group *armenica–souvageaui*, showing the disappearance of the ribbing.

Upwards in the sequence, the genus *Heinzia* appears. *Heinzia sayni* HYATT, 1903 is particularly common in certain beds. From the latter species both micro- and macroconchs were recognised. The presence of the very characteristic ammonite *Toxancyloceras vandenheckii* ASTIER, 1851 (Plate I: 3–4) is also indicative, suggesting the presence of the Vandenheckii Zone. The zonal boundary between the Moutonianum and Vandenheckii Zones was recognised in section A and also in the parallel section E. Therefore beds 7–1, and 300/15–300/1 were ranged into the first zone of the Upper Barremian. There is no doubt, that at least the lower part of the section D, a section with the highest position in the studied profile, represents also the Vandenheckii Zone. Unfortunately, all of the ammonites from this section are very poorly preserved, and also the stratification is disturbed by cryoturbation and weathering. So it is not known if all the beds (411–300) represent the same zone. Throughout the section *Heinzia* sp. and *Subpulchellia* from the *brevicostata* group occur. The latter species is supposed to disappear within the Sartousiana Zone, consequently the uppermost part of the studied profile is definitely not younger than this level.

In the description of the biostratigraphical frame of the Bersek-hegy sections, only the most important elements of the diverse ammonite fauna were mentioned, while numerous other species occur. Desmoceratids (*Barremites, Melchiorites* and closely allied forms) (Plate I: 1) are very common in all the sections and in some beds they are the major component of the fauna. The genus *Torcapella*, appears to be especially rare, and is represented by a single find from bed 134. Many others, like representatives of the Leptoceratoidinae (Plate I: 2), the Silestidae (Plate II: 17), and the Hamulinidae, are relatively common, but not very well understood at the moment. Specimens belonging to the genera *Macroscaphites, Ptychoceras, Dissimilites, Crioceratites* sl. (with round shaped cross section) are typical but relatively rare faunal elements.

Contrary to the ammonite record, comparable detailed stratigraphic data on the distribution of belemnites are largely absent. NAZARISHVILI (1968, 1973), ALI–ZADE (1972), KHALILOV & ALIEV (1986), KELEPTRISHVILI (1990, 1998), VAŠÍČEK et al. (1994) provided regional, informal (no type sections; no definitions) basic zonations, in which most details are based on the Barremian–Aptian boundary sediments. Eventually, by combining various papers on belemnites and ammonites, comparing belemnites faunal associations, and using the scarce material (pers. obs.; CLÉMENT, 2000) from the Barremian stratotype in Angles (ABST), it seems possible to become a more detailed picture of the stratigraphic distribution of the various belemnites species and groups of species (cf. Figures 3–5).

Taxonomical notes on selected elements of the belemnite fauna

This work largely concentrates on the distinction between the morphologically close, but stratigraphically different group of belemnites that belongs to the superfluous "*Mesohibolites*" STOLLEY. They make up characteristic but distinct groups in the Upper Valanginian to lowermost Hauterivian, in the upper Lower Barremian to lower Upper Barremian (= "mid" Barremian), and in the Upper Barremian to Lower Aptian.

In the previous part, *Adiakritobelus* was introduced for the Valanginian – lowermost Hauterivian part of the "*Mesohibolites*" s.l. This new genus includes the species *Belemnites minaret* RASPAIL, 1829 (former genotype of *Mesohibolites* STOLLEY, 1919). "*Mesohibolites*" could be proposed as a *nomen conservandum*, but a new genotype has to be indicated. STOLLEY (1919, p. 45) listed among his *Mesohibolites* species *Hibolites uhligi* SCHWETZOFF. It is also one of the "typical" *depressi* of SHVETSOV (1913). This species would excellently serve as a new genotype, showing all generic characteristics. It is a typical aspect of the Barremian–Aptian (Giraudi to Weissi Zones) Mediterranean Tethyan belemnite fauna, and is represented in the ABST (= "faune à *Mesohibolites* 2" in CLÉMENT 2000; pers. obs.), Bulgaria (STOYANOVA–VERGILOVA 1970), the Carpathian Mountains (UHLIG 1883b; VAŠÍČEK et al. 1994), and the Caucasus (SHVETSOV 1913; MISHUNINA 1935; KRYMGOL'TS 1939; KHECHINASHVILI 1952; KHALILOV 1959; ALI–ZADE 1972; NAZARISHVILI 1973; KHALILOV & ALIEV 1986; TOPCHISHVILI et al. 2002).

The "mid" Barremian belemnites are characterized by belemnites morphologically close to *Belemnites platyurus* DUVAL–JOUVE, 1841. For this group of species a new genus, i.e. *Conohibolites* genus novum, is introduced below. These belemnites can be found together with, in some ways morphologically close, but smaller, *Curtohibolites* STOYANOVA–VERGILOVA, 1963. Additionally, together with some hibolitoid species, the first *Duvalia* gr. *grasiana* (DUVAL–JOUVE, 1841) occur. These belemnites characterize the late early to earliest late Barremian.

The late Barremian to Aptian belemnite fauna is characterized by the "true *Mesohibolites*", which generally appear more hibolitoid as compared to *Conohibolites* new genus. In this material, only few belemnites are recorded from late Barremian sedimentary rocks. *Mucrohibolites* NAZARISHVILI, 1969, with *Mesohibolites schaoriensis* KHECHINASHVILI, 1952 as type species (cf. NAZARISHVILI, 1969) characteristically occurs in the Barremian to Aptian sediments but is not recorded from the Bersek fauna.

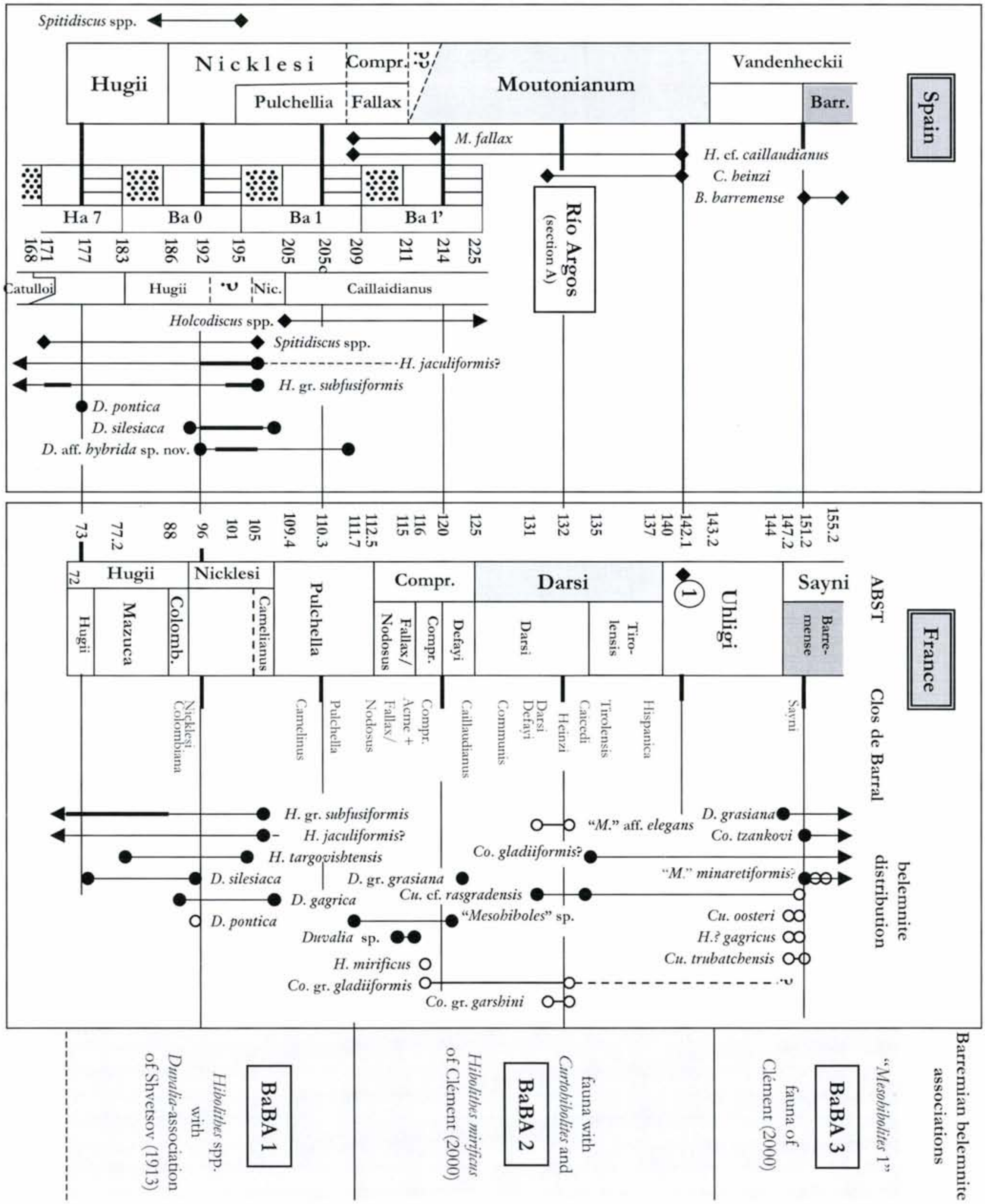


Figure 3 — Distribution of belemnites in south-east Spain and France. — The Spanish belemnite data are based on correlation with the Río Argos sequence (belemnite distribution modified after JANSSEN (1997), and sequence stratigraphical interpretation after HOEDEMAEKER & HERNGREEN 2003). Note that in south-east France, a compilation of the ranges of belemnites in the ABST and in the Clos de Barral section are given (cf. CLÉMENT, 2000 pers. obs.). Belemnite faunal assemblages are indicated on the right (BaBA 1, BaBA 2, and BaBA 3). **Barr.** — Barremense; **Colomb.** — Colombiana; **Compr.** — Compressissima; **Nic.** — Nicklesi.

The lowermost to "mid" Barremian belemnites

Most Barremian belemnite species are originally described from areas in south-eastern Europe, i.e. northern Bulgaria, Carpathians and parts of Georgia; only few were described from south-east France. Especially the Bulgarian material lacks however any detailed stratigraphy. The Georgian material originates mainly from "mid" Barremian and Upper Barremian–Aptian platform to shelf deposits; or from more open marine settings in Abkhazia, while the Lower Barremian deposits mainly yield *Hibolithes* type of belemnites (cf. NAZARISHVILI 1968).

Recently CLÉMENT (2000, p. 8) concluded correctly that the lowermost Barremian belemnite association in the Barremian stratotype of the Angles section (ABST), is characterized by Duvaliidae, his "fauna à *Duvalia*". The latter being an equivalent of the Abkhazian sediments of Gagry that SHVETSOV (1913, pp. 47, 67) called "greenish glauconitic marls with an extremely rich Hauterivian/Barremian fauna", or "les couches inférieurs du Barrémien" (cf. SHVETSOV 1913, p. 64). These early Lower Barremian sediments are characterized by an association of belemnites that consists of *Hibolithes* gr. *subfusiformis* (RASPAIL, 1829), *H.* gr. *jaculiformis* SHVETSOV, 1913, together with some specific Duvaliidae (i.e. *Duvalia silesiaca* UHLIG, 1902 (= *Duvalia* aff. *binervia* (RASPAIL, 1829)), *Duvalia pontica* SHVETSOV, 1913, *Duvalia gagrica* SHVETSOV, 1913, and closely related specimens). A more or less comparable association is mentioned by STOYANOVA–VERGILOVA (1962, 1964, 1979) from Targovishko and Varnensko (Bulgaria), by JANSSEN (1997; cf. Figure 3) from the Río Argos sequence (Murcia, Spain), and from Georgia (cf. SHVETSOV (1913), NAZARISHVILI (1968, 1973), KELEPTRISHVILI (1990, 1998), TOPCHISHVILI et al. (2002)). Figure 3 gives the distribution of the belemnite material in Spain, the ABST and in Clos de Barral, which is useful to compare with the distribution of the Hungarian material (Figure 4).

The sections in the Gerecse Mts yielded belemnites in the top of section C (cf. JANSSEN & FŐZY 2004) that are typical for the belemnite association of the lowermost Barremian. Above this section, sections B, A, D and E covers younger strata, up to the lower Upper Barremian (Vandenheckii Zone). These beds yielded a rich belemnite association. The majority of the species belong to the Mesohibolitidae NERODENKO, 1983 (here including *Curtohibolites*, *Hibolithes*, "*Mesohibolites*" sensu lato (= *Conohibolites* new genus), "*Mesohibolites*" auct. pl.). This fauna is treated below in details.

Subordinately occur Duvaliidae PAVLOV, 1914, in beds 300/34 (Plate III: 38–39) and 300/29 (Moutonianum Zone), and in beds 300/10, 300/2 and 300/1 (Vandenheckii Zone) with *Duvalia grasiana* (DUVAL–JOUVE, 1841). In bed 26 (Moutonianum Zone) of section A, occurs *Duvalia* n. sp. (Plate III: 1–2; = *D.* aff. *silesiaca* UHLIG in CLÉMENT, 2000, Plate 4: 16); and in the same section in beds 33, 25, 23, and 7 occurs *D. grasiana* (DUVAL–JOUVE, 1841). Furthermore *D. grasiana* (DUVAL–JOUVE, 1841) occurs in bed 336 of section D, in sediments attributed to the top of the Vandenheckii Zone, or even younger sediments. Also, in the beds 123, 124 (section B; Plate V: 25–26), and bed 125. This species, or a closely related one, first occurs approximately at the same level as in the ABST. In the latter, it occurs in the middle of the Compressissima Zone [= *Duvalia* sp. nov. 5 in CLÉMENT (2000); which is probably a predecessor of *D. grasiana* (DUVAL–JOUVE, 1841) sensu stricto].

Concerning the Duvaliidae of the Bersek fauna, a further, comprehensive evaluation of all the included specimens seems to be necessarily. Therefore in this paper they are just mentioned and partly figured, but not described in details.

All of the listed belemnites from the Bersek-hegy are stored in the Geological and Palaeontological Department of the Hungarian Natural History Museum (Budapest), inventory numbers from 2005.10. to 2005.83.

Family Mesohibolitidae NERODENKO, 1983
Genus *Hibolithes* DENYS DE MONTFORT, 1808
***Hibolithes jaculiformis*? SHVETSOV, 1913**
(Plate III: 3–4)

2004: *Hibolithes* gr. *jaculiformis* SHVETSOV — JANSSEN & FŐZY, p. 44, pl. III, figs 6, 24–25.

Material — A relatively robust, compressed, badly preserved specimen reminiscent of *H. jaculiformis* SHVETSOV, 1913 with a relative long alveolar groove and a short alveolus, from bed 135.

Remarks — This species is extensively treated in part I (cf. JANSSEN & FŐZY, 2004).

Stratigraphical distribution — The material originates from sediments to be attributed to the Pulchella Zone (= Pulchella Subzone of the former Nicklesi Zone).

***Hibolithes mirificus* STOYANOVA-VERGILOVA, 1965**
(Plate III: 5-6; Plate V: 14)

1964: *Hibolites mirificus* sp. nov. — STOYANOVA–VERGILOVA, pp. 139, 145 [nom. nud.]
* 1965: *Hibolites mirificus* [nov.] — STOYANOVA–VERGILOVA, pp. 151–152, pl. I, figs 1 [HT]–4.

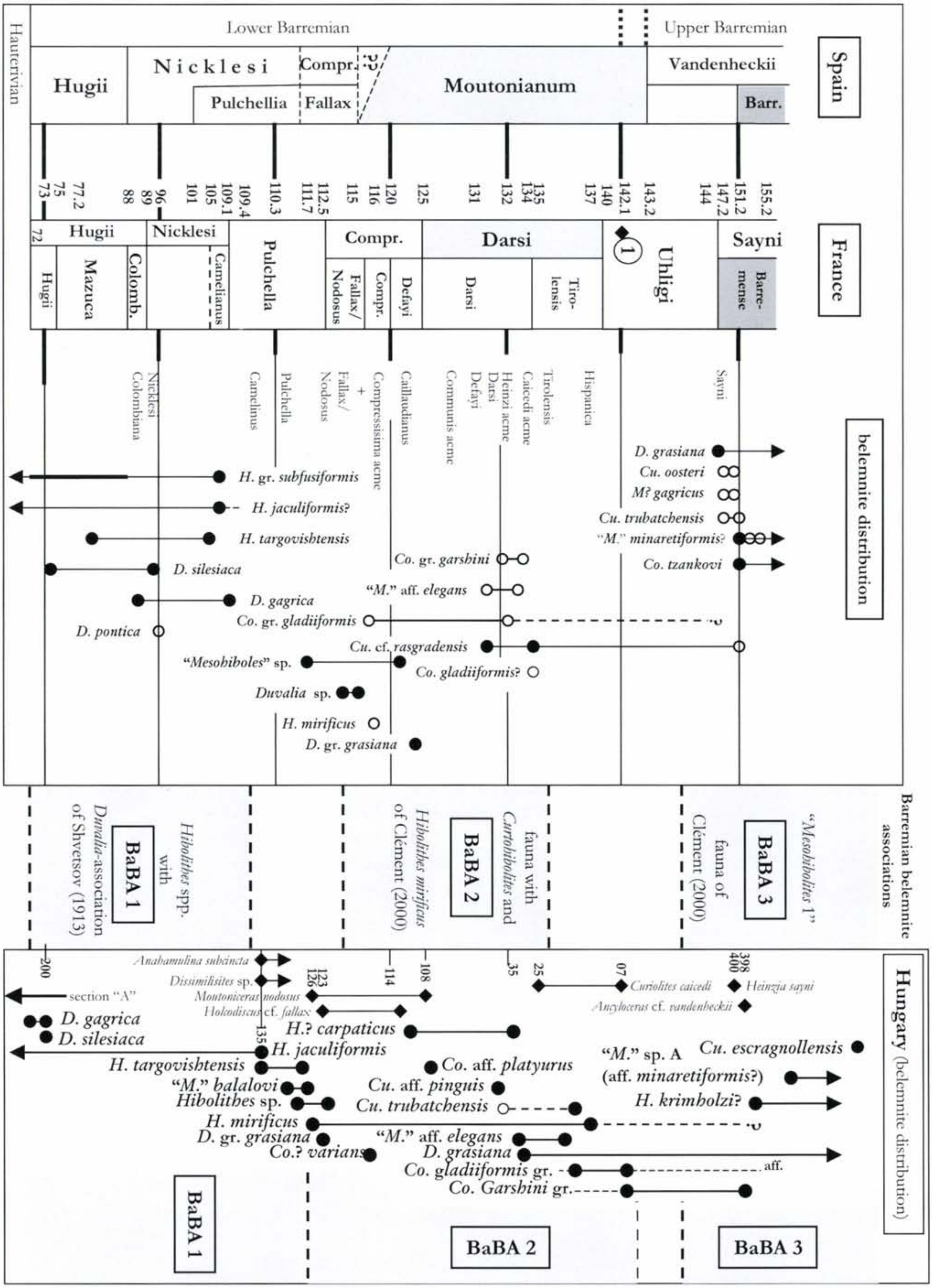


Figure 4 — Distribution of belemnites in Hungary, with (inferred) correlation towards the distribution of the belemnites in the western part of the Mediterranean Tethys. — Modification of the boundaries between the belemnite faunal assemblages, based on the Hungarian material, is indicated on the right (BaBA 1, BaBA 2, and BaBA 3). **Barr.** = Barremense; **Compr.** = Compressissima.

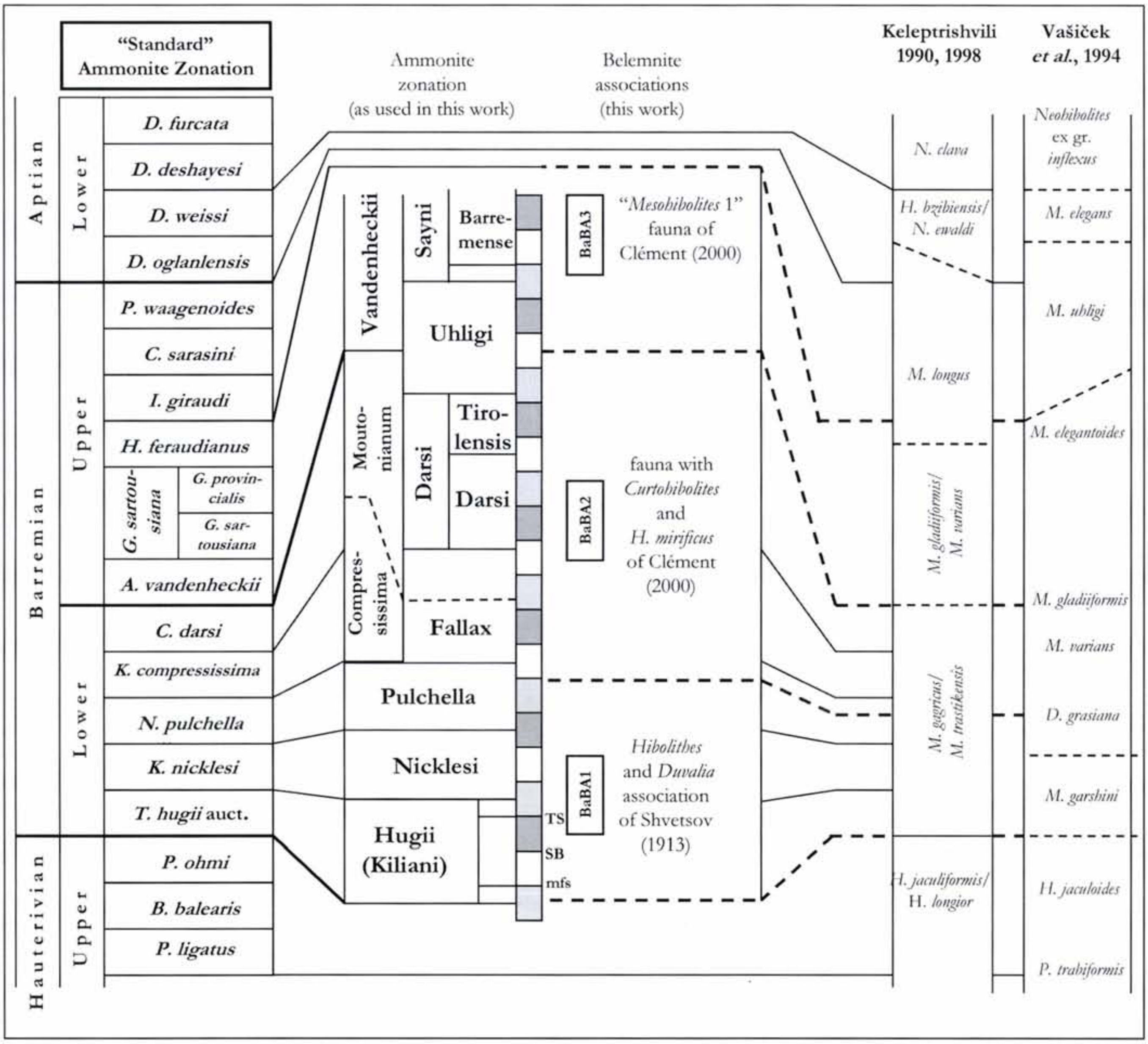


Figure 5 — Compilation of the "standard" ammonite zonation, the Barremian belemnite fauna associations, and some zonal schemes based on the distribution of belemnites from Georgia (KELEPTRISHVILI 1990, 1998) and the Carpathian Mts (VAŠÍČEK et al. 1994).

1970: *Hibolites mirificus* STOYANOVA–VERGILOVA — STOYANOVA–VERGILOVA, p. 19, pl. V, figs 1–4[=STOYANOVA–VERGILOVA, 1965], pl. XXXII, fig. 2.
1984: *Combemorelites mirificus* (STOYANOVA–VERGILOVA) — GAYTE, p. 99.
1989: *Hibolites mirificus* STOYANOVA–VERGILOVA — MICHALÍK & VAŠÍČEK, p. 516, pl. 3, fig. 4.
1994: *Hibolites mirificus* STOYANOVA–VERGILOVA — VAŠÍČEK et al., pp. 79–80, pl. 27, figs. 11–12 [= MICHALÍK & VAŠÍČEK, 1989].
1995: *Pseudohibolites mirificus* (STOYANOVA–VERGILOVA) — RIEGRAF, p. 104.
non 1997: *Hibolithes mirificus* STOYANOVA–VERGILOVA — JANSSEN, pp. 9–10, pl. 5, figs 5–6[= *H.* gr. *subfusiformis* (RASPAIL)].
2000: "*Hibolithes*" *mirificus* STOYANOVA–VERGILOVA — CLÉMENT, pl. 4, fig. 6 [Darsi].
2003: *Hibolithes mirificus*? STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — One juvenile specimen from bed 126 (cf. STOYANOVA–VERGILOVA, 1965: pl. 1, fig. 4) but complete (Plate III: 5–6, Plate V: 14). Actually it shows a very faint ventral groove in the middle of the apical part only. Furthermore, a specimen from bed 12; ontogenetically between two specimens figured by STOYANOVA–VERGILOVA (1965, pl. 1, figs 2, 4). The specimens, grouped within *Belemnites pistilliformis* RASPAIL by JANSSEN & FŐZY (2003) are also included from beds 410 and 399.

Stratigraphic distribution — The specimen from bed 126 originates from the base of the Compressissima Zone (Fallax/Nodosus Subzone, or the topmost part of the

Pulchella Zone), and the other specimen from the Moutonianum Zone (bed 12). The specimens from the beds 410 and 399 originate from the Vandenheckii Zone (possible equivalent of the top of the Darsi and/or the base of the Sayni Zone of VERMEULEN 2002). The Bulgarian specimens originate from the Lower Barremian, while the Carpathian and French material originate from the "mid" Barremian.

Hibolithes targovishtensis STOYANOVA–VERGILOVA, 1979

(Plate III: 7–8, 9–10, 11–12; Plate V: 12–13)

? 1913: *Hibolites jaculiformis* n. sp. — SHVETSOV, pl. III, fig. 6 (var. *inflata*).
non 1937: *Hibolites jaculum* PHILLIPS — KUZNETSOVA, p. 40 [from Lower Aptian *fide* KRYMGOL'TS, 1939, p. 12, pl. I, fig. 8 => imm? *Mesohibolites renngarteni* KRYMGOL'TS, 1939].
pars 1939: *Hibolites jaculum* PHILLIPS — KRYMGOL'TS, pp. 11–12.
1964: *Hibolites* sp. — STOYANOVA–VERGILOVA, p. 139 [coll. BRESKOVSKI].
? 1966: *Mesohibolites varians* SCHWETZOFF — GORN, p. 130 [association with a.o. "*D. binervia*"].
pars? 1970: *Hibolites krimholzi* n. sp. — STOYANOVA–VERGILOVA, pp. 18–19, 67–68, pl. I, figs 1[HT]–2, 3[non?], pl. XXXII, fig. 3.
pars? 1970: *Hibolites pistilliformis* (BLAINVILLE) — STOYANOVA–VERGILOVA, pl. I, fig. 4.
* 1979: *Hibolites targovishtensis* n. sp. — STOYANOVA–VERGILOVA, pp. 37–39, pl. I, figs 1 [HT]–7.
+ 1979: *Hibolites targovichtensis* — STOYANOVA–VERGILOVA, p. 37.
? 1994: *Hibolites jaculoides* cf. *torpedinus* SWINNERTON — VAŠÍČEK et al., pl. 25, figs 5–6.
2003: *Hibolithes jaculiformis*? SHVETSOV — JANSSEN & FŐZY, p. 292.
pars 2003: *Hibolithes* gr. *jaculiformis* SHVETSOV — JANSSEN & FŐZY, p. 292 [bed 135 only].
pars 2003: *Hibolithes* gr. *subfusiformis*? (RASPAIL) — JANSSEN & FŐZY, p. 293 [not bed 200].

Material — Several specimens from section B; bed 135, among which one apical part, one alveolar part, and a compressed juvenile specimen occur. Moreover, one complete specimen from bed 134, two slightly flattened specimens from bed 132 (Plate III: 7–8, 9–10, Plate V: 12–13), one apical part and one complete specimen from bed 131, and slightly more flattened specimens from bed 130 and 128. Some rounded, slightly compressed, juvenile specimens (cf. STOYANOVA–VERGILOVA 1970: pl. I, fig. 4) from beds 131, 129 (Plate III: 11–12), and 128(2) most probably belong to this species, too.

Stratigraphical distribution — The material from Hungary originates from sediments to be attributed to the (topmost Nicklesi and) Pulchella Zone. The Bulgarian type material was found in marly deposits, with abundant *Hibolithes* and juvenile *Duvalia silesiaca* UHLIG, 1902, attributed to the Emerici Zone (corresponding approximately to the Lower Barremian).

Remarks — Most of the specimens are smaller than those in the original material from Bulgaria. Their size and general morphology, but for one, is intermediate between the Bulgarian specimens and a belemnite figured in SHVETSOV (1913: pl. III, fig. 6). The dorsal side tends to be slightly more flattened as compared to the ventral side. The Bulgarian type specimens originate from Targovish in north-eastern Bulgaria. Probably, the different size and slightly different morphology indicate that the Hungarian specimens are not fully mature. The alveolar part can be slightly depressed while the rest of the rostrum is more or less compressed.

With respect to the Hungarian material, it seems appropriate to assume that the species can be found in the early Lower Barremian, eventually up to the late Lower Barremian. Morphologically comparable specimens are known (pers. obs.; cf. Figure 2) from the Hugii and Nicklesi Zones in the ABST.

Hibolithes? sp.

(Plate III: 18–19)

pars 2003: Mesohibolitidae undet. — JANSSEN & FŐZY, p. 292.
pars 2003: "*Mesohibolites*" aff. *beskidensis* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — One mature specimen from bed 129. It shows a rather long, robust, moderately compressed guard with a very short alveolar groove and no alveolus. The ventral side is flattened, and the apex is pointed. Both, lateral as ventral views; show a cylindrical to sub-cylindrical outline. A double lateral line is visible on the middle of the lateral side. An apical part, probably belonging to this species, is found in bed 122.

Stratigraphical distribution — The Hungarian specimens originate from the base of the Compressissima Zone.

Remarks — A comparable specimen is found in bed 104–105 (Pulchella Zone), of the ABST.

Hibolithes? *carpaticus* (UHLIG, 1883)

(Plate III: 20–21, 22–23, 24–25, 26, 27; Plate V: 15, 17)

1883a: *Belemnites Carpaticus* n. sp. — UHLIG, p. 87 [nom. nud.].
* 1883b: *Belemnites carpaticus* n. sp. — UHLIG, p. 177, pl. I, fig. 1[MT; apparently missing, cf. VAŠÍČEK, 1978a, p. 4].

1920: *Mesohibolites* (?) *carpathicus* [sic!] UHLIG — BÜLOW-TRUMMER, p. 156.
non? 1951: *Mesohibolites carpathicus* [sic!] (UHLIG) — DELATTRE, pp. 53–54, pl. II, fig. 23.
? 1951: *Mesohibolites carpaticus* UHLIG — RENGARTEN, p. 54.
? 1955: *Mesohibolites* cf. *carpaticus* UHLIG — ERISTAVI, p. 29.
? 1971: *Hibolites carpathicus* [sic!] (UHLIG) — COTILLON, pp. 127, 302.
? 1972: *Hibolites subfusiformis* (RASPAIL) — ALI-ZADE, pl. IV, fig. 3.
1978b: *Mesohibolites carpaticus* (UHLIG) — VAŠÍČEK, p. 118.
? 1990: ?*Vaunagites* sp. — VAŠÍČEK, p. 97.
1994: *Mesohibolites varians* (SCHWETZOFF) — VAŠÍČEK et al., pl. 27, figs 9–10.
1995: *Pseudohibolithes carpathicus* [sic!] (UHLIG) — RIEGRAF, p. 100.
pars 2003: "*Mesohibolites*" (gr.) *gladiiformis* (UHLIG) — JANSSEN & FŐZY, p. 293 [beds 111, 44, 43].
2003: *Vaunagites*? sp. A — JANSSEN & FŐZY, p. 293.

Material — The alveolar part of a rostrum with long alveolar groove, depressed alveolar opening and compressed stem fragment originates from section B, bed 111 (Plate III: 20–21b). The slit is hibolitoid. A morphologically comparable specimen originates from bed 44 of section A (but it is slightly more hastate and less compressed). An alveolar part from bed 43, two elongated specimens from bed 36, and a furthermore one from bed 35 might be also comparable (Plate III: 24–25, Plate V: 17). *Vaunagites*? sp. A (cf. JANSSEN & FŐZY 2003) from bed 102 (Plate III: 22–23, Plate V: 15) and 36 (2 specimens) are more or less comparable. They show a much more typical hibolitoid rostrum, with a regular elongated apical area. The development of the alveolar region is comparable with the specimen from bed 111, but smaller, with a shorter groove (bed 36; Plate III: 26, 27) and with no traces of a groove (beds 102 and 35). They differ from the nominal *Belemnites carpaticus* UHLIG, either by a less well differentiated compression of the stem-region, or by a more depressed alveolar region. Contrary to *Belemnites gladiiformis* UHLIG or *Belemnites beskidensis* UHLIG they do not show the constriction in the alveolar area before the development of the elongated (epirostrum-like) apex.

Remarks — In first impression these specimens are in some ways morphologically comparable, but in other characters, they seem to belong to two different species. However, this is believed to be the result of, more or less similarly to the ontogenetic development of *H. mirificus*, the course in which mature species apparently shifted the built up of the rostrum from the apical part towards the alveolar opening, from dart-like to dagger-like. It is highly possible that this species should be grouped within the new genus *Conohibolites*.

Stratigraphical distribution — The Hungarian material originates partly from section B, from the upper part of the Compressissima Zone, while the material from section A originates either from the Moutonianum Zone, or from slightly older sediments (? probably equivalent of the lower part of the Darsi Zone). The Carpathian material (VAŠÍČEK et al. 1994) originates from the base of the Upper Barremian (approximately Vandenheckii Zone), and the Caucasian specimen (ALI-ZADE 1972, p. 32) originates from the upper part of the Lower Barremian.

Hibolithes sp. (aff? *krimholzi* STOYANOVA-VERGILOVA, 1970) new?

(Plate III: 28–29, 30–31, 32–33, 34–35; Plate V: 4–5, 16)

pars? 1937: *Hibolites jaculum* PHILLIPS — KUZNETSOVA, p. 40.
pars? 1939: *Hibolites jaculum* PHILLIPS — KRYMGOL'TS, pp. 11–12.
aff? 1952: *Hibolites jaculum* PHILLIPS — KHECHINASHVILI, pp. 70–71, pl. I, figs 5–10, pl. II, fig. 1.
pars 1964: *Hibolites krimholzi* nom. nov. — STOYANOVA-VERGILOVA, pp. 138–139, 145 [nom. nud.].
aff?* 1970: *Hibolites krimholzi* n. sp. — STOYANOVA-VERGILOVA, pp. 18–19, 67–68, pl. I, figs 1[HT]–2, pl. XXXII, fig. 3.
1970: *Hibolites krimholzi* n. sp. — STOYANOVA-VERGILOVA, pl. I, fig. 3.
1973: *Hibolites jaculum* PHILLIPS — NAZARISHVILI, pp. 21–22, pl. 1, figs 12–13.
? 1976: *Hibolithes* aff. *krimholzi* STOYANOVA-VERGILOVA — PATRULIUS & AVRAM, p. 148(14).
? 1990: *Hibolites jaculum* (PHILLIPS) — KELEPTRISHVILI, p. 15.
pars? 1998: *Hibolites jaculum* (PHILLIPS) — KELEPTRISHVILI, p. 445.
2000: "*Hibolithes*" nov. sp. 1 — CLÉMENT, pl. 3, fig. 2 [Giraudi].
non 2002: *Hibolites jaculum* (PHILLIPS) — TOPCHISHVILI et al., pl. VII, fig. 1.
2003: "*Hibolithes krimholzi*" STOYANOVA-VERGILOVA — JANSSEN & FŐZY, p. 292.

Material — In section E from bed 300/9 one (im)-mature specimen and a juvenile, incomplete specimen that probably belongs to this species, too. In bed 300/10, one juvenile (Plate III: 34–35, Plate V: 4–5), one immature apical part, and two complete (im)mature specimens (Plate III: 32–33). In bed 300/13 six (im)mature complete specimens, some morphologically close to *varians*-species, and in bed 300/8 one (very) mature specimen (Plate III: 28–29, Plate V: 16) with a relatively deep alveolus (30 mm) and a central apical line. The slit appears to be hibolitoid.

Remarks — These specimens are probably equivalent to *Hibolites* [sic!] *krimholzi* n. sp. STOYANOVA-VERGILOVA, 1970. Especially the specimen figured on pl. I, fig. 3 (from Shumensko), is comparable to the Hungarian material (Plate III: 28–29). However, the stratigraphic position of the Hungarian material (Vandenheckii Zone) with respect to the early Lower Barremian occurrence of the morphologically close *H. targovishtensis* makes attribution of these belemnites to this early Barremian species somewhat doubtful. Probably, we are dealing with one of the homeomorphic *Hibolithes* species, often classified as a Barremian representative of *Hibolites jaculum* auct. pl. These species, originally descending from Boreal ancestors, were probably repeatedly able to penetrate the northern perephery of the Tethyan Realm.

Stratigraphical distribution — The Hungarian material occurs in the Vandenheckii (or Sayni Zone). The stratigraphic position of the Bulgarian type material is somewhat vague, but *H. krimholzi* originates apparently from so-called Hauterivian(?)–Barremian sedimentary rocks (cf. STOYANOVA–VERGILOVA, 1970). However, STOYANOVA–VERGILOVA (1964, p. 145) also indicates the specimen to be present in the Lower/Upper Barremian boundary sediments.

Genus *Conohibolites* n. gen.

Type species — *Belemnites platyurus* DUVAL–JOUVE, 1841, pl. 11, fig. 4.

Type strata and locality — The "calcaire blanc dur avec grains verts" of the hemipelagic deposits at the southern border of the French Vocontian Basin. Actually these sediments can partially be correlated with the "mid" Barremian. The exact locality remains unclear, but most probably would be Escragnolles or its surroundings.

Name — After the general appearance of the rostrum.

Diagnosis — Generally, robust specimens with conical, subconical, cylindrical or sub-cylindrical ventral outline. The lateral view is generally subconical to (sub)-cylindrical. The maximum outline of the rostrum is situated either in, or approximately near the alveolar opening, or only slightly towards the alveolar area. Sometimes elongation of the apical region occurs that gives rise to an epirostrum-like extension. The alveolar area is rounded, while the apical area is compressed. The depth of the alveolus varies, and the length of the alveolar groove like-wise. The alveolus is shifted towards the dorsal side in the alveolar opening. However, the apical line is central. Juvenile and very immature specimens appear more hibolitoid.

Species included — As mentioned above, this genus might possibly consist of two closely related groups of species, among which the most typical are: *Belemnites platyurus* DUVAL–JOUVE, 1841, *Belemnites* aff. *platyurus* DUVAL–JOUVE, 1841, *Belemnites chumennensis* TSANKOV, 1930, *Belemnites (Hibolites?) escragnollensis* DELATTRE, 1952, *Mesohibolites garshini* STOYANOVA–VERGILOVA, 1965, pars *Belemnites minaret* auct. pl., *Mesohibolites trastikensis* STOYANOVA–VERGILOVA, 1965, *Mesohibolites tzankovi* STOYANOVA–VERGILOVA, 1965, and pars *Hibolites varians* SHVETSOV, 1913. Moreover, the elongated species, like: *Mesohibolites* aff. *beskidensis* UHLIG in STOYANOVA–VERGILOVA (1965), *Belemnites gladiiformis* UHLIG, 1883, pars *Hibolites varians* SHVETSOV, 1913, and perhaps *Mesohibolites* aff. *uhligi* SHVETSOV in STOYANOVA–VERGILOVA (1965).

Remarks — Apparently, except for one (cf. MICHALÍK & VAŠÍČEK, 1989, pl. 2, fig. 3), all species included are known from the "mid" Barremian sedimentary deposits only. This group of belemnites is called "faune à *Mesohibolites* 1" by CLÉMENT (2000, p. 17), and together with the "fauna à *Curtohibolites*" of CLÉMENT (2000, p. 17) characterize the "mid" Barremian belemnite fauna aspect.

Conohibolites escragnollensis (DELATTRE, 1952)

(Plate IV: 1–2; Plate V: 6–7)

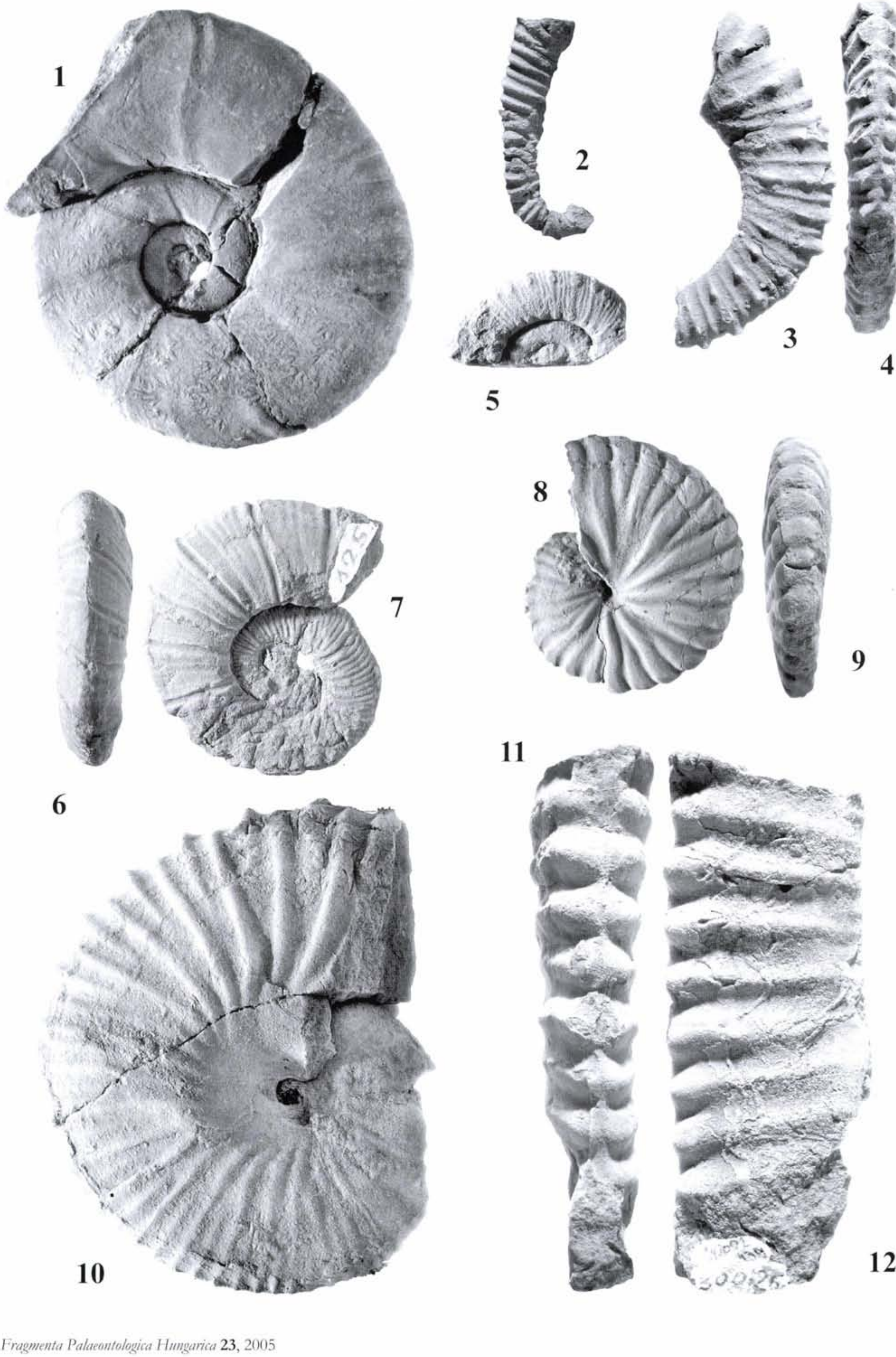
1898: *Belemnites minaret* RASPAIL — SIMIONESCU, p. 108(52), pl. I, fig. 3.
? 1930: *Belemnites Chumennensis* n. sp. — TSANKOV, pp. 62, 74, pl. III, figs. 5–7.
1945: *Mesohibolites tzankovi* [nov.] — MANDEV, p. 144 [nom. nud.] (*fide* STOYANOVA–VERGILOVA, 1965).
pars 1951: *Belemnites extinctorius* RASPAIL — DELATTRE, pp. 150–154, text-figs. 60–63, pl. V, fig. 69.
* 1952: *Belemnites (Hibolites?) escragnollensis* n. sp. — DELATTRE, pp. 283–285, pl. XIVa, figs 1–3.
1962: *Mesohibolites tzankovi* MANDEV — STOYANOVA–VERGILOVA, p. 103 [nom. nud.].
1964: *Mesohibolites tzankovi* sp. nov. — STOYANOVA–VERGILOVA, pp. 139, 145 [nom. nud.].
* 1965: *Mesohibolites tzankovi* sp. nov. — STOYANOVA–VERGILOVA, pp. 158–159, pl. I, fig. 7[HT; = MANDEV 1945], pl. IV, fig. 8, pl. VII, figs 2–4.

Explanation to Plate I

(All specimens in natural size)

1 *Melchiorites* cf. *blayaci* (KILIAN in BLAYAC, 1900) (2005.85.) — section B; bed 135; Compressissima Zone.
2 *Manoloviceras saharieve* (MANOLOV, 1962) (2005.87.) — section B; bed 131; Compressissima Zone.
3–4 *Toxancyloceras vandenheckii* ASTIER, 1851 (M.2002.577.) — section E; bed 300/11; Vandenheckii Zone.
5 *Macroscaphites* cf. *binodosus* (UHLIG, 1883) (M.2002.513.) — section A; bed 25; Moutonianum Zone.
6–7 *Holcodiscus gastaldianus* (D'ORBIGNY, 1850) (2005.86.) — section B; bed 125; Compressissima Zone.
8–9 *Subpulchellia didayana* (D'ORBIGNY, 1841) (M.2002.671.) — section B; bed 112; Compressissima Zone.
10 *Phyllopachyceras infundibulum* (D'ORBIGNY, 1841) (M.2002.706.) — section D; bed 401; Vandenheckii Zone.
11–12 *Moutoniceras moutonianum* (D'ORBIGNY, 1850) (M.2002.439.) — section E; bed 300/26; Moutonianum Zone.

Plate I



1970: *Mesohibolites tzankovi* STOYANOVA–VERGILOVA — STOYANOVA–VERGILOVA, pp. 37–38, pl. X, figs 1[= STOYANOVA–VERGILOVA, 1965, pl. I, fig. 7], 2–3[=STOYANOVA–VERGILOVA, 1965, pl. VII, figs. 3–4], 4[=STOYANOVA–VERGILOVA, 1965, pl. IV, fig. 8], pl. XXXII, fig. 14.

pars 1970: *Mesohibolites platyurus* (DUVAL–JOUVE) — STOYANOVA–VERGILOVA, pl. XIX, figs 5–7.

2003: "*Mesohibolites*" *tzankovi*? STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — A nearly complete rostrum from bed 363. The apical part is very elongated while the ventral side is flat; the ventral and lateral views show an extreme, tapering, conical rostrum. The alveolus shifted towards the dorsal side.

Remarks — The specimen from Hungary is morphologically comparable to "*Mesohibolites platyurus*" (DUVAL–JOUVE) in STOYANOVA–VERGILOVA (1970: pl. XIX. fig. 7). However, *Conohibolites platyurus* (DUVAL–JOUVE, 1841), has a lesser conical outline, and a larger rostrum sollidum, i.e. the distance between the apical part and the alveolar part is larger. This species is reminiscent of *Conohibolites chumenensis* (TSANKOV, 1930), but with some *gladiiformis*-like characteristics. The apical part is much more flattened, respectively elongated.

Stratigraphical distribution — The Hungarian specimen originates from deposits that can probably be attributed to the top of the Vandenheckii (Sayni) Zone, or younger (?).

Conohibolites garshini (STOYANOVA–VERGILOVA, 1965)

(Plate III: 36–37; Plate IV: 3–4)

1964: *Mesohibolites garschini* sp. nov. — STOYANOVA–VERGILOVA, pp. 139, 145 [nom. nud.].

* 1965: *Mesohibolites garshini* sp. nov. — STOYANOVA–VERGILOVA, p. 157, pl. III, figs 4[HT]–6.

1970: *Mesohibolites garshini* STOYANOVA–VERGILOVA — STOYANOVA–VERGILOVA, pp. 36–37, pl. XVI, figs 5–7[=STOYANOVA–VERGILOVA, 1965, pl. III, figs 4–6], pl. XXXII, fig. 15.

non 1975: *Mesohibolites garschini* [sic!] STOYANOVA–VERGILOVA — KVANTALIANI & NAZARISHVILI, pp. 140–141, pl. I, fig. 2 [=? *Curtohibolites wernsdorfensis* (UHLIG)].

? 1989: *Mesohibolites garshini* STOYANOVA–VERGILOVA — MICHALÍK & VAŠÍČEK, p. 516, pl. 2, fig. 3[uppermost Hauterivian!?].

? 1994: *Mesohibolites garshini* STOYANOVA–VERGILOVA — VAŠÍČEK et al., pp. 82–83, pl. 26, figs 3–4[= MICHALÍK & VAŠÍČEK, 1989], pl. 26, fig. 5.

pars 2002: *Mesohibolites garshini* STOYANOVA–VERGILOVA — TOPCHISHVILI et al., pp. 78–79, pl. VIII, fig. 6, non pl. IX, fig. 4[= KVANTALIANI & NAZARISHVILI, 1975].

pars 2003: *Mesohibolites garshini* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293 [not bed 42].

Material — Essentially, immature specimens occur in the beds 300/15, 300/13 (Plate IV: 3–4), 300/11, and in bed 300/26 (Plate III: 36–37) a juvenile specimen that probably belongs to this species, too.

Stratigraphical distribution — The specimens come from the base of the Vandenheckii Zone, but the specimen from bed 300/26 occurs probably in sediments to be attributed to the Uhligi Zone (or with other words, part of the Moutonianum Zone).

Remarks — Actually expected to be a typical early to "mid" Barremian type of belemnite. However, MICHALÍK & VAŠÍČEK (1989) indicate the specimen from uppermost Hauterivian sedimentary rocks. However, judging from the distribution of the cephalopods (VAŠÍČEK et al., 1994, p. 24) it most probably originates from the lowermost Barremian. Still, it remains in fact the oldest representative of this genus.

Explanation to Plate II

(All specimens in natural size)

1–2 ***Subpulchellia caicedi* (KARSTEN, 1856)** (M.2002.670.) — section A; bed 25; Moutonianum Zone.

3 ***Subpulchellia didayana* (D'ORBIGNY, 1841)** (M.2002.655.) — section B; bed 112; Compressissima Zone.

4 ***Heinzia sayni* HYATT, 1903** (M.2002.660.) — section D; bed 400; Vandenheckii Zone.

5–6 ***Subpulchellia compressissima* (D'ORBIGNY, 1841)** (M.2002.465.) — section B; bed 123; Compressissima Zone.

7 ***Ptychoceras puzosianum* (D'ORBIGNY, 1842)** (M.2002.550.) — section E; bed 300/11; Vandenheckii Zone.

8 ***Moutoniceras* aff. *moutonianum* (D'ORBIGNY, 1850)** (M.2002.441.) — section E; bed 300/8; Vandenheckii Zone.

9 **"*Metahoplites*" cf. *henoni* (COQUAND, 1880)** (2005.88.) — section B; bed 111; Compressissima Zone.

10 ***Holcodiscus caillaudianus* (D'ORBIGNY 1850)** (2005.90.) — section B; bed 114; Compressissima Zone.

11 ***Holcodiscus caillaudianus* (D'ORBIGNY 1850)** (2005.89.) — section B; bed 117; Compressissima Zone.

12–13 ***Subpulchellia sauvageaui* (HERMITE, 1879)** (2005.91.) — section A; bed 14; Moutonianum Zone.

14 ***Subpulchellia changarnieri* (SAYN, 1890)** (M.2002.473.) — section E; bed 300/40; Moutonianum Zone.

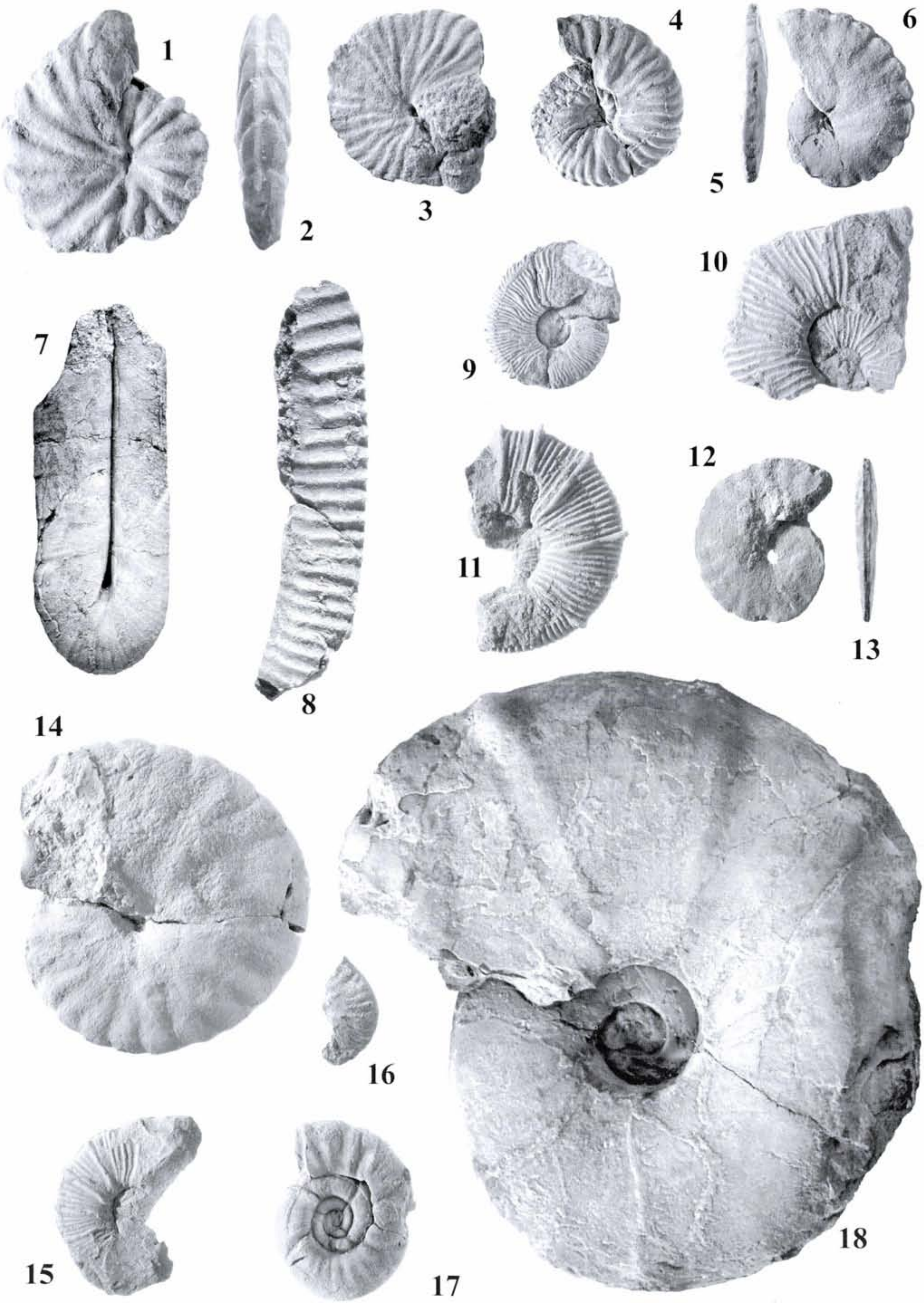
15 ***Holcodiscus fallax* (COQUAND, 1878)** (2005.92.) — section B; bed 115; Compressissima Zone.

16 ***Discoidella favrei* (OOSTER, 1860)** (M.2002.172.) — section C; bed 201; Hugii Zone.

17 ***Silesites* aff. *vulpes* (COQUAND, in MATHERON, 1878)** (2005.93.) — section B; bed 135; Pulchella Zone.

18 ***Barremites difficilis* (D'ORBIGNY, 1841)** (2005.94.) — section B; bed 135; Pulchella Zone.

Plate II



Conohibolites gladiiformis (UHLIG, 1883)
(Plate IV: 5–6, 7–8, 9–9ab, 10–11; Plate V: 22)

1883a: *Belemnites gladiiformis* n. sp. — UHLIG, p. 87 [nom. nud.].
* 1883b: *Belemnites gladiiformis* n. sp. — UHLIG, p. 176, pl. I, fig. 2[MT; apparently missing, cf. VAŠÍČEK, 1978a, p. 4].
pars 1907: *Hibolites gladiiformis* UHLIG — KARAKASH, pp. 24(= *varians* SHVETSOV *fide* KRYMGOL'TS, 1939, p. 17), 343.
pars? 1913: *Hibolites varians* n. sp. — SHVETSOV, pl. IV, figs 3e–i (*fide* NAZARISHVILI, 1973; ? *fide* VAŠÍČEK, 1978).
pars 1920: *Neohibolites gladiiformis* UHLIG — BÜLOW-TRUMMER, p. 159.
1970: *Mesohibolites gladiiformis* (UHLIG) — STOYANOVA-VERGILOVA, p. 29, pl. XVI, fig 1.
1973: *Mesohibolites gladiiformis* (UHLIG) — NAZARISHVILI, pp. 26–27, pl. 2, figs 5–6.
? 1978a: *Mesohibolites* cf. *gladiiformis* (UHLIG) — VAŠÍČEK, pp. 14–16, pl. II, fig. 5.
1989: *Mesohibolites gladiiformis* (UHLIG) — MICHALÍK & VAŠÍČEK, p. 516, pl. 3, fig. 3.
2002: *Mesohibolites gladiiformis* (UHLIG) — TOPCHISHVILI et al., pp. 81–82, pl. IX, fig. 2.
pars 2003: "*Mesohibolites*" (gr.) *gladiiformis* (UHLIG) — JANSSEN & FŐZY, p. 293 [not beds 111, 44, 43].

Material — The first specimens from this group of peculiar belemnites were found in beds 15 (Plate IV: 5–6) and 12. They are more or less atypical, they can be compared to the specimens figured by TOPCHISHVILI et al. (2002), i.e. lacking the typical constricted, elongated (epirostrum-like) apical part and (near) absence of an alveolar groove. They are thought to be immature specimen of the nominal species. A juvenile specimen (Plate IV: 7–8) from bed 15 and an apical(?) part in bed 7, might belong to this species, too. In bed 6 (Plate IV: 9–9ab, Plate V: 22) an immature specimen is found with a nearly complete very elongated, rounded but still compressed, apical part. In alveolar view the rostrum more or less tapers from the alveolar opening to the apex; part of the apical region is missing. The alveolar groove is rather distinct, but slightly weathered, and the alveolus is very short. Bed 411 delivered two more mature specimens, one of them is almost complete (Plate IV: 10–11), and the other is slightly more compressed, with a very flat ventral side. In all specimens the ventral side is straight in lateral view, while the dorsal side tapers toward the compressed, elongated apex. The alveolus is (slightly) shifted toward the dorsal side in the alveolar opening.

Bed 395 delivers a mature specimen without its elongated apical part. It is reminiscent of *M. garshini* STOYANOVA-VERGILOVA in TOPCHISHVILI et al. (2002: pl. VIII, fig. 6) but smaller and it differs from the nominal species due to its flat ventral side. *Garshini*-like specimens show a typical bend in the apical part, both in the ventral and the dorsal side.

Remarks — This species is used in several regional belemnite zonations (cf. VAŠIČEK et al., 1994; KELEPTRISHVILI, 1990, 1998). They appear to characterize the boundary between the "mid" and late Barremian.

Stratigraphical distribution — The Hungarian specimens originate most probably from the Moutonianum Zone [top of Darsi Zone (Tirolensis Subzone) to the Uhligi Zone], while bed 411 might belong to the top of the Uhligi Zone or the base of the Vandenheckii (Sayni) Zone.

Conohibolites aff. *gladiiformis* (UHLIG, 1883)
(Plate IV: 12–13)

pars 1913: *Hibolites varians* n. sp. — SHVETSOV, pl. IV, figs 3g–i (= *gladiiformis* UHLIG *fide* NAZARISHVILI, 1973; ? *fide* VAŠÍČEK, 1978a).
pars 1939: *Mesohibolites varians* SCHWETZOFF — KRYMGOL'TS, pl. III, figs 8a–b [=SHVETSOV, 1913].
pars 2003: "*Mesohibolites*" *garshini* STOYANOVA-VERGILOVA — JANSSEN & FŐZY, p. 293 [bed 395 only].

Material — One rather robust, depressed, both in dorso-ventral, as well in lateral view, tapering specimen with an alveolar groove that does not seem to reach the border of the alveolar opening (but its preservation is not really good in that area). The alveolus is rather deep, reaching about halfway the preserved part of the rostrum. The alveolus initiates in the middle of the rostrum.

Remarks — Compared to the nominal species, it is much more robust [cf. SHVETSOV 1913, p. 73; probably mature and apparently belonging to the same species (*varians*)].

Stratigraphical distribution — The specimen originates from the lowermost Upper Barremian Vandenheckii Zone (bed 395).

Conohibolites gr. *gladiiformis* (UHLIG, 1883) ?n. sp.
(Plate IV: 14–15; Plate V: 23–24)

pars 2003: "*Mesohibolites*" *garshini* STOYANOVA-VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — Two very elongated specimens from bed 300/28. The alveolar part is compressed with a very shallow alveolus and a clear, sharp alveolar groove. Towards the apical part of the rostrum, the alveolar groove gradually widens, to become a relative shallow but broad depression that gradually debouches. Towards the apical part, the rostrum gradually becomes lesser compressed, and the apical part is almost subrounded, but still depressed. Generally, the cross-sections are slightly irregular, compressed, but sometimes, especially in the apical part, almost rounded in some places.

Remarks — No comparable specimens are figured, nor described in the available literature. It is most probably a new species, morphologically close to *Conohibolites gladiiformis* (UHLIG). Perhaps these species are to be grouped in a separate (sub)-genus, but more material is needed. For instance the slit, the intra-specific variation, and the ontogeny are unknown. Initially, because of the resemblance between the alveolar-part of this rostrum, with *garshini*-type of species, JANSSEN & FŐZY (2003) believed it to be specimens with elongated apical parts. They thought that this elongation of the apical area was not a species characteristic, but probably a sign of dimorphism.

Stratigraphic distribution — From the Moutonianum Zone, or in other terms, probably from the top of the Darsi Zone (Tirolensis Subzone).

Conohibolites aff. *platyurus* (DUVAL–JOUVE, 1841) ?n. sp.

(Plate IV: 18–19; Plate V: 8–9)

pars 1965: *Mesohibolites platyurus* (DUVAL–JOUVE) — STOYANOVA–VERGILOVA, pl. XVIII, figs 5a–b.
pars 2003: "*Mesohibolites*" *garshini* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293 [bed 42 only].

Material — The specimen from bed 42 is morphologically comparable to the material from Popovo (Bulgaria). It is a rather robust looking medium sized rostrum, with a well developed alveolar groove. Both the alveolar as the dorsal side are straight, except for its apical part. The dorsal side shows a slightly stronger curve towards the more or less centrally placed apex. The alveolus is very shallow.

Remarks — *Belemnites platyurus* DUVAL–JOUVE shows a much more penetrating alveolus.

Stratigraphic distribution — The Hungarian material most probably originates from the base of the Darsi Zone, or from the top of the Compressissima Zone.

Conohibolites? varians (SHVETSOV, 1913)

(Plate IV: 16–17; Plate V: 2–3)

pars 1913: *Hibolites varians* n. sp. — SHVETSOV, pl. IV, figs. 3a–b, 3c–d, non pl. IV, figs 3e–f(= LT *fide* TOPCHISHVILI et al., 2002 [(= gr. *gladiiformis* UHLIG)], nec pl. IV, figs. 3g–i (= *gladiiformis* UHLIG *fide* NAZARISHVILI, 1973; ? *fide* VAŠÍČEK, 1978a).
non 1924: *Mesohibolites* cf. *varians* (SCHWETZOFF) — WHITEHOUSE & BRIGHTON, p. 360 [bed C7 of Speeton section (= Inversum Zone) => *Hibolithes jaculoides* SWINNERTON].
pars 1939: *Mesohibolites varians* SCHWETZOFF — KRYMGOL'TS, pl. III, figs. 10a–b[=SHVETSOV, 1913, pl. IV, figs 3a–b].
? 1946: *Mesohibolites varians* SCHWETZOFF — COHEN, p. 137.
? 1966: *Mesohibolites varians* SCHWETZOFF — GORN, p. 130.
? 1968: *Mesohibolites warians* [sic!] SCHWETZOFF — NAZARISHVILI, p. 635 [=? gr. *gladiiformis* UHLIG].
? 1971: *Hibolites varians* SCHWETZOFF — SPAETH, p. 31.
non 1994: *Mesohibolites varians* (SCHWETZOFF) — VAŠÍČEK et al., pl. 27, figs 9–10 [= *H*? *carpaticus* UHLIG, 1883b].
pars 2002: *Mesohibolites varians* (SCHWETZOFF) — TOPCHISHVILI et al., pp. 80–81, pl. IX, fig. 1, non pl. IX, fig. 3[= gr. *gladiiformis* UHLIG].
pars 2003: *Hibolithes jaculiformis*? SHVETSOV — JANSSEN & FŐZY, p. 292 [bed 117 only].

Material — The specimen from bed 117 (Plate IV: 16–17, Plate V: 2–3) is much like *H. varians* SHVETSOV (1913: pl. IV, figs. 3a–d), but with a much sharper apical part, and a shorter alveolar groove (cf. TOPCHISHVILI et al., 2002: pl. IX, fig. 1). Its alveolar part is also compressed.

Stratigraphical distribution — The Hungarian material probably originates from the middle of the Compressissima Zone (sensu Vermeulen).

Remarks — *Hibolithes varians* SHVETSOV originates from Gagry, apparently from "couches supérieures du Barremian", cf. SHVETSOV (1913: p. 64), and on pp. 56–57 it is indicated to originate from the same calcareous beds as *Hibolites pinguis* SHVETSOV, 1913. KRYMGOL'TS (1939, p. 17) attributes these to the Lower Barremian. This confusion might be caused by the lack of any precise stratigraphic data at the time of publication of these papers; or depends on the species' concept of the author. With respect to the Hungarian material, it seems appropriate to assume that the species can be found in the lower part of the late Lower Barremian.

Conohibolites sp.

Material — Bed 300/31 delivered a juvenile *Conohibolites* species. *Conohibolites* differs from *Curtohibolites*, due to a shallow alveolus, and a more tapering aspect of the more compressed rostrum in lateral view.

Genus "*Mesohibolites*"? auct. pl. (new genus)

"*Mesohibolites*"? cf. *bakalovi* STOYANOVA–VERGILOVA, 1965

(Plate III: 13–14, 15–17c; Plate V: 1)

1945: *Mesohibolites pinguis* SCHWETZOFF — MANDEV, p. 144 (*fide* STOYANOVA–VERGILOVA, 1965).
1946: *Mesohibolites pinguis* SCHWETZOFF — COHEN, p. 137.
1951: *Hibolites minaret* RASPAIL — RENGARTEN, p. 50.
1964: *Mesohibolites bakalovi* sp. nov. — STOYANOVA–VERGILOVA, pp. 139, 144, 145 [nom. nud.].

* 1965: *Mesohibolites bakalovi* sp. nov. — STOYANOVA–VERGILOVA, pp. 161–162, pl. V, figs 3[HT]–4.
1965: *Mesohibolites* aff. *bakalovi* sp. nov. — STOYANOVA–VERGILOVA, pl. VI, fig. 5.
1995: *Mesohibolites bakalovi* (STOYANOVA–VERGILOVA) — RIEGRAF, p. 89.
2003: "*Mesohibolites*" aff. *beskidensis* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — The material consists of a well compressed, spindle-like specimen with a shallow, central placed, alveolus. The lateral view is less hastate as compared to the ventral view, and almost sub-cylindrical. The apex is blunt to pointed, eventually slightly elongated. From bed 130 originates one immature and one more mature specimen (Plate III: 13–14, Plate V: 1). A mature rostrum is recovered from bed 127 which lacks the apical part (Plate III: 15–17c). The alveolar part shows a typical hibolitoid slit (Plate III: 16) or splitting-surface (cf. STOYANOVA–VERGILOVA, 1970, text-fig. 2b). The alveolus is shifted towards the dorsal side and so is the apical line initially. After about 2 mm it bends towards a central position.

Stratigraphic distribution — The Hungarian material originates from the base of the Compressissima Zone.

Remarks — It might be derived through *Hibolithes*-type of belemnites. It differs due to a spindle-like, more robust and short rostrum, with a much shorter alveolar region. Moreover, the maximum diameter is more to the middle of the rostrum, and thus not typical hibolitoid. The alveolar opening is compressed, and not rounded as is common in *Hibolithes*. The alveolus appears to be shifted towards the dorsal side in the alveolar opening, but is initially in a central position. This is uncommon in hibolitoid belemnites. However, the alveolar slit is hibolitoid.

Explanation to Plate III

(All lateral views show ventral side to the left, unless otherwise indicated; all specimens in natural size)

1–2 ***Duvalia* sp. nov. (immature?)** (2005.10.) — Section A, bed 26; Moutonianum Zone, Tirolensis? Subzone (Lower Barremian). **1** — Dorsal view; **2** — Lateral view (dorsal side to the left).

3–4 ***Hibolithes jaculiformis?* SHVETSOV, 1913** (2005.11.) — Section B, bed 135; Pulchella Zone (Lower Barremian). **3** — Ventral view; **4** — Lateral view.

5–6 ***Hibolithes mirificus* STOYANOVA–VERGILOVA, 1965 (juvenile/immature)** (2005.12.) — Section B, bed 126; Compressissima Zone (Lower Barremian). **5** — Ventral view; **6** — Lateral view.

7–8 ***Hibolithes targovishtensis* STOYANOVA–VERGILOVA, 1979** (2005.13.) — Section B, bed 132; Pulchella Zone (Lower Barremian). **7** — Ventral view; **8** — Lateral view.

9–10 ***Hibolithes targovishtensis* STOYANOVA–VERGILOVA, 1979** (2005.14.) — Section B, bed 132; Compressissima Zone (Lower Barremian). **9** — Ventral view; **10** — Lateral view.

11–12 ***Hibolithes targovishtensis* STOYANOVA–VERGILOVA, 1979 (juvenile)** (2005.15.) — Section B, bed 129; Compressissima Zone (Lower Barremian). **11** — Ventral view; **12** — Lateral view.

13–14 **"*Mesohibolithes*"? cf. *bakalovi* STOYANOVA–VERGILOVA, 1965** (2005.16.) — Section B, bed 130; Compressissima Zone (Lower Barremian). **13** — Ventral view; **14** — Lateral view.

15–17 **"*Mesohibolithes*"? cf. *bakalovi* STOYANOVA–VERGILOVA, 1965** (2005.17.) — Section B, bed 127; Compressissima Zone (Lower Barremian). **15** — Ventral view; **16** — Internal lateral view, showing dorsally skewed position of alveolus; **17a–c** — Cross-sections.

18–19 ***Hibolithes*? sp.** (2005.18.) — Section B, bed 129; Compressissima Zone (Lower Barremian). **18** — Ventral view; **19** — Lateral view (with bi-paired lateral line).

20–21 ***Hibolithes*? *carpaticus* (UHLIG, 1883)** (2005.19.) — Section B, bed 111; top Compressissima Zone *sensu* VERMEULEN (Lower Barremian). **20** — Ventral view; **21** — Lateral view; **21a–b** — Cross-sections.

22–23 ***Hibolithes*? *carpaticus* (UHLIG, 1883)** (2005.20.) — Section B, bed 102; Moutonianum Zone (Lower Barremian). **22** — Ventral view; **23** — Lateral view.

24–25 ***Hibolithes*? *carpaticus* (UHLIG, 1883)** (2005.21.) — Section A, bed 35; Moutonianum Zone (Lower Barremian). **24** — Ventral view; **25** — Lateral view.

26 ***Hibolithes*? *carpaticus* (UHLIG, 1883)** (2005.22.) — Section A, bed 36; Moutonianum Zone (Lower Barremian). **26** — Ventral view.

27 ***Hibolithes*? *carpaticus* (UHLIG, 1883)** (2005.23.) — Section A, bed 36; Moutonianum Zone (Lower Barremian). **27** — Ventral view.

28–29 ***Hibolithes* sp. (aff? *krimholzi* STOYANOVA–VERGILOVA, 1970)** (2005.24.) — Section E, bed 300/8; Vandenheckii Zone (Upper Barremian). **28** — Ventral view; **28a** — Cross-section; **29** — Lateral view (ventral side to the right).

30–31 ***Hibolithes* sp. (aff? *krimholzi* STOYANOVA–VERGILOVA, 1970) (immature)** (2005.25.) — Section E, bed 300/9; Vandenheckii Zone (Upper Barremian). **30** — Ventral view; **31** — Lateral view.

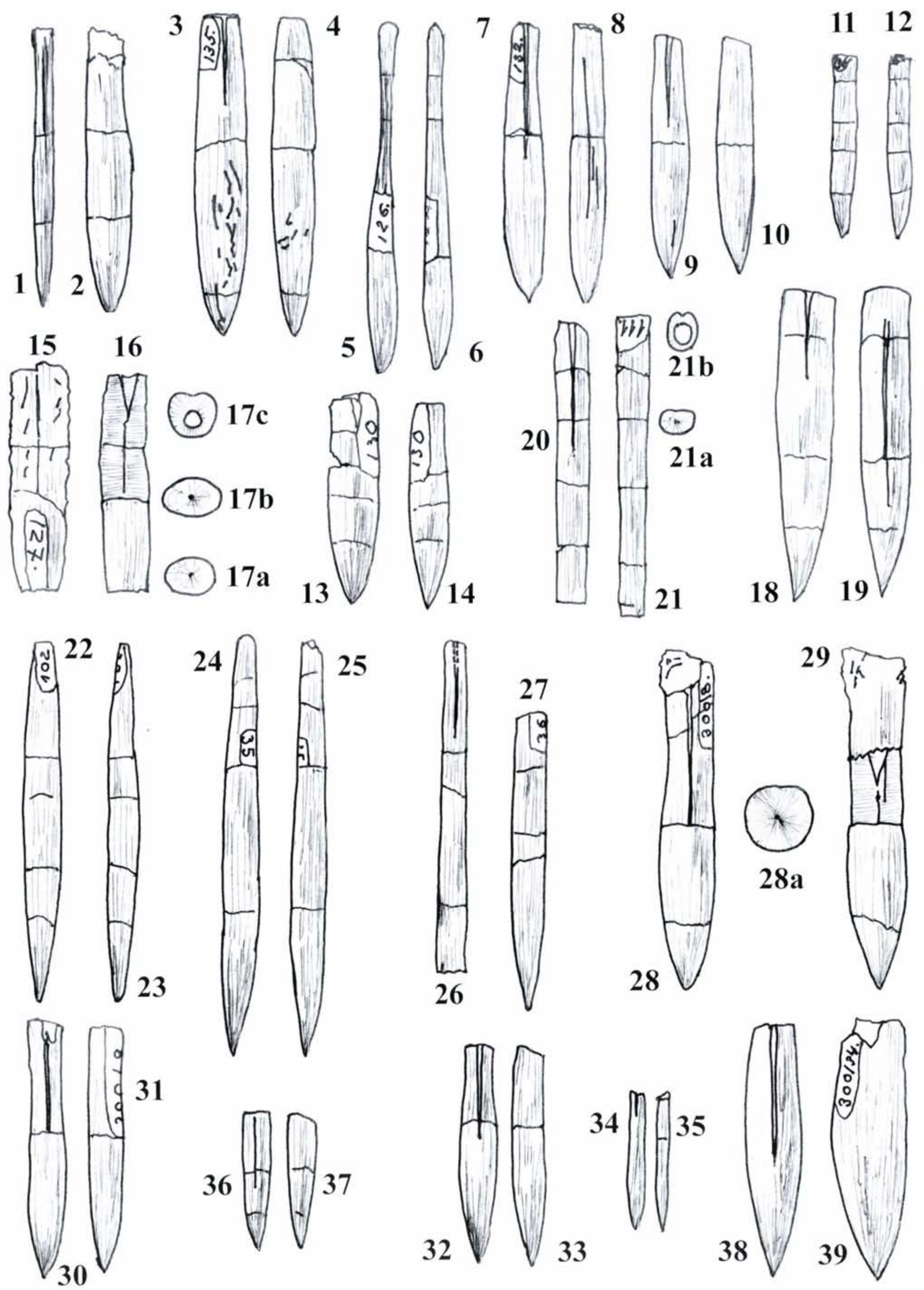
32–33 ***Hibolithes* sp. (aff? *krimholzi* STOYANOVA–VERGILOVA, 1970) (immature)** (2005.26.) — Section E, bed 300/10; Vandenheckii Zone (Upper Barremian). **32** — Ventral view; **33** — Lateral view.

34–35 ***Hibolithes* sp. (aff? *krimholzi* STOYANOVA–VERGILOVA, 1970) (juvenile)** (2005.27.) — Section E, bed 300/10; Vandenheckii Zone (Upper Barremian). 34 — Ventral view; 35 — Lateral view.

36–37 ***Conohibolites garshini* (STOYANOVA–VERGILOVA, 1965) (juvenile)** (2005.28.) — Section E, bed 300/26; Moutonianum Zone (Lower Barremian). 36 — Ventral view; 37 — Lateral view.

38–39 ***Duvalia grasiana* (DUVAL–JOUVE, 1841)** (2005.30.) — Section E, bed 300/34; Moutonianum Zone (Lower Barremian). 38 — Dorsal view; 39 — Lateral view.

Plate III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"*Mesohibolites*"? aff. *elegans* (SHVETSOV, 1913) sp. n.?

(Plate IV: 20–21, 22–23, 24–25; Plate V: 10–11)

? 1898: *Belemnites jaculum* PHILLIPS — SIMIONESCU, pp. 108–109(52–53), pl. I, figs 5 (=*Hibolites simionescui* sp. n. *fide* STOYANOVA–VERGILOVA, 1970), 6.

aff. 1913: *Hibolites elegans* n. sp. — SHVETSOV, pp. 60–61, 70, pl. V, figs 3a–f, 8c.

non 1970: *Hibolites simionescui* sp. n. — STOYANOVA–VERGILOVA, pp. 21–22, pl. VI, figs 4a–b.

? 1994: *Mesohibolites elegantoides* STOYANOVA–VERGILOVA — VAŠÍČEK et al., p. 82, pl. 27, figs 3–4.

2000: «*Mesohibolites*» aff. *elegans* (SCHWETZOFF) — CLÉMENT, pl. 2, fig. 15.

2003: "*Mesohibolites*" aff. *elegans* (SHVETSOV) — JANSSEN & FŐZY, p. 293.

Material — An immature rostrum from bed 34 (Plate IV: 22–23) and a more juvenile from bed 33 (Plate IV: 20–21). Bed 17 delivered a mature rostrum (Plate IV: 24–25, Plate V: 10–11). This species is comparable to the Aptian *Mesohibolites elegans* (SHVETSOV) but differs, apart from its stratigraphic position, in being more compressed in the alveolar part of the rostrum and in the stem-region, up to the rounded apical part. The alveolar groove is long and reaches for about half the length of the rostrum, while the alveolus is short and skewed towards the dorsal side of the guard. However, the slit appears to be "mesohibolitoid" (cf. STOYANOVA–VERGILOVA, 1970, text-fig. 2c). The juvenile or immature specimen is more or less hastate (alveolar view), well compressed and comparable to specimen figured by STOYANOVA–VERGILOVA (1970, pl. VIII, fig. 6) as juvenile or immature "*Mesohibolites minaret*" (RASPAIL). The specimen from bed 34 shows very well the dorsally skewed alveolus.

Remarks — These belemnites show characteristics that relates them to the "true *Mesohibolites*". This species characterize the uppermost Barremian to lower Aptian. They are superfluous *Hibolites*-like, but are characterized by a different development of the alveolar part of the rostrum.

Stratigraphical distribution — The Hungarian specimens originate from the top of the Darsi Subzone (beds 34 and 33). Bed 25 delivered the ammonite *Heinzia caicedi* (indicating approximately boundary between the Darsi Subzone and the Tirolensis Subzone). The specimen from bed 17 originates most probably from the top of the Darsi Zone (Tirolensis Subzone).

"*Mesohibolites*"? sp. A (aff. *minaretiformis* SHVETSOV, 1913)

(Plate IV: 26–27; 28–29)

non 1829: *Belemnites minaret* nob. — RASPAIL, p. 324(54), pl. 8, fig. 94.

pars 1883a: *Belemnites minaret* RASPAIL — UHLIG, pp. 87, 89.

pars? 1883b: *Belemnites minaret* RASPAIL — UHLIG, p. 176, pl. I, fig. 8, non fig. 9, *nec* fig. 17 (= *H. zlatarskii* n. sp. *fide* STOYANOVA–VERGILOVA, 1970).

non 1898: *Belemnites minaret* RASPAIL — SIMIONESCU, p. 108(52), pl. I, fig. 3 [= *escragnollensis* DELATTRE, 1952].

? 1898: *Belemnites* sp. — SIMIONESCU, p. 110(54), pl. I, fig. 7.

? 1913: *Hibolites minaretiformis* n. sp. — SHVETSOV, pp. 54–55, 68–69, pl. IV, figs 5a–f.

non 1921: *Belemnites* (*Hibolites*) *minaret* RASPAIL — PETKOVIC, p. 47, pl. I, fig. 1 [= "*Mesohibolites*" gr. *longus* SHVETSOV, 1913].

1935: *Mesohibolites minaret* RASPAIL — MISHUNINA, pp. 11–13, pl. I, figs 3–4.

pars? 1939: *Mesohibolites minaret* RASPAIL — KRYMGOL'TS, pp. 13–14, pl. I, figs. 12[=KARAKASH, 1907], 13–14.

? 1970: *Mesohibolites minaret* (RASPAIL) — STOYANOVA–VERGILOVA, pp. 25–26, pl. VIII, figs 1–6, pl. XXXII, fig. 10.

non 1972: *Mesohibolites minaret* (RASPAIL) — ALI–ZADE, pp. 141–143, text-fig. 48, pl. IV, fig. 2[= *Mucrohibolites krimholzi* NAZARISHVILI, 1973], pl. VII, figs 1–2[= *Mucrohibolites imerethica* KELEPTRISHVILI & KVANTALIANI in TOPCHISHVILI et al., 2002].

non 1973: *Mesohibolites minaret* RASPAIL — NAZARISHVILI, pp. 38–39, pl. 4, figs 4–5, pl. 9, figs 9–10 [apparently from Aptian deposits].

pars? 2002: *Mesohibolites minaret* (RASPAIL) — TOPCHISHVILI et al., pp. 94–95, pl. XI, fig. 6, pl. XIV, fig. 5, pl. XII, fig. 3.

pars 2003: Mesohibolitidae undet. — JANSSEN & FŐZY, p. 292.

pars 2003: "*Mesohibolites*" sp. — JANSSEN & FŐZY, p. 293.

pars 2003: "*Mesohibolites*" *garshini* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 293.

Material — Bed 392 yielded an apical part, and bed 389 the alveolar part of an immature specimen. Bed 353 (Plate IV: 26–27) delivered a mature specimen that lacks the larger part of the alveolus and bed 350 a specimen without apical part. The alveolus is shifted to the dorsal side, and the alveolar groove is well developed. The depth of the alveolus is less as compared to the length of the alveolar groove, while the apical line, at least in this specimen, remains, more or less, to the dorsal side. Juvenile and immature specimens tend to be rounded towards the alveolar part, but being slightly depressed in the apical area. In bed 316 an immature specimen was collected, and bed 379 delivered a juvenile specimen (Plate IV: 28–29) that probably belong to this species, too. It has a very shallow alveolus, apparently initially situated in the ventral side.

Remarks — Most of the above specimens are incomplete and do in fact have some characteristics in common with the species of SHVETSOV.

Stratigraphic distribution — The oldest specimens are from the Vandenheckii (Sayni) Zone, thus part of the lowermost Upper Barremian, and eventually partially derived from younger sedimentary deposits, i.e. the top of the Vandenheckii Zone. There are however no ammonites that indicate the presence of the Sartousiana Zone.

"*Mesohibolites*"? *gagricus* (SHVETSOV, 1913)

1913: *Hibolites gagricus* n. sp. — SHVETSOV, pp. 57–58, 69, pl. IV, figs 1a–b[LT *fide* ALI–ZADE, 1972], c [LT not figured *fide* STOYANOVA–VERGILOVA (1970, pp. 30–31)].
1919: *Mesohibolites*? *gagricus* SCHWETZOFF — STOLLEY, p. 45.
1935: *Mesohibolites gagricus* SCHWETZOFF — MISHUNINA, pp. 11–13, pl. I, figs 1–2.
pars? 1939: *Mesohibolites gagricus* SCHWETZOFF — KRYMGOL'TS, p. 17, pl. III, figs 6[= SHVETSOV, 1913, pl. IV, figs 1a–b], non fig. 5 [= gr. *longus*? SHVETSOV; coll. RENGARTEN, Lower Aptian].
pars? 1952: *Mesohibolites gagricus* SCHWETZOFF — KHECHINASHVILI, pl. IV, fig. 4 [= gr. *longus*? SHVETSOV].
1959: *Mesohibolites gagricus* SCHWETZOFF — KHALILOV, pp. 38–39, pl. I, fig. 1.
? 1970: *Mesohibolites gagricus* (SCHWETZOFF) — STOYANOVA–VERGILOVA, pp. 30–31, pl. XVI, fig. 2.
? 1972: *Mesohibolites gagricus* SCHWETZOFF — ALI–ZADE, pp. 150–151, pl. VIII, fig. 3 [= KHALILOV, 1959].
2000: *Mesohibolites* nov. sp. 20. — CLÉMENT, pl. 2, fig. 12.
2002: *Mesohibolites gagricus* (SCHWETZOFF) — TOPCHISHVILI et al., pp. 76–77, pl. VIII, fig. 1.
pars 2003: Mesohibolitidae undet. — JANSSEN & FŐZY, p. 292.
pars 2003: "*Mesohibolites*" sp. — JANSSEN & FŐZY, p. 293.

Material — Bed 316 delivered a near complete, slightly depressed specimen. Only a part of the alveolar area is missing. The rostrum is hibolitoid in appearance, and shows a faint alveolar groove. The alveolus apparently is very shallow, but not preserved. A rounded juvenile specimen originates from bed 312. It lacks any sign of an alveolar groove, and shows no trace of an alveolus. Eventually, another juvenile or immature specimen comes from bed 304.

Remarks — Traditionally, this species is grouped among the *Mesohibolites* auct. pl. The Hungarian material shows a hibolitoid species, which does not show any sign of a deep alveolar cavity. This is believed to be the result of preservation, as apparently the alveolar area is particularly well sensitive to destruction (the specimens are comparable with the specimen figured in TOPCHISHVILI et al., 2002, pl. VIII, fig. 1).

Stratigraphical distribution — Probably upper part of Sayni Zone, thus part of the lowermost Upper Barremian (Vandenheckii Zone), eventually partially derived from younger sedimentary deposits.

Genus *Curtohibolites* STOYANOVA–VERGILOVA, 1963

Curtohibolites aff. *pinguis* (SHVETSOV, 1913)

(Plate IV: 30–31; Plate V: 20–21)

aff. 1913: *Hibolites pinguis* n. sp. — SHVETSOV, pp. 56, 69, pl. IV, figs 2a–c[LT], b–d, e.
? 1937: *Mesohibolites pinguis* SCHWETZOFF — KUZNETSOVA, p. 40 [=? *M. brevis* SHVETSOV, 1913].
? 1939: *Mesohibolites abkhasiaensis* nom. nov. — KRYMGOL'TS, p. 17, pl. III, fig. 7[= KUZNETSOVA, 1937] (HT *fide* ALI–ZADE, 1972; TOPCHISHVILI et al., 2002).
? 1972: *Mesohibolites abkhasiaensis* KRIMHOLZ — ALI–ZADE, p. 143, pl. V, figs 6–7.
? 2002: *Mesohibolites abkhasiensis* [sic!] KRIMHOLZ — TOPCHISHVILI et al., pp. 82–83, pl. VIII, fig. 4.
2003: *Curtohibolites*? *pinguis* (SHVETSOV) — JANSSEN & FŐZY, p. 292.

Material — One complete specimen from bed 38 with a more peer-shaped cross-section as compared to the original material. The alveolus is centrally placed. It starts more or less at the point the rostrum starts to become more depressed, i.e. the alveolar part of the rostrum. The cross-section is more or less oval, but in the middle the dorsal side is wider. The apex is dorsally placed.

Remarks — KRYMGOL'TS (1939) introduced a new name based on the assumption the original name being a junior synonym of *Neohibolites minimus* var. *pinguis* STOLLEY, 1911. He introduced his new name based on a comparable specimen from the collection of KUZNETSOVA (apparently from Aptian deposits!?). It appears to us that the two species could be different, *pinguis* being a more droplet-like specimen. However, as the original material has not been studied, it is only provisionally proposed. Asmentioned by STOYANOVA–VERGILOVA (1965) the material of SHVETSOV is rounded in all aspects, as can be seen in the specimens figured by all other authors, but not in the material figured by the first author.

There is a possibility that the material of KUZNETSOVA (= KRYMGOL'TS 1939), which apparently originates from Aptian sedimentary rocks, should be put into synonymy with ?*Mesohibolites brevis* SHVETSOV, 1913.

Stratigraphical distribution — The Hungarian specimen probably originates from the top of the Darsi Subzone.

The specimen figured by ALI–ZADE appears to be collected in Aptian deposits. However, ALI–ZADE (1972, pp. 32, 43, and 53) mentions this species from (Lower) Barremian sedimentary deposits with *Hibolites subfusiformis* (RASPAIL). The latter, figured on pl. IV, fig. 3 is in our opinion a *Hibolithes carpaticus* (UHLIG).

Curtohibolites trubatchensis STOYANOVA–VERGILOVA, 1963
(Plate IV: 32–33, 34–35)

1962: *Curtohibolites trubacensis* n. sp. — STOYANOVA–VERGILOVA, p. 102 [nom. nud.].
* 1963: *Curtohibolites trubatchensis* sp. nov. — STOYANOVA–VERGILOVA, pp. 217–218, pl. II, figs 1[HT]–6.
1964: *Curtohibolites trubatchensis* STOYANOVA–VERGILOVA — STOYANOVA–VERGILOVA, pp. 139, 146.
1991: *Curtohibolites trubatchensis* STOYANOVA–VERGILOVA — COMBÉMOREL & STOYANOVA–VERGILOVA, p. 35.
2000: *Curtohibolites trubatchensis* STOYANOVA–VERGILOVA — CLÉMENT, pl. 4, fig. 19.
? 2000: *Curtohibolites* nov. sp. 3. — CLÉMENT, pl. 4, fig. 21.
2003: *Curtohibolites trubatchensis* STOYANOVA–VERGILOVA — JANSSEN & FŐZY, p. 292.

Material — Two moderately preserved mature specimens, one (im)mature specimen (Plate IV: 32–33), and two juvenile specimens from bed 15. The alveolar area is depressed, tending towards a square-like outline. The apical area shows a more rounded outline. The juvenile specimens show no alveolar groove (Plate IV: 34–35). Bed 300/45 delivered a specimen of *Curtohibolites*, that either belongs to *C. trubatchensis* STOYANOVA–VERGILOVA or *C. oosteri* STOYANOVA–VERGILOVA, 1963. The apex is dorsally placed.

Stratigraphic distribution — The Hungarian material originates from the Moutonianum Zone *sensu* COMPANY et al. 1995 ("middle" to top of the Darsi Zone *sensu* VERMEULEN 2002). The Bulgarian material apparently originates from Lower Barremian strata (cf. STOYANOVA–VERGILOVA 1964: 139).

Remarks — *Curtohibolites* occurs sporadically in the Barremian stratotype profile of Angles from beds 129–134 (middle part of the Darsi Zone). In the Clos de Barral section (cf. VERMEULEN 1980, 2002) this species occurs rather abundant in the Barremian condensed hemipelagic deposits of the Darsi to Sayni Zone (pers. obs.; CLÉMENT 2000).

Explanation to Plate IV

(All lateral view shows ventral side to the left, unless otherwise indicated; all specimens in natural size)

1–2 ***Conohibolites escragnollensis* (DELATTRE, 1952)** (2005.31.) — Section D, bed 363; post? Vandenheckii Zone (Upper Barremian). **1** — Ventral view; **2** — Lateral view; **2a–b** — Cross-sections.

3–4 ***Conohibolites garshini* (STOYANOVA–VERGILOVA, 1965)** (2005.32.) — Section E, bed 300/13; Vandenheckii Zone (Upper Barremian). **3** — Ventral view; **4** — Lateral view.

5–6 ***Conohibolites gladiiformis* (UHLIG, 1883)** (2005.33.) — Section A, bed 15; top Moutonianum Zone (Lower Barremian). **5** — Ventral view; **6** — Lateral view.

7–8 ***Conohibolites gladiiformis* (UHLIG, 1883) (juvenile)** (2005.34.) — Section A, bed 15; Vandenheckii Zone (Upper Barremian). **7** — Ventral view; **8** — Lateral view.

9–9 ***Conohibolites gladiiformis* (UHLIG, 1883)** (2005.35.) — Section A, bed 6; Vandenheckii Zone (Upper Barremian). **9** — Ventral view; **9a–b** — Cross-sections.

10–11 ***Conohibolites gladiiformis* (UHLIG, 1883)** (2005.36.) — Section D, bed 411; Vandenheckii Zone (Upper Barremian). **10** — Ventral view; **11** — Lateral view.

12–13 ***Conohibolites* aff. *gladiiformis* (UHLIG, 1883)** (2005.37.) — Section D, bed 395; Vandenheckii Zone (Upper Barremian). **12** — Ventral view; **13** — Lateral view.

14–15 ***Conohibolites* gr. *gladiiformis* (UHLIG, 1883)** (2005.38.) — Section E, bed 300/28; Moutonianum Zone (Lower Barremian). **14** — Ventral view; **15** — Lateral view.

16–17 ***Conohibolites? varians* (SHVETSOV, 1913)** (2005.39.) — Section B, bed 117; Compressissima Zone (Lower Barremian). **16** — Ventral view (with part of alveolus visible); **17** — Lateral view.

18–19 ***Conohibolites* aff. *platyurus* (DUVAL–JOUVE, 1841) sp. nov?** (2005.40.) — Section A, bed 42; Moutonianum Zone (Lower Barremian). **18** — Ventral view; **19** — Lateral view.

20–21 **"*Mesohibolites*"? aff. *elegans* (SHVETSOV, 1913)** (2005.41.) — Section A, bed 33 or 34; Moutonianum Zone, (Lower Barremian). **20** — Ventral view; **21** — Lateral view.

22–23 **"*Mesohibolites*"? aff. *elegans* (SHVETSOV, 1913)** (2005.42.) — Section A, bed 33; Moutonianum Zone (Lower Barremian). **22** — Ventral view; **23** — Lateral view.

24–25 **"*Mesohibolites*"? aff. *elegans* (SHVETSOV, 1913) (juvenile/immature)** (2005.43.) — Section A, bed 17; Moutonianum Zone (Lower Barremian). **24** — Ventral view; **25** — Lateral view.

26–27 **"*Mesohibolites*"? sp. A (aff. *minaretiformis* SHVETSOV, 1913)** (2005.44.) — Section D, bed 353; post? Vandenheckii Zone (Upper Barremian). **26** — Ventral view; **26a** — Cross-section in alveolar part; **27** — Lateral view.

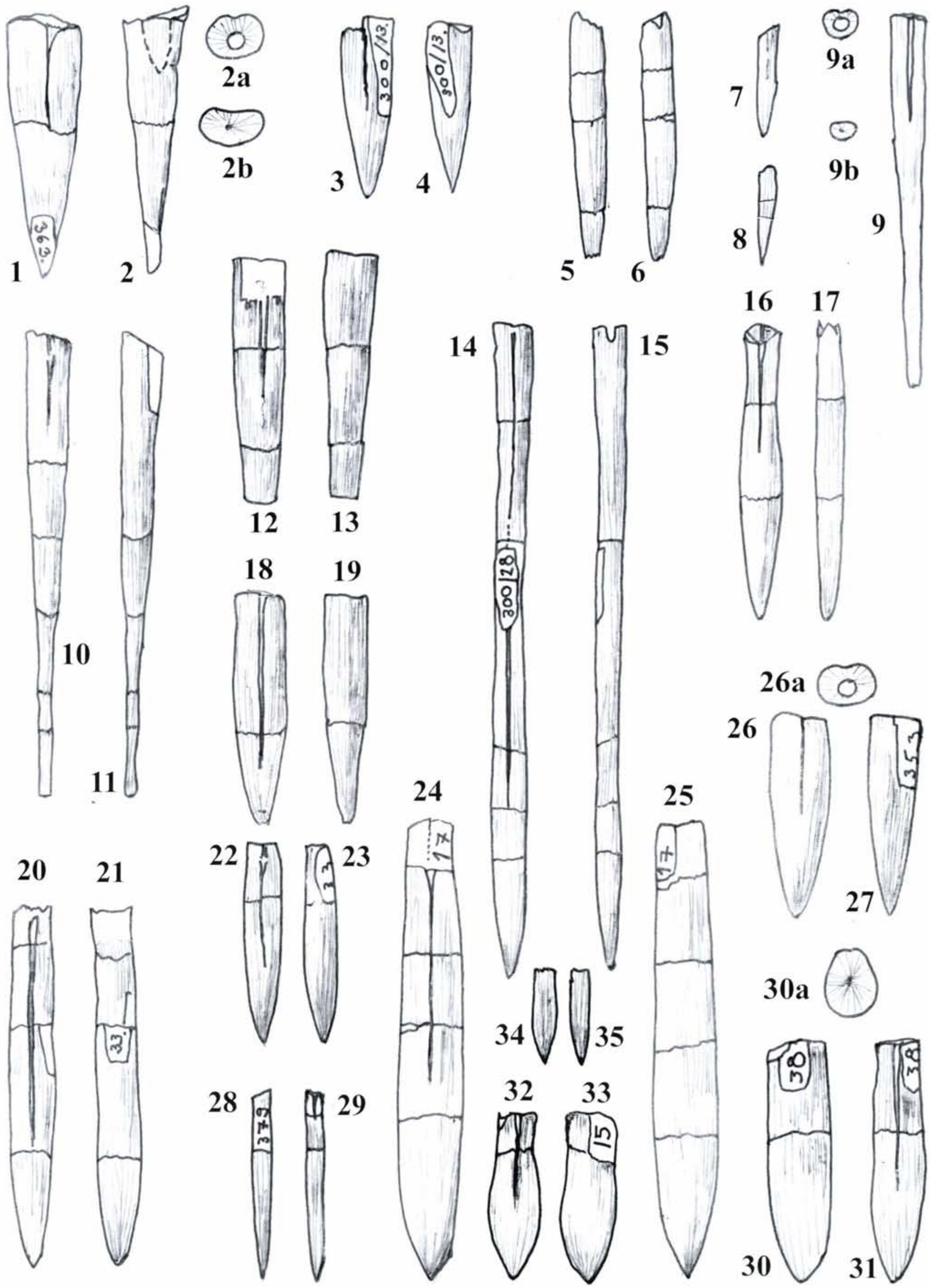
28–29 **"*Mesohibolites*"? sp. A (aff. *minaretiformis* SHVETSOV, 1913) (juvenile)** (2005.45.) — Section D, bed 379; Vandenheckii? Zone or younger (Upper Barremian). **28** — Ventral view; **29** — Lateral view.

30–31 ***Curtohibolites* aff. *pinguis* (SHVETSOV, 1913)** (2005.46.) — Section A, bed 38; Moutonianum Zone (Lower Barremian). **30** — Ventral view; **30a** — Cross-section; **31** — Lateral view.

32–33 ***Curtohibolites trubatchensis* (STOYANOVA–VERGILOVA, 1963)** (2005.47.) — Section A, bed 15; top Moutonianum Zone (Lower Barremian). **32** — Ventral view; **33** — Lateral view.

34–35 ***Curtohibolites trubatchensis* (STOYANOVA–VERGILOVA, 1963) (juvenile)** (2005.48.) — Section A, bed 15; top Moutonianum Zone (Lower Barremian). **34** — Ventral view; **35** — Lateral view.

Plate IV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Mesohibolitidae indet.

Material — This includes parts of Mesohibolitidae NERODENKO, 1983 and juvenile or immature specimens that can not be attributed to any specific genus by us. It includes, largely incomplete specimens from beds 18 and 17 (Moutonianum Zone); and juvenile specimens from beds 349 and 304 (Vandenheckii Zone and probably younger strata).

The following species belong (most probably) to the "true *Mesohibolites*":

– In bed 316 a depressed immature specimen is collected. It shows a relatively deep alveolus, but no trace of an alveolar groove. The alveolar part shows a square-like cut-section.

– In bed 301 a depressed specimen occurs, which is at least morphologically, comparable to "*Belemnites minaret*" RASPAIL in UHLIG (1883b, Pl. I, fig. 9).

– In bed 300/1, a "*Mesohibolites*" specimen occurs that has been grouped in *H. jaculiformis* SHVETSOV by JANSSEN & FŐZY (2003). It shows a depressed rostrum, slightly fusiform rostrum without alveolar groove, and without alveolus.

Conclusion

The Hauterivian–Barremian boundary sediments show the last *Duvalia dilatata* (DE BLAINVILLE) and some related specimens. Mesohibolitidae are rather abundant, dominated by *H.* gr. *subfusiformis* (RASPAIL) and *H.* gr. *jaculiformis* SHVETSOV. The lowermost Barremian sediments are characterized by various new Duvaliidae, like *Duvalia silesiaca* UHLIG, 1902 (= pars *Duvalia binervia* auct.) and *Duvalia gagrica* SHVETSOV, 1913. Moreover, by the last representatives of the *Hibolithes* mentioned above, including what herein is called *H. targovishtensis* STOYANOVA–VERGILOVA. This association of belemnites (BaBA1) characterizes the lower part of the early Barremian (Figures 4–5).

Younger sediments delivered the first belemnites previously put into the genus *Mesohibolites* STOLLEY, 1919, including: pars *Belemnites minaret* auct. pl., *Conohibolites* (gr.) *gladiiformis* (UHLIG), *Conohibolites? varians* (SHVETSOV, 1913), "*Mesohibolites*" aff. *elegans* (SHVETSOV) and species like *Duvalia grasiana* (DUVAL–JOUVE), *Hibolithes? carpaticus* (UHLIG), and *H. mirificus* STOYANOVA–VERGILOVA first occur. This belemnites association (BaBA2, cf. Figures 4–5) characterizes the upper part of the early Barremian, and the eventually lowermost part of the late Barremian. It is succeeded by belemnite association BaBA3, characteristic for the lower part of the late Barremian. Together these two associations make up the so called "mid" Barremian belemnites.

The "mid" Barremian (= upper Lower Barremian to lower Upper Barremian; Compressissima to Feraudianus Zones) shows some of the classical Barremian elements with "*Mesohibolites*" auct. pl. and *D. grasiana* (DUVAL–JOUVE) but its characteristic elements are the peculiar *Curtohibolites* and elongated belemnites around *Belemnites gladiiformis* UHLIG. They precede the "true *Mesohibolites*" and *Mucrohibolites* that characterize the uppermost Barremian and Early to Mid Aptian strata (not treated in this work).

Despite the abundant occurrence of belemnites in the Barremian sedimentary rocks, biostratigraphic classifications are sparse and more or less depend on the development of a useful and adequate zonation based on ammonites. As mentioned before some generally rudimentary, biostratigraphic zonation schemes exist based on the distribution of belemnites, i.e. NAZARISHVILI (1968, 1973), ALI–ZADE (1972), KHALILOV & ALIEV (1986), and KELEPTRISHVILI (1990, 1998), VAŠÍČEK et al. (1994), and CLÉMENT (2000) which show already much more detail (cf. Figure 5).

This research adds some more details to the biostratigraphic distribution of the belemnites. A compilation made from the sources mentioned in this work (cf. Figure 5), added with the present information, confirms more or less the basic ideas of the biozonations thus far published.

* * *

Acknowledgements — Jaap KLEIN (University of Leiden) and Miguel COMPANY (University of Granada) are especially thanked for providing literature and also for consulting on ammonite taxonomy and biostratigraphy. The leadership of the HOLCIM Cement Factory (Lábatlan) is also thanked for allowing free access to the sections of the Bersek-hegy quarry. This research has been sponsored by the Hungarian Scientific Research Fund (OTKA), project no.: T 34208.

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Explanation to Plate V

(All lateral view shows ventral side to the left, unless otherwise indicated; all specimens in natural size)

1 ***"Mesohibolithes"*? cf. *bakalovi* STOYANOVA–VERGILOVA, 1965** (2005.16.) — Bed 130; Compressissima Zone (Lower Barremian). Ventral view.

2–3 ***Conohibolites*? *varians* (SHVETSOV, 1913)** (2005.39.) — Bed 117; Compressissima Zone (Lower Barremian). **2** — Ventral view (with part of alveolus visible); **3** — Lateral view.

4–5 ***Hibolithes* sp. (aff. *krimholzi* STOYANOVA–VERGILOVA, 1970) (immature)** (2005.26.) — Bed 300/10; Vandenheckii (Sayni) Zone (Upper Barremian). **4** — Ventral view; **5** — Lateral view.

6–7 ***Conohibolites escragnollensis* (DELATTRE, 1952)** (2005.31.) — Bed 363; post? Vandenheckii Zone (Upper Barremian). **6** — Ventral view; **7** — Lateral view.

8–9 ***Conohibolites* aff. *platyurus* (DUVAL–JOUVE, 1841) sp. nov?** (2005.40.) — Bed 42; Moutonianum Zone (Lower Barremian). **8** — Ventral view; **9** — Lateral view.

10–11 **"*Mesohibolites*"? aff. *elegans* (SHVETSOV, 1913) (juvenile/immature)** (2005.43.) — Bed 17; top Moutonianum Zone (Lower Barremian). **10** — Ventral view; **11** — Lateral view.

12–13 ***Hibolithes targovishtensis* STOYANOVA–VERGILOVA, 1979** (2005.14.) — Bed 132; Compressissima Zone (Lower Barremian). **12** — Ventral view; **13** — Lateral view.

14 ***Hibolithes mirificus* STOYANOVA–VERGILOVA, 1965 (juvenile/immature)** (2005.12.) — Bed 126; Compressissima Zone (Lower Barremian). Lateral view.

15 ***Hibolithes carpaticus* (UHLIG, 1883)** (2005.20.) — Bed 102; Moutonianum Zone (Lower Barremian). Ventral view.

16 ***Hibolithes* sp. (aff. *krimholzi* STOYANOVA–VERGILOVA, 1970)** (2005.24.) — Bed 300/8; Vandenheckii (Sayni) Zone (Upper Barremian). Ventral view.

17 ***Hibolithes carpaticus* (UHLIG, 1883)** (2005.21.) — Bed 35; Moutonianum Zone (Lower Barremian). Ventral view.

18–19 ***Duvalia grasiana* (DUVAL–JOUVE, 1841)** (2004.61.1.) — Bed 33; Moutonianum Zone (Lower Barremian). **18** — Dorsal view; **19** — Lateral view.

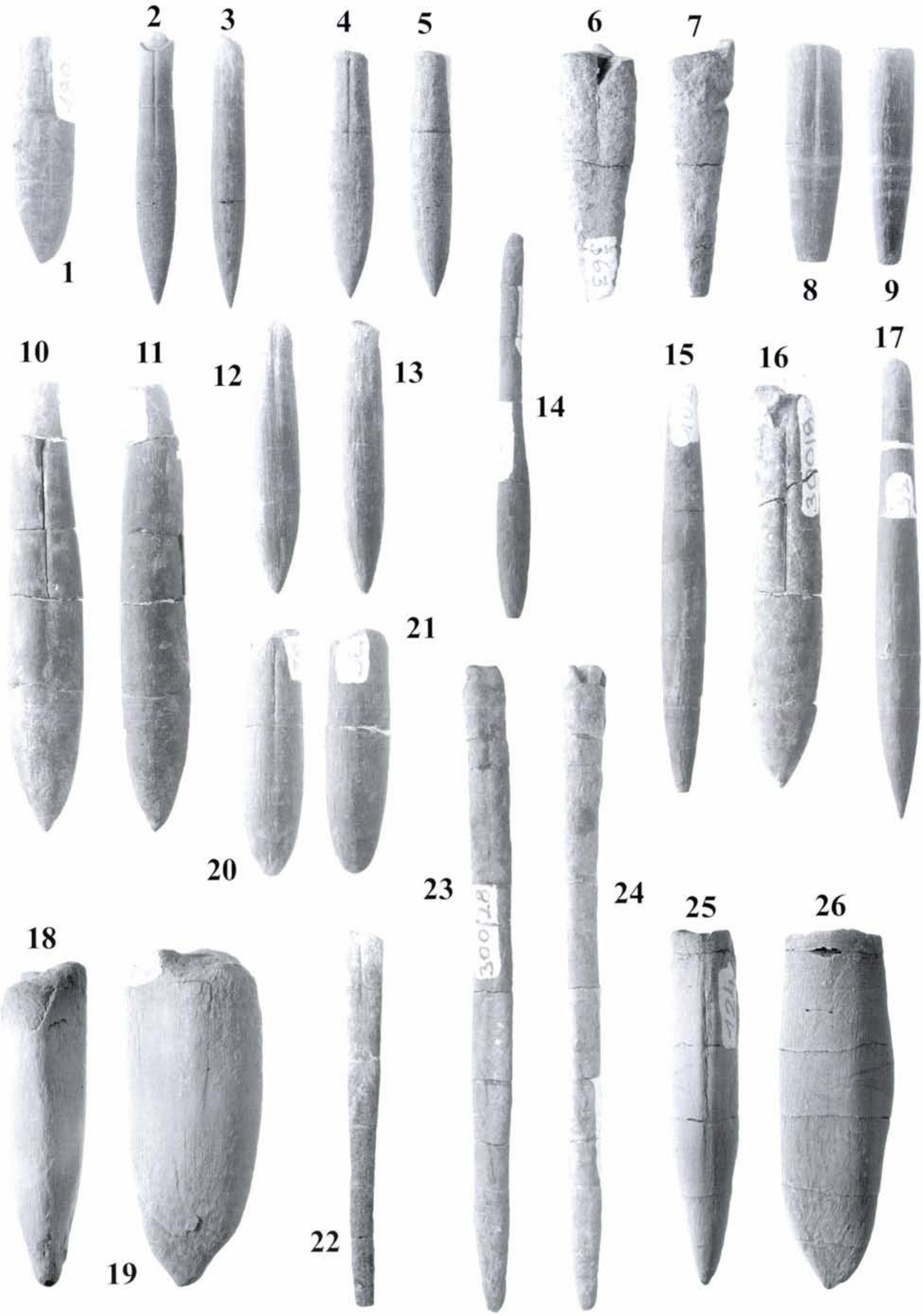
20–21 ***Curtohibolites* aff. *pinguis* (SHVETSOV, 1913)** (2005.46.) — Bed 38; Moutonianum Zone (Lower Barremian). **20** — Ventral view; **21** — Lateral view.

22 ***Conohibolites gladiiformis* (UHLIG, 1883)** (2005.35.) — Bed 6; Vandenheckii Zone (Lower Barremian). Ventral view.

23–24 ***Conohibolites* gr. *gladiiformis* (UHLIG, 1883)** (2005.38.) — Bed 300/28; Moutonianum Zone (Lower Barremian). **23** — Ventral view; **24** — Lateral view.

25–26 ***Duvalia grasiana* (DUVAL–JOUVE, 1841)** (2004.59.1.) — Bed 124; Compressissima Zone (Lower Barremian). **25** — Ventral view; **26** — Lateral view.

Plate V



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